

PRODUCTIVITY PERFORMANCE of DIGITAL WORKPLACES

Insights from
Selected APO Member Economies



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INSIGHTS FROM SELECTED APO MEMBER ECONOMIES

Productivity Performance of Digital Workplaces: Insights from Selected APO Member Economies

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FOREWORD

Advances in technology have made digital workplaces possible. This is supported by new work styles and performance measured by output rather than physical presence. The new workplace model focuses on productivity, collaboration, leadership, and culture in the digital age. Nevertheless, there are challenges to be addressed in measuring productivity in digital workplaces. Since the outbreak of COVID-19 in the recent past, remote and hybrid work have become the norm worldwide. However, techniques for measuring productivity in digital workplaces have not been fully assessed. This report, *Productivity Performance of Digital Workplaces: Insights from Selected APO Member Economies*, provides insights into the changing workforce needs accompanying digital transformation by exploring the productivity implications of rapid increases in digital workplaces. It defines a digital workplace as essentially a virtual representation of a traditional office, but with some key differences. It is an environment that brings together various technologies and tools to allow employees to work remotely, collaborate effectively, and access information seamlessly, regardless of their location or device.

In today's rapidly evolving digital landscape, the measurement of productivity within digital workplaces has become a critical focus for many organizations, enabling them to assess the gains in their overall digitalization process. The cases outlined in this report delve into the experiences of 10 APO member economies, namely, Bangladesh, India, the Republic of Korea (ROK), Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Thailand, and Türkiye, in exploring innovative strategies and methodologies for enhancing the quality of productivity measurement in digital work environments. Each economy has witnessed a rapid surge in digital workplace adoption in recent years. Based on the lessons learned from examining digital workplaces, the report outlines eight key recommendations to enhance productivity measurement in digital workplaces. Each recommendation aims to address certain unique challenges posed by digital transformation, e.g., aligning productivity metrics with strategic goals, utilizing real-time digital tools, fostering cross-departmental collaboration, supporting flexible work arrangements, adopting effective change management strategies, incorporating cultural considerations, proactively addressing challenges, and ensuring regular review and adaptation of productivity systems.

The report concludes by emphasizing the growing importance of dynamic and flexible productivity metrics in the digital age when measuring productivity gains in a digital workplace. It also underscores the need for any organization to continuously evolve its strategies to align with

technological advancements and the consequential organizational changes for driving productivity and innovation in the fast-growing digital workplaces embraced in recent times.

The APO extends sincere gratitude to the chief expert, Professor Seong Ju Kang, Department of Electronic Engineering, Sejong University, the ROK, and the national experts from Bangladesh, India, the ROK, Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Thailand, and Turkiye.

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EXECUTIVE SUMMARY

This report presents a comprehensive and forward-looking analysis of how digital transformation is reshaping productivity in the workplace across 10 APO member economies: Bangladesh, India, Indonesia, the ROK, Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Thailand, and Turkiye. As the global economy continues to evolve, these countries are experiencing rapid shifts in how work is conducted, evaluated, and enhanced through digital technologies.

The digital workplace, characterized by remote collaboration, intelligent automation, cloud computing, and AI integration, has introduced both new opportunities and novel challenges. With the acceleration of hybrid and remote work models, particularly in response to the COVID-19 pandemic, conventional metrics of productivity have become insufficient. The need to reframe how productivity is defined, measured, and improved has never been more critical.

This report serves as a practical and theoretical guide for national productivity organizations (NPOs), public and private institutions, and researchers aiming to modernize productivity strategies in line with digital advancements. Drawing on national studies, global frameworks, academic research, and industry benchmarks, the report analyzes productivity measurement frameworks, synthesizes country-specific developments, and proposes future-ready recommendations.

Highlights of the Productivity Landscape

Key findings from the report emphasize the diversity of digital transformation progress and productivity outcomes across APO member economies:

- **Bangladesh** has witnessed increasing labor productivity through public service digitization and financial inclusion tools like bKash. Government-led initiatives in e-governance and digital service delivery have helped streamline administrative processes and improve citizen satisfaction.
- **India** continues to strengthen its digital infrastructure through the “Digital India” campaign, experiencing measurable gains in service delivery and workforce agility. The integration of Aadhaar-based identification and mobile-based services has accelerated citizen access to public programs.
- **Indonesia** and **Malaysia** are prioritizing public–private partnerships to enhance SME digital readiness. E-commerce platforms, digital payment systems, and online training initiatives have boosted productivity in the service and manufacturing sectors.
- **The ROK** leads with robust data governance and “smart work center” initiatives, anchoring its leadership in digital productivity policy. Government policies are promoting innovation clusters, telecommuting hubs, and cross-sectoral collaboration to sustain high labor efficiency.

- **Mongolia and Nepal** are experimenting with mobile services and e-governance to bridge geographic and infrastructural gaps. In rural areas, mobile banking and decentralized service delivery are vital tools for improving economic participation.
- **Pakistan, Philippines, and Thailand** show regional leadership in hybrid work adaptation and digital public service rollout. These countries are leveraging cloud computing and workforce upskilling to enhance digital service capacity and resilience.
- **Turkiye** promotes digital transformation through various incentive and support mechanisms for SMEs and large-scale companies. Digital transformation is considered one of the top priorities in Turkiye's highest-level policy documents. Although some sectors and enterprises are in a good position in terms of digital maturity, public incentives and support aim to raise the level of digital maturity across all enterprises and sectors.

Despite differences in maturity levels, each country faces shared challenges in scaling digital solutions while maintaining equity, inclusiveness, and measurable performance gains.

Eight Key Recommendations for Action

- (1) **Align metrics with organizational goals:** Organizations should ensure that productivity indicators reflect their strategic priorities. Metrics must be relevant, clearly defined, and connected to the overarching goals. Having a Specific, Measurable, Achievable, Relevant, and Time-bound (SMART) criteria is essential for goal setting. Balanced Scorecards and customized KPIs are recommended to drive strategic alignment.

In digitally evolving organizations, alignment requires continuous dialogue between strategy units, HR departments, and operations teams. Metrics must not only reflect output, but also innovation, collaboration, and learning agility. Periodic reviews of goals and corresponding indicators can help ensure that productivity measurement remains integrated with broader performance management systems.

- (2) **Provide training and development:** To keep pace with rapid digital transformation, employees must continuously upgrade their skills. This recommendation emphasizes the importance of structured training programs focused on digital tools, remote collaboration, cybersecurity awareness, and change management. Organizations should also support lifelong learning through certifications, workshops, and peer learning initiatives.

Effective training programs blend technical instruction with behavioral coaching. Soft skills such as digital communication, project coordination, and conflict resolution are increasingly vital. Partnerships with academic institutions and digital training platforms can help scale up capacity-building efforts. Training should also include middle management, who serve as critical enablers of digital adoption.

- (3) **Implement employee engagement initiatives:** Motivated and connected employees are crucial to sustaining productivity in digital workplaces. Initiatives such as virtual town halls, wellness programs, real-time feedback mechanisms, and recognition platforms help foster engagement. Encouraging two-way communication and aligning tasks with employee strengths enhances commitment and output.

Engagement must be sustained across different levels of digital maturity. Organizations should measure employee engagement through pulse surveys, one-on-one check-ins, and feedback loops integrated into daily operations. Creating digital communities of practice and collaborative innovation labs also boosts motivation and knowledge sharing.

- (4) Address challenges proactively:** Workplace bottlenecks, whether technical, operational, or interpersonal, must be identified and mitigated early. Tools like workflow diagnostics, real-time monitoring, and employee sentiment analysis enable leaders to detect friction points.

A proactive approach could support business continuity and cultivate a culture of agility and problem-solving. It could include recognizing the impact of digital fatigue, unclear role definitions, or tool overload. Creating centralized helpdesks, standard operating procedures, and designated digital coaches can mitigate disruptions. A strong feedback culture reinforces agility and adaptive behavior across teams.

- (5) Consider cultural nuances:** Cultural contexts influence how productivity is perceived and achieved. For instance, collectivist cultures may prioritize team achievements, while individualist settings may focus on personal KPIs. Tailoring communication, incentives, and performance review systems to cultural norms ensures more inclusive and accurate measurement frameworks.

Measurement strategies should account for communication styles (direct vs. indirect), time orientation (short-term vs. long-term), and hierarchy sensitivity. Localizing technology adoption campaigns and codesigning solutions with end users from different cultural backgrounds improves success rates and long-term adoption.

- (6) Leverage technology:** Digital tools are central to modern productivity. Platforms for project management, time tracking, collaboration, and performance analytics should be integrated into daily operations. The recommendation also highlights the role of AI, automation, and data visualization in optimizing workflows and delivering real-time insights for decision-makers.

Tools like Microsoft Teams, Google Workspace, Slack, Jira, and Tableau help standardize communication and automate routine tasks. Cloud-based platforms support flexibility, while analytics dashboards provide instant visibility into productivity trends. IT governance frameworks should ensure secure, ethical, and efficient technology usage.

- (7) Establish policy and governance:** Clear policies and governance frameworks ensure consistency, accountability, and security in digital operations. These include data protection protocols, cybersecurity measures, remote work guidelines, and ethical standards for AI use. Governance structures must also be adaptable to accommodate technological advancements and regulatory changes.

Establishing roles such as chief digital officers (CDOs) and creating digital steering committees can help anchor responsibility. Organizations should audit their digital maturity periodically, aligning policy reforms with employee needs and sectoral benchmarks. Good governance supports compliance, reduces risk, and enables scale.

- (8) Implement regular review and adjustment:** Productivity strategies must evolve alongside organizational needs and external conditions. Establishing periodic review mechanisms, quarterly or biannually, helps assess the relevance and effectiveness of current metrics. Adjustments should be informed by employee feedback, market trends, and strategic shifts to ensure continuous improvement.

An agile review process includes setting up dashboards for near-real-time data, performance retrospectives, and lessons-learned sessions. Organizations should also benchmark their performance against peers and industry standards to remain competitive and forward-looking.

Broader Implications and the Path Forward

The findings and recommendations presented in this report underscore the dynamic, multi-dimensional nature of productivity in digital workplaces. Success depends on more than adopting the right tools; it requires a strategic, inclusive, and culturally attuned approach to measurement.

For policymakers, the challenge lies in establishing national frameworks that balance standardization with local flexibility. Investment in digital infrastructure, data governance, and upskilling programs is essential. Governments should also support the development of sector-specific benchmarks and offer guidance to small and medium enterprises (SMEs) in adopting productivity tools.

For business leaders, there is an opportunity to reposition productivity not just as an output metric but as a holistic indicator of organizational health. This involves integrating productivity into broader performance management systems and aligning it with employee engagement, innovation, and well-being.

For academic and research institutions, the digital productivity landscape presents a fertile ground for new research. Cross-country comparisons, longitudinal studies, and interdisciplinary frameworks are needed to capture the complex interplay between technology, behavior, and performance.

Through coordinated efforts across these domains, APO member economies as well as other global countries can develop future-ready systems for measuring and improving workplace productivity. This transformation requires not only new tools but also new mindsets. A digital future calls for productivity models that are human-centered, responsive to change, and capable of capturing the full spectrum of value created in modern work environments. The insights and roadmap offered in this report are a step toward realizing that vision.

INTRODUCTION

Overview

This report attempts to assess the productivity gains from digital workplaces brought about by recent advances in digital technologies. Digital technologies have made a series of contributions to the entire economy as well as to individuals and organizations. Economists see productivity as the key source of economic growth and competitiveness, whether it is being measured in a business, an industry, or a nation. Digital technologies have also contributed to make the society inclusive. For example, smart schools can help more students access learning, and smart healthcare can help seniors stay healthier.

Digital workplaces are rapidly being adopted throughout APO member economies due to technological progress and socioeconomic shifts brought about by COVID-19. Technologies such as ERP, internet, and cloud computing have enabled firms to realize economic gains such as time savings, error reduction, and punctuality, all of which have led to increased productivity. COVID-19 encouraged firms to adopt online work due to concerns about contagion.

A country's ability to improve its standard of living depends on its ability to raise its output per worker. This does not necessarily mean that every worker works harder. It means that some combination of improvements in equipment, the production process, and the work environment drives workers to increase the overall production.

The most commonly reported productivity measure is labor productivity. This is based on the ratio of GDP to total hours worked in the economy. Labor productivity growth comes from increases in the amount of capital available per worker (called capital deepening); the education and experience of the workforce (labor composition); and improvements in technology (multi-factor productivity growth). Advances in digital technologies, including artificial intelligence (AI), ERP, social networking services (SNS), and cloud, make labor productivity better due to various sources of productivity gains, including management, organization, and work environment. The measurement of productivity has been challenged but the issue remains unsolved yet.

Due to the Digital Readiness Assessment report (APO, 2022), digitalization is becoming a significant tool for improving productivity. Research shows that SMEs are lagging behind larger organizations in introducing digitalization. This study therefore aims to assess the extent and impact of digital adoption and sophistication of organizations in driving better performance and efficiency.

Objectives of Research

In assessing the productivity gains from digital workplaces, this report will discuss the benefits for the following key stakeholders:

- **Leaders and managers:** The report provides evidence to justify the costs and efforts associated with digital workplace adoption. By demonstrating productivity gains, it

supports decision-makers in making informed choices and securing stakeholder approval for further investments in digital technologies.

- **Practitioners and engineers:** It offers practical insights for those implementing digital workplace systems, guiding the selection, design, and management of technologies. The report provides valuable lessons to enhance performance and ensure that digital tools align with organizational needs.
- **Employees:** It addresses how digital workplaces can improve work efficiency, job satisfaction, and work–life balance. It highlights how digital tools can create more flexible, engaging, and supportive work environments, thereby enhancing employee well-being.
- **Scholars and researchers:** The report contributes to academic research on productivity in digital environments. It provides data and insights that scholars can use to explore new areas of study, offering a foundation for further investigation into the impact of digital workplace transformation.

Overall, the report serves as a comprehensive resource for leaders, practitioners, employees, and researchers, offering evidences, lessons, and insights to enhance productivity in digital workplaces.

Digital Workplace

A digital workplace is essentially a virtual space of a traditional office, but with some key differences. It is an environment that brings together various technologies and tools to allow employees to work remotely, collaborate effectively, and access information seamlessly, regardless of the location or device. Government entities or private companies can provide digital workplaces, either as self-managed setups or rented solutions.

Here is a breakdown of the key features of a digital workplace:

- (1) **Technology ecosystem:** It involves a set of digital tools and platforms that work together. These could include communication tools like e-mail, instant messaging, and video conferencing, as well as project management tools such as ERP, big data, AI, file sharing platforms, and even social networking applications for work purposes.
- (2) **Anytime, anywhere access:** A core aspect of a digital workplace is that employees can access the tools and information they need from any device, at any time. This provides flexibility and caters to remote work or hybrid work models.
- (3) **Collaboration:** Digital workplaces are designed to foster collaboration among employees, even if they are not physically in the same space. This is achieved through features like shared workspaces, document co-editing, and real-time communication tools.
- (4) **Improved productivity:** By providing employees with the right tools and easy access to information, digital workplaces can streamline workflows and boost overall productivity.
- (5) **Employee experience:** A well-designed digital workplace can enhance employee experience by offering a user-friendly interface, personalized tools, and a sense of connection, even in remote settings like smart work centers.

The key difference between a traditional workplace and a digital workplace boils down to the location and the tools. Traditional workplaces provide the following:

- (1) **Location:** Work happens in a physical office space with designated work stations.
- (2) **Tools:** Tasks are primarily completed with physical items like papers, files, and whiteboards. Digital tools may be supplementary.
- (3) **Schedule:** Fixed work hours are the norm, typically from 9 am to 5 pm.
- (4) **Collaboration:** This relies on in-person meetings, discussions by the water cooler, and physical whiteboards.

On the other hand, digital workplaces provide the following:

- (1) **Location:** Work can be done from anywhere with an internet connection. This allows for remote work, flexible schedules, and geographically dispersed teams.
- (2) **Tools:** Digital tools are central. These include cloud storage, project management software, communication platforms, and video conferencing.
- (3) **Schedule:** Schedules can be more flexible, though core working hours may still exist.
- (4) **Collaboration:** This is achieved by leveraging digital tools for communication, file sharing, and real-time document editing. Therefore, in this report, the digital workplace is a result of digital transformation (DX).

Overall, digital workplaces are transforming the way we work, making it more flexible, efficient, and collaborative. Due to these benefits, many economies provide incentives to introduce digital workplace programs, i.e., technological support from professional groups, and indirect support including voucher and tax exemption.

This research could identify the types of benefits, in addition to legal and institutional settings, to encourage people and businesses to introduce digital workplace activities.

Productivity

Workplace productivity refers to how efficiently employees work toward achieving an organization's goals. It is not about working long hours, but about working smart and getting things done effectively. Types of productivity are: (1) individual productivity, which refers to an employee's personal ability to manage time and resources to achieve the set goals; (2) organizational productivity, which means how efficiently a business gets things done, focusing on output per worker or resources used; and (3) national productivity, which looks at the economic performance of a country, considering the goods and services produced compared to the inputs used.

There are many factors affecting productivity: (1) time management questions how good one is at prioritizing tasks and avoiding distractions; (2) organizational factors focus on how well one keeps track of one's to-do lists and resources; (3) the motivation factor asks whether one has a clear

purpose and the drive to complete tasks; (4) tools and technology factors question how one uses the right equipment and software to streamline work. (5) the work environment factor focuses on keeping the workspace free from distractions and conducive to focus. Among these factors, this research focuses on the technological aspect, especially on digital technology in the workplace.

Digital workplaces offer several advantages that can lead to significant productivity gains for businesses and employees. These are:

- (1) **Improved efficiency:** Repetitive tasks can be automated using digital tools, freeing up employee time for more strategic work; and digital platforms can connect different stages of a project, reducing bottlenecks and delays. Cloud storage and document sharing tools ensure that everyone has access to the latest information, thus minimizing the time wasted on searching for files.
- (2) **Enhanced collaboration:** Digital tools like instant messaging and video conferencing, e.g., Zoom, enable seamless communication and collaboration, regardless of the location (Zoom, 2020). Document sharing platforms and wikis facilitate knowledge sharing and ensure that everyone is on the same page. Project management software helps teams track progress, assign tasks, and meet deadlines efficiently.
- (3) **Increased flexibility:** Digital workplaces allow employees to work from anywhere with an internet connection, leading to a better work–life balance and potentially a wider talent pool. Employees can flexibly work during their most productive hours, which can boost efficiency and morale. Digital tools can help accommodate employees with disabilities, expanding the talent pool and fostering a more inclusive work environment.
- (4) **Employee empowerment:** Employees can access information and complete tasks independently, reducing reliance on others and improving responsiveness. Also, real-time data and analytics can empower employees to make data-driven real-time decisions. A digital workplace can foster a sense of ownership and accountability, leading to higher engagement and productivity.

Researchers have also found some additional points to consider about productivity gains:

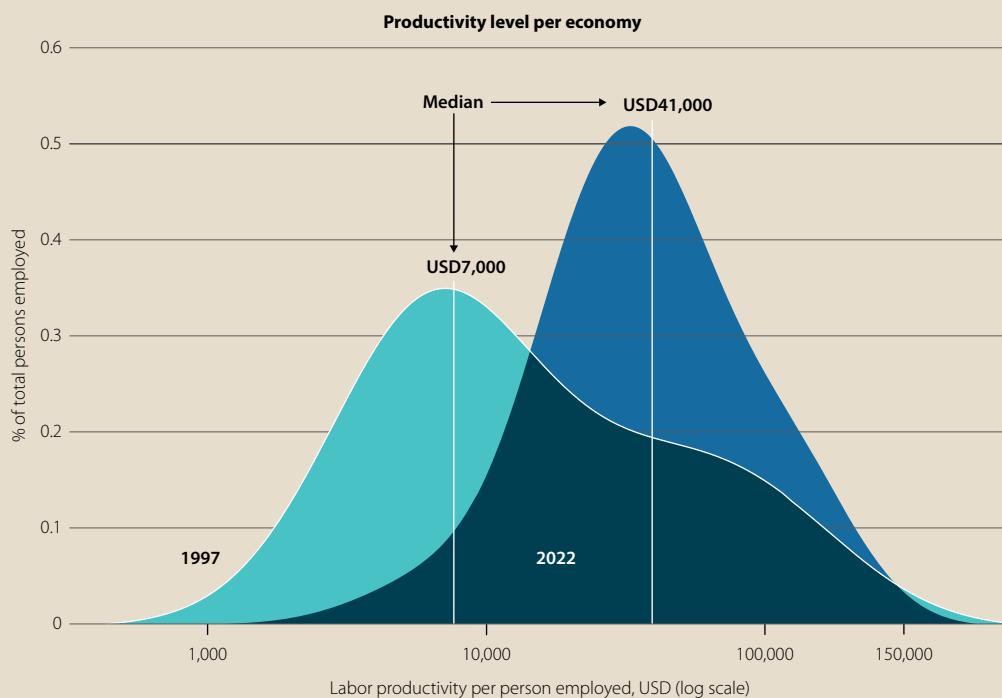
- (1) **Technology investment:** While digital workplaces offer long-term benefits, there is an initial investment in technology and training.
- (2) **Change management:** Transitioning to a digital workplace requires effective change management to ensure employee adoption.
- (3) **Security and privacy:** Digital workplaces require robust security measures to protect sensitive information.

Overall, a well-designed digital workplace can significantly improve productivity by streamlining processes, enhancing collaboration, and empowering employees. This research project attempts to identify the productivity gains, both quantitatively and qualitatively, observed after the adoption of digital workplace endeavors across the participating countries.

According to recent research, during the last 25 years, the world productivity has grown up six times than before, which is seen in Figure 1 below (McKinsey & Company, 2024). Among those rapidly productive countries, APO member economies have contributed profoundly, i.e., 2.6% compared to global average 2.3%, which is shown at Figure 2 below.

FIGURE 1

COMPARATIVE VIEW OF PRODUCTIVITY, 1997 VERSUS 2022.



Source: (McKinsey & Company, 2024). pp 6.

FIGURE 1

COMPARATIVE VIEW OF PRODUCTIVITY, 1997 VERSUS 2022.



Source: (McKinsey & Company, 2024). pp 7.

Another research shows that digitally intensive sectors performed better than non-digitally intensive sectors, as given in Table 1 (Mollins & Taskin, 2023).

TABLE 1**PRODUCTIVITY COMPARISON BETWEEN DIGITALLY INTENSIVE AND NON-DIGITALLY INTENSIVE SECTORS.**

	1997		2018	
	Digitally intensive sectors	Non-digitally intensive sectors	Digitally intensive sectors	Non-digitally intensive sectors
Labor productivity	51	40	76 (48%)	52 (28%)
Labor share	56%	62%	58% (2 pp)	57% (-4 pp)
Share of total hours worked	22%	78%	22% (0 pp)	78% (0 pp)
Compensation per hour	25	17	47 (88%)	31 (87%)
Average hours per job	1,895	1,825	1,824 (-4%)	1,718 (-6%)
Share of output (approx.)	26%	73%	29% (3 pp)	71% (-3 pp)

Source: Mollins and Taskin, 2023, pp. 6.

COVID-19 and Productivity

The COVID-19 pandemic impacted productivity as well as the digital workplace. Many studies have been done on different aspects of productivity. A Boston Consulting Group study in 2020 found that 75% of employees maintained or improved their perceived productivity on individual tasks during the first few months of the pandemic. However, only 51% felt they could maintain or improve productivity on collaborative tasks. In PwC's US Remote Work Survey in January 2021, 52% of executives said average employee productivity had improved compared with the pre-pandemic levels, i.e., up from 44% in June 2020 (PwC, 2021). Sector-specific impacts were observed. McKinsey survey data showed that tech and IT sectors experienced productivity increases of up to 13% during the pandemic. However, the construction industry saw a 12% decrease in productivity, likely due to the physical nature of work and new safety protocols. A Harvard Business School study found that industries with higher educational requirements and lower physical proximity needs (e.g., professional services, information) saw smaller declines in productivity (Harvard Business School, 2020).

The pandemic made changes in working hours and workday structure. The National Bureau of Economic Research found that the average workday lengthened by 48.5 minutes in the early months of the pandemic (National Bureau of Economic Research, 2020). Atlassian reported employees working an average of 30 minutes longer per day by April 2020 compared with pre-pandemic levels. A study by NordVPN Teams showed that home/remote working had led to a 2.5-hour increase in the average working day in the USA, the UK, and Canada. During the working hour, changes in meeting dynamics were also observed. Microsoft's Work Trend Index reported a 148% increase in the weekly time spent in Microsoft Teams meetings for the average user between February 2020 and February 2021 (Microsoft, 2021). The average Teams meeting increased in length from 35 minutes to 45 minutes year-on-year. A study by Otter.ai found that professionals were spending an average of 11.7 hours in meetings per week, up from 10.9 hours in 2019 (Otter.ai, 2020).

Due to the pandemic, psychological changes were also observed. Clockwise found that employees had 22% less focus time in April 2020 compared with January 2020, likely due to increased meetings and notifications (Clockwise, 2020). A RescueTime study showed that knowledge workers checked email and IM every six minutes on an average during the pandemic, up from every 7.5 minutes before the pandemic (RescueTime, 2020). Long-term remote work productivity improved. A two-year Stanford study of a Chinese travel agency found that remote workers were 13% more productive than their office-based counterparts (Bloom et al., 2015). This broke down to 9% more minutes worked per shift and a 4% increase in calls per minute (for call center workers). Regarding burnout and well-being, Microsoft's Work Trend Index found that 54% of workers felt overworked, and 39% felt exhausted (Microsoft, 2021). A study by Indeed found that 52% of respondents experienced burnout in 2021, up from 43% prior to the pandemic (Indeed, 2021). FlexJobs and Mental Health America survey showed that 75% of the people experienced burnout at work, with 40% saying it was a direct result of the COVID-19 pandemic (FlexJobs & MHA, 2021). Adaptation and learning curve changed. Prodoscore reported a 47% productivity increase in March/April 2020 compared with March/April 2019, suggesting rapid adaptation to remote work (Prodoscore, 2020). A Boston Consulting Group study found that 78% of employees felt they had maintained or improved productivity in their individual tasks after an initial adjustment period.

Many factors mattered. A Joblist survey said that 43% of remote workers reported their productivity being negatively impacted by distractions at home (Joblist, 2020). Also, 26% cited lack of proper equipment or technology as a factor decreasing their productivity. As per a Pipedrive study, 41% of salespeople reported being more productive working from home, while 48% said their productivity remained the same (Pipedrive, 2020). Tools played a critical role as well. A Forrester study commissioned by LogMeIn found that organizations using collaboration tools saw a 3.3x return on investment, primarily through improved productivity (Forrester, 2021). Asana's Anatomy of Work Index 2021 reported that employees switched between 10 apps 25 times a day on an average, leading to fragmented time and reduced productivity (Asana, 2021). Zoom reported a 355% increase in revenue year-on-year in Q2 2020, reflecting the massive shift to video conferencing (Zoom, 2020). Microsoft Teams saw daily active users grow from 32 million in March 2020 to 145 million by April 2021. The impact differed by industry and geography.

These statistics reveal a complex picture of productivity during the pandemic. While many workers and organizations reportedly maintained or improved productivity, particularly for individual tasks, challenges remained around collaboration, work-life balance, and adapting to new tools and workflows. The impact varied significantly by industry, job role, individual circumstances, and time as people adapted to new ways of working.

Regarding the region of Asia, productivity also changed due to the pandemic. A 2020 survey by Cisco Systems across APAC (including Southeast Asian countries) found that 64% of organizations reported productivity increases with remote work (Cisco, 2020). A study by Luno in 2020 found that 64% of Singaporean employees felt more productive working from home. The share of such employees was 69% in Malaysia and 37% in the Philippines (Luno, 2020). However, an Ergotron survey in the same year reported that 60% of Singaporean employees experienced decreased productivity due to poor home-office setups (Ergotron, 2020). McKinsey reported that Southeast Asia saw an acceleration in digital adoption across sectors. For instance, 60 million new digital consumers in Southeast Asia came online due to COVID-19. Some barriers were also cited. Many Southeast Asian countries faced challenges with internet connectivity and power supply stability, which could impact remote work productivity. And a World Economic Forum report highlighted

that the digital skills gap in Southeast Asia could hinder productivity gains from remote work (World Economic Forum, 2020) (World Economic Forum, 2023).

AI and Productivity

Artificial intelligence (AI) has significantly impacted productivity across various sectors and APO member economies, and its influence is expected to grow even more in the future. Since the release of ChatGPT by Open AI in November 2022, AI has been adopted in multiple areas of business and the trend has been growing rapidly (OpenAI, 2022).

Currently, the contributions of AI to productivity are of various types. First, automation of routine tasks is common. AI has automated many repetitive and mundane tasks, allowing employees to focus on more complex and creative work. For instance, AI-powered chatbots handle customer service inquiries, reducing the workload on human agents and improving response times. According to a report by McKinsey, automation could raise productivity growth globally by 0.8% to 1.4% annually. Second, AI could enhance decision-making. AI systems analyze vast amounts of data to provide insights that aid in decision-making. For example, in the healthcare sector, AI algorithms can predict patient outcomes and suggest treatment plans, leading to better patient care and operational efficiency. A study by Accenture found that AI could potentially double annual economic growth rates by 2035 by changing the nature of work and creating a new relationship between the man and the machine. Third, AI enhances personalization and customer engagement; it enables businesses to offer personalized experiences to their customers. E-commerce platforms use AI to recommend products based on user behavior, which increases sales and customer satisfaction. Amazon's recommendation engine, for instance, is responsible for 35% of its total sales. Fourth, predictive maintenance is also possible. In manufacturing, AI-driven predictive maintenance helps in anticipating equipment failures before they occur, thus reducing downtime and maintenance costs. General Electric (GE) uses AI to predict when its jet engines need maintenance, which has saved the company millions of dollars.

AI is also predicted to contribute to productivity in future across various channels. First, generative AI, such as GPT-4, can create content, write code, and even generate new product designs. This technology is expected to revolutionize creative industries and software development. Second, healthcare sector could benefit from AI. The future of AI in healthcare looks promising with advancements in diagnostics, personalized medicine, and robotic surgery. AI can analyze genetic information to provide personalized treatment plans, thereby improving patient outcomes and reducing healthcare costs. According to a report by PwC, AI could contribute up to USD15.7 trillion to the global economy by 2030, with healthcare being one of the major beneficiaries (PwC, 2021). A third area is smart manufacturing. AI will continue to enhance manufacturing processes through smart factories where machines communicate with each other to optimize production. This will lead to higher efficiency, lower costs, and reduced wastage. The World Economic Forum predicts that AI could increase labor productivity by up to 40% by 2035 (World Economic Forum, 2020). Fourth, the financial sector could also benefit from AI. In this sector, AI is expected to improve fraud detection, risk management, and customer service. AI algorithms can analyze transaction patterns to detect fraudulent activities in real time, protecting both consumers and financial institutions. A study by Deloitte suggests that AI could reduce financial crimes by up to 50% (Deloitte, 2021).

Although AI could contribute to enhance productivity, there are several challenges to be addressed. Job displacement is cited as the first challenge. While AI creates new jobs, it also has the potential

to eliminate others, particularly in routine task-oriented roles. A 2023 World Economic Forum report estimated that by 2027, 85 million jobs may be displaced by AI and automation, while 97 million new roles may emerge (World Economic Forum, 2020) (World Economic Forum, 2023). Data privacy and security concerns constitute the second challenge. The use of AI often requires large amounts of data, raising concerns about privacy and data security. In 2023, a major tech company faced a USD5 billion class-action lawsuit over allegations that its AI training practices violated user privacy. Third, algorithmic bias from hallucination is critical. AI systems can perpetuate or amplify existing biases if not carefully designed and monitored. In 2022, a large financial institution had to revise its AI-powered loan approval system after it was found to be disproportionately rejecting applications from minority communities. Fourth, implementation and integration challenges exist as the technology has not matured yet. Many organizations struggle with effectively implementing AI systems and integrating them with existing processes. A 2023 Gartner survey found that only 54% of AI projects make it from pilot to production, citing integration difficulties as a major hurdle (Gartner, 2023). Lastly, skills gap is critical. There is a growing demand for AI-related skills that the current workforce may not fully meet. According to a 2023 IBM report, 39% of companies cited limited AI expertise or knowledge as a barrier to AI adoption.

In conclusion, while AI has demonstrated significant potential to boost productivity across various sectors, it also presents challenges that need to be carefully addressed. As AI technology continues to evolve, its impact on productivity and the associated challenges will likely continue to be significant for businesses, policymakers, and researchers.

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METHODOLOGY

Measurement

Measuring productivity gains from digital workplace has been considered a tricky task, so much so that scholars have referred to a paradox called the Solow Productivity Paradox. It has posed challenges for many researchers since the late 1980s, particularly after the rapid adoption of IT applications. Brynjolfsson & Hitt (1998) and Jorgenson, Ho & Stiroh (2008) found that while productivity gains were 1–2% in some developed countries but more than that in developing countries.

The Solow Productivity Paradox (Solow, 1987), named after economist Robert Solow, refers to the observation that despite significant investments in IT, productivity growth in many economies did not increase as much as expected. Solow famously remarked in NY Times in 1987, “You can see the computer age everywhere but in the productivity statistics.” This paradox has been a subject of much debate and research in economics.

The theory behind the Solow Productivity Paradox (Solow, 1987) is based on the idea that technological advancements should lead to increased productivity. According to the Solow growth model, economic growth is driven by technological progress and capital accumulation. Therefore, investments in new technologies, such as IT, should result in higher output per worker. However, empirical studies have shown that the relationship between IT investment and productivity growth is not as straightforward as predicted by the theory. While IT investments have led to significant changes in the way businesses operate and interact with customers (Bloom et al. 2015), the resulting productivity gains have often been less than anticipated.

In practice, the Solow Productivity Paradox (Solow, 1987) has been evident in many industries and economies. For example, despite the widespread adoption of computers and software in offices, productivity growth has not always been significantly higher than in the pre-computer era. Similarly, investments in automation and robotics have not always resulted in substantial increases in manufacturing productivity.

Several factors have been cited as contributing to the Solow Productivity Paradox (Solow, 1987):

- (1) **Measurement issues:** It is possible that traditional productivity measures, such as output per worker, may not accurately capture the full benefits of IT investments. For example, IT may improve the quality of products or services, but these improvements may not be reflected in output measures.
- (2) **Time lags:** The full impact of IT investments may take time to materialize. It may take several years for businesses to fully adapt to new technologies and realize their productivity benefits.
- (3) **Complementarities:** IT investments may need to be combined with other factors, such as investments in human capital or organizational changes, to realize their full potential.

- (4) **Diminishing returns:** As businesses become more saturated with IT, the marginal returns to further investments may decline.

While the Solow Productivity Paradox (Solow, 1987) remains a topic of debate, researchers and policymakers have proposed several solutions:

- (1) **Improved measurement:** Develop new productivity measures that better capture the benefits of IT investments, such as measures of innovation or quality.
- (2) **Investment in human capital:** Ensure that workers have the skills and training necessary to effectively use new technologies.
- (3) **Organizational changes:** Implement organizational changes that facilitate the adoption (Bresciani, Ferraris & Del Giudice, 2021) and make use of new technologies, such as improving communication and collaboration.
- (4) **Policy support:** Provide policy support for research and development, education, and infrastructure investments that can promote technological progress.

Despite these efforts, challenges remain in addressing the Solow productivity paradox Solow (1987). It is difficult to measure the full impact of IT investments, as the relationship between technology and productivity is complex and multifaceted. Additionally, the pace of technological change continues to accelerate, making it difficult to keep up with the latest developments.

The Solow productivity paradox Solow (1987) highlights the complexities of measuring and understanding the relationship between technology and economic growth. While there is evidence that IT investments can lead to productivity gains, the full extent of these gains is often difficult to quantify. Addressing the Solow Productivity Paradox (Solow, 1987) requires a combination of improved measurement, investment in human capital, organizational changes, and policy support.

New Metrics of KPIs in Digital Workplaces

The rapid digital transformation sweeping across Southeast Asian economies is reshaping traditional workplace practices, and, more importantly, the way productivity is measured (OECD, 2019). Historically, key performance indicators (KPIs) have focused on tangible, easily measurable factors like hours worked, employee attendance, and production volumes. These metrics, while effective in more structured, industrial settings, often fall short in today's dynamic digital workplaces.

As businesses increasingly shift to remote work, embrace automation, and prioritize innovation, traditional KPIs are being replaced by new performance metrics that more accurately reflect the complexities of modern productivity. In this evolving landscape, businesses need to measure not just outputs, but also intangible factors like employee engagement, collaboration, digital agility, and innovation. This shift is particularly relevant in Southeast Asia, where countries are rapidly digitizing, with economies like the ROK, Malaysia, Indonesia, and Thailand becoming hubs for tech innovation and digital services.

This comparison highlights the transition from traditional to new KPIs, using real-world case examples from Southeast Asian workplaces to illustrate the need for more sophisticated, output-focused, and digitally aligned performance measures.

For instance, the emphasis is now on measuring task completion rather than hours worked OECD (2020), as seen in remote IT teams in the Philippines who are evaluated based on project milestones achieved. Similarly, employee presence is being replaced by engagement and collaboration metrics, as shown by a Singaporean marketing agency that tracks team participation in virtual meetings. These examples underscore how digital tools and new approaches to performance measurement are becoming critical to maintaining competitiveness in the region's rapidly evolving business environment.

Through this comparison and case-based exploration, it becomes clear that adopting these new KPIs not only enhances productivity measurement but also fosters a work culture that prioritizes innovation, collaboration, and sustainable value creation in the digital age.

Table 2 provides a comparison of traditional KPIs with new KPI metrics that better enhance the quality of productivity measurement in digital workplaces, particularly in Southeast Asian economies. This table reflects the shift from conventional productivity measures to more dynamic and holistic approaches that address the evolving nature of work in the digital age.

TABLE 2
COMPARISON OF TRADITIONAL AND NEW KPI METRICS.

Traditional KPI metrics	New KPI metrics for digital workplaces	Explanation
Hours worked	Output-based measurement (task completion rate)	In digital workplaces, focus shifts to completion of tasks or projects.
Employee attendance	Engagement and collaboration metrics	Physical presence is no longer as relevant in remote or hybrid environments.
Revenue per employee	Innovation and value creation	New KPIs assess contributions to innovation and long-term value creation, such as developing new products or processes.
Cost per unit produced	Automation utilization and efficiency gains	New KPIs track how efficiently automation is integrated, reducing manual processes.
Sales growth	Customer experience (CX) and digital touchpoints	KPIs now measure user interaction across digital touchpoints and improvements in the customer journey.
Project deadlines	Agility and flexibility (response to change)	New KPIs also assess how well adapt and handle evolving requirements, critical in fast-moving digital environments.
Error rates and defects	Continuous learning and improvement cycles	New KPIs highlight how quickly learn from mistakes and improve processes by continuous learning.
Production volume	Digital collaboration output	New KPIs evaluate how well use digital tools for collaboration and sharing knowledge.
Employee retention	Talent development and skill growth	New KPIs measure how well foster employee skill development and talent growth, essential in a digital economy
Profit margins	Sustainability and corporate social responsibility (CSR)	New KPIs measure a company's ability to contribute to sustainability and corporate social responsibility, alongside financial performance.

Source: Author.

Methodology

Theoretically, there are several methods. We can use DeLone & McLean (1992) and Davis (1989) to get a good picture of productivity. We have taken a two-pronged approach combining quantitative data (numbers) and qualitative data (insights).

Qualitative data has been collected to find out the gains but not supported extensively due to the limit of generalization: (1) Employee feedback is a popular method. This method conducts surveys or interviews to gather employee insights on how the digital workplace has impacted their work (Aral, Brynjolfsson & Wu, 2012). Does it make collaboration easier? Has communication improved? (2) Focus group discussions method facilitates discussions to understand how specific digital tools are being used and their impact on productivity. (3) Customer satisfaction survey method questions if the digital workplace affects how one interacts with clients (e.g., faster response times), track customer satisfaction to see if there has been an improvement. Among other methods, these methods have been widely adopted in the early stage of IT adoption to find out insights of the investment and helpful to sketch the big picture of productivity which could be helpful for further research.

Quantitative data, collected through various methods, are widely used to find out productivity gains more precisely, in spite of the difficulty of research design and the cost: (1) Track time spent on tasks could possible that many digital tools have built-in time tracking features. (2) Comparison of tasks method compares pre-digital workplace task completion times to post-implementation times. (3) Output measurement focuses on the volume of work completed within a timeframe (this is most commonly selected by researchers). This method asks if teams completed more projects or reports after the digital tools were introduced. (4) Error reduction rates are also a useful measure. Certain digital tools can help streamline processes and reduce errors, leading to higher quality work, so researchers track error rates before and after to see if the digital workplace has improved accuracy. (5) Employee satisfaction surveys are also widely adopted, which include questions about perceived improvements in efficiency or workload after the digital workplace rollout. (6) Cost savings approach is the most commonly adopted. This method questions if the digital workplace eliminated the need for physical resources (e.g., paper, printing) that led to cost savings.

There are some additional considerations to decide which method is to be selected. These are:

- (1) **Setting clear goals beforehand:** Researchers need to define what “productivity” means in the context of digital workplace initiative. Is it faster turnaround times, increased collaboration, or cost savings? This point leads the direction of IT investment.
- (2) **Time series:** Researchers need to track data over time. To find out meaningful results, researchers do not rely on a single snapshot and instead monitor metrics over a period to see if trends emerge.
- (3) **External factors that could distort the observations:** Did any other changes occur around the same time as the digital workplace rollout that might have impacted productivity?

There are several challenges to be considered:

- (1) **Multiple factors:** Productivity is influenced by various factors, making it hard to isolate the impact of digital tools alone.

- (2) **Subjectivity:** Employee perceptions of productivity can differ from objective data.
- (3) **Long-term impact:** Productivity gains may take time to materialize and require sustained use of digital tools.

By combining these methods, researchers can build a strong picture of how the digital workplace has impacted an organization's productivity. It is important to remember that the most effective approach will depend on specific research goals and the digital tools implemented. Throughout this research we see how researchers carry out measurements.

Research Framework

There is not a single universally accepted research framework to measure productivity gains from digital workplaces. However, there are several established frameworks that researchers use, and studies often adapt these frameworks to their specific needs. Table 3 shows that a variety of approaches to measure productivity have been developed so far.

TABLE 3

APPROACHES TO MEASURING PRODUCTIVITY.

Key performance indicators (KPIs)	Track specific metrics related to business processes before and after digitalization. Examples: time saved, error reduction, output increase
Return on investment (ROI)	Calculate the financial benefits of digitalization versus its costs. Consider both direct and indirect savings.
Employee productivity metrics	Measure output per employee. Track time spent on tasks pre- and post-digitalization.
Customer satisfaction	Survey customers to gauge improvements in service quality or delivery speed.
Process efficiency	Analyze workflow improvements. Measure reduction in manual interventions.
Data quality and accessibility	Assess improvements in data accuracy and availability. Measure time saved in data retrieval and analysis.
Innovation metrics	Track new products or services enabled by digitalization. Measure time-to-market for new offerings.
Operational costs	Monitor changes in operational expenses. Assess reductions in material usage or waste.
Scalability	Measure the ability to handle increased workload without proportional cost increase.
Competitive advantage	Analyze market share changes. Compare your digital capabilities to industry benchmarks.

Among them, some approaches have been recognized:

- (1) **DeLone and McLean Information Systems Success Model (1992):** This framework focuses on six key dimensions such as system quality, information quality, use, user satisfaction, individual impact, and organizational impact. It can be adapted to assess how a digital workplace impacts productivity through user satisfaction and its influence on individual and organizational outcomes.
- (2) **Work Facilitation Model (WFM) by Bailey & Choi (1983):** This framework focuses on how technology influences three work facilitation categories like information acquisition, interaction, and decision-making. Studies can use the WFM to see if a digital workplace improves access to information, communication, and ultimately decision-making speed, leading to productivity gains.
- (3) **The Technology Acceptance Model (TAM) by Davis (1989):** This framework examines factors affecting user acceptance of technology. Studies can use TAM to see if employees find the digital workplace tools user-friendly and useful, which can impact adoption rates and indirectly contribute to productivity gains.

Based on the established framework, while specific metrics may vary, some common ones used to assess productivity gains in a digital workplace include (1) output per employee. This could be the number of tasks completed, revenues and sales generated, or projects finished, which is widely adopted in many research studies. (2) Time spent on tasks. Digital tools can track time spent on specific tasks, helping identify areas for improvement. (3) Meeting duration and frequency. Efficient digital communication can reduce unnecessary meetings, freeing up productive time. (4) Employee engagement surveys. These surveys can gauge employee sentiment toward the digital workplace and its impact on their work. (5) Customer satisfaction metrics. Improved collaboration and communication in a digital workplace can lead to faster response times and better customer service.

Since this research attempts to measure productivity gains, productivity ratio analysis is also required to be considered. This framework focuses on measuring output relative to input. Here are some relevant ratios: (1) Labor productivity. Total output (goods/services) divided by total labor hours. (2) Multi-factor productivity considers all inputs (labor, capital, materials) to measure overall efficiency gains. (3) Revenue per employee refers to total revenue divided by the number of employees. (4) Total factor productivity (TFP) considers all inputs (labor, capital, and technology) and assesses the overall efficiency of production. It accounts for technological advancements and improvements.

These ratios can show whether the digital workplace has led to employees producing more output in the same amount of time or with fewer resources. Among those productivity ratios, we choose only one indicator: labor productivity, which refers to economic output (gross domestic product, GDP) per hour worked. This indicator is a commonly used productivity measure and the most consequential determinant of long-run economic and social growth.

Two input factors affect labor productivity. First, the amount of capital per worker, which is called capital deepening if increased. Capital can be tangible, such as machines or infrastructure, or intangible like AI and R&D investment. Workers could be more productive if they are equipped

with PCs, connected to the internet, and supported by infrastructure, all else being equal. The second is the human factor. Education, morale, and accumulated experience could lead to better productivity. TFP is measured as a residual after subtracting capital and human factors.

In addition to analyzing labor productivity, we consider the balanced scorecard approach, which uses a combination of quantitative and qualitative metrics to evaluate the digital workplace across four different perspectives: (1) Financial. Track cost savings from automation, reduced need for physical office space, etc. (2) Customer. Measure improvements in customer satisfaction due to faster response times or better collaboration. (3) Internal Processes. Quantify efficiency gains through metrics like task completion times or project turnaround times. (4) Learning and Growth. Assess employee satisfaction with the digital tools and their impact on skills development. This approach helps build a holistic picture of the digital workplace's impact on productivity as well as providing insight to entities to consider more investment in the digital workplace.

Based on those approaches to measure productivity, this report uses a qualitative approach and quantitative methods together due to the lack of empirical research on the digital workplace in this region. First, we try to identify productivity trends since 2000, which result from digitalization, including the digital workplace, rigorously due to the rapid penetration of the internet. Second, we delve into the results of digital workplace projects from various cases qualitatively and quantitatively based on the reports of 10 national experts. Third, we can identify some lessons learned from those country reports.

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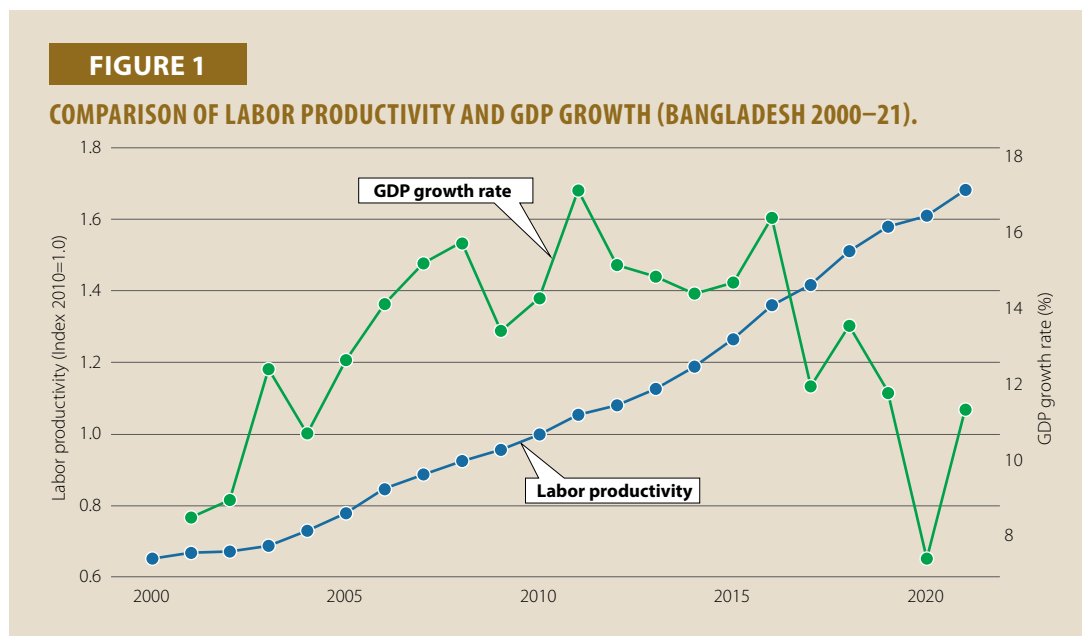
COUNTRY REPORTS

In today's rapidly evolving digital landscape, the measurement of productivity within digital workplaces has become a critical focus for organizations worldwide. This case study delves into the experiences of ten APO member economies (Bangladesh, India, the ROK, Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Thailand, and Turkiye) to explore innovative strategies and methodologies for enhancing the quality of productivity measurement in digital environments.

Asia, with its diverse economic landscapes and varying levels of technological adoption, provides a unique and rich context for examining productivity in digital workplaces. The region's dynamic growth and increasing integration into the global digital economy underscore the importance of accurate and effective productivity measurement tools. By analyzing the approaches and outcomes from these ten countries, this study aims to identify best practices, common challenges, and potential solutions that can be applied across different organizational settings.

The findings from this case study are expected to offer valuable insights for policymakers, business leaders, and researchers who are striving to optimize productivity in digital workplaces. Through a comprehensive evaluation of current practices and the identification of innovative techniques, this study seeks to contribute to the ongoing discourse on productivity enhancement in the digital age.

Bangladesh



Labor productivity (blue line) has shown steady and consistent growth since 2000. Labor productivity, which measures output per hour worked, demonstrates a steady upward trend throughout the entire period, indicating continuous improvements in the efficiency of workers.

- **Gradual growth pre-2010:** From 2000 to 2010, labor productivity grew slowly, indicating incremental improvements in productivity. This could be due to gradual investments in technology, education, or industrialization.
- **Faster growth post-2010:** After 2010, labor productivity rose at a faster rate, particularly between 2015 and 2021. This might reflect structural changes, modernization, or technological advancements in key sectors like manufacturing, services, or agriculture.
- **Productivity growth during 2020–21:** Despite the economic disruption caused by the COVID-19 pandemic in 2020, labor productivity continued to rise. This could be due to shifts toward more productive sectors or better use of resources during the pandemic.

Additionally, GDP growth (green line) shows a different trend. Unlike labor productivity, GDP growth is far more volatile, reflecting macroeconomic fluctuations. GDP growth rates oscillate over time, with periods of rapid growth followed by slower or even negative growth.

- **High growth periods (2003–07, 2016–19):** These periods stand out for particularly high GDP growth, reaching around 7-8%. These surges could be driven by industrial expansion, exports, foreign investment, or economic reforms.
- **Sharp slowdown in 2020:** GDP growth dropped sharply in 2020 due to the global impact of COVID-19, falling below zero. The recovery in 2021 was apparent but still below pre-pandemic levels.

Labor productivity and GDP growth move independently. There is no direct, year-by-year correlation between labor productivity and GDP growth. For instance, labor productivity grows steadily, while GDP growth fluctuates significantly. This suggests that GDP growth is influenced by factors beyond labor efficiency, such as investment, external trade, and fiscal policy.

- **2000–10:** Labor productivity grew slowly, while GDP growth fluctuated, with both moderate and high-growth periods. This divergence indicated that GDP growth was more likely driven by other factors such as capital investment or external demand rather than productivity gains alone.
- **2010–20:** While GDP growth experienced both highs and lows, labor productivity steadily accelerated. This indicated a structural improvement in worker efficiency that may not have immediately reflected in GDP, possibly due to lags in how productivity improvements impact overall economic output.
- **Post-pandemic realignment (2020–21):** The sharp drop in GDP growth due to the pandemic contrasted with continuous labor productivity improvements. This may reflect productivity gains from sectors less affected by lockdowns or a reduction in low-productivity activities, such as informal work, which weren't captured as sharply in GDP.

Implications

Steady Productivity Improvements: The continuous rise in labor productivity is a good sign of long-term structural improvements in the economy. It indicates that Bangladesh is moving toward more efficient production methods and that workers are becoming more productive,

potentially due to technological advancements, better education, or sectoral shifts to more productive industries.

GDP growth sensitivity: GDP growth is more susceptible to short-term economic conditions, external shocks, or policy changes. The volatility suggests that factors such as global market conditions, government policies, or investment inflows play a significant role in Bangladesh's economic performance.

While labor productivity in Bangladesh has shown steady growth over the past two decades, GDP growth has been more volatile. This divergence highlights the complexity of economic growth: productivity improvements are necessary for long-term economic stability, but GDP is also influenced by external factors like global demand, investments, and economic policy. The resilience in labor productivity during the pandemic suggests a maturing economy, even as GDP faced significant challenges during the same period.

The Growth of Bangladesh's Digital Economy

The rise of the digital economy has been a major contributor to Bangladesh's economic growth in recent years. Government initiatives aimed at digitizing public services have significantly enhanced efficiency. For example, ministries and government departments have digitized public services, saving citizens both time and money. In particular, the telecommunications sector has been a leader in this digital transformation, with performance management systems improving employee productivity and reducing costs. However, the digital transformation has also introduced challenges, such as the digital divide, particularly in rural areas where many lack the skills and resources needed to fully embrace digital tools. Closing this gap through targeted training programs and leadership support is essential.

Sector-specific Impact of Digital Transformation

Various sectors in Bangladesh have experienced specific impacts from the integration of digital technologies:

- **Telecommunications:** The telecommunications industry has effectively utilized digital tools to improve productivity, sustainability, and operational efficiency. Automated digital systems have replaced manual processes, reducing errors and costs.
- **Ready-made garment (RMG) industry:** This industry has seen significant improvements in human resource management due to digital tools. These tools have led to better employee performance and retention, demonstrating the direct relationship between digital transformation and productivity.
- **Public sector:** The digitization of public administration has led to greater accountability and transparency. By digitizing human resource practices and performance management systems, the public sector has improved its service delivery and overall efficiency.

However, despite the advancements, Bangladesh still lacks a 'Digital/Smart Workplace Guideline.' Developing such a guideline would help ensure uniformity and effectiveness in digital workplace setups, optimizing productivity and regulation.

Regulatory Framework Governing Digital Workplaces

Several laws and policies support the growth of digital workplaces in Bangladesh, but they also reveal significant gaps:

- **Information and Communication Technology (ICT) Act of 2006:** This act provides a legal framework for electronic transactions and the security of digital documents, aiming to build trust in digital activities. However, it does not cover workers' rights in digital workplaces, particularly for remote or gig workers.
- **Cyber Security Act 2023:** This law was designed to protect data and combat cybercrime, but it lacks specific provisions for protecting digital workers or regulating remote working conditions.
- **Right to Information Act of 2009:** Though this act promotes transparency in public sector administration, it does not apply extensively to the private sector, leaving a regulatory gap in the oversight of private digital workplaces.
- **Post COVID-19 National ICT Roadmap (ICT Division, 2020):** Launched by the ICT Division in 2020, this roadmap outlines strategies to strengthen the ICT infrastructure and promote digital education, internet access, and digital literacy in the wake of the pandemic. It also emphasizes the need for a strong legal framework to protect digital assets and promote sustainable development in the digital economy.
- **ICT Master Plan 2041 (Dhaka District Commissioner's Office, 2023):** This long-term strategy sets out to transform Bangladesh into a knowledge-based, innovation-driven digital economy by 2041. It aligns with national goals such as the Perspective Plan of Bangladesh 2021-2041 and the Eighth Five-Year Plan July 2020- June 2025, with an emphasis on job creation and digital infrastructure.

Despite these laws, the regulatory framework remains incomplete, particularly when addressing the rights, protections, and performance standards for digital workers. As digital workplaces expand, comprehensive legislation is essential for ensuring fairness and equity for all workers.

Case Study 1: Union Digital Centers

The Union Digital Centers (BIGD, 2022) (UDCs) are a government initiative aimed at providing digital services to rural areas. Established at the local level, these centers have become a crucial part of the digital transformation process, especially in underserved regions. There are now over 8,280 UDCs across the country, offering more than 300 services, including paying utility bills, applying for government documents, accessing health advice, and registering for exams. These centers also play a role in promoting entrepreneurship, particularly among women and youth.

Key achievements of UDCs include:

- **Women empowerment:** 25% of UDC service recipients are women, and these centers have helped foster women's entrepreneurship.
- **Migrant workers:** UDCs have assisted over 2.2 million migrant workers, including 40,000 female workers, by offering online registration for employment.
- **Financial inclusion:** Through mobile banking services, UDCs have helped more than 78,000 individuals, most of whom are women, gain access to financial services.

The UDCs exemplify a successful Public-Private-People's Partnership (PPPP) model, empowering local communities and contributing significantly to rural development.

Case Study 2 (E-Nothi and D-Nothi Systems): Revolutionizing Public Administration

The E-Nothi (The Daily Star, 2023) and D-Nothi systems have been critical in digitizing government operations. These platforms allow for the digital management and tracking of official government documents, which has significantly sped up the decision-making process. The systems have also improved transparency by reducing paperwork and allowing for real-time access to files. Since their implementation, these systems have been adopted by more than 19,000 government offices and have been used by over 150,000 officials.

Some key benefits include:

- faster file processing;
- reduced need for physical file storage; and
- enhanced accountability and transparency in government offices.

By enabling paperless governance, the E-Nothi (The Daily Star, 2023) and D-Nothi systems align with Sustainable Development Goals (SDG) 16.6, which promote effective and transparent institutions.

Case Study 3 (Mobile Financial Services): The Case of bKash

bKash (bKash, 2023), Bangladesh's largest mobile financial service provider, has transformed the financial landscape by providing easy access to financial services for millions of people, especially those in rural areas who do not have access to traditional banking. With over 70 million registered users, bKash (bKash, 2023) has revolutionized transactions, allowing users to send money, pay bills, and receive remittances through their mobile phones.

During the COVID-19 pandemic, bKash (bKash, 2023) played a vital role in distributing financial aid to people below the poverty line, further showcasing the importance of mobile financial services in fostering financial inclusion and resilience in Bangladesh's economy.

Challenges in Measuring Productivity in Digital Workplaces

Productivity in digital workplaces is challenging to measure, as traditional metrics do not always apply. The shift to digital tools has enabled faster communication and collaboration, but it also requires a new framework for evaluating performance. Key challenges include:

- lack of clear productivity metrics for remote and digital work;
- difficulties in assessing the impact of digital tools on employee engagement and satisfaction; and
- the need for more standardized methods for evaluating productivity in sectors such as telecommunications, garment industries, and public administration.

Government training initiatives have started to address these challenges by introducing innovative methods for gauging productivity in digital settings.

Future Outlook: ICT Master Plan 2041

The ICT Master Plan 2041 (Dhaka Deputy District Commissioner's Office, 2023) sets ambitious goals for the next two decades, focusing on making Bangladesh a global hub for ICT services. The plan aims to create 2 million jobs by 2041, driven by enhanced digital literacy, better internet infrastructure, and increased investment in technology. The master plan emphasizes the importance of:

- developing a highly skilled workforce;
- encouraging entrepreneurship and innovation; and
- expanding high-speed internet access across the country.

These initiatives aim to position Bangladesh as a leader in the global digital economy, contributing to its goal of becoming a developed nation by 2041.

Recommendations

Develop a digital workplace framework: Bangladesh lacks a Digital/Smart Workplace Guideline. Establishing clear guidelines will standardize digital practices and set expectations for productivity across sectors.

Invest in digital literacy: A significant portion of the workforce, especially in rural areas, lacks digital skills. Targeted training programs will enable employees to effectively use digital tools, improving overall productivity.

Implement outcome-based KPIs: Shift from traditional time-based metrics to outcome-based KPIs such as task completion rates. This will encourage efficiency and focus on results rather than hours worked.

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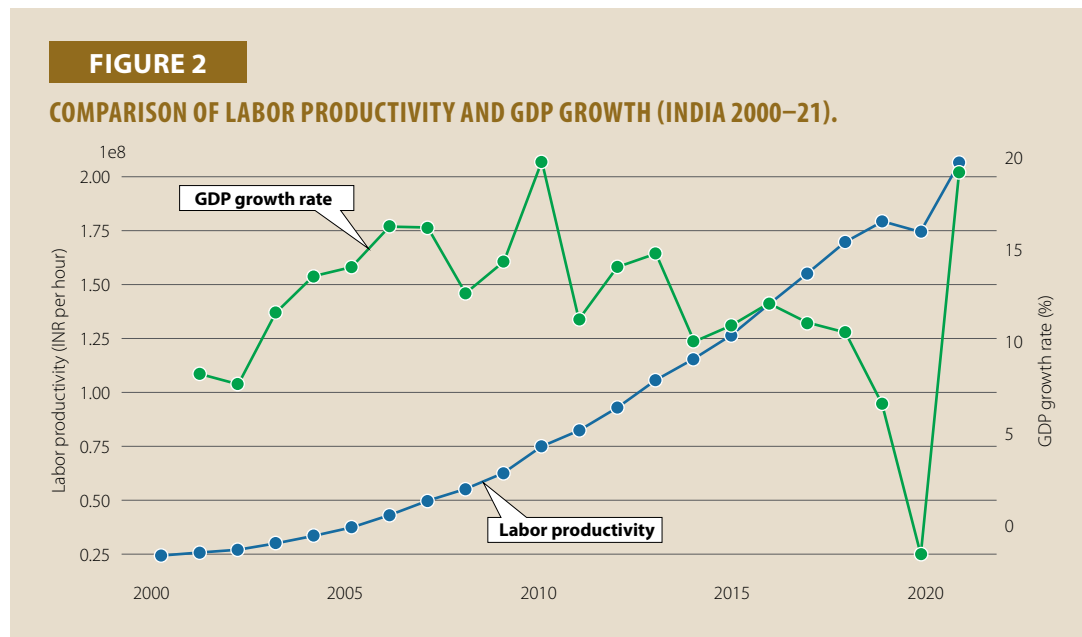
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India



Labor productivity (red line) shows steady growth. Labor productivity in INR per hour shows a gradual and sustained upward trajectory. This steady rise indicates that India's workforce has been generating more output per hour worked over time, reflecting improvements in technology, education, skills, and more efficient use of resources.

Post-2003 acceleration: From 2003 onwards, the growth in labor productivity became more pronounced. This acceleration likely corresponded with economic reforms, industrial expansion, technological advancements, and the adoption of more efficient production processes. It shows that India's productivity improvements were not just incremental but picked up momentum in the mid-2000s.

Sustained productivity growth during economic downturns: Despite economic downturns, such as during the 2008 financial crisis and the 2020 COVID-19 pandemic, labor productivity continued to increase. This suggests that sectors driving productivity were either more resilient or that businesses focused on improving efficiency, such as through automation or workforce optimization, even during tough economic times.

In terms of GDP growth (green line), trends show high volatility. In contrast to labor productivity, GDP growth rates exhibit significant volatility. Periods of rapid expansion (2003-2007, 2010-2017) are followed by slower growth or contractions (2008-2009, 2020). This volatility reflects how GDP growth is more sensitive to short-term factors like global market conditions, domestic policies, and external economic shocks.

Comparing labor productivity with GDP growth, the most striking difference between the two metrics is that labor productivity shows a steady upward trend, whereas GDP growth is much more volatile. This suggests that while India's workforce has become more efficient over time, overall economic growth has been influenced by external factors like global market conditions, domestic economic policies, and crises like the pandemic or financial downturns.

- From 2008 to 2009 (Financial Crisis), labor productivity continued to rise during the global financial crisis, while GDP growth slowed sharply. This indicates that certain sectors maintained or improved efficiency, even as overall economic output faltered.
- In 2020 (Pandemic), similarly, during the COVID-19 pandemic, labor productivity kept rising, while GDP growth contracted sharply. This suggests that the pandemic had a disproportionate impact on lower-productivity sectors (like informal labor), while higher-productivity sectors (e.g., technology, finance) managed to stay afloat or even thrive by adopting remote work, automation, or streamlined operations.
- There are also periods when labor productivity and GDP growth rise together, such as from 2003 to 2007 and from 2010 to 2017. This indicates that during these periods, both overall economic activity and worker efficiency were improving in sync, leading to strong overall economic performance.

Productivity growth independent of short-term GDP fluctuations means that the steady rise in labor productivity suggests underlying structural improvements in India's economy. These could include:

- technological advances, including the adoption of technology, automation, and better production techniques across industries;
- sectoral shifts like the movement of labor from low-productivity sectors (e.g., agriculture) to higher-productivity sectors (e.g., manufacturing and services); and
- improvements in workforce education and skills that enhance productivity.

In contrast, GDP growth's volatility shows that the broader economy is highly sensitive to external factors such as global demand, trade, and crises. Even if the workforce becomes more productive, the overall economy can still experience slowdowns or contractions due to these external factors.

While India's labor productivity has consistently increased, indicating long-term structural improvements in workforce efficiency, GDP growth has been much more volatile. This suggests that while worker productivity is an important factor in economic growth, overall GDP is influenced by a wider range of factors, including global market conditions, policy decisions, and external shocks like the 2008 financial crisis and the 2020 COVID-19 pandemic. The resilience of labor productivity during downturns hints at the adaptability and efficiency improvements in India's economy, even when broader economic conditions are challenging.

History of Digital Workplace Efforts in India

Digital transformation in India took off in the early 2000s with the growth of the IT and BPO sectors. Major digital workplace milestones are listed below:

- **2005–10:** Large organizations implemented Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems. Core Banking Solutions (CBS) were introduced, particularly in the banking sector.
- **2010–15:** Cloud computing and mobile technologies revolutionized work flexibility and mobility.

- **2015–20:** Government initiatives such as “Digital India” and widespread smartphone adoption fueled a digital transformation boom.
- **2020 and beyond:** The COVID-19 pandemic accelerated digital adoption as organizations were forced to adapt to remote work and online collaboration tools.

The Indian government’s role has been pivotal in driving this transformation, promoting policies and initiatives to digitize both urban and rural areas.

Government Initiatives and Their Impact on Productivity

The Government of India has played a crucial role in advancing digitalization. Major initiatives include the following:

National e-Governance Plan (NeGD): This initiative, under the Ministry of Electronics and Information Technology (MeitY), supports the implementation of e-governance systems across the country. It lays the groundwork for digital workplaces by standardizing processes and offering templates for effective governance.

Digital India Act (Ministry of Electronics and Information Technology, 2023): This upcoming legislation aims to replace the Information Technology Act of 2000, creating a more robust legal framework for modern digital economies. The act will regulate emerging technologies like AI and blockchain, fostering a more secure and regulated digital ecosystem.

Other notable projects include the GST Portal, which has simplified tax compliance and enhanced business operations; Aadhaar, the world’s largest biometric identification system; DigiLocker, which allows for secure document storage; and the Unified Payments Interface (UPI), which has revolutionized cashless transactions. Each of these initiatives has played a significant role in boosting workplace productivity. Emphasis on skilling policies has been introduced, including the Digital Literacy Curriculum in Schools, Teacher Training, NSDC, and ISRO.

Economic Growth and Productivity Trends in India

The report provides a detailed analysis of India’s economic growth and its correlation with digital adoption. The main economic indicators used to measure productivity include GDP per person employed, labor productivity per hour worked, and especially internet penetration.

GDP per person employed (2000–23): The steady rise in GDP per person employed from approximately USD 10,000 in 2000 to around USD 23,150 in 2023 reflects improved labor productivity. Economic reforms, technological adoption, and digital workplace tools contributed to this upward trend, even accounting for the slight dip caused by the COVID-19 pandemic.

GDP in PPP terms (2000–23): India’s GDP (PPP) grew from USD 2.2 trillion in 2000 to over USD 14 trillion by 2023, illustrating the country’s rapid economic expansion. Digital adoption, infrastructure investment, and the rise of the services and IT sectors were major contributors.

Labor productivity per hour (2000–18): Labor productivity tripled from USD 3 in 2000 to USD 9 in 2018, with the biggest growth spurts occurring post-2010, driven by digitalization, automation, and better labor policies. This highlights the increasing efficiency of the workforce as digital tools and processes became widespread.

Internet users (2000–23): The number of internet users (IAMAI, 2023) increased from 7 million in 2000 to 821 million in 2023, showing exponential growth. The availability of affordable mobile data plans and smartphones played a key role in driving internet penetration, which in turn enhanced workplace productivity by enabling real-time collaboration and remote work.

Methodology for Measuring Productivity in Digital Workplaces

The research employs a mixed-methods approach, combining quantitative and qualitative analyses. Key metrics include GDP per employed person, GDP (PPP), and labor productivity per hour (Statista, 2023). Additionally, the study examines the growth in internet users (IAMAI, 2023), as digital infrastructure is a crucial driver of productivity.

Quantitative analysis: The study focuses on labor productivity growth and GDP trends over time, particularly from 2000 to 2023. It correlates the rise in digital tools with improvements in workplace efficiency, using metrics like labor output and the purchasing power parity indicator.

Qualitative analysis: Case studies of Indian organizations, along with feedback from surveys conducted with IT managers and digital officers, provide insights into how digital tools are transforming workplace processes.

Survey Findings: Digitalization's Impact on Workplace Productivity

The study conducted a survey among digital officers and IT managers in India to assess how digital tools have impacted productivity. The survey focused on key areas such as key performance indicators (KPIs), return on investment (ROI), employee productivity, and process efficiency.

Key findings include:

- **Improved efficiency:** Respondents reported a reduction in the time required to complete key business processes, with most attributing this to the elimination of manual tasks and the automation of workflows.
- **Increased employee productivity:** Digital tools improved task management, reduced repetitive tasks, and enhanced time management, allowing employees to complete their work more quickly and efficiently.
- **Enhanced collaboration:** Digital tools facilitated better communication and coordination, particularly in hybrid and remote work environments.
- **Operational costs:** Digitalization reduced overall operational costs, especially through automation and the use of online systems that minimized the need for physical infrastructure and resources.
- **Challenges:** Some respondents pointed to challenges such as the skill gap, system bugs, and the difficulty in integrating digital systems across departments.

Case Studies: Digital Interventions Enhancing Workplace Productivity

The report presents multiple case studies from key industries, each illustrating how digital interventions have transformed productivity in Indian organizations:

- **Goods and Services Tax (GST):** The implementation of the GST portal digitized tax filing, reducing errors and manual processes. It also promoted the adoption of ERP systems, leading to more streamlined business operations and improved supply chain efficiency.
- **Flipkart (Flipkart Stories, 2023):** The e-commerce giant used AI-driven supply chain optimization to forecast demand more accurately and automate warehouse processes, resulting in faster delivery times and reduced operational costs.
- **Infosys:** A digital learning platform (Lex) helped upskill over 300,000 employees in emerging technologies, enabling the company to meet client demands and retain talent.
- **Tata Motors:** The integration of connected vehicle technology and predictive maintenance solutions reduced vehicle downtime and lowered maintenance costs, improving operational efficiency and customer satisfaction.
- **HDFC Bank (Pangrow, 2023):** The adoption of biometric authentication, AI chatbots, and digital payments helped the bank increase customer satisfaction and reduce reliance on physical branches, contributing to significant cost savings.
- **Aditya Birla Capital (Aditya Birla Capital, 2023) Ltd (ABCL):** During the COVID-19 pandemic, ABCL accelerated its digital transformation, implementing AI and automation tools to ensure business continuity and enhance employee productivity while working remotely.

Digitalization and Sustainability in the Workplace

The document emphasizes that digital workplaces not only improve productivity but also contribute to sustainability by reducing operational costs and environmental footprints. Remote work, for instance, reduces the need for physical office space and commuting, cutting down on energy consumption and carbon emissions.

Digital workplaces align with the “People, Planet, Profit” framework, as they improve employee well-being, reduce resource use, and enhance organizational profitability. By integrating digital tools, businesses can streamline operations while also reducing their impact on the environment.

Conclusion: Challenges in Digital Workplace Productivity Measurement

While digitalization has clearly contributed to productivity gains, measuring these improvements accurately is complex. Traditional productivity metrics like output per worker or GDP per hour worked may not fully capture the efficiencies created by digital tools.

Studies suggest a need for new metrics that consider the qualitative aspects of digital workplaces, such as improved collaboration, employee satisfaction, and flexibility. Moreover, measuring the indirect benefits of digital tools, such as reduced errors and faster decision-making, requires more nuanced assessment methods.

Studies recognize that digital workplaces in India have led to substantial productivity improvements, largely driven by technological adoption, government initiatives, and corporate investment in digital tools. However, there are challenges in measuring these gains and ensuring that all employees are equipped to handle the shift to digital work.

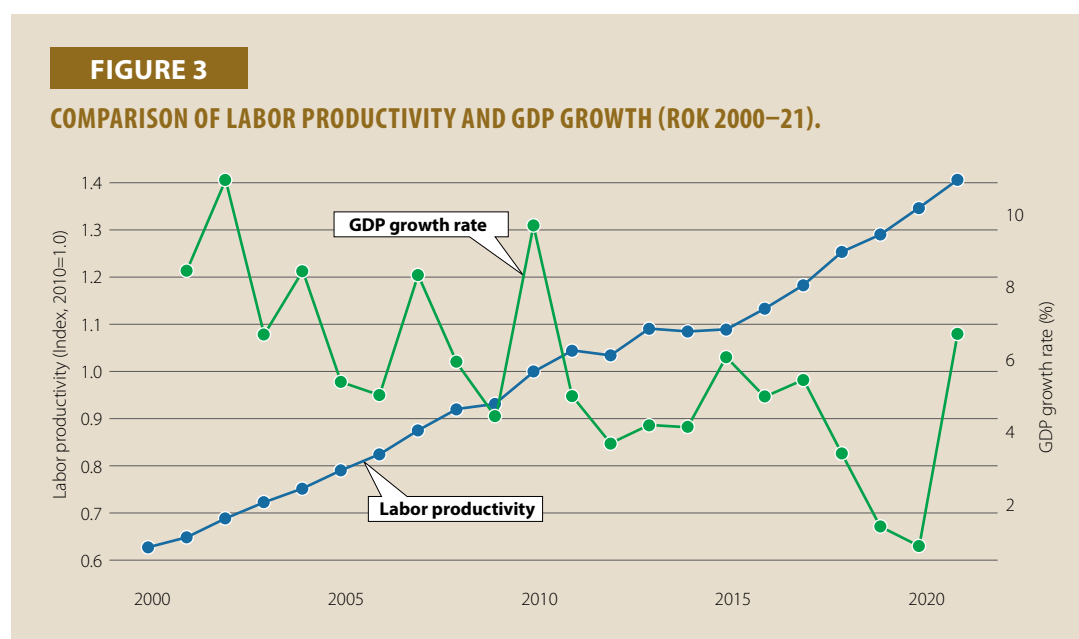
Key Recommendations

- **Ongoing Investment in Digital Tools:** Organizations should continue to invest in digital infrastructure, particularly in sectors like IT, manufacturing, and finance, where digital tools can significantly enhance productivity.
- **Skilling and Reskilling:** The government and private sector should collaborate on skilling initiatives to address the digital skill gap and ensure that employees are prepared for the demands of a digital economy.
- **Balanced Digitalization:** While digital tools can enhance productivity, organizations should also consider employee well-being and the societal impacts of digital work, such as the potential for increased stress or burnout.

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ROK



Labor productivity (blue line) shows consistent and strong growth: Labor productivity, measured as output per hour worked, shows a steady and upward trend throughout the 2000–2021 period. This indicates that Korean workers became significantly more efficient over time, with each hour of work producing more economic value.

Faster growth post-2010: From 2010 onward, the rate of productivity increase accelerates. This can be attributed to several factors, such as advancements in technology, industrial modernization, and shifts toward high-productivity sectors like technology and high-end manufacturing.

Resilience during crises: Notably, during the global financial crisis (2008–2009) and the COVID-19 pandemic (2020), labor productivity continued to rise despite GDP growth falling. This suggests that during economic downturns, businesses and sectors that were still operating became more efficient, potentially through cost-cutting, better resource utilization, or shifting toward higher-value activities.

However, GDP growth (green line) shows volatility. Unlike labor productivity's steady rise, GDP growth in The ROK is volatile, reflecting short-term economic shocks and recoveries. This volatility is seen in sharp declines during the 2008–2009 financial crisis and the 2020 pandemic, with rapid recoveries in the subsequent years.

The relationship between productivity and GDP represents productivity as a long-term driver of GDP. Labor productivity is a key determinant of long-term economic growth. The ROK's steady rise in productivity suggests that the economy's potential output increased over time. When productivity rises, each worker generates more output, which directly supports GDP growth. This long-term improvement is critical in ensuring that the economy grows sustainably.

Labor productivity has been a key factor in the ROK's long-term economic growth, driving GDP expansion through improved efficiency in the workforce. While GDP growth is more volatile and

subject to external shocks, labor productivity has shown consistent upward momentum, reflecting deep structural improvements in the ROK's economy. This steady rise in productivity, particularly in high-value sectors, has allowed the ROK to maintain growth during good times and mitigate the impact of economic downturns. Overall, labor productivity's positive impact on GDP highlights the ROK's transformation into a highly productive, technologically advanced economy.

Since 2000, labor productivity in the ROK has grown but remains below the OECD average. The country's growth challenge has shifted from accumulating physical and human capital to boosting productivity through structural changes. To address this, the ROK must reconsider the strategies that fueled its rapid economic rise and be open to necessary adjustments. Successful adaptation could turn these challenges into opportunities.

Historically, the ROK's strong labor productivity growth (7.4% from 1980-99 and 4% from 2001-12) helped close the productivity gap. This sustained growth also led to strong wage increases, better working conditions, and reduced long working hours. The labor market became more inclusive, with the share of low-income workers dropping from 17% in 2006 to 13% in 2019, while the gender pay gap narrowed from 39.5% in 2010 to 32.5% in 2019, although both figures remain above the OECD average.

Despite progress, the ROK's productivity still lags behind most advanced economies and the OECD average. One reason is the mismatch between the skills in the workforce and business needs, particularly in technology-intensive sectors. Although the ROK has a high rate of tertiary education (69.8% of 25-34-year-olds compared to the OECD average of 45.6%), these skills are not fully utilized in the market. For example, the ROK has a relatively low share of adults excelling in problem-solving in technology-rich environments compared to other innovation leaders like Finland, Japan, and Germany. In 2018, the ROK also had the second-highest rate of adults failing the ICT test in the OECD Survey of Adult Skills, highlighting a skills gap in the labor force.

Digital Transformation in the ROK

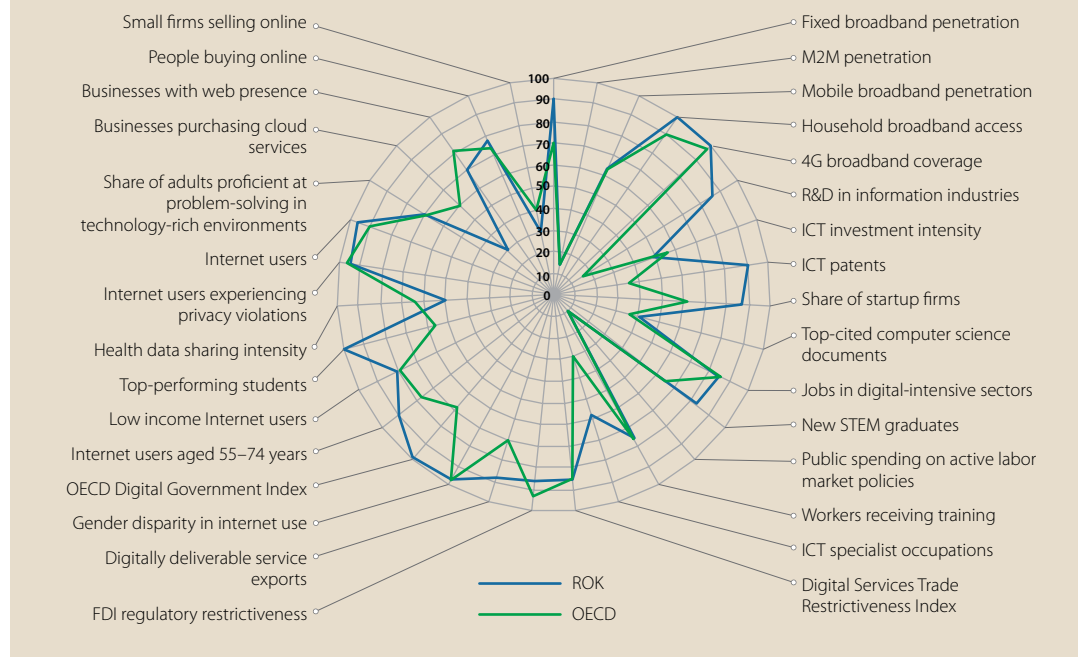
The ROK has established itself as a global leader in digital transformation, becoming the first country to roll out 5G technology on a large scale in 2019. The government's "5G+" strategy aims to integrate 5G into critical sectors like smart cities, healthcare, and manufacturing, positioning 5G as a backbone for innovation in these industries. By September 2024, 5G subscriptions accounted for 28% of all mobile users, surpassing regional and global averages.

The ROK performs exceptionally well in key digital indicators, such as the number of ICT patents, digital governance, and broadband penetration. The country has the highest share of fiber-optic broadband among OECD nations, with 86.6% of its fixed broadband subscriptions being fiber-based. This high-speed infrastructure supports advanced digital technologies, enabling seamless data transfer for businesses and fostering the adoption of cloud computing.

However, despite these strengths, SME adoption of cloud services remains lower than the OECD average, primarily due to high costs and a shortage of digital skills, especially among older workers. The government is addressing this through various support programs, including consulting, training, and development vouchers, to help SMEs embrace digital technologies. Additionally, the ROK's spending on active labor market policies is lower than the OECD average, which hinders efforts to upskill the workforce, especially in ICT-related areas.

FIGURE 4

RESULTS OF OECD ANALYSIS.



In parallel with its leadership in 5G, the ROK is making significant advancements in artificial intelligence (AI). The National Strategy for Artificial Intelligence (Ministry of Science and ICT, 2019), launched in 2019, aims to create a vibrant AI ecosystem in the country. The government has also launched the AI Hub, a platform that processes and provides data for AI development, making AI tools and resources more accessible for businesses and researchers.

Private sector involvement is crucial to the ROK's digital transformation. Samsung Electronics, for example, announced a USD 356 billion investment in AI, 5G, 6G, and other high-tech industries over five years, which is expected to create around 80,000 jobs. This investment, along with the government's strategic initiatives, reinforces the ROK's position as a global leader in digital innovation, driving progress in AI, 5G, and the broader digital economy.

Through a combination of government policies and substantial private sector investments, the ROK is shaping its future as a global digital powerhouse. Its efforts in digital infrastructure, 5G, and AI development are setting the stage for continued leadership in the global technology landscape, with significant potential to influence advancements in smart cities, healthcare, and next-generation technologies.

Legal and Institutional Aspect of Digital Workplaces

As the ROK's national informatization entered an advanced stage in the 2000s, policies focused on utilizing informatization achievements rather than informatization itself, including the convergence of IT with other industries and the utilization of IT across all sectors, recognizing that the development of the IT industry as a major growth engine had reached its limit.

During this period, the movement to seek another leap as a global ICT leader became active, emphasizing digital transformation and the Fourth Industrial Revolution. To this end, the Korean

government formulated a series of comprehensive plans, such as the 6th Basic Plan for National Informatization (2018–2022) (2018.12) and the AI Strategy (2023). All these plans emphasized the importance of preparing for the advent of the Fourth Industrial Revolution and generative AI. Additionally, the Korean government announced the National Strategy for Artificial Intelligence (Ministry of Science and ICT, 2019) (2019.12), under the vision of “Beyond IT Powerhouse Toward an AI Powerhouse,” indicating the direction of ROK’s ICT policy. In terms of ICT infrastructure, many plans related to IoT, cloud computing, and blockchain have been announced to respond to digital transformation. Regarding e-government policies, there has been increasing emphasis on intelligence, opening, and the use of public data. Recently, the Korean government has been promoting digital government innovation from the perspective of e-government, responding to the era of the Fourth Industrial Revolution and digital transformation.

A notable change in the policy implementation system during this period is that the ICT related policy functions, which had been dispersed into four agencies in 2008, were re-integrated back into the newly established ministry, MSIT. The Ministry was responsible for both science and technology policy and ICT policy.

On the other hand, regarding the coordination body for national DX policies, the Committee on Information and Communications Strategy (Chair: Prime Minister), several measures were taken to prepare for the Fourth Industrial Revolution and the advent of the intelligent information society. The Task Force for the Promotion of the Intelligent Information Society was established (2016.9) within the MSIT and was later reorganized into a bureau responsible for artificial intelligence policy (2019.11). Furthermore, the Presidential Committee on the Fourth Industrial Revolution (Chair: private member), a public-private joint organization, was established in September 2017. In the area of e-government, the government’s commitment to pursuing proactive policies to open and utilize public data was emphasized by establishing the Open Data Strategy Council in December 2013.

During this period, a number of laws related to coping with the Fourth Industrial Revolution and the intelligent information society were enacted or amended. These include the Act on Promotion of the Provision and Use of Public Data (2013) and the Special Act on Promotion of Information and Communications Technology, Activation of Convergence Thereof, etc. (2014). In 2019, as part of regulatory innovation, a regulatory sandbox system in the area of ICT convergence was also introduced by the revision of the Special Act.

In addition, notable revisions were also made during this period. The revision of the Three Data Acts (2020) opened the way for the industrial use of pseudonymized information, which is processed so that a specific individual cannot be recognized without additional information, and reorganized the governance of personal information protection. Also, the full revision of the Basic Act on National Informatization, replaced by the Basic Act on Intelligent Informatization (2020), offers a legal framework for the national promotion of the 4th industrial revolution and the transition to an intelligent information society. Meanwhile, the Electronic Signature Act was also fully revised (2020), abolishing the accredited certificate system and thereby shifting the electronic signature framework from a government-led to a private sector-led system.

Remote Work in the ROK: A Growing Trend

Remote work in the ROK has been steadily gaining traction in recent years, driven by technological advancements, changing work cultures, and the desire for greater flexibility. While still relatively new compared to Western countries, remote work is becoming increasingly accepted and embraced

by both employers and employees. According to a 2020 survey, 95% of workers and managers are aware of remote work, up from 67% in 2015, and 8% of companies have adopted it. Approximately 240K workers are using remote work, accounting for 17% of the total employees. Due to COVID-19, this trend is becoming a more common phenomenon.

There are three types of remote work in the ROK. First, fully remote, in which employees work from home or other locations entirely, with no requirement for physical office presence. Companies like WeWork and CaCao have been creating models for this. Second, hybrid remote, in which employees split their time between working in an office and working remotely, often following a predetermined schedule. Third, remote-first, in which companies prioritize remote work and have policies and infrastructure in place to support it, even if they maintain a physical office. This model is the most popular.

Users of remote work are diverse. Foreigners who work remotely while traveling, often choosing the ROK for its vibrant culture and high-speed internet. A growing number of Korean workers are seeking remote jobs for flexibility, work-life balance, and the ability to work from locations that suit their lifestyles. Additionally, independent workers often choose remote work to have more control over their projects and schedules.

There have been various benefits of remote work cited. The most common advantage is increased flexibility. Remote work offers employees the freedom to work from locations that suit their needs, whether it is a home office, a coffee shop, or a coworking space. Another benefit is improved work-life balance. Remote work can help employees manage their personal and professional responsibilities more effectively, leading to reduced stress and increased job satisfaction. Cost savings is also a benefit. Remote work can reduce overhead costs for companies, as they can downsize their physical office space and save on utilities. Remote work allows companies to hire talent from anywhere in the world, expanding their access to skilled professionals. Lastly, remote work could enhance productivity. Studies have shown that remote workers can be more productive due to fewer distractions and the ability to create a personalized work environment.

While remote work is becoming more common in the ROK, there are still challenges to overcome, such as establishing clear communication channels, ensuring employee engagement, and addressing legal and tax considerations. As the country continues to embrace digital transformation, remote work is likely to play an increasingly important role in the Korean workforce.

Challenges

There has been discussion about effective strategies for improving labor productivity in the ROK and several options have been suggested.

First, digital transformation could contribute to enhancing productivity. It is necessary to actively introduce cutting-edge technologies such as AI and big data to innovate production processes. Since the ROK is competitive in manufacturing, smart factory programs could increase productivity in the manufacturing industry.

Second, expanding R&D investment could contribute to increasing productivity, especially in low-productivity industries including SMEs and the service sector. Activating investment in intangible assets could also enhance innovation capabilities.

Third, innovative human capital is critical. The government needs to expand education programs for fostering digital talent. Improving visa systems and settlement conditions could attract excellent overseas talent. Current vocational programs need to improve workers' job skills.

Four, the industrial structure requires reorganization, i.e., reducing the proportion of low-productivity service industries and promoting the transition to high value-added industries. Increase productivity by strengthening the competitiveness of key manufacturing industries as well.

Five, corporate ecosystem rebuilding. Innovative policies are required to reduce the productivity gap between large corporations and small and medium-sized enterprises. The ecosystem needs to support the growth of innovative small and medium-sized enterprises to create a healthy corporate ecosystem.

Six, improving labor market flexibility. It has been cited as a way to alleviate the rigidity of the labor market through flexible working hours, etc. Establishing a new system to expand the labor participation of women and the elderly is also required.

Seven, regulatory improvement. The government needs to work to eliminate and improve unnecessary regulations that hinder corporate innovation activities, as well as secure new growth engines by easing regulations in new industries.

By comprehensively promoting these strategies, it is possible to improve the ROK's labor productivity and lay the foundation for sustainable economic growth.

Recommendations

Promote AI and big data utilization: Encouraging the adoption of AI and big data in production processes can significantly boost productivity, especially in sectors like smart manufacturing.

Develop digital skills training programs: Fostering digital talent through improved vocational programs and targeted training will ensure workers are equipped to meet the demands of technology-intensive sectors.

Improve the regulatory framework: Reducing regulatory barriers and creating incentives for innovation in digital and high-tech industries can promote productivity improvements across the economy.

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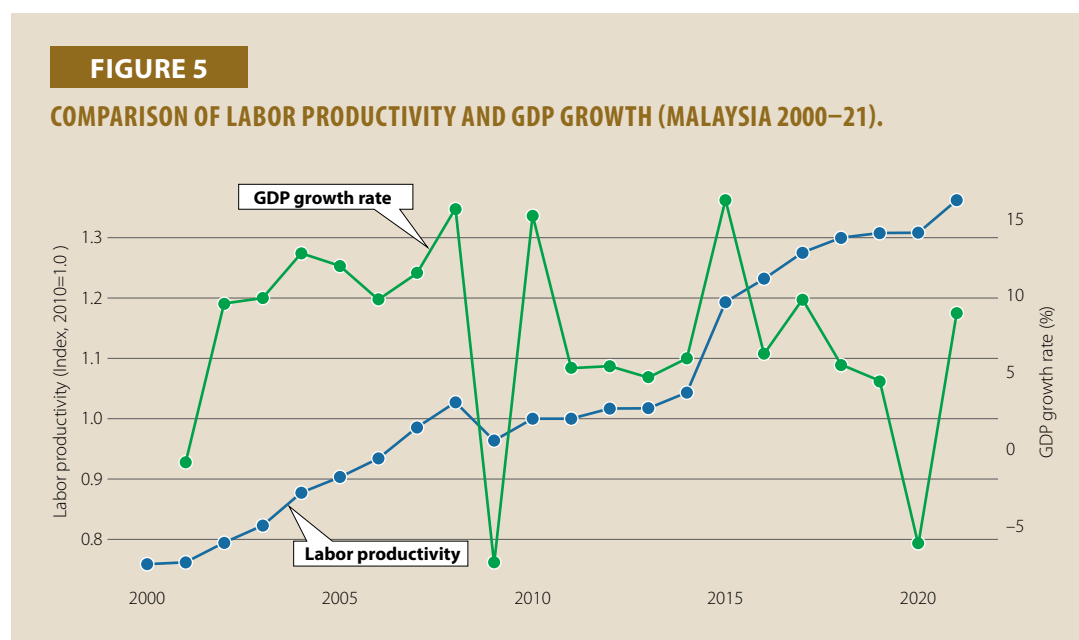
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Malaysia



Labor productivity (blue line) shows a consistent upward trend. Labor productivity demonstrates a steady increase over the entire period, with significant gains after 2010. This suggests that workers in Malaysia became more efficient, producing more output per hour worked.

Post-2010 acceleration: After 2010, labor productivity accelerated, which could be a result of structural improvements in the economy, such as technological advancements, which mean increased use of technology, automation, and digital tools likely enhanced worker output, sectoral shifts indicating that the economy may have shifted toward more productive industries like manufacturing, high-tech services, and finance, and finally, education and skills development, as

improvements in workforce education and skills may have contributed to higher productivity, allowing workers to produce more efficiently.

Resilience during the COVID-19 pandemic: In 2020, during the economic downturn caused by the COVID-19 pandemic, labor productivity remained stable and even increased in 2021. This indicates that even though overall economic activity slowed, sectors that could adapt to the crisis (e.g., technology, finance, remote work industries) maintained or enhanced productivity levels.

In addition, GDP growth (green line) shows significant volatility. Unlike labor productivity, GDP growth is highly volatile, reflecting the economy's sensitivity to external factors like global demand, commodity prices, and economic policies.

Key insights from the comparison highlight labor productivity as a long-term growth factor. The consistent rise in labor productivity indicates structural improvements in Malaysia's economy. These improvements, such as technological adoption, skill development, and sectoral shifts, have helped maintain steady productivity gains even when GDP growth fluctuated. This suggests that productivity is a key driver of long-term growth. During the financial crisis in 2008, GDP growth contracted, but labor productivity continued to rise. This indicates that, while the economy was hit by the global slowdown, industries that were more efficient were able to sustain or increase output per worker. Similarly, during the pandemic in 2019, labor productivity remained stable, while GDP growth saw a sharp decline. The ability of high-productivity sectors to adapt quickly during crises helped mitigate the economic impact.

GDP growth is more sensitive to external shocks like global market changes, financial crises, and pandemics. While labor productivity shows a more stable trend, GDP growth fluctuates based on external factors, such as commodity price swings and global financial and trade conditions. Malaysia's integration into the global economy makes its GDP growth susceptible to financial crises and trade disruptions.

During economic downturns like the 2008 financial crisis and the 2020 pandemic, labor productivity continued to rise even when GDP growth contracted. This suggests that productivity gains helped cushion the economy during these crises. By maintaining or increasing output per worker, Malaysia's economy avoided more severe contractions, as higher productivity sectors remained resilient.

The steady rise in labor productivity is a key indicator of Malaysia's long-term economic potential. As the country's workforce becomes more efficient, the economy can generate more output with the same level of inputs, driving sustained GDP growth over time. This is particularly important for Malaysia as it transitions into a more developed economy, where growth will increasingly depend on productivity rather than labor force expansion.

The steady rise in labor productivity has played a crucial role in Malaysia's long-term economic growth. While GDP growth has been volatile due to external shocks like the 2008 financial crisis and the COVID-19 pandemic, labor productivity has shown consistent improvements, providing stability to the economy. The ability of high-productivity sectors to maintain efficiency during downturns suggests that productivity gains have been a key factor in Malaysia's resilience. As Malaysia continues to develop, sustained productivity growth will be essential for maintaining economic expansion and mitigating the impact of future economic shocks.

Introduction to Digital Workspaces

Digital workspaces refer to virtual environments where employees collaborate, communicate, and perform their tasks remotely using digital tools and platforms. The rise of cloud computing and AI has driven the growth of digital workspaces globally, and Malaysia has been significantly affected by this shift, particularly due to the COVID-19 pandemic. The pandemic forced organizations to adopt remote work models, prompting them to rethink traditional office structures and invest in digital infrastructure. This has created more flexible working environments, enabling better work-life balance and reducing operational costs.

However, the digital divide between urban and rural areas in Malaysia poses a challenge, as not all regions have the same level of access to advanced technologies and infrastructure. Companies in urban centers have benefited from faster digital adoption, but rural businesses struggle due to poor connectivity and limited digital resources.

Traditional measures of productivity—such as task completion and hours worked—are no longer sufficient in digital environments. Instead, productivity in digital workspaces is increasingly assessed by how effectively employees utilize digital tools, engage in communication, and collaborate across distributed teams. In Malaysia, tools like Microsoft Teams, Zoom, and Google Drive have become essential in tracking key performance indicators (KPIs) such as project progress and employee engagement. These tools allow for real-time performance analytics, which help organizations assess both the quantity and quality of work.

Despite the advantages, managing remote teams introduces complexities. There is a need to ensure that employees remain engaged and focused, even without direct supervision. Additionally, remote work can blur the boundaries between professional and personal life, making accountability a key concern.

Measuring Productivity in Digital Workspaces: A Malaysian Perspective

Productivity in digital workspaces is no longer just about hours worked but also focuses on key metrics like:

- output per employee: measuring tangible results, such as the number of tasks completed or projects finalized;
- collaboration efficiency: tracking how efficiently employees use digital collaboration tools;
- task completion rates: tools like Asana or Trello allow managers to track how effectively teams meet deadlines; and
- employee engagement: measured through digital surveys or participation in virtual meetings and discussions.

In Malaysia, organizations across industries have adopted digital productivity tools to manage remote work effectively. For instance, the banking sector has used these tools to track customer service efficiency and loan processing times, while the manufacturing sector has leveraged real-time monitoring to reduce production downtime and improve overall output.

Case Studies: Financial and Manufacturing Sectors in Malaysia

CIMB Group, financial sector: CIMB Group (CIMB Group, 2021), one of Malaysia's leading financial institutions, experienced a significant digital transformation during the COVID-19 pandemic.

The bank integrated digital tools to meet the rising demand for online banking, leading to a 47.7% increase in digital transactions. Key productivity metrics, such as loan processing times, improved by 29%, while customer satisfaction increased due to the adoption of AI-powered customer service tools.

CIMB (CIMB Group, 2021) demonstrates the importance of digital dashboards and remote collaboration tools in ensuring operational continuity and productivity during times of crisis.

Top Glove, manufacturing sector: Top Glove (Top Glove Corporation Bhd, 2021), the world's largest rubber glove manufacturer, experienced a surge in demand during the pandemic. The company adopted Industry 4.0 technologies, such as automation and real-time production monitoring, which increased output by 20%. By reducing machine downtime and implementing automated quality control systems, Top Glove (Top Glove Corporation Bhd, 2021) was able to meet global demand while maintaining high standards of product quality.

These case studies illustrate the transformative impact of digital workspaces on productivity in Malaysia's financial and manufacturing sectors.

GDP per Labor Hour and GDP per Worker in Malaysia

Malaysia's GDP per labor hour and GDP per worker have steadily increased over the years, driven by the adoption of digital tools in high-value industries such as electronics, manufacturing, and services. From 2000 to 2023, Malaysia's GDP per labor hour grew from USD13.5 to USD33.2, while GDP per worker increased from USD18,500 to USD48,500. These improvements highlight how digitalization has enhanced labor productivity in the country.

The key drivers are technological advancement, workforce upskilling, and government initiatives identified. In addition, investment in technology and the digital divide are cited as challenges ahead.

Digital Transformation in Malaysia

The Malaysia Digital Economy Blueprint: The Malaysian government introduced the MyDIGITAL (Economic Planning Unit, 2021) blueprint in 2021 to transform the country into a digitally driven economy by 2030. Key strategies include improving digital infrastructure, fostering innovation, and enhancing the workforce's digital skills. The government aims to increase the digital economy's contribution to GDP to 22.6% by 2025. Six key pillars include:

- a digitally enabled government;
- an inclusive digital society;
- high-skilled digital talent;
- digitally driven businesses;
- robust digital infrastructure; and
- a secure digital environment.

Industry4WRD (Industry 4.0 in Malaysia): The Industry4WRD initiative (Ministry of International Trade and Industry, 2018) focuses on integrating smart technologies such as IoT, AI, and robotics into industries, particularly manufacturing. By leveraging these technologies, companies can optimize production processes, reduce operational costs, and improve decision-

making. This is already evident in the electronics and automotive sectors in Malaysia, where Industry 4.0 technologies have significantly increased productivity.

Challenges to Digital Transformation

Despite its promise, digital transformation in Malaysia faces several challenges:

- **Digital divide:** The gap between urban and rural areas continues to hinder widespread digital adoption. While urban centers enjoy high-speed internet and access to digital tools, rural areas struggle with poor connectivity, limiting their participation in the digital economy.
- **Digital literacy:** Sectors that are traditionally less digitized, such as agriculture and construction, are slower to adopt digital tools. Additionally, fears of job displacement due to automation and concerns over data privacy and cybersecurity remain barriers to digital adoption.
- **Workforce upskilling:** To bridge the digital divide, the Malaysian government has initiated upskilling programs like TVET, which focus on providing workers with the skills necessary for a digital economy.

Future of Digital Workspaces in Malaysia

The future of digital workspaces in Malaysia is promising, driven by government support, private sector innovation, and continued investment in digital infrastructure. Emerging technologies like AI, blockchain, and IoT will play an essential role in further enhancing productivity and operational efficiency. The Malaysian government is also integrating these technologies into public services to improve efficiency.

However, to fully capitalize on these opportunities, Malaysia must address digital inequality and workforce training. Expanding broadband access to underserved areas and continuing to invest in digital skills development will be key to ensuring that all Malaysians benefit from digital transformation.

Recommendations for Enhancing Digital Workspaces

To maximize the benefits of digital workspaces in Malaysia, the report offers several recommendations:

- **Close the digital divide:** Invest in rural digital infrastructure to ensure equitable access to the digital economy. This includes expanding high-speed internet access and offering financial incentives to rural businesses for adopting digital tools.
- **Enhance cybersecurity:** Organizations should implement strong cybersecurity measures, such as data encryption and regular security audits, to protect sensitive information and foster trust in digital systems.
- **Continuous upskilling:** Ongoing training programs in areas like AI, data analytics, and cybersecurity are crucial. Collaboration between the government, educational institutions, and the private sector will help provide workers with the skills they need to thrive in a digital environment.
- **Fostering a digital culture:** Leadership is key in guiding organizations through digital transformation. Transformational leadership, which promotes innovation, flexibility, and the effective use of digital tools, is essential for fostering a productive digital workspace culture.

- **Support for SMEs:** SMEs often face barriers in adopting digital technologies due to limited resources. Providing financial support and advisory services can help SMEs transition into digital workspaces.

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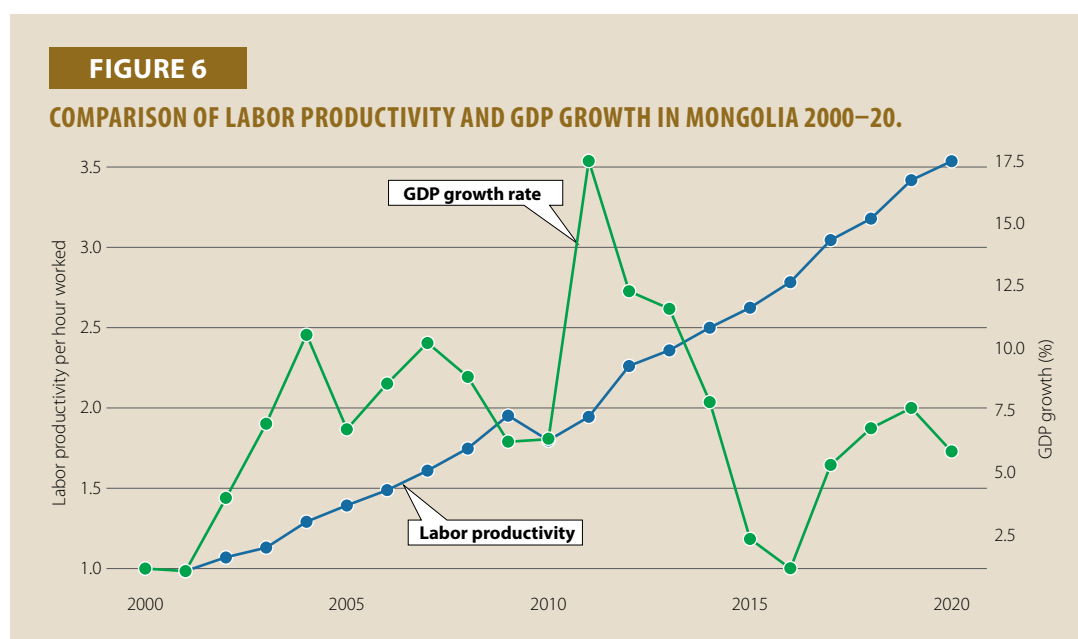
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Mongolia



Labor productivity per hour worked is a critical measure of economic efficiency, representing how much output is generated by each worker in a given amount of time. In Mongolia, the trends in labor productivity from 2000 to 2020 reflect a combination of factors, including structural shifts in the economy, industrial output, and external shocks.

In the early 2000s, modest growth was observed. Labor productivity in 2000 was relatively low, starting around 0.99 units of GDP per hour worked, and showed gradual improvement, reaching approximately 1.30 by 2004. During this period, Mongolia was transitioning to a more market-oriented economy, with much of the workforce still employed in lower-productivity sectors such as agriculture. Growth in productivity was primarily driven by modest technological improvements and initial reforms aimed at liberalizing the economy. Agriculture remained a dominant employer, but its labor productivity was limited due to traditional farming practices and low capital investment.

From 2005 onward, labor productivity began to rise sharply, from 1.40 in 2005 to approximately 1.80 by 2010. This increase was driven by a mining boom. Foreign direct investment (FDI) surged during this period, particularly in the extraction of copper and gold. Large-scale projects such as the Oyu Tolgoi mine became major contributors to Mongolia's output, leading to a rapid rise in labor productivity in this capital-intensive sector. The mining sector's reliance on advanced machinery and technology made it highly productive compared to other sectors. The labor force involved in mining was small, but the output per worker was significant, contributing disproportionately to national productivity figures.

By 2011, labor productivity peaked at around 2.00 GDP per hour worked and remained high through 2014, reaching approximately 2.20 in some years. This period represents the zenith of Mongolia's productivity growth, driven by a combination of high global commodity prices and increased extraction of minerals. In 2011, GDP growth reached an astonishing 17.5%, underpinned by the mining boom, and labor productivity saw corresponding gains. However, reliance on mining created imbalances. Other sectors, particularly agriculture and services, did not experience the same gains in productivity. This created a dual economy where mining thrived while other sectors lagged behind, leading to uneven growth across the labor market.

From 2015 onward, labor productivity growth slowed, hovering around 2.30-2.50 by 2020. The most significant dip occurred in 2020, driven by the pandemic. The fall in commodity prices, particularly copper and coal, had a major impact on Mongolia's productivity figures. As the prices of these key exports fell, mining production slowed, leading to stagnant productivity growth. This was compounded by structural issues, such as poor infrastructure and insufficient investment in human capital in non-mining sectors. The global pandemic had a particularly detrimental effect on productivity in 2020, as lockdowns and reduced demand for minerals caused economic activity to contract. Non-mining sectors, which had lower productivity to begin with, were severely impacted by reduced business activity.

Regarding GDP, during the early 2000s, GDP growth was relatively low, ranging between 1.1% and 4.0%. The slow growth in labor productivity mirrored the slow GDP growth. Most of the workforce was employed in lower-productivity sectors such as agriculture, which constrained overall economic output. While there was progress in opening up the economy, the effects on GDP growth were modest due to limited structural changes at this time. However, during 2005-2010, rapid GDP growth was observed, fueled by mining. Investments in large-scale mining projects significantly boosted output, leading to high levels of GDP growth. The mining sector, though employing a

relatively small percentage of the workforce, contributed disproportionately to GDP due to its high productivity. In 2011, GDP growth peaked at 17.5%, with subsequent years maintaining high growth rates above 10% until 2014. By 2015, GDP growth had slowed to around 2.4%, and although it recovered to around 6.8% in 2019, the pandemic caused a contraction of 5.3% in 2020.

The relationship between labor productivity and GDP growth in Mongolia between 2000 and 2020 reveals several key dynamics:

- **Mining dependency:** Mongolia's productivity and GDP growth are closely tied to the performance of the mining sector. Periods of high mining output led to significant productivity gains, which in turn drove strong GDP growth.
- **Vulnerability to external shocks:** The reliance on mining also makes the economy vulnerable to external shocks, such as fluctuations in global commodity prices and the COVID-19 pandemic. When mining slows down, both productivity and GDP growth suffer.
- **Sectoral imbalances:** The disparity in productivity between the mining sector and other sectors, such as agriculture and services, has contributed to uneven growth. To sustain GDP growth in the future, Mongolia will need to improve productivity in non-mining sectors through diversification, infrastructure development, and human capital investment.

While mining has been a powerful driver of productivity and GDP growth, other alternatives have been observed, which are technological and structural influences on labor productivity.

- **Gradual technological improvements:** Over the period, labor productivity has shown consistent, incremental growth. This likely reflects improvements in technology and infrastructure that enhance workforce efficiency. However, these improvements are gradual, explaining the steady (rather than dramatic) rise in productivity.
- **Human capital development:** Mongolia's education and training programs may have contributed to this stable growth in labor productivity. Workforce skills and educational improvements help to gradually increase labor efficiency, especially in sectors like agriculture, services, and light industry.
- **Industrial diversification:** Mongolia has started to diversify its economy beyond mining, which helps stabilize labor productivity growth. As new industries grow, the reliance on capital-intensive sectors may decrease, potentially leading to more robust productivity gains in the long term.

The analysis of labor productivity and GDP growth in Mongolia between 2000 and 2023 highlights a complex and often disconnected relationship. Mongolia's GDP growth, driven by external factors such as global commodity demand and capital investments in mining, often fluctuates more dramatically than labor productivity. Labor productivity, on the other hand, shows steady and consistent improvement, reflecting long-term structural gains in workforce efficiency.

Overview of Mongolia's Digital Transformation and Economic Context

Mongolia, a sparsely populated country in Central Asia, is experiencing significant economic growth. Its GDP per capita reached USD5,033 in 2022, and the economy has tripled over the past

three decades, primarily driven by the extraction of mineral resources, which accounted for 22% of the GDP. Despite the country's mineral wealth, Mongolia has recognized the need to diversify its economy, especially through information technology and digital transformation.

Over the past ten years, Mongolia has embraced digital technologies, particularly among its younger population, which is highly adaptable to innovations. The government has launched several initiatives to transform the country into a “Digital Nation,” with ICT identified as a priority sector. This initiative aims to facilitate economic and social development by leveraging new technologies like artificial intelligence (AI), blockchain, and data analytics. Entrepreneurship and start-up culture have flourished, with young Mongolians using these technologies to address local challenges in areas such as financial inclusion, education, and health.

The E-Mongolia (Government of Mongolia, 2023) platform is one of the key achievements of the government's digital agenda. Launched in 2020, the platform integrates numerous government services online, allowing citizens to access public services more efficiently. This shift has been particularly important for Mongolia's capital, Ulaanbaatar, which houses nearly half of the country's population and faces issues such as corruption, bureaucratic delays, and the need for public participation.

Legal Environment for Digital Transformation

The report outlines Mongolia's legal environment for ICT, highlighting several critical pieces of legislation aimed at facilitating digital transformation. Key laws include:

- Technology Law (1998);
- Law on Science and Technology (2006);
- Telecommunications Law (2001);
- Law on Digital Signatures (2022);
- Law on Cyber Security (2022); and
- Law on Personal Data Protection (effective from 2022).

These laws provide the foundation for building Mongolia's digital economy. They focus on enhancing digital infrastructure, ensuring cybersecurity, and improving e-governance to increase transparency and reduce bureaucracy.

The most important strategic document guiding ICT development in Mongolia is the State Policy on the Development of Information and Communications Technology (2017–25). This policy is part of Mongolia's long-term development vision, aligned with the Sustainable Development Goals (SDGs) of 2030. Additionally, the VISION 2050 (Government of Mongolia, 2020) Long-Term Development Policy, adopted by Parliament in 2020, sets forth digital transformation as a national priority.

The Communications Regulatory Commission (CRC, 2023) plays a central role in regulating Mongolia's ICT sector, ensuring that frameworks are flexible and up-to-date to support the country's goal of becoming a Digital Nation. However, challenges remain, particularly in areas such as e-commerce, where the lack of regulation on logistics and payments hampers development.

National Productivity and Impact of Digitalization

Productivity in Mongolia is measured primarily in terms of GDP per employed person. The report provides a detailed historical overview of productivity growth from 2000 to 2023. During this period, Mongolia experienced significant increases in productivity, particularly between 2010 and 2020. However, despite these gains, research on how digital workplaces contribute to productivity is still limited, as the digital economy is in its early stages and not all sectors have adopted advanced technologies.

The table of GDP per employed person highlights the following:

- There was significant growth in productivity from 2000 to 2023.
- There were variations in productivity due to fluctuations in the exchange rate of the Mongolian tugrik (MNT) against the USD.
- There is lack of comprehensive data on productivity per hour, limiting a more detailed understanding of how digitalization impacts labor efficiency.

Best Practices in Digital Transformation

The E-Mongolia Platform, public sector: Launched in October 2020, E-Mongolia (Government of Mongolia, 2023) is a comprehensive e-government platform that offers 994 services from 83 government organizations. As of 2023, the system had 1.64 million users, with 31.7 million services accessed through the platform. The platform has drastically reduced the time and cost required for citizens to access government services. For example, a service that previously took 1.3 hours to access now takes only 5 minutes on average.

In addition to public services for individuals, the E-Mongolia (Government of Mongolia, 2023) platform also offers services for businesses, service providers, and government operators. The system's successful implementation demonstrates the potential of digital technology to streamline bureaucratic processes and increase government transparency.

Banking and financial services, private sector: Mongolia's banking sector has undergone a significant digital transformation. The introduction of digital signatures in 2018 allowed banks to simplify transactions and offer more secure financial services. Today, 93% of the population has a bank account, and a majority of transactions are conducted digitally. Over the past five years, Mongolia has updated its national payment system and introduced the ₮-card, a national debit card.

The digitalization of the banking sector has significantly enhanced financial inclusion and convenience for citizens. However, challenges remain, particularly regarding the legal framework for e-signatures, which still pose obstacles for online lending.

Survey Results and Challenges in Digital Competitiveness

Despite progress, Mongolia ranks 62nd out of 64 countries in the 2023 Global Digital Competitiveness Ranking. This low rank reflects several challenges in Mongolia's digital transformation:

- **Weak technology adoption:** Many industries, particularly in manufacturing and agriculture, have been slow to adopt advanced technologies like AI and automation.

- **Limited digital literacy:** A significant portion of the population lacks the skills needed to fully benefit from digital tools and technologies.
- **Low high-tech penetration:** Only a few sectors, such as banking and telecommunications, have embraced cutting-edge technologies. Other sectors, such as e-commerce, suffer from outdated logistics and insufficient payment integration.

According to a survey conducted by the Mongolian Chamber of Commerce, the main challenges to digital transformation include inadequate government support for new technologies, low high-tech penetration, and limited collaboration between academic and research institutions. The report emphasizes the need for more investment in digital infrastructure, research, and education.

Recommendations

There are several key recommendations to improve productivity in Mongolia's digital workplaces:

- **Adopt a state program for the digital economy:** Mongolia needs a comprehensive program that clearly defines long-term and medium-term goals for developing the digital economy. This program should focus on expanding digital infrastructure, improving cybersecurity, and fostering innovation.
- **Update educational curricula:** Universities and colleges should update their curricula to provide students with modern knowledge of digital technologies. Additionally, the government should offer scholarships to students pursuing studies in digital technology abroad to build a future workforce capable of implementing cutting-edge technologies in Mongolia.
- **Increase investment:** The government should prioritize national and foreign investments in advanced technologies. It should also create favorable conditions for foreign investors by reducing bureaucratic hurdles and increasing transparency.
- **Promote technological adoption in agriculture and mining:** Sectors like agriculture and mining, which are vital to Mongolia's economy, must adopt more advanced technologies to improve productivity. For example, agricultural productivity can be enhanced by using AI and IoT to monitor livestock and manage resources more efficiently. The mining sector should also focus on automating processes and adopting better technology to increase efficiency.
- **Strengthen cybersecurity:** As Mongolia continues its digital transformation, ensuring the security of its digital infrastructure is critical. The government must invest in cybersecurity measures to protect its systems from cyber threats and ensure the safety of both public and private sector digital services.

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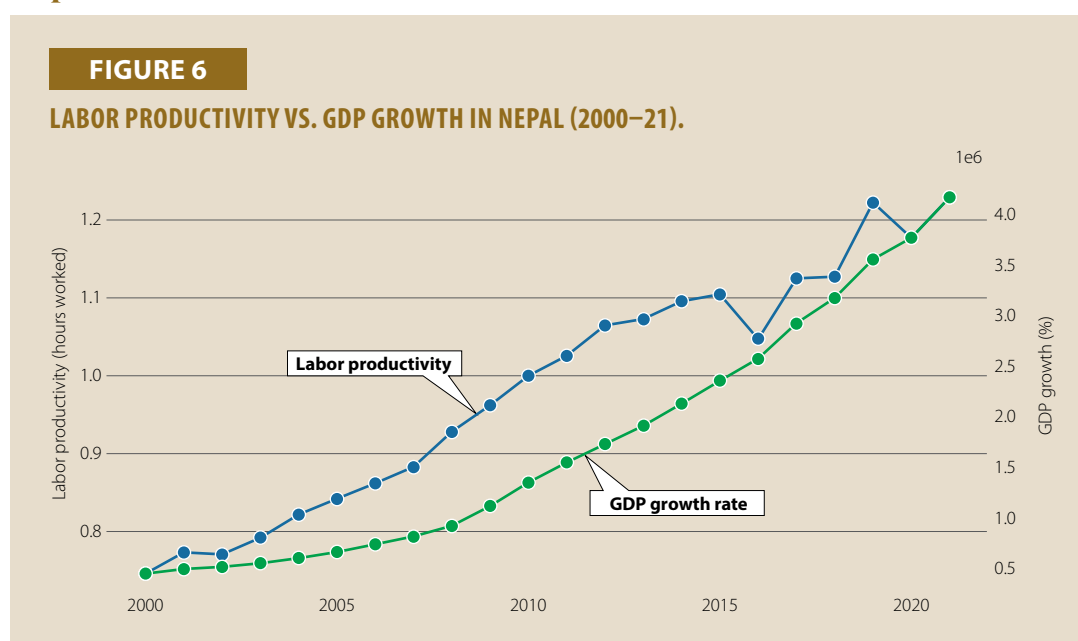
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Nepal



Labor productivity per hour worked reflects the efficiency of a workforce in generating economic output. In Nepal, labor productivity from 2000 to 2020 has shown a gradual but modest increase, reflecting the nation's reliance on agriculture, the rise of the services sector, remittances, and the impact of infrastructure development.

In 2000, labor productivity was 0.066 units of GDP per hour worked. By 2004, it only slightly increased to around 0.070. During this period, Nepal's productivity remained very low due to its heavy dependence on low-productivity sectors, especially agriculture. Around 70% of the workforce was engaged in

agriculture, which contributed little to productivity gains. Political instability, including the Maoist insurgency, further stifled economic growth and discouraged investment in technology and infrastructure.

By 2010, labor productivity had increased slightly, reaching 0.087 units of GDP per hour worked. This period saw gradual improvement in productivity as Nepal began stabilizing politically after the peace agreement of 2006. The economy started to shift toward services and remittances. The end of conflict encouraged some infrastructure investment, though agriculture remained dominant. Remittances from Nepali workers abroad became a key factor in improving household incomes and driving economic activity.

By 2015, labor productivity had increased to 0.093 units of GDP per hour worked. With the political environment more stable, Nepal saw steady growth in labor productivity, driven by the rise of the services sector and infrastructure projects. Tourism, in particular, began to play a more prominent role in the economy. In addition, remittances continued to increase, supporting domestic consumption. While agriculture still employed a significant proportion of the workforce, efforts were made to modernize farming techniques, albeit slowly.

By 2020, labor productivity had risen to approximately 0.10 units of GDP per hour worked. Labor productivity continued to rise steadily during this period, thanks to increased infrastructure investments, especially in hydropower and transportation. The industrial sector, while still small, saw some growth, particularly in energy and small-scale manufacturing. However, the COVID-19 pandemic in 2020 severely impacted productivity, as key sectors like tourism, retail, and transportation were disrupted. Tourism, which had become a vital contributor to GDP, saw an abrupt halt, highlighting Nepal's vulnerability to external shocks.

Several key trends and challenges have been observed;

- **Slow transition from agriculture:** The slow transition away from agriculture has limited overall productivity growth. Even though efforts have been made to modernize the sector, progress has been slow, and agriculture continues to contribute little to overall productivity gains compared to sectors like services and industry.
- **Dependence on remittances:** While remittances have provided an important boost to household incomes, dependence on this external source of income has not translated into substantial productivity growth. Remittances fuel consumption but do not create structural changes in productivity.
- **Vulnerability to external shocks:** The COVID-19 pandemic highlighted Nepal's vulnerability to external shocks. Tourism, a vital sector for productivity growth, was severely impacted, and the lack of diversification in the economy made recovery challenging.
- **Gradual improvement in infrastructure:** Infrastructure development, particularly in energy (hydropower) and transportation, has begun to show results. These sectors have seen steady productivity improvements, but overall, Nepal's economic productivity remains hampered by poor infrastructure in many regions.

Nepal's labor productivity per hour worked has seen a gradual upward trend from 2000 to 2020, driven by improvements in the services sector, infrastructure development, and remittances.

However, the overall level of productivity remains low, reflecting the continued dominance of low-productivity agriculture and slow technological adoption.

The sustained increase in labor productivity means that workers have been producing more output per hour worked. This improvement can provide a foundation for long-term economic growth, even during periods when GDP growth fluctuates. The GDP growth line is much more volatile compared to labor productivity. This reflects the susceptibility of the overall economy to external shocks and domestic factors, such as political instability, natural disasters (like the 2015 earthquake), or global economic crises. The GDP growth plummeted in 2020 due to the COVID-19 pandemic. Despite the sharp decline in overall economic activity, labor productivity was less affected, showing a slight decline but remaining relatively stable. This could indicate that while economic activity slowed, the industries that remained operational were still productive.

The steady increase in labor productivity reflects long-term improvements in workforce efficiency, possibly due to advancements in technology, education, or industrial shifts. These gains have provided stability, even during economic disruptions. GDP growth, on the other hand, is more volatile, reflecting external shocks like the global financial crisis, the 2015 earthquake, and the COVID-19 pandemic. However, GDP growth tends to recover quickly after these downturns, supported by ongoing improvements in labor productivity. The graph highlights the resilience of labor productivity in Nepal, showing that even during crises, workforce efficiency tends to either remain stable or improve, providing a foundation for economic recovery.

Nepal has experienced sustained improvements in labor productivity over the past two decades, despite economic fluctuations. The economy's overall resilience is shown in how labor productivity bounces back quickly after disruptions like the 2015 earthquake and the 2020 pandemic. However, the GDP growth pattern is more variable, influenced by both domestic and international events. The long-term upward trend in productivity suggests that Nepal is laying a foundation for sustained growth, even though the GDP's year-to-year performance can be erratic.

Economic Overview and Productivity Gains in Nepal

Nepal, as a least-developed, landlocked country in South Asia, has been witnessing a gradual shift in its economic landscape from agriculture toward services, trade, and remittances. As of the fiscal year 2023–24, the agriculture, industry, and services sectors contributed 24.10%, 13.00%, and 62.90%, respectively, to the country's GDP. This shift reflects the decreasing relevance of agriculture, with a rising dependency on the services sector. Leading sub-sectors include banking, telecommunications, education, tourism, and IT services.

Nepal's labor productivity has improved substantially. According to the Asian Productivity Organization's 2023 Productivity Databook, labor productivity in Nepal increased by 24.36% between 2010 and 2021. This growth can be attributed to factors such as technological advancements, improved education, skill development, and infrastructure improvements. However, the report highlights that productivity growth in Nepal has not been uniform across sectors, with agriculture and traditional industries still lagging behind in terms of digital adoption.

Digital Transformation and Its Key Drivers in Nepal

Digital transformation in Nepal has become a crucial factor in enhancing workplace productivity, especially in urban settings. Key drivers for this transformation are:

- **Expansion of digital connectivity:** Nepal has made notable progress in expanding digital connectivity, particularly with mobile broadband penetration surpassing 95% and fixed broadband reaching nearly 49% by April 2024. The widespread adoption of smartphones and 4G services has facilitated the use of digital tools across workplaces. However, the digital divide remains a significant challenge, as rural areas still struggle with poor connectivity and infrastructure, which inhibit widespread digital adoption.
- **Data centers and cloud infrastructure:** Recent advancements in cloud services and data centers have played a pivotal role in Nepal's digital transformation. Both public and private sectors have invested in these technologies, offering scalable infrastructure, data security, and accessibility to businesses. Notable public sector initiatives include G-Cloud services, while private entities like Access World have been instrumental in driving cloud adoption. These systems support e-governance platforms, startups, and business applications, transforming traditional work environments into more efficient digital workplaces.

COVID-19 and Acceleration of Digital Workplace Adoption

The COVID-19 pandemic acted as a major catalyst for digital transformation in Nepal. It forced many businesses and government agencies to adopt remote working models and digital workplace solutions such as Zoom, Microsoft Teams, and WhatsApp for communication and collaboration. This rapid adoption of digital platforms was essential for business continuity during lockdowns and other restrictions.

During the pandemic, remote working became a viable alternative for organizations, particularly those in urban areas. Many businesses started to develop and adopt specialized digital tools for scheduling appointments, conducting meetings, and automating business processes. Digital payment platforms also saw exponential growth during this period. Digital transactions in Nepal increased significantly, from NPR3.1 billion in 2016–17 to NPR221.1 billion in 2019–20. This trend is expected to continue, driven by the increased reliance on online payments for goods and services.

While these advancements have been promising, the pandemic also exposed the productivity paradox—where digital investments do not always result in immediate productivity gains. This issue is especially evident in sectors where digital literacy is low, or infrastructure is insufficient.

Key Challenges in Establishing Digital Workplaces

The establishment of digital workplaces in Nepal is not without its challenges. Some of the major issues include:

- **Limited awareness and leadership support:** Many organizations, especially in the public sector, lack awareness regarding the long-term benefits of digital workplaces. Leadership inconsistencies and a lack of sustained commitment from management also contribute to slow digital transformation. Resistance to change is evident across many sectors, where traditional paper-based processes remain dominant.
- **Technological reluctance and resistance to change:** Nepal's workforce, especially in rural regions, tends to be resistant to adopting new technologies. This reluctance is partly due to a lack of digital literacy and fear of technological disruption. As a result, many workers continue to follow outdated practices, which negatively impacts overall productivity.

- **Digital skills gap:** The gap in digital skills remains a significant barrier to fully realizing the potential of digital workplaces in Nepal. Despite efforts from both public and private sectors to invest in training programs aimed at digital skill development (such as data analytics, software development, and digital marketing), many workers, particularly in rural areas, remain under-skilled. Without addressing this gap, many organizations are unable to effectively leverage digital tools for productivity.

National Policies and Government Initiatives Supporting Digital Workplaces

Several government initiatives and policies aim to support the growth of digital workplaces and enhance productivity in Nepal:

The Electronic Transaction Act (2006): The Electronic Transaction Act provides the legal framework for electronic transactions in Nepal, ensuring the security and reliability of digital records. This act has been critical for the legal acceptance of digital workplaces, allowing businesses and government entities to operate in a secure digital environment.

National ICT Policy (2015): Nepal's National ICT Policy outlines a vision to integrate information and communication technology (ICT) into various sectors to promote economic development, digital literacy, and good governance. The policy serves as a foundation for digital workplace initiatives, focusing on driving ICT growth and establishing Nepal as a digitally connected economy.

Digital Nepal Framework: The Digital Nepal Framework (MoCIT, 2019) is a strategic initiative designed to foster digital transformation across eight key sectors, including education, governance, and finance. The framework consists of 80 initiatives aimed at stimulating economic growth and addressing challenges through technological innovation. These projects are intended to create opportunities for Nepal to actively participate in the global digital economy.

Government Digital Workplace Initiatives

The Government of Nepal has launched several digital workplace initiatives that have significantly improved efficiency and transparency in public services:

Nepal National Single Window (NNSW): The NNSW, managed by the Department of Customs, integrates over 40 trade-related government agencies onto a single digital platform. It streamlines international trade processes by allowing businesses to exchange documents electronically. This system has reduced delays in trade documentation and is seen as a major step toward achieving paperless trade in Nepal.

Public Service Recruitment Management System (PSRMS): PSRMS is a web-based platform that enhances the efficiency of the Public Service Commission (PSC) by digitalizing recruitment processes. The system allows for online applications, reduces administrative costs, and integrates with other government IT systems to provide a seamless experience for both candidates and recruiters.

Nagarik App: The Nagarik App (Government of Nepal, 2023) is an integrated platform for accessing various government services such as applying for citizenship documents, paying taxes, and updating personal records. This app has significantly reduced the need for citizens to physically visit government offices, streamlining service delivery and improving public access to essential services.

Best Practices in Nepal's Digital Workplaces

Nepal has successfully implemented several digital workplace systems that can be considered best practices in the region:

Government Integrated Office Management System (GIOMS): GIOMS is a unified platform designed to streamline communication, document sharing, and decision-making processes across government departments. The system has introduced automation into day-to-day administrative tasks, such as letter tracking and approvals, which significantly reduces delays. GIOMS has also helped many government offices transition to a paperless environment, making document retrieval faster and more efficient.

Integrated Tax System (ITS): ITS is a centralized platform that integrates all tax-related processes, allowing taxpayers to file returns, pay taxes, and receive refunds digitally. The system has reduced administrative costs, increased transparency, and improved compliance. Taxpayers can now access services through a mobile app or online portal, reducing the need for physical visits to tax offices.

Challenges to Full Implementation of Digital Systems

The implementation of digital systems such as GIOMS and ITS has led to improved efficiency in public sector service delivery. By reducing administrative costs, enhancing transparency, and eliminating paper-based workflows, these systems have promoted better decision-making and inter-departmental coordination. Digital workplaces also offer flexibility for government employees, allowing them to work from anywhere, which has been particularly beneficial during the COVID-19 pandemic.

Despite notable successes in the public sector, several challenges still hinder the full implementation of digital workplace systems in Nepal:

Limited infrastructure in rural areas: In rural and remote areas, poor internet connectivity, frequent power outages, and inadequate infrastructure prevent the full adoption of digital workplace systems.

Cybersecurity concerns: With the rise of digital platforms, there is an increasing risk of data breaches and cyberattacks. Ensuring proper cybersecurity frameworks and conducting regular vulnerability testing are crucial to safeguarding government and business data.

Digital literacy gaps: The lack of digital skills and resistance to new technologies in both urban and rural areas continue to slow the adoption of digital workplace practices. Public and private initiatives have been launched to address this, but the digital divide remains a significant challenge.

Policy Recommendations

To further enhance digital workplaces in Nepal, the following policy recommendations are proposed:

Enhance digital infrastructure: Expanding internet connectivity and improving the reliability of power systems, especially in rural areas, are critical for the growth of digital workplaces.

Strengthen cybersecurity measures: The government should focus on developing robust cybersecurity frameworks and conducting regular security audits to protect sensitive data.

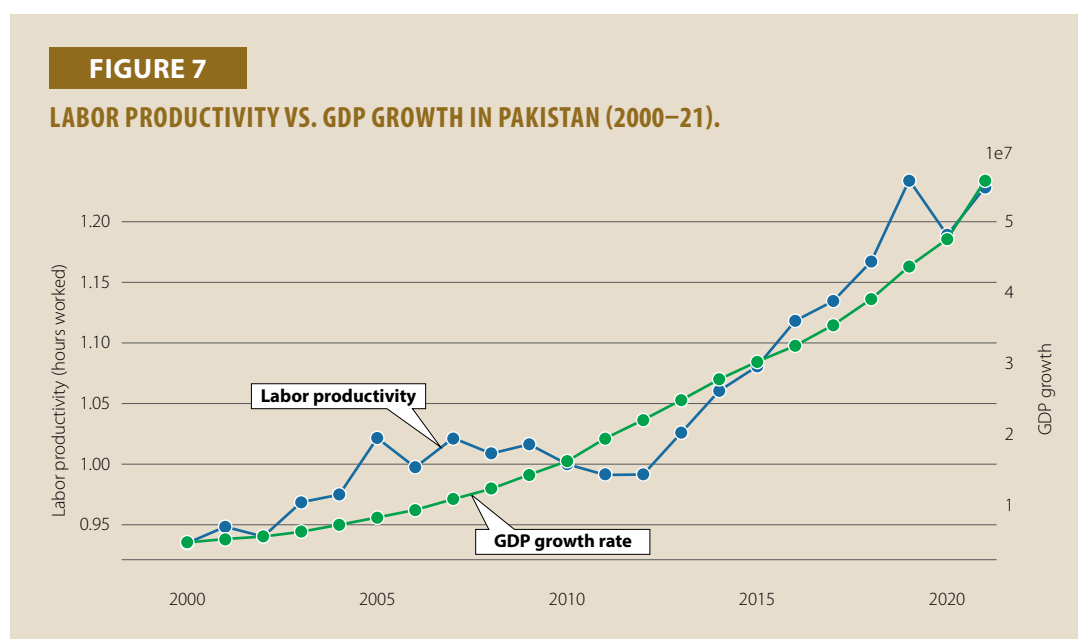
Promote digital literacy: Initiatives aimed at improving digital skills should be expanded to reduce the digital divide and equip workers with the necessary tools to work in digital environments.

Promote government and private-sector collaboration: Foster collaboration between the public and private sectors to drive innovation in productivity measurement and digital workplace practices.

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Pakistan



Labor productivity in Pakistan from 2000 to 2020 shows notable fluctuations with periods of growth, decline, and stagnation, driven by structural shifts in key sectors, external economic factors, and political challenges.

In 2000, labor productivity stood at 1.045 units of GDP per hour worked. This figure fluctuated through the early 2000s, slightly increasing to 0.79 units by 2004, indicating signs of instability. Agriculture was a major employer during this period, accounting for a large proportion of the workforce. However, the sector was characterized by low productivity due to outdated farming methods, lack of mechanization, and minimal technological investment. The industrial base was underdeveloped, focusing on low-value-added industries like textiles, which contributed to slow productivity growth.

Labor productivity experienced modest gains during this period, particularly in the mid-2000s. By 2010, labor productivity had improved, with sporadic gains reaching 1.14 units in 2002 and around 0.87 units in 2010. The manufacturing sector, particularly the textile industry, saw improvements due to global demand for exports. Textiles remained one of Pakistan's primary export products, helping drive productivity growth in industrial areas. The services sector, including retail, finance, and telecommunications, began to expand, particularly in urban areas. This sectoral growth contributed positively to overall productivity, as higher productivity services outpaced low-productivity agricultural activities.

The period from 2011 to 2015 saw stagnation in labor productivity, with values fluctuating around 0.80-0.85 units of GDP per hour worked. Growth during this period was limited, reflecting the economic challenges Pakistan faced. One of the most significant challenges was Pakistan's persistent energy crisis. Frequent power outages disrupted industrial operations, particularly in energy-intensive sectors like manufacturing. The lack of a reliable energy supply led to inefficiencies and reduced productivity. Pakistan's industrial sector, especially textiles, continued to rely on outdated technology, limiting productivity gains. Investments in modern machinery and automation were insufficient, and the lack of modernization in agriculture further contributed to slow growth.

By 2020, labor productivity saw a modest recovery, reaching approximately 1.0 units of GDP per hour worked, indicating signs of improvement following years of stagnation. The China-Pakistan Economic Corridor (CPEC), a flagship project under China's Belt and Road Initiative, brought significant infrastructure investment to Pakistan. The development of roads, railways, and energy projects under CPEC began to ease infrastructure bottlenecks, particularly in transportation and energy supply. These projects helped improve industrial efficiency and productivity. The telecommunications sector continued to expand, with the introduction of 3G and 4G services, improving connectivity across the country. Growth in services such as banking, retail, and real estate also contributed to labor productivity in urban centers. In 2020, the COVID-19 pandemic (UNDP, 2021) disrupted economic activity, especially in services and manufacturing sectors. Lockdowns and disruptions to global trade affected industrial output, slowing productivity growth. However, the impact was somewhat cushioned by ongoing infrastructure projects.

Several challenges have been cited:

- **Energy constraints:** Energy shortages throughout the 2000s and early 2010s severely constrained productivity, particularly in manufacturing. While CPEC projects have helped address these issues, ongoing efforts are needed to ensure a stable energy supply for industries.

- **Lack of diversification:** The economy's heavy reliance on agriculture and low-value-added textile manufacturing has constrained overall productivity growth. The lack of diversification into higher-value-added industries, such as electronics, machinery, or pharmaceuticals, has limited Pakistan's ability to achieve sustained productivity growth.
- **Technological advancement in services:** The growth of telecommunications, banking, and digital services presents opportunities for higher productivity in urban centers. Investments in technology, particularly in IT and digital infrastructure, could boost productivity in these sectors.

While labor productivity in Pakistan experienced slow and uneven growth between 2000 and 2020, it was constrained by critical challenges such as energy shortages, political instability, and the lack of industrial diversification. However, with ongoing investments in infrastructure through CPEC, growing service sectors, and improvements in energy supply, Pakistan has the potential to achieve more substantial productivity gains in the future.

In contrast to labor productivity, GDP growth is more volatile, with several sharp peaks and dips over the period. This is typical of an economy influenced by external factors like global economic conditions and domestic events such as political instability or natural disasters. After recovering from the global financial crisis, both GDP growth and labor productivity experienced a phase of alignment, with both metrics showing upward trends. The simultaneous increase suggests that as the economy recovered, it was accompanied by improvements in worker productivity. The most significant divergence occurred in 2020, when GDP growth plummeted due to the pandemic, but labor productivity was only slightly affected. This indicates that while the broader economy contracted sharply, sectors that remained operational or adapted to the crisis continued to see improvements in worker efficiency. Both GDP growth and labor productivity showed signs of recovery in 2021. GDP growth bounced back sharply after the pandemic-induced contraction, while labor productivity continued its upward trend. This suggests that the underlying productivity of the workforce remained strong and contributed to the overall recovery of the economy.

Labor productivity in Pakistan has shown remarkable resilience over the period, with a consistent upward trend despite economic shocks like the global financial crisis and the COVID-19 pandemic (UNDP, 2021). The steady improvement in productivity suggests that long-term structural changes in the workforce, technology, and industrial focus have driven efficiency gains. Even during periods of economic contraction, labor productivity remained stable or continued to grow. This indicates that improvements in workforce efficiency are not necessarily tied to short-term economic fluctuations and that the gains are likely driven by deeper, more sustainable factors.

Introduction

It has been addressed the transformative power of the digital revolution on the global economy, especially in the context of workplace productivity. However, not all countries, particularly developing nations like Pakistan, are fully prepared to leverage the benefits of this transformation. The COVID-19 pandemic (UNDP, 2021) highlighted the urgency for such preparedness as remote work, digital platforms, and e-commerce surged.

Pakistan, a lower-middle-income country, faces significant socio-economic challenges but also has considerable opportunities. With a population of 241.49 million, a young demographic, and increasing internet connectivity, Pakistan holds great potential for digitalization. The country ranks

164th out of 193 in the Human Development Index (HDI) and 135th on the Gender Inequality Index, reflecting significant disparities in access to technology and digital skills.

The advent of social media and smartphones has allowed Pakistan to connect a vast segment of its population to the digital economy. In 2020, Pakistan had 87.35 million internet users, largely due to increased mobile connectivity. Digital platforms are enhancing participation in the economy, governance, and social inclusion. Strategic investments in digital infrastructure and human capital development could lead to sustainable socio-economic improvements.

Digital Financial Services and Workplace Impact

A central focus of the report is the growth of digital financial services (State Bank of Pakistan, 2023) in Pakistan. The rapid expansion of mobile and internet banking is illustrated through data from 2019–20. There has been a steady rise in the use of digital channels for utility bill payments (Figure 1 in the report), which shows a significant upward trend after 2019. Similarly, the report presents trends in merchant payments (POS transactions), which have been growing consistently (Figure 2). This shift to digital forms of payment has important implications for workplace productivity, particularly as businesses and consumers increasingly rely on these systems for transactions.

The digitalization of financial services can improve overall productivity by streamlining operations, reducing paperwork, and minimizing errors. This trend is not only seen in the financial sector but also in how organizations across various industries manage transactions and services.

Review of Literature on Digital Workplaces in Pakistan

Several academic studies have reviewed the impact of digital workplaces in Pakistan, providing qualitative and quantitative insights into specific sectors.

- **Health sector:** A study on MARHAM (Raza et al., 2022), a digital health platform in Pakistan, analyzed data from social media (Facebook, Twitter/X) and mobile apps. The findings revealed that digital platforms are crucial in spreading health-related information, especially concerning women's and children's health. However, limited internet access and low literacy rates in rural areas remain significant challenges.
- **Mining sector:** Another study focused on the adoption of autonomous mining systems (Ahmed & Khan, 2022) in Pakistan. The research highlighted that while automation could significantly enhance productivity and safety in the mining sector, there is a substantial gap in the knowledge and skills needed to adopt these technologies. The study revealed that although industry stakeholders were willing to adopt autonomous systems, resistance from government agencies due to fears of unemployment and lack of policy planning hinder progress.
- **Industry 4.0 (Ali & Rehman, 2023) in SMEs:** SMEs in Pakistan have the potential to benefit from Industry 4.0 technologies such as big data, cyber-physical systems (CPS), and the internet of things (IoT). One study found that while technologies like big data and CPS had a positive impact on business performance, IoT did not show significant results. The report suggests that SMEs could become more competitive and productive through better access to these technologies, but governmental facilitation and human capital development are necessary.

- **Banking sector:** In the banking sector, data analytics has been identified as a tool for enhancing productivity. One study found that investments in data analytics led to a 6% productivity increase in Pakistani banks. However, the study also pointed out that human capital investment is crucial for sustaining these gains.

Case Studies of Digital Workplaces in Pakistan

Case 1: Digital Trade Prospects and Challenges

This case study examines the digital trade landscape in Pakistan from 2010 to 2020. Using WTO e-commerce and USITC definitions, the study analyzed digital trade volumes and identified the top digital export and import items. Key findings include:

- **Top export and import items:** The study found that unused postage stamps (HS Code 490700) accounted for the highest imports, valued at USD 1.3 billion, while printed matter (HS Code 490199) was the top digital export item, valued at USD 21.8 million.
- **Top trade markets:** The leading export market for Pakistan's digital goods was Saudi Arabia, while China was the largest import market, reflecting Pakistan's dependence on China for digital technology and goods.
- **Infrastructure needs:** A key recommendation from the study is that Pakistan must improve its digital infrastructure, reduce fiscal and trade barriers, and address issues of data security and privacy to enhance digital trade integration.

Case 2: Government Digitization Projects in Khyber Pakhtunkhwa

This case study focuses on the digitization of government projects in Khyber Pakhtunkhwa (KP). The study used qualitative surveys to assess factors that contributed to the success or failure of these projects. Key findings include:

- **Completion and sustainability rates:** Approximately 70% of government ICT projects were completed on time, but sustainability dropped to 45% after two years, indicating issues with long-term project viability.
- **Sources of project ideas:** A significant portion of project ideas originated from international organizations and donors, highlighting external influence on government digitization initiatives.
- **Bureaucracy and political will:** The study identified that bureaucratic will and political pressure were key factors in project completion. However, frequent shuffling within government and bureaucracy negatively impacted project success.

Policies and Regulations for Digital Productivity

Telecommunication policies: Early efforts such as the establishment of the Pakistan Telecommunication Corporation (1991) and the Pakistan Telecommunication Authority (1994) laid the groundwork for digital transformation in the country.

Recent initiatives: In 2018, the Digital Pakistan Policy was launched, focusing on emerging technologies, entrepreneurship, and youth skills development. Other recent initiatives include the RAAST payment system introduced by the State Bank of Pakistan in 2022, designed to facilitate

real-time payments, and the National Data Protection Regulations policy in 2024, aimed at safeguarding data privacy.

Best Practices from Public and Private Sectors

Punjab Information Technology Board, public sector: The Punjab Information Technology Board (PITB, 2023) (PITB) has been instrumental in digitizing government services in the province.

Key initiatives include:

- **e-Pay Punjab:** An online payment platform that allows citizens to pay taxes and utility bills electronically. Since its inception, the platform has processed over 15 million transactions, generating PKR 70 billion in revenue within 30 months (Figure 9).
- **Land Record Management:** PITB has digitized land records through the Land Record Management Information System (LRMIS), reducing corruption and increasing transparency in land transactions.

Habib Bank Limited, private sector: Habib Bank Limited (HBL, 2023) (HBL) is a leader in digital banking transformation. Key practices include:

- **HBL Mobile:** A comprehensive mobile banking platform that enables millions of users to perform transactions remotely, reducing the need for physical bank visits. As of 2023, HBL Mobile had 4 million active users (Table 8).
- **Data Analytics:** HBL uses data analytics to understand consumer behavior and improve service delivery. The bank has also invested in cloud computing to enhance operational efficiency and disaster recovery capabilities.

Recommendations for Enhancing Productivity in Digital Workplaces in Pakistan

Based on the insights gathered, the following recommendations can help boost productivity in the digital workplaces across Pakistan:

- (1) **Investment in digital infrastructure:** To enhance productivity in digital workplaces, Pakistan needs to make substantial investments in digital infrastructure, particularly in rural and underserved areas. Improving internet accessibility and broadband penetration is critical for extending the benefits of digitalization to all parts of the country. In addition, the expansion of 4G and 5G networks can improve connectivity and enable real-time digital transactions and remote work.
- (2) **Upskilling the workforce:** A key challenge identified in the report is the lack of digital literacy and technical skills. To overcome this, both public and private sectors must invest in upskilling programs that focus on developing expertise in Industry 4.0 (Ali & Rehman, 2023) technologies, such as big data, IoT, and artificial intelligence (AI). Collaborative programs between academia, government, and industry should focus on equipping the workforce with skills necessary for autonomous systems, digital trade, and fintech.
- (3) **Strengthening legal and regulatory frameworks:** The government must continue to develop and enforce policies that promote digital adoption while ensuring data privacy and security. The National Data Protection Regulations, introduced in 2024, are a step in the right direction, but more needs to be done to protect consumer data and ensure compliance

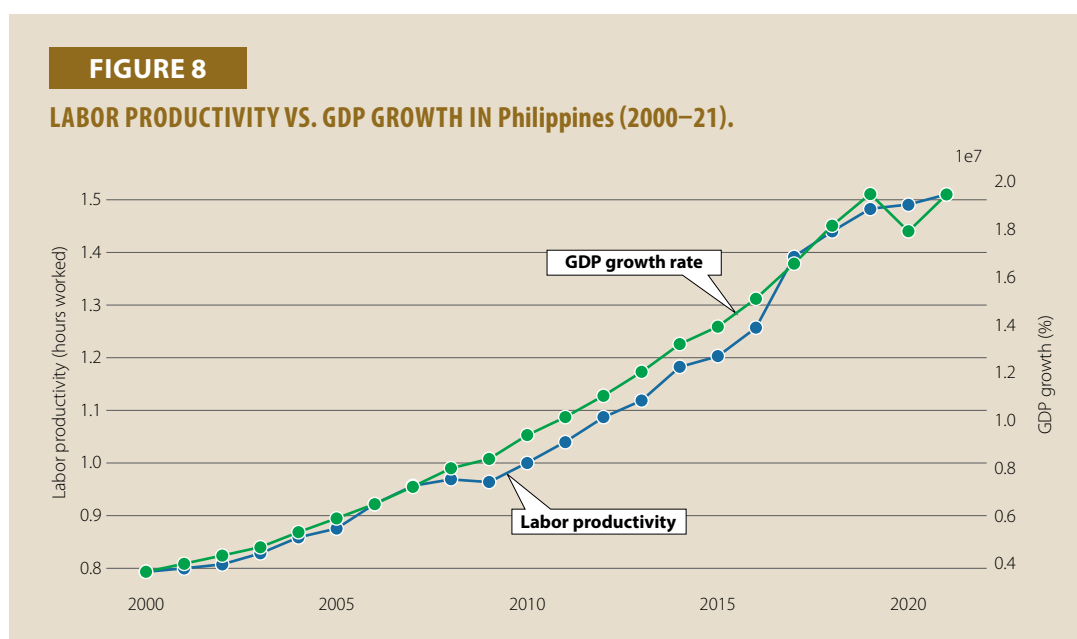
with global standards. Clearer regulations around digital trade and e-commerce can also help attract foreign investment and foster a competitive digital economy.

- (4) Encouraging public-private partnerships (PPPs): To drive digital innovation, the government should foster stronger public-private partnerships. Successful examples, such as PITB's collaboration with local and international organizations, show that PPPs can play a critical role in implementing large-scale digitization projects. Private sector players, such as HBL, have shown that investments in technology can lead to significant productivity gains, and similar collaborations can benefit other sectors as well.
- (5) Incentivizing digital transformation in SMEs: SMEs form the backbone of Pakistan's economy, and their adoption of digital technologies can significantly enhance productivity. The government should offer incentives such as tax breaks, grants, or low-interest loans to encourage SMEs to invest in digital tools and technologies. These incentives should be coupled with training programs to ensure that SMEs can effectively use digital tools to optimize their operations.
- (6) Promoting digital leadership and governance: To sustain productivity gains, organizations need strong digital leadership. The report notes that leadership and governance are key to the success of digitization projects. Training programs that focus on building digital leadership skills within government agencies and businesses should be a priority. Leaders who understand the potential of digital technologies can drive cultural and operational shifts that lead to enhanced productivity.

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The Philippines



Labor productivity in the Philippines shows consistent growth, driven by structural changes, sectoral shifts, and external factors.

In 2001, labor productivity was approximately PHP35.02 per hour worked, growing to PHP59.63 by 2004, which indicates slow growth in a low-productivity economy. During this period, agriculture still accounted for a large share of the workforce but contributed minimally to productivity. The sector relied on labor-intensive practices, with limited use of technology and modern farming techniques. The underdeveloped nature of agriculture kept overall productivity low. The early 2000s saw the first signs of growth in the services sector, particularly in finance and telecommunications. However, the overall economy remained reliant on lower-productivity sectors such as agriculture and manufacturing, where value addition was minimal.

Labor productivity reached PHP85.29 per hour worked by 2010, marking significant progress compared to the early 2000s. The Philippines began to establish itself as a global leader in the BPO industry during this period. The BPO sector experienced rapid growth, particularly in call centers, IT support, and back-office services. These jobs typically had higher productivity rates compared to agriculture, providing a major boost to urban productivity levels. The manufacturing sector, particularly in electronics and semiconductor assembly, benefited from global demand for exports. The sector saw improvements in productivity, though it remained focused on low-value-added production, limiting its potential for significant gains.

By 2015, labor productivity per hour worked had grown to PHP 105.50, reflecting continued steady growth during this period. The BPO industry expanded further during this period, becoming one of the largest contributors to economic growth and productivity. The sector attracted foreign investment and generated millions of jobs, particularly in urban areas like Metro Manila, Cebu, and Davao. The high productivity in the BPO industry, compared to other sectors, continued to push overall productivity upward. Besides BPO, other services like banking, real estate, and telecommunications expanded rapidly. Services overtook agriculture and manufacturing as the

dominant sectors in the economy, accounting for a large share of GDP and contributing significantly to productivity growth.

By 2020, labor productivity reached PHP110.68 per hour worked, showing moderate gains despite the challenges posed by the COVID-19 pandemic. The BPO industry continued to drive economic growth and productivity. With advancements in technology, the sector began to incorporate more value-added services such as IT consulting, software development, and healthcare services. This shift toward higher-value services helped sustain productivity growth, particularly in urban centers. The increasing adoption of digital technologies across multiple sectors, including banking, retail, and telecommunications, helped improve efficiency and productivity. This trend became particularly evident during the pandemic, as businesses shifted operations online and embraced digital solutions.

Unlike labor productivity, GDP growth shows significant fluctuations, with sharp dips and rebounds over time. These fluctuations are typical of an economy subject to external and internal shocks, such as global financial crises, natural disasters, and the COVID-19 pandemic. The GDP growth trend is not as smooth as labor productivity, indicating that economic output is more sensitive to external economic conditions than productivity, which continues to improve at a steady rate.

Throughout various economic downturns, such as the 2008 financial crisis and the 2020 pandemic, labor productivity continued to improve or remained stable, showing the resilience of the workforce. The long-term gains in labor productivity suggest that underlying improvements in education, technology, or industrial shifts have made workers more efficient, regardless of short-term economic shocks.

There have been several challenges ahead based on the analysis:

- **Dependence on low-value manufacturing:** The manufacturing sector's focus on low-value-added industries like electronics assembly limits its ability to drive substantial productivity growth. Diversifying into more value-added industries, such as pharmaceuticals or machinery manufacturing, is essential for improving productivity.
- **Underdeveloped agriculture:** The agricultural sector continues to struggle with low productivity due to traditional farming methods, poor infrastructure, and limited access to modern technology. Addressing these issues will be critical for improving productivity in rural areas.
- **Vulnerability to external shocks:** The COVID-19 pandemic highlighted the economy's vulnerability to external shocks, particularly in sectors like tourism and retail. Diversifying the economy and improving resilience in key industries will be crucial for sustaining productivity growth.
- **Digital transformation:** The rapid growth of the BPO industry and the increasing adoption of digital technologies offer significant opportunities for productivity growth. Investments in automation, artificial intelligence (AI), and workforce upskilling will help enhance productivity in the services sector.

The Philippines has made steady progress in improving labor productivity from 2000 to 2020, driven by the expansion of the BPO sector, growth in services, and investments in infrastructure.

While there are challenges, such as reliance on low-value manufacturing and underdeveloped agriculture, there are significant opportunities for future productivity growth through digital transformation, manufacturing diversification, and continued infrastructure development. If the country can capitalize on these opportunities and address structural bottlenecks, it is well-positioned to achieve sustained productivity growth and long-term economic prosperity.

Introduction and Economic Overview

The Philippines, with a population of 119 million (as of 2024), is one of Southeast Asia's fastest-growing economies, with a 5.6% economic growth rate in 2023. However, inflation has been a concern, reaching 6% in the same year, exceeding the government's target of 4%. The country's digital transformation began in 1994 when the Philippines established its first Internet connection. The liberalization of the telecommunications sector via the Public Telecommunications Policy Act of 1995 spurred the growth of internet service providers (ISPs) and led to an increase in digital adoption across the country.

The COVID-19 pandemic accelerated the growth of the digital economy as consumers increasingly turned to online shopping, education, and financial services. Despite these advancements, many micro, small, and medium enterprises (MSMEs) in the Philippines still struggle with low levels of digital adoption, creating a gap between larger businesses and smaller enterprises in terms of productivity.

Legislative Framework for Digital Workplaces

The Philippine government has enacted several laws to support digital workplaces and foster the digital transformation of its economy. Key pieces of legislation include:

- **Telecommuting Act (Government of the Philippines, 2018):** This law institutionalizes telecommuting as an alternative work arrangement for private-sector employees, ensuring transparency, fairness, and compliance with labor laws.
- **Philippine Digital Workforce Competitiveness Act (Government of the Philippines, 2022):** This law aims to equip Filipinos with globally competitive digital skills, enhancing their employability and ability to thrive in the digital economy. It also supports the creation of shared service facilities and co-working spaces for digital workers.
- **Executive Order on Digital Payment Systems (2023):** Mandates the adoption of digital payment systems for government transactions, aiming to improve efficiency and transparency in financial processes.

The government's commitment to digital transformation is reflected in the proposed PHP12.47 billion budget for 2023, allocated to improving government digital services and processes.

Digital Transformation and the Productivity Paradox

Despite significant investments in digital technologies, the impact on productivity remains uncertain, a phenomenon known as the Solow Productivity Paradox (SPP). The paradox refers to the disconnect between increasing investments in technology and the lack of corresponding increases in productivity. In the Philippines, labor productivity grew by 2.32% between 1992 and 2023, which is relatively strong, but the expected gains from digitalization have yet to be fully realized.

Several factors contribute to this paradox, including mismeasurement of productivity, compensation mechanisms, and labor displacement due to automation. Digital tools can boost output, but the displacement of workers to less productive sectors and the challenge of measuring the quality improvements of digital services contribute to the perception that productivity gains are stagnating.

Labor Productivity and Economic Growth (2012–22)

Between 2012 and 2022, the Philippines experienced an increase in labor productivity, with GDP per capita rising from USD6,351 in 2012 to USD8,723 in 2022. The country's economic growth, driven by a real GDP increase of 60.2% over this period, has been significantly influenced by workforce productivity. Key drivers of productivity in the Philippines include:

- **Investment-friendly policies:** These policies encourage foreign direct investment, which helps MSMEs access advanced technologies and resources.
- **Efficient resource allocation:** Reforms in manufacturing aimed at reducing inefficiencies have helped boost overall productivity.
- **Market competition:** Deregulation in industries like telecommunications and air transport has forced companies to improve performance, driving innovation and efficiency.
- **Trade policies:** Export-oriented policies have improved productivity by encouraging businesses to meet international standards.

While the Philippines has made significant strides in productivity, there remains room for improvement, particularly in the service sector and MSMEs, which make up the majority of businesses.

Digitalization and Productivity Enhancement

Digitalization is seen as a key driver of productivity, particularly in the public sector. The Ease of Doing Business and Efficient Government Service Delivery Act (2018) was passed to streamline bureaucratic processes and reduce inefficiencies in government transactions. Government agencies such as the Land Transportation Office (LTO) and the Bureau of Internal Revenue (BIR) have embraced digital tools to improve service delivery.

Challenges remain, however, particularly in the cost of doing business. High electricity costs and logistics expenses put the Philippines at a disadvantage compared to its neighbors. Moreover, many government agencies struggle with the slow adoption of digital platforms due to inconsistent access to reliable internet and varying levels of digital literacy among employees.

Effects of Digitalization in Public and Private Sectors

The COVID-19 pandemic drastically changed how the public and private sectors operate, bringing digitalization to the forefront. Public school teachers, for example, were forced to adapt to online teaching, while government agencies such as the Securities and Exchange Commission (SEC) implemented e-filing systems that made company registration more efficient. The SEC's eSPARC and OneSEC platforms, launched in 2021, led to a 15% increase in new business registrations by 2023.

The private sector has also seen significant gains from digitalization, particularly in services such as e-commerce, insurance, and customer support. Online selling platforms like Lazada and Shopee have enabled businesses to reach a wider customer base while reducing overhead costs. Additionally, the adoption of e-wallets such as GCash and PayMaya has revolutionized online payments, enabling even those without bank accounts to participate in the digital economy.

Best Practices in Digital Workplaces

TESDA Online Program (TOP): TESDA (Technical Education and Skills Development Authority) introduced e-learning programs in 2011 to offer vocational education online. By 2023, over 1.2 million individuals had enrolled in TESDA's programs, with over 872,000 receiving certification. This initiative is a prime example of how digital tools can expand access to education and skills training.

Bureau of Internal Revenue (BIR) E-filing and Payment System: The TRAIN Law (2017) mandated the use of e-invoicing and digital tax filing, which has greatly improved tax collection efficiency. In 2020, 86% of taxes were collected via electronic payment channels, and the number of business taxpayers registering with the BIR increased by 6.15%.

Challenges to Full Digital Transformation

While the Philippines has made significant strides, several challenges still hinder the full realization of digital workplace benefits:

- **Inconsistent internet access:** Many rural areas lack reliable, high-speed internet, limiting the reach of digital platforms and their effectiveness.
- **literacy gaps:** Many government employees and citizens still lack the necessary digital skills to fully engage with new technologies, slowing down adoption.
- **Cybersecurity concerns:** Several data breaches in government agencies have raised concerns about the security of digital systems, highlighting the need for more robust cybersecurity frameworks.
- **Bureaucratic hurdles:** Resistance to organizational change and the complexity of government processes can slow the adoption of digital platforms.

Policy Recommendations

To overcome the challenges and further enhance digital productivity, several policy recommendations are suggested:

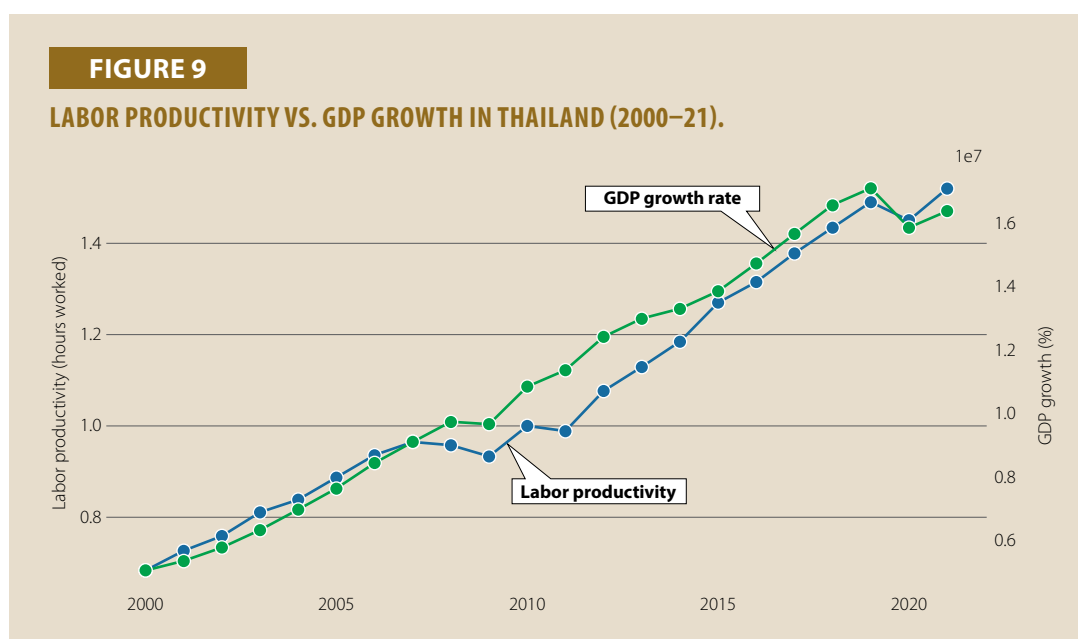
- **Investment in digital infrastructure:** The government needs to invest in expanding reliable internet access, particularly in rural areas, through public-private partnerships.
- **Promoting digital literacy:** Continuous training programs should be implemented for government employees and the general workforce to ensure they can effectively use digital tools.
- **Strengthening data security:** Comprehensive frameworks must be established to safeguard sensitive information and ensure compliance with international data security standards.

- **Encouraging a culture of innovation:** The government should foster a more flexible regulatory environment that encourages experimentation with new digital solutions.
- **Monitoring and evaluation:** Regular monitoring and assessment can facilitate improvements and adaptability in the long run.

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Thailand



Labor productivity has consistently increased throughout the 2000–21 period. This suggests that workers in Thailand have been producing more output per hour worked over time, reflecting improvements in efficiency. There are several underlying factors. First, technological advancements. Increased adoption of technology across various sectors could be a significant factor behind rising productivity. Automation, digitization, and better use of data likely contributed to improving output per hour worked. Second, improved human capital. Investments in education, workforce training, and skill development have likely resulted in more productive workers. Thailand has been focusing on upgrading its workforce to align with more knowledge-based and skilled sectors. Lastly, sectoral shifts. Structural changes in the economy, with a shift from agriculture to more productive sectors like manufacturing, services, and technology, may have also contributed to improved labor productivity.

In contrast, GDP growth in Thailand fluctuates significantly over the period, with noticeable peaks and troughs. The volatility suggests that the economy has been susceptible to both external and internal shocks, such as global financial crises, political instability, and natural disasters. There is a sharp dip in GDP growth during the global financial crisis, reflecting the impact of the downturn in global trade and investment. Thailand's export-oriented economy was hit hard, resulting in slower economic activity. However, labor productivity continued its rise during this period, highlighting the resilience of worker efficiency despite the overall economic downturn. The sharpest decline in GDP growth occurs in 2020 due to the global economic impact of the COVID-19 pandemic. Thailand's economy contracted sharply as international trade, tourism, and domestic consumption dropped. Despite the severe impact on GDP, labor productivity experienced only a slight decline. This suggests that the industries that continued to operate or adapt during the pandemic were able to maintain efficiency, likely through digital transformation and remote work.

During 2000–07, both labor productivity and GDP growth increased in tandem. This suggests a period of stable economic expansion, where the Thai economy grew, and workers became more efficient at producing output. The steady alignment indicates a healthy relationship between overall

economic activity and workforce efficiency, likely driven by strong export performance, growth in manufacturing, and rising investments. After recovering from the global financial crisis, Thailand's economy again experienced a period of alignment between labor productivity and GDP growth. Both metrics rose, with GDP growth being somewhat more volatile. During this phase, improvements in productivity were likely driven by shifts toward higher-value industries such as electronics, automotive manufacturing, and services. The economy rebounded, supported by a strong labor force that became increasingly efficient.

Despite the sharp dip in GDP growth during the financial crisis in 2008–09, labor productivity continued to rise steadily. This divergence indicates that while overall economic activity slowed due to global market contractions, the efficiency of workers improved. Possible reasons include less efficient firms exiting the market, leaving the more productive ones to continue operating. The crisis may have spurred investments in technology, which improved efficiency as businesses sought to cut costs and enhance productivity. The most notable divergence occurred in 2020 due to COVID-19. While GDP growth plummeted due to the pandemic, labor productivity experienced only a small dip, showing resilience. This divergence can be explained by sectoral shifts and digitalization. While sectors like tourism, hospitality, and retail were hit hard, industries like manufacturing, logistics, and technology remained operational or even saw increased demand. Furthermore, many firms adopted digital tools and remote work, which allowed them to maintain or even improve productivity during the pandemic, contributing to the stability of labor productivity despite economic disruptions.

In 2021, both GDP growth and labor productivity began to recover. GDP growth saw a sharp rebound, driven by the reopening of the economy, recovery in international trade, and domestic stimulus measures. Labor productivity continued its steady rise, suggesting that efficiency gains persisted even during the recovery phase. The continued growth in labor productivity post-crisis suggests that the efficiency improvements made during the pandemic, such as digitization and automation, have become embedded in the economy. This positions Thailand for long-term economic stability and growth.

One of the key takeaways from the graph is the resilience and steady rise in labor productivity, even during times of economic turmoil. While GDP growth fluctuates in response to external shocks, labor productivity remains relatively stable and consistently increases. Thailand's economy has been undergoing structural changes, moving away from agriculture toward more productive sectors such as manufacturing, technology, and services. This structural transformation has allowed labor productivity to grow steadily. The adoption of technology, especially in industries such as manufacturing, logistics, and financial services, has helped to improve efficiency and productivity, even in periods of economic downturn. During both the financial crisis and the COVID-19 pandemic, Thailand's economy adapted through efficiency-enhancing measures, such as remote work and digital tools. These adaptations helped maintain labor productivity despite the overall contraction in GDP.

In conclusion, labor productivity in Thailand has shown consistent growth over the two decades, reflecting long-term structural improvements, technological adoption, and better workforce skills. Even during economic crises, productivity remained resilient, indicating that deeper changes in the economy have helped to drive sustained efficiency gains. The volatility in GDP growth reflects the Thai economy's sensitivity to external shocks, such as the global financial crisis and the COVID-19 pandemic. However, the sharp recoveries in GDP growth after each downturn suggest that Thailand's economy is capable of bouncing back quickly, supported by strong labor productivity. Both metrics are recovering in 2021, with GDP growth rebounding strongly and labor productivity continuing its steady

rise. This suggests that Thailand's economy is emerging from the pandemic on a strong footing, with improvements in both economic output and worker efficiency. This analysis shows that Thailand's long-term growth prospects are supported by consistent gains in labor productivity, which have helped buffer the economy against external shocks and will continue to drive future growth.

Digital Transformation and Its Role in Enhancing Productivity

One of the most significant factors driving productivity growth in Thailand is digital transformation. As the world shifts toward a digital economy, Thailand's ability to adopt and integrate new technologies into the workplace plays a critical role in enhancing productivity.

- **Digital workplace:** The report emphasizes the role of a digital workplace, where employees can access tools and collaborate from anywhere through the use of technology. This shift is essential for increasing work efficiency, especially in the post-pandemic world where remote work has become the norm.
- **Automation in operations:** The integration of AI, robotics, and data analytics into business operations has led to a significant reduction in manual tasks, thereby cutting costs and improving accuracy. By automating repetitive processes, companies can focus more on high-value tasks, ultimately enhancing productivity.
- **Sales and marketing:** The use of digital marketing platforms, CRM tools, and data analytics has transformed how businesses approach sales and customer outreach. These tools enable businesses to target specific markets, automate customer interactions, and analyze real-time data. This results in higher conversion rates and reduced marketing costs, which are crucial for productivity.

The Thailand Digital Technology Foresight 2035 (Frost & Sullivan, 2023) report outlines the growing role of digital transformation, with technologies such as AI, cloud services, and data analytics being adopted across various sectors. A significant percentage of businesses in Thailand have embraced data analytics (69.89%) and cloud services (47.46%), signaling a shift toward more data-driven and agile operations. This digital shift is crucial for sustaining productivity growth in Thailand, as it allows companies to optimize their operations and reduce manual workloads.

Impact of the ICT Sector and Post-COVID Economic Recovery

The COVID-19 pandemic accelerated the adoption of ICT in Thailand, positioning the ICT sector as a key driver of economic recovery and productivity enhancement. As businesses adapted to the new normal, the demand for digital tools skyrocketed.

E-commerce growth: One of the most significant impacts of the ICT sector has been the growth of e-commerce in Thailand. The market grew from USD23.4 billion in 2022 to USD26.5 billion in 2023, and is projected to reach USD32 billion by 2025. The widespread use of mobile wallets and improved logistics systems has made online shopping more accessible, efficient, and convenient. This shift toward digital commerce has streamlined sales processes, reducing transaction times and increasing the productivity of retail businesses.

Remote work and digital collaboration: The shift to remote work during the pandemic underscored the importance of digital collaboration tools like Zoom, Google Meet, and Microsoft Teams. These tools allowed businesses to maintain productivity despite physical restrictions by enabling real-time communication, file sharing, and project management from remote locations.

Moreover, tools like Asana and Trello became essential for managing tasks and workflows, helping teams stay organized and meet deadlines.

Growth in digital services: With more businesses investing in digital services and software, the ICT sector has become a cornerstone of Thailand's productivity enhancement efforts. Businesses are increasingly using AI platforms, cloud services, and other digital tools to automate workflows and manage data more effectively. This not only improves operational efficiency but also helps businesses reduce overhead costs and make faster decisions.

Case Studies on Enhancing Productivity through Digital Tools

Ajinomoto Thailand (Ajinomoto, 2023): This food manufacturing company adopted UiPath Robotic Process Automation (RPA) in its Finance and Accounting department. By automating manual tasks such as generating cash flow reports and processing financial transactions, Ajinomoto saved over 14,000 minutes per month. The automation of the daily cash flow report reduced the time required by 95%, and similar processes were optimized to improve overall productivity.

Food Project (Siam) Co., Ltd. (Food Project, 2023): A major food service provider, Food Project (Siam) utilized Microsoft Power Automate and Power BI to streamline its sales process. The company developed an application that provides real-time inventory, sales, and customer information, enabling sales staff to access this data on mobile devices. This digital tool reduced communication errors, sped up decision-making, and helped close sales more quickly, thus improving overall business productivity.

Siam Commercial Bank (SCB, 2023): SCB implemented Blue Prism's RPA to automate its ATM error resolution process. When an error occurs, digital workers handle the entire process—from verifying the issue to refunding the customer—all within five minutes. This automation drastically reduced the time and effort required to resolve customer issues, demonstrating how digital tools can improve operational efficiency and customer satisfaction.

Line Thailand (Line Thailand, 2023): The software company adopted a "Happy Digital Workplace" model to support remote work while ensuring employee well-being. Line implemented secure remote access tools, provided health insurance and telemedicine services, and fostered a positive work environment through regular feedback and social activities. These measures helped maintain productivity levels and employee engagement, even in a remote work setting.

Siriraj Hospital (Siriraj Hospital, 2023): Thailand's largest public medical institution has undergone a significant digital transformation to enhance healthcare delivery and operational efficiency. The hospital has implemented a 5G private network, hybrid cloud solutions, and AI-assisted diagnostic tools, enabling rapid processing of medical cases, efficient patient data management, and improved patient care.

The Revenue Department, Thailand (Revenue Department, 2021): Thailand's Revenue Department launched the D2RIVE strategy in 2018 to modernize tax administration through digital transformation. The initiative aimed to simplify compliance, enhance taxpayer services, and leverage data analytics to improve operational efficiency and policy responsiveness. As noted in the 2020 Annual Report, the D2RIVE strategy significantly enhanced service resilience during the COVID-19 pandemic and drove a substantial increase in public sector productivity, thereby advancing Thailand's digital economy agenda and setting a benchmark for data-driven governance.

Challenges in Achieving Digital Transformation and Enhancing Productivity

Despite the clear benefits of digital transformation, Thailand faces several significant challenges that could hinder the country's ability to fully realize its productivity potential:

Skills gap: One of the biggest obstacles to enhancing productivity in Thailand is the lack of a skilled workforce. Although digital tools are becoming more prevalent, many workers lack the necessary digital skills to use them effectively. The report “Fostering Foundational Skills in Thailand” by the World Bank (2022) notes that 64.7% of Thai workers have literacy skills below international standards, and 74.1% have substandard digital skills. This skills gap could lead to long-term economic losses, estimated at up to 3.3 trillion baht annually, due to reduced labor productivity and limited capacity for innovation.

Budget constraints: Many SMEs in Thailand struggle with the costs associated with adopting digital technologies. Budget constraints limit their ability to invest in new tools, upgrade their infrastructure, and provide adequate training for their employees. Without sufficient financial resources, many businesses are unable to take full advantage of the productivity gains offered by digital tools.

Data security and privacy concerns: As businesses move more of their operations online and adopt cloud-based technologies, ensuring data security and privacy becomes a critical challenge. Companies need to implement robust cybersecurity measures to protect sensitive information, particularly when dealing with customer data. Failure to address these concerns can lead to data breaches, which can disrupt business operations and damage customer trust.

Integration of new technologies: Many organizations face difficulties integrating new digital tools into their existing workflows. The complexity of transitioning from traditional systems to modern digital platforms often leads to resistance from employees or operational bottlenecks. Successfully integrating these technologies requires careful planning, effective change management, and a focus on aligning new tools with the organization's strategic objectives.

Government Initiatives and Policy Support

The Thai government has implemented several key policies and initiatives aimed at fostering digital transformation and enhancing productivity:

Thailand 4.0 Strategy: This national strategy aims to transform Thailand's economy into one driven by innovation and high-value industries, such as digital technology. The government encourages investments in AI, Big Data, and telecommunications, which are key drivers of productivity and economic growth. The strategy also aims to increase the country's Total Factor Productivity (TFP) by 2% annually.

National Digital Plan: The Digital Economy Promotion Agency (DEPA) was established to drive the digital economy by improving telecommunications infrastructure, supporting the adoption of digital tools by businesses, and promoting innovation. Key achievements of the National Digital Plan – Phase 1 (2018-2022) include advancements in hardware, software services, telecommunications, and digital content, which are essential for building a more productive and technologically advanced economy.

The National Digital Identity (NDID) framework was established to develop a digital identity verification system, improve public services, and create a Trusted Ecosystem connecting data across sectors. The Ministry of Finance and the Ministry of Digital Economy and Society played key roles in its formation, along with the Digital Identity Committee, which includes experts from various sectors.

The Cloud First Policy encourages government agencies to prioritize cloud computing solutions when adopting new IT systems. The policy aims to enhance efficiency, reduce costs, and improve data security by leveraging cloud technology. It also promotes the development of digital infrastructure that supports the country's digital economy and government services.

The National AI Strategy and Action Plan (2022–27) focuses on advancing artificial intelligence to drive economic growth, improve public services, and enhance innovation. The strategy emphasizes building a robust AI ecosystem, including research, development, and collaboration between the government, private sector, and educational institutions. It aims to position Thailand as a regional leader in AI technology while addressing ethical, legal, and social implications of AI adoption.

Recommendations

Support digital skill development: Expand digital literacy and skills training for employees to ensure they can effectively use the latest tools, contributing to better productivity measurement and performance.

Foster cross-functional collaboration: Encourage team-based metrics and cross-department collaboration to break down silos and improve organizational-wide productivity.

SMEs should be supported through digital transformation hubs, government grants, and mentorship programs, while expanding broadband access and promoting cloud-based solutions can help improve their efficiency.

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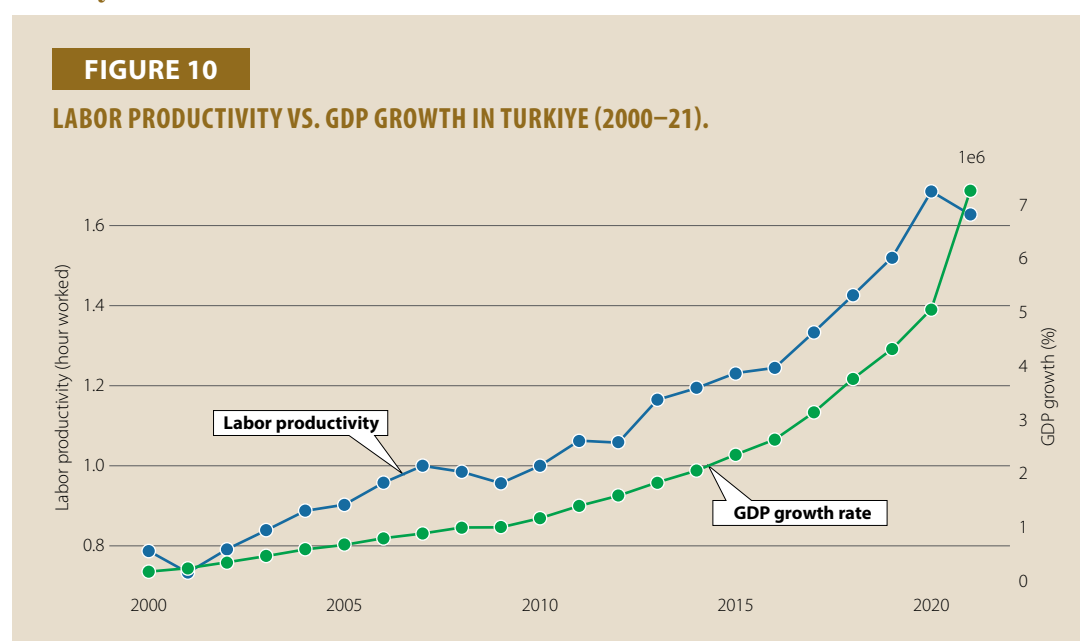
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Turkiye



Labor productivity based on hours worked shows a general upward trend during the 2000–21 period. This suggests that the Turkish workforce has been increasingly efficient, producing more output per hour worked. Labor productivity accelerates particularly in the mid-2000s (2005–08), reflecting economic reforms, structural changes, and growth in key sectors such as manufacturing, services, and construction. After the global financial crisis in 2008–09, labor productivity in Türkiye continued to rise, though at a slower pace. This period marked a gradual recovery with a focus on improving worker efficiency in industries that were bouncing back from the crisis. Despite external shocks, such as the global financial crisis and other political/economic challenges (e.g.,

regional conflicts in the south and north of Türkiye, and exchange rate fluctuations), labor productivity remained resilient. Even though GDP growth fluctuated, the efficiency of labor continued to improve, showing structural improvements in workforce skills, technology adoption, and industry productivity.

On the other hand, GDP growth in Türkiye experienced significant volatility during this period, with periods of rapid growth followed by sharp contractions. After a high-growth phase during 2000 to 2007, driven by investments, exports, and rising domestic demand, this period aligned well with rising labor productivity. The global financial crisis led to a sharp contraction in Türkiye's GDP growth, mirroring global economic conditions. However, labor productivity continued to increase, indicating that some sectors may have become more efficient despite the slowdown in overall economic activity. More recent years show slower or volatile GDP growth, impacted by regional instability, currency devaluation, and external shocks. Despite this, labor productivity showed resilience, continuing its upward trend.

Impact of labor productivity on GDP growth shows a positive correlation during growth phases. During periods of high GDP growth (e.g., 2003–07, 2010–17), labor productivity also grew steadily. This indicates that productivity gains were a critical driver of economic expansion. Improved worker efficiency contributed to higher output and, by extension, stronger economic growth. However, during the global financial crisis (2008–09) and regional political/economic crises (2018–21), labor productivity in Türkiye continued to rise despite significant fluctuations in GDP growth. This suggests that even though the overall economy was under pressure, the workforce's efficiency helped mitigate the impact of these crises. Workers were able to produce more with fewer inputs, which likely prevented even sharper GDP declines.

The steady rise in labor productivity indicates long-term structural changes in the Turkish economy. Investments in education, skills development, technology, and infrastructure have likely contributed to this improvement. Over time, these factors helped Türkiye become more competitive in global markets, leading to stronger export performance and industrial efficiency. Structural changes in the economy, with shifts away from lower-productivity sectors like agriculture toward higher-productivity sectors such as manufacturing and services, contributed to the rise in labor productivity. These shifts also supported GDP growth, particularly during periods of global economic expansion.

Despite recent economic challenges, including regional political instability, inflationary pressures, and currency depreciation, labor productivity in Türkiye has remained resilient. While GDP growth slowed, labor productivity continued to rise, suggesting that the underlying efficiency of the workforce is improving, likely due to technological adoption and a more skilled labor force. The gradual adoption of digital technologies and automation has also played a role in enhancing labor productivity. In sectors like manufacturing, logistics, and services, technology has allowed workers to become more efficient, which is reflected in the rising productivity figures.

Labor productivity has provided a foundation for long-term growth. The steady rise in labor productivity, despite fluctuations in GDP growth, indicates that Türkiye's workforce has become increasingly efficient over time. This improvement offers a solid foundation for future economic growth, as productivity gains are essential for sustained economic expansion. The increase in labor productivity has helped Türkiye weather economic storms. During periods of GDP contraction, higher worker efficiency meant that the overall economic output was not as severely impacted as it might have been otherwise. This suggests that investments in productivity-enhancing measures, such

as education and technology, have paid off. The continued improvement in labor productivity is crucial for the sustainability of long-term GDP growth. As Türkiye faces future economic challenges, including inflation and external economic pressures, maintaining and enhancing worker efficiency will be key to ensuring stable growth. While labor productivity has risen, Türkiye faces challenges in sustaining GDP growth due to external factors like geopolitical risks, inflation, and global market volatility. However, if the country continues to invest in education, skills development, and technological innovation, it can continue to improve productivity and support economic expansion.

Labor productivity has been a key factor in Türkiye's economic performance from 2000 to 2023. While GDP growth has been more volatile, labor productivity has shown consistent gains, acting as a stabilizing force during economic crises and downturns. The structural shifts in the economy, such as the transition from agriculture to higher-value sectors, investments in technology, and workforce skills, have all contributed to rising productivity. Going forward, maintaining these gains will be critical for ensuring sustainable economic growth in Türkiye.

Digital Workplaces in Türkiye

In Türkiye, the spread of digital workplaces has been accelerated by several factors, including the development of internet access and the rapid digitalization of industries. The COVID-19 pandemic further accelerated this trend by making remote work a necessity, prompting businesses to adopt digital tools at a faster rate. Sectors like e-commerce, software development, and digital marketing have become highly digitalized, benefiting from Türkiye's young and dynamic population, which is well-positioned to support the country's digital transformation.

Key Digitalization Indicators in Türkiye

Internet use: As of 2023, internet access in Türkiye reached 95.5% of households, an increase from the previous year. Among individuals aged 16–74, internet use (TurkStat, 2023) rose to 87.1%, with higher usage among men (90.9%) than women (83.3%). These statistics indicate that Türkiye has a strong foundation for digital workplaces, with the necessary infrastructure for widespread digital adoption.

Businesses in Türkiye have also embraced digital technologies: 97% had internet access in 2022, and 43% engaged in online sales. Cloud computing is used by more than half of businesses, while 35% have adopted big data analytics to improve business operations. These indicators demonstrate that Türkiye's businesses are rapidly adopting digital tools, contributing to the spread of digital workplaces.

e-Government statistics: Türkiye's e-Government Portal (Digital Türkiye, 2023) has become a vital element in the country's digital transformation, with over 64 million users accessing more than 7,700 services in 2023. The number of institutions offering services through the portal also increased, reflecting the government's commitment to digitalizing public services and making them more accessible to citizens. According to the United Nations e-Government Index (UN DESA, 2022), Türkiye's e-Government Index score doubled between 2010 and 2022, rising from 0.48 to 0.80. This improvement brings Türkiye closer to the European Union average of 0.86, highlighting the progress the country has made in digitalizing its public services and infrastructure.

R&D: Türkiye continues its strategy to enhance global competitiveness by increasing R&D expenditures. In 2022, the share of Türkiye's R&D expenditures in its GDP reached 1.32%. The number of R&D and design centers established by the private sector in Türkiye has been increasing

every year. As of 2024, the number of R&D centers in Türkiye has reached 1,326, and design centers reached 332. These centers aim to contribute to Türkiye's industrial infrastructure through technology and innovation. They are particularly concentrated in sectors such as information technology, electronics, automotive, defense industry, biotechnology, and pharmaceuticals. Additionally, Technology Development Zones (Techno parks) have become an important part of R&D and innovation activities in Türkiye. As of 2024, there are 104 Technology Development Zones across the country. These zones serve as areas where high-tech firms collaborate with universities and research institutions to conduct R&D activities. Firms operating in these zones have the opportunity to carry out their R&D projects more efficiently, benefiting from tax incentives and various government supports.

Policies Supporting Digital Transformation

Development plans: Türkiye's development plans have prioritized digital transformation as a key driver of economic development. The 11th Development Plan (Presidency of Strategy and Budget, 2019) (2019–23) emphasized the role of digitalization in enhancing competitiveness in industries such as e-commerce, financial technologies (fintech), and public services. Investments in infrastructure, such as expanding broadband and implementing 5G technology, are central to this plan.

The upcoming 12th Development Plan (Presidency of Strategy and Budget, 2023) (2024–28) builds on these initiatives by focusing on green and digital transformations as drivers of competitive production. This plan aims to improve productivity by integrating digital technologies across priority sectors like manufacturing.

Industry and Technology Strategy 2023 (Ministry of Industry and Technology, 2023): Türkiye's Industry and Technology Strategy (2023) is focused on enhancing the country's global competitiveness by integrating digital technologies into industrial processes. This strategy promotes the use of smart manufacturing, AI, big data, and the IoT to improve productivity, flexibility, and innovation in industries. SMEs are a key focus, with the strategy offering incentives and support to help smaller businesses adopt digital technologies.

National Artificial Intelligence Strategy (Digital Transformation Office, 2021): The National AI Strategy (2021–25) positions AI as a central component of Türkiye's digital transformation. The strategy aims to enhance efficiency in business processes and public services by leveraging AI technologies. It also focuses on developing a skilled workforce capable of using AI tools, ensuring that Türkiye remains competitive in the global digital economy.

Manufacturing Industry

Manufacturing sector through digital transformation is part of the 12th Development Plan (Presidency of Strategy and Budget, 2023). The main objectives are to increase productivity and competitiveness in key sectors by leveraging digital technologies.

Key goals include:

- raising the added value per worker in the manufacturing industry to USD35,000;
- boosting manufacturing industry exports to USD210 billion;
- ensuring that 50% of these exports come from medium- and high-tech products; and

- developing at least 23 smart products with global leadership in market share or brand value within disruptive technology areas.

To achieve these goals, various programs have been implemented to support the digital transformation of SMEs and larger businesses:

- KOSGEB KOBİGEL (KOSGEB, 2023) SME Development Support Program: Provides consultancy and support for digitalization in manufacturing.
- MoIT Technology-Oriented Industry Move Program (MoIT, 2023a): Offers calls for proposals on innovative technologies and products to accelerate digital transformation.
- MoIT Digital Transformation Incentive Program (MoIT, 2023b): Provides indirect support, such as tax incentives, for businesses investing in digital technologies.

These initiatives aim to make Türkiye's industry more innovative, efficient, and technologically advanced, positioning the country to compete on a global scale.

Labor Productivity in Türkiye

In 2023, the labor force in Türkiye grew to 34.896 million people, with a labor force participation rate of 53.3%. Men have a significantly higher participation rate (71.2%) compared to women (35.8%). Employment is concentrated in the services sector (57.6%), followed by industry (21.2%), agriculture (14.8%), and construction (6.3%).

Türkiye's labor productivity has fluctuated significantly between 2000 and 2022. The highest growth rate was recorded in 2004, followed by a sharp decline during the 2008 global financial crisis. Productivity rebounded after 2010, with significant gains during the COVID-19 pandemic in 2020, when many businesses adopted remote work and digital tools, making their operations more efficient. However, in 2021, productivity growth fell sharply, reflecting post-pandemic economic adjustments.

Sectoral Productivity

The manufacturing sector has seen productivity improvements, rising from 12.9 in 2005 to 25.6 in 2022, largely driven by automation and digitalization. Sectors like information and communication, financial services, and retail have experienced even larger productivity gains due to the adoption of digital technologies, further highlighting the positive impact of digitalization on workplace productivity in Türkiye.

A survey conducted by the Turkish Informatics Industry Association (TÜBİSAD) in 2020 and 2022 evaluated the long-term effects of the COVID-19 pandemic on the digital workplace. Key findings show that

- 68% of companies plan to extend remote work for employees;
- 66% of businesses will make greater use of online platforms;
- 42% of businesses are considering reducing office space; and
- 72% of companies are focusing on improving employee productivity through digital tools.

The survey results indicate that remote work and flexible working arrangements have become permanent in many sectors, underscoring the lasting impact of the pandemic on Türkiye's digital workplace landscape.

Digital Workplaces and Remote Work

Türkiye addresses the growing importance of remote work and flexible working models, especially in the context of digital transformation. It highlights how the 12th Development Plan (Presidency of Strategy and Budget, 2023) (2024–28) and other policy documents integrate remote work into national strategies as follows:

- 12th Development Plan (Presidency of Strategy and Budget, 2023): The plan emphasizes the expansion of flexible working models like remote work in a secure and regulated manner. It underscores the importance of ensuring these models are properly integrated into Türkiye's labor market while maintaining a balance between work and personal life.
- Coordination Council for the Improvement of the Investment Environment (YOİKK): YOİKK includes actions to simplify regulations for new flexible work models, such as remote work and temporary employment. The council aims to extend remote work rights for employees in R&D, Design Centers, and Technology Development Zones.
- Industry and Technology Strategy 2023 (Ministry of Industry and Technology, 2023): This strategy supports remote work as part of Türkiye's broader digital transformation goals. It promotes the creation of digital work environments, enhancement of digital skills, and the adoption of flexible work models.
- National Artificial Intelligence Strategy (Digital Transformation Office, 2021) (NAIS): The NAIS emphasizes the role of AI technologies in enabling more flexible and efficient remote working environments. It supports the integration of AI into labor markets to boost productivity and flexibility.
- National Youth Employment Strategy 2021–23: This strategy focuses on increasing youth participation in the labor market by promoting digital skills and remote work opportunities. It encourages youth entrepreneurship through digital platforms, e-commerce, and freelancing.

Legislation Supporting Digital Workplaces

Türkiye has introduced several legal frameworks to support the development of digital workplaces:

- Labor Law (Law No. 4857): In 2016, an amendment was made to define remote work as a legitimate form of employment. Employers are required to provide digital tools and ensure the safety of remote workers.
- Occupational Health and Safety Law (Law No. 6331): Extends health and safety standards to remote workers, ensuring they work in a safe digital environment.
- Regulation on Home-based and Flexible Working Models: Introduced in 2021, this regulation outlines the responsibilities of employers and employees in remote working arrangements, addressing issues such as data security, confidentiality, and working hours.

Governance Structure Regarding Digital Transformation

The governance structure regarding digital transformation in Türkiye is multi-layered and is shaped by various public institutions, private sector actors, academic organizations, and civil society organizations operating in different fields. The roles and responsibilities of the institutions responsible for and involved in digital transformation are summarized as follows:

Presidency's Office of Digital Transformation: It is responsible for the creation, implementation, and monitoring of digital transformation policies in the public sector. It coordinates Türkiye's digitalization processes, promotes digital government applications, and supports national technology policies.

Ministry of Industry and Technology: It supports Türkiye's digital and industrial transformation processes, with a particular focus on the integration of advanced technologies such as AI and automation into the industry. It is responsible for developing digital industry policies, supporting the digital transformation of the manufacturing industry, and creating policies to enhance technology and R&D infrastructure.

Ministry of Transport and Infrastructure: It ensures the development of Türkiye's digital infrastructure, widespread access to broadband internet, and the advancement of digital connectivity technologies. It is responsible for promoting investments in 5G and fiber infrastructure, developing communication infrastructure strategies, strengthening the digital economy, and enhancing communication infrastructure.

TÜBİTAK (The Scientific and Technological Research Council of Türkiye): It encourages R&D activities in digital transformation, supports technology-focused projects, and contributes to the development of the innovation ecosystem. It is responsible for supporting research projects in digital transformation areas such as AI, big data, and IoT, managing national and international R&D programs, and providing funds to technology-based companies to foster innovation.

Ministry of Trade: It promotes the development of e-commerce and digital trade and formulates policies for the digital economy. It is responsible for enhancing the infrastructure for digital trade and strengthening the e-commerce ecosystem.

Information and Communication Technologies Authority (BTK): It regulates Türkiye's communication infrastructure, supervises internet and telecommunication services, and develops cybersecurity policies. It is responsible for regulating telecommunications and broadband services, developing policies for digital security and data protection, and acting as a regulatory body in cybersecurity matters.

KOSGEB (Small and Medium Enterprises Development Organization): It provides various incentives and support programs to enhance the digitalization and competitiveness of SMEs, encouraging their participation in digital transformation processes. It is responsible for offering grants and support for SME digitalization, supporting technology and innovation-based entrepreneurship projects, and facilitating the integration of SMEs into national and international digital markets.

Best Practices in Digital Workplaces

Several programs in Türkiye have been successful in promoting digital workplaces:

- **KOSGEB SME Development Support Program:** This program provides financial and technical assistance to SMEs, including support for digital transformation initiatives.

- **Technology Oriented Industry Move Program (Hamle):** This initiative supports companies that invest in digital technologies, particularly in areas such as smart manufacturing and digital automation.

These programs have helped businesses, especially SMEs, adapt to the digital economy, providing them with the tools and training needed to thrive in a digital workplace.

Recommendations

- Expand digital infrastructure: strengthen broadband access and 5G networks across regions to ensure reliable internet connectivity for digital workplaces.
- Promote digital skills training: invest in upskilling workers through digital literacy and AI-focused training to ensure they can effectively use digital tools, leading to better productivity outcomes.
- Foster collaboration through digital tools: promote the use of collaboration platforms and cloud-based tools to improve communication and teamwork, helping measure productivity across dispersed teams effectively.

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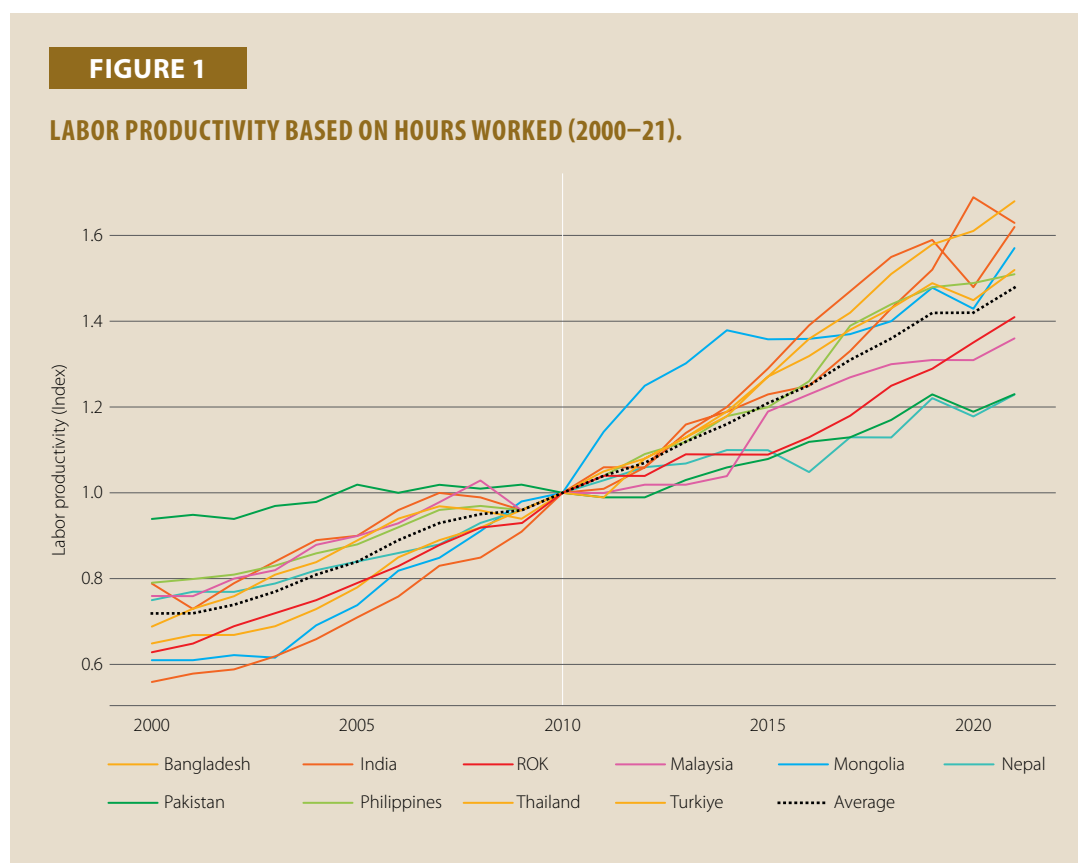
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ANALYSIS OF COUNTRIES

Overview

Labor productivity changes for last 10 years (2000~2023)



Labor productivity, measured as output per hour worked, where 1.0 in 2020, shows an overall increase across all countries over the two decades. This trend indicates improvements in workforce efficiency driven by various factors such as technological advancements, better education and skill development, infrastructure investments, and sectoral shifts from lower productivity industries like agriculture to higher productivity sectors like manufacturing, services, and technology.

Periods of Rapid Growth

The early 2000s (2000–2007) saw strong productivity growth in most countries. This period coincided with global economic expansion, marked by increased trade, industrialization, and higher foreign direct investment (FDI) in emerging economies, including Southeast Asian economies.

Another phase of rapid productivity growth occurred between 2013 and 2017. This period reflects the adoption of digital technologies, improvements in logistics and supply chain efficiency, and the rise of knowledge-based economies in countries like the ROK, Malaysia, and the Philippines.

Economic Resilience During Shocks

Global Financial Crisis (2008–09): During this global economic downturn, labor productivity in most countries either stagnated or slowed but generally did not decline sharply. This resilience highlights the structural improvements in workforce efficiency that many economies experienced prior to the crisis. Countries like the ROK, Malaysia, and Thailand quickly recovered, demonstrating their ability to weather external shocks.

COVID-19 Pandemic (2020): The COVID-19 pandemic disrupted economic activity globally, but labor productivity did not collapse in most countries. While certain sectors, such as tourism and hospitality, were severely impacted, industries that adapted through digitization, remote work, and technology adoption maintained or even improved productivity. This mixed impact reflects the uneven effect of the pandemic across sectors.

Country Comparisons, 2000–21

The ROK: High, Consistent Growth

The ROK demonstrates one of the highest and most consistent labor productivity growth rates among the 10 countries. This is due to the country's focus on advanced industries like ICT, automotive, and high-tech manufacturing, which are known for high output per worker. The ROK's productivity growth remained strong even during economic downturns, underscoring its resilience.

Impact on GDP: High labor productivity in the ROK has been a key driver of its sustained GDP growth. The country's shift toward knowledge-based industries, coupled with significant R&D investment and technological innovation, has allowed it to maintain a competitive edge globally.

Malaysia: Strong but Volatile Growth

Malaysia's labor productivity grew rapidly during periods of economic expansion, especially between 2003 and 2007 and 2013 and 2017. The country's diversified economy—particularly in electronics manufacturing, petrochemicals, and services—supported these gains. However, Malaysia also experienced more volatility compared to the ROK, especially during global economic downturns.

Impact on GDP: Malaysia's productivity growth directly fueled its GDP growth during periods of global economic prosperity. However, volatility in global demand, especially for its export products, contributed to fluctuations in both productivity and GDP growth.

Thailand: Moderate Growth

Thailand's labor productivity showed steady but moderate growth during this period. The country's strong manufacturing base, particularly in automotive and electronics, contributed to this, as did its growing services sector (e.g., tourism). However, the pace of productivity growth slowed after 2017, reflecting broader economic challenges, such as political instability and shifts in global trade.

Impact on GDP: Thailand's labor productivity supported its economic growth, particularly in the early 2000s when global trade was booming. However, slower productivity growth in recent years has coincided with slower GDP growth, highlighting the need for structural reforms to sustain long-term economic expansion.

Turkiye: Moderate but Resilient Growth

Labor productivity in Türkiye improved moderately but steadily, even during periods of economic volatility. Economic instability, including inflation and currency depreciation, has weighed on overall growth. However, key sectors such as manufacturing and construction continued to see productivity gains.

Impact on GDP: Türkiye's labor productivity has played a stabilizing role, helping to mitigate the impact of economic shocks on GDP growth. However, the moderate pace of productivity improvement has constrained Türkiye's ability to achieve more robust GDP growth, especially in comparison to rapidly growing economies like the ROK and Malaysia.

India: Slow, Steady Growth

India's labor productivity grew slowly but steadily. The country's large agricultural sector and vast informal economy contribute to its relatively slow productivity growth. Nevertheless, high-productivity sectors like IT services and telecommunications have seen significant gains, albeit not enough to raise overall productivity at the pace of more industrialized countries.

Impact on GDP: India's labor productivity growth, while slow, has supported its economic expansion, particularly in high-value sectors. However, the country's dependence on agriculture, which remains less productive, and the slow pace of structural reforms have limited the potential for higher GDP growth.

Bangladesh: Gradual Increase

Bangladesh has seen gradual improvements in labor productivity, driven by the rise of its garment and textile industries. However, the overall pace of growth is slow, reflecting the country's reliance on low-productivity sectors and limited industrial diversification.

Impact on GDP: The productivity gains in the garment sector have been a major contributor to Bangladesh's strong GDP growth over the last decade. However, to sustain this growth in the long run, the country will need to diversify into higher-productivity industries and improve workforce skills.

Pakistan: Volatile, Slow Growth

Pakistan's labor productivity has experienced significant volatility. Political instability, infrastructure bottlenecks, and reliance on low-productivity sectors like agriculture have limited the country's ability to consistently improve productivity. While there have been periods of growth, they have been followed by stagnation or decline.

Impact on GDP: Pakistan's inconsistent labor productivity growth has constrained its economic development. Without sustained improvements in productivity, particularly in its industrial and services sectors, the country will struggle to achieve higher GDP growth rates.

Nepal: Very Slow Growth

Nepal has one of the lowest labor productivity growth rates in the region. The country's reliance on subsistence agriculture and its limited industrial base have kept productivity gains minimal. External factors, including the 2015 earthquake and political instability, have further hindered progress.

Impact on GDP: Nepal's slow productivity growth has severely limited its economic potential. Without major structural changes and investments in sectors like manufacturing, services, and infrastructure, the country will continue to experience low GDP growth.

Mongolia: Volatile, Commodity-driven Growth

Mongolia's labor productivity has grown at a moderate pace, largely driven by its mining sector. However, the country's dependence on commodities means that productivity gains are closely tied to global commodity prices, leading to periods of volatility.

Impact on GDP: Mongolia's GDP growth has been heavily influenced by productivity gains in its mining sector. However, the volatility in global commodity markets poses a significant risk to sustained productivity and economic growth.

Philippines: Steady Growth

The Philippines has seen steady growth in labor productivity, driven by improvements in sectors such as business process outsourcing (BPO), manufacturing, and services. However, the pace of growth has been slower compared to top performers like the ROK and Malaysia.

Impact on GDP: Labor productivity gains have supported steady GDP growth in the Philippines, particularly in services. However, further industrialization and improvements in workforce skills will be necessary for the country to sustain higher levels of economic growth.

Insights from Comparisons

Top Performers

The ROK and Malaysia are the clear leaders in terms of labor productivity growth. Both countries have invested heavily in technology, education, and industrialization, driving significant improvements in workforce efficiency. Their economies are highly competitive, with productivity gains directly supporting robust GDP growth.

Middle Performers

Thailand, Turkiye, and the Philippines have seen moderate labor productivity growth. While these countries have strong industrial sectors, political instability, economic volatility, and slower structural reforms have limited their ability to match the productivity growth of top performers.

Modest Performers

Nepal, Pakistan, and Bangladesh show much slower productivity growth, reflecting their reliance on low-productivity sectors like agriculture, political instability, and insufficient investments in infrastructure and workforce development. These countries will need significant reforms and investments to improve long-term productivity and economic growth.

Volatility

Countries like Mongolia and Pakistan have experienced highly volatile productivity growth due to their reliance on commodities or political instability. Such volatility can undermine long-term economic development by creating uncertainty and reducing investor confidence.

The trends in labor productivity across the 10 countries from 2000 to 2021 reveal significant differences in workforce efficiency, industrialization, and economic resilience. While countries like the ROK and Malaysia have shown strong, sustained improvements in productivity, others like Nepal and Pakistan continue to struggle with slower growth.

Key Drivers by Country

Based on the previous productivity analysis, there are several drivers of productivity change in each country.

The ROK

Technological I: The ROK is a global leader in technology and innovation, with high investment in R&D (around 4.8% of GDP) and significant technological adoption in industries like electronics, robotics, and telecommunications.

Education and skills development: The ROK's highly educated workforce, especially in STEM fields, supports high productivity in high-tech industries. The country has one of the highest literacy rates and a strong emphasis on vocational and higher education.

Export-led growth: The ROK's export-oriented economy, driven by competitive sectors like automotive, semiconductors, and shipbuilding, has contributed to consistent labor productivity gains.

Institutional support: The ROK's robust institutional framework fosters innovation, with government policies encouraging R&D, collaboration between industries and universities, and the commercialization of technologies.

Malaysia

Technological adoption: Malaysia has steadily invested in upgrading its digital infrastructure and adopting new technologies, particularly in electronics manufacturing and petrochemicals.

Diversified economy: Malaysia's export-driven growth in high-value sectors like electronics, palm oil, and petroleum has driven productivity improvements. The country is well integrated into global supply chains, which boosts competitiveness.

Skilled workforce: Malaysia has invested in improving education and vocational training, especially in technical fields, which helps workers adapt to new technologies and industry needs.

Government policy: Malaysia's government has implemented supportive policies for business development, attracting FDI, and fostering innovation.

Thailand

Export-oriented manufacturing: Thailand's economy is driven by its manufacturing sector, particularly in automotive and electronics, which has seen continuous improvements in productivity through better capital investments and integration into global value chains.

Service sector growth: Thailand's growing tourism and services sectors have also contributed to productivity gains, although these sectors faced challenges during the COVID-19 pandemic.

Institutional support: The government has promoted industrial modernization and invested in infrastructure to facilitate productivity growth, though political instability has occasionally slowed progress.

Turkiye

Industrial growth: Turkiye has experienced productivity growth in key sectors such as manufacturing and construction. However, regional political and economic instability have hampered more significant progress.

Skilled labor: There has been an increasing focus on education and skills development in recent years, but the pace of development lags behind other industrialized nations.

Government reforms: Despite economic challenges, reforms aimed at liberalizing the economy and attracting foreign investment have contributed to modest productivity improvements.

India

IT services boom: India's labor productivity has been significantly driven by the growth of its IT and services sectors, which benefit from a large pool of technically skilled workers.

Education and skills development: India has made strides in education, particularly in engineering and IT fields, which support productivity growth in these sectors. However, large portions of the population remain in low-productivity sectors like agriculture.

Economic reforms: Government initiatives like "Make in India" have aimed to promote manufacturing and productivity, but the impact has been uneven across sectors.

Bangladesh

Garment industry: The growth of the garment and textile sectors has been the primary driver of productivity gains. Investments in better manufacturing practices and technology adoption in factories have improved output per worker.

Workforce training: While education levels are rising, Bangladesh still faces challenges in improving skills across the wider workforce, limiting broader productivity improvements.

Export-led growth: The country's focus on exporting ready-made garments has integrated Bangladesh into global supply chains, which has driven efficiency and labor productivity in this sector.

Pakistan

Agriculture and low-productivity sectors: Pakistan's reliance on low-productivity agriculture has constrained overall productivity growth. Despite some improvements in manufacturing, productivity gains have been limited.

Education and skills gap: The country struggles with low education levels and limited access to vocational training, which restricts the workforce's ability to transition into more productive sectors.

Economic instability: Frequent political changes, infrastructure bottlenecks, and inconsistent economic policies have hindered efforts to improve productivity across sectors.

Nepal

Limited industrial base: Nepal's labor productivity remains low due to the country's heavy reliance on subsistence agriculture and a small industrial base. The transition to higher-productivity sectors has been slow.

Infrastructure gaps: Poor infrastructure, including transport and digital connectivity, limits productivity growth by making it difficult for businesses to scale and innovate.

Education and vocational training: Nepal faces significant challenges in improving workforce skills, with low levels of education and limited access to job training programs.

Mongolia

Mining sector growth: Mongolia's labor productivity growth has been closely tied to its mining sector, particularly coal, copper, and gold. Investments in modern extraction techniques and equipment have improved productivity in this sector.

Economic volatility: Mongolia's reliance on commodities makes it vulnerable to fluctuations in global prices, which creates volatility in productivity growth.

Diversification challenges: The lack of diversification in Mongolia's economy limits productivity gains, as industries outside of mining remain underdeveloped.

Philippines

BPO sector: The Philippines has experienced labor productivity growth largely due to its expanding BPO sector, which has benefited from improvements in digital infrastructure and a young, English-speaking workforce.

Service-oriented growth: Besides BPO, the country has seen productivity improvements in tourism and other service-oriented sectors. However, manufacturing productivity remains underdeveloped compared to other ASEAN countries.

Institutional and infrastructure development: While the Philippines has made progress in regulatory reforms to improve the business environment, gaps in infrastructure (e.g., transport, power) continue to hold back productivity gains in certain sectors.

Characteristics of Productivity Changes

Productivity growth in Southeast and South Asia from 2000 to 2023 has been influenced by various factors related to technology, economics, socio-cultural conditions, and legal-institutional frameworks. By analyzing ten countries through this framework, we can understand the distinct patterns of productivity growth and the key drivers that have shaped their economic trajectories.

Technological Factors

Technological advancements are a critical driver of productivity growth, with varying degrees of impact across the region. The ROK stands out as a technological leader, making significant investments in R&D, innovation, and digital infrastructure. The country's focus on high-tech industries like electronics, semiconductors, and telecommunications has led to substantial productivity gains. Similarly, Malaysia has also advanced in integrating digital technologies and enhancing its manufacturing base, contributing to consistent productivity improvements.

In contrast, countries like Bangladesh, Nepal, and Mongolia have experienced slower technological adoption. These countries are still in the process of shifting from agrarian-based economies to more industrialized sectors, and their productivity growth has been limited by lower levels of digital infrastructure and limited access to advanced technologies. India and Türkiye have shown notable technological progress, particularly in IT services and industrial automation, yet challenges related to uneven technological adoption persist across different regions and industries.

Economic Factors

Economic policies and the structure of these economies have played a key role in shaping productivity growth. Countries with more diversified economies and stronger industrial bases,

such as the ROK, Malaysia, and Turkiye, have experienced higher levels of productivity growth. The ROK's export-oriented industrial strategy and Malaysia's diversified economy, with a strong focus on electronics and oil and gas, have allowed these countries to capitalize on global economic opportunities and increase productivity.

By contrast, economies like Bangladesh, Nepal, and Pakistan have struggled with a heavier reliance on agriculture and lower levels of industrial diversification, which have limited their ability to achieve sustained productivity growth. India, despite its impressive economic growth and expansion of sectors like IT and pharmaceuticals, continues to face challenges such as labor market rigidity, infrastructure bottlenecks, and regional disparities, which have constrained productivity growth. The Philippines has seen notable improvements in productivity within its services sector, particularly in the business process outsourcing (BPO) industry, which has become a significant contributor to economic growth.

Sociocultural Factors

Sociocultural factors, including education, workforce participation, and cultural attitudes toward innovation, have significantly shaped productivity growth. Countries like the ROK and Malaysia have benefited from strong educational systems and a cultural emphasis on hard work, innovation, and technological adaptation. The ROK's focus on education and skills development, particularly in Science, Technology, Engineering, and Mathematics (STEM) fields, has been a major driver of its productivity growth.

In countries such as Bangladesh, Nepal, and Pakistan, lower levels of education, gender disparities in the workforce, and a large informal economy have acted as barriers to productivity growth. For these countries, challenges such as limited access to quality education, insufficient vocational training, and low female labor participation have restricted the development of a highly skilled workforce. India has made significant progress in higher education, particularly in technical fields, but regional disparities in educational outcomes and skilling opportunities have affected productivity across different sectors.

Demographic factors also play a significant role. Countries like Bangladesh, Pakistan, and India have a large and growing youth population, which offers the potential for a demographic dividend. However, realizing this potential requires substantial investments in education, healthcare, and job creation to ensure that the growing workforce can contribute to higher productivity levels.

Legal–institutional Factors

The quality of legal–institutional frameworks, governance, and regulatory environments plays a crucial role in shaping the business climate and influencing productivity growth. Countries with strong institutional frameworks, such as the ROK and Malaysia, have benefited from stable regulatory environments, efficient public administration, and strong property rights protection, all of which encourage investment, innovation, and economic growth.

On the other hand, countries like Pakistan, Bangladesh, and Nepal have struggled with weaker governance, regulatory inefficiencies, and corruption, which have created barriers to entrepreneurship, investment, and business expansion. These institutional challenges have hindered the ability of firms in these countries to scale up and adopt more efficient production methods, limiting productivity growth. India has made substantial efforts to improve its institutional environment by simplifying regulations and introducing reforms aimed at improving the ease of

doing business. However, challenges related to bureaucratic inefficiency, slow legal processes, and infrastructure deficits continue to impede productivity gains. Türkiye, while experiencing periods of strong growth, has seen institutional instability in recent years, which has dampened business confidence and impacted long-term productivity growth.

The region's future productivity growth will depend on addressing these gaps by investing in technological innovation, education, infrastructure development, and improving governance. For countries like India, Bangladesh, and Pakistan, leveraging their young and growing populations while improving institutional quality and addressing economic challenges will be key to unlocking higher productivity and sustained economic development.

Detailed Comparisons by Country, 2000–21

Technological Perspectives

Technological advancement and digital infrastructure: The ROK stands out with its extensive investments in technology and innovation, particularly in high-tech industries like electronics, robotics, and AI. The ROK's advanced digital infrastructure, including 5G networks and high-speed internet, has boosted productivity across manufacturing and services.

Malaysia has also made significant strides in adopting new technologies, particularly in the electronics and petrochemical sectors, enabling high output per worker.

Philippines has leveraged digital technologies in its services sector, particularly in BPO (Business Process Outsourcing) and IT-enabled services. However, digital infrastructure and tech adoption in other sectors remain limited compared to the ROK.

Slow tech adoption economies: Bangladesh, Nepal, and Pakistan lag in technological advancement, especially in their agricultural and manufacturing sectors. Limited access to technology and poor digital infrastructure have constrained productivity growth, with many industries relying on labor-intensive methods rather than automation and innovation.

Mongolia, while adopting advanced technology in mining, lacks technological progress in other sectors, leading to uneven productivity growth across its economy.

Impact on productivity: Countries like the ROK and Malaysia, which have invested heavily in digital infrastructure, advanced manufacturing, and automation, have seen substantial productivity gains. On the other hand, Bangladesh, Nepal, and Pakistan have experienced slower productivity growth due to limited technological advancement, particularly in agriculture and traditional manufacturing.

Economic Perspectives

Sectoral shifts from low-productivity to high-productivity sectors: The ROK, Malaysia, and Thailand have successfully transitioned from agrarian economies to industrialized ones, focusing on high-value sectors like electronics, automotive, and services. This structural shift has enabled substantial gains in productivity as workers move from low-productivity sectors (e.g., agriculture) to high-productivity ones (e.g., manufacturing, technology).

Bangladesh and Pakistan remain heavily reliant on low-productivity sectors, especially agriculture. While Bangladesh has made progress through its garment industry, the broader economy still suffers from slow productivity gains due to insufficient diversification.

Export-driven growth and global competitiveness: The ROK, Malaysia, and Thailand have thrived by integrating into global supply chains and adopting export-led growth strategies. Export-oriented industries, such as electronics, automotive, and textiles, have driven productivity improvements by encouraging competition and efficiency gains.

Philippines has also experienced productivity growth through its export-oriented BPO sector, though the overall economy remains less diversified compared to advanced economies like the ROK and Malaysia.

Resource-driven economies and volatility: Mongolia's productivity growth has been driven primarily by its resource extraction industries, especially mining. However, this makes the economy vulnerable to fluctuations in global commodity prices, resulting in volatile productivity growth.

Turkiye has a more diversified economy, with productivity gains spread across sectors like textiles, manufacturing, and services. However, the country has experienced slower productivity growth in recent years due to economic instability, inflation, and currency devaluation.

Impact on productivity: Countries that have undergone successful structural shifts toward high-productivity sectors, such as the ROK and Malaysia, have seen more consistent labor productivity improvements. Countries still heavily reliant on agriculture, such as Nepal and Bangladesh, have faced slower productivity growth due to the lower efficiency of these sectors.

Sociocultural Perspectives

Education, skills, and workforce development: The ROK and Malaysia have invested heavily in education and workforce development, leading to a highly skilled labor force. The ROK, in particular, emphasizes STEM education, contributing to the country's high level of innovation and technological adoption, which drives productivity.

India has made strides in improving education, particularly in technical fields like IT, which has supported productivity growth in the services sector. However, large portions of the population remain in low-skilled jobs, especially in agriculture, limiting overall productivity improvements.

Bangladesh and Nepal struggle with low levels of education and vocational training, which hinder productivity growth. A significant portion of their workforce remains unskilled, limiting their ability to engage in high-productivity sectors like manufacturing or technology.

Cultural attitudes toward work and innovation: The ROK is known for its culture of hard work, discipline, and innovation. This cultural emphasis on efficiency and technological advancement has contributed to high productivity levels across various sectors.

In Bangladesh and Nepal, traditional cultural ties to agriculture, combined with slow rural-to-urban migration, have slowed the shift toward higher-productivity sectors. There is also less emphasis on innovation and R&D compared to more industrialized countries.

Demographic characteristics: India and Pakistan have large and young populations, which can serve as a demographic dividend if these countries are able to provide education and skills training to their youth. However, in both countries, large portions of the workforce remain undereducated and underemployed in low-productivity sectors.

The ROK faces a demographic challenge due to its aging population. While labor productivity remains high, the shrinking labor force poses long-term risks unless mitigated by continued technological advancements and automation.

Impact on productivity: Countries with strong education systems and cultural support for innovation, such as the ROK and Malaysia, have achieved higher labor productivity growth. In contrast, Bangladesh, Nepal, and Pakistan have struggled to achieve similar gains due to lower education levels and slower workforce development.

Legal–institutional Perspectives

Regulatory frameworks and business environment: The ROK and Malaysia have relatively strong regulatory frameworks that support innovation, entrepreneurship, and business development. These countries have policies that encourage foreign direct investment (FDI), which has brought new technologies and increased competition, ultimately boosting labor productivity.

India has made improvements in its regulatory environment, especially with reforms aimed at simplifying business processes and promoting manufacturing (e.g., “Make in India”). However, bureaucratic inefficiencies and legal hurdles continue to slow progress in sectors like manufacturing.

Nepal and Pakistan face challenges related to regulatory inefficiency, corruption, and a lack of institutional capacity. These factors make it difficult for businesses to scale and adopt productivity-enhancing technologies.

Labor laws and employment protections: Countries with more flexible labor markets, such as Malaysia and Thailand, have been able to adapt quickly to changes in global demand, contributing to productivity growth. However, in some cases, this has come at the cost of weaker worker protections, particularly in low-wage sectors.

Pakistan and Bangladesh face challenges with labor informality, where large portions of the workforce remain outside of the formal labor market. This limits access to training, benefits, and long-term productivity gains.

Institutional support for innovation and R&D: The ROK has a well-developed institutional framework that supports innovation, research, and development (R&D). The government’s investment in R&D and its close collaboration with private industry have helped drive technological advancements and productivity growth.

Mongolia and Nepal lack strong institutional support for innovation, which has slowed technological adoption and productivity growth. Weak governance and limited capacity for long-term planning have hampered efforts to modernize industries.

Impact on productivity: Strong legal and institutional frameworks, as seen in the ROK and Malaysia, have fostered environments conducive to innovation and business development, leading to substantial productivity gains. Countries with weaker institutions, such as Pakistan and Nepal, have struggled to implement reforms and build the infrastructure needed to support higher productivity growth.

From technological, economic, socio-cultural, and legal–institutional perspectives, it is clear that the countries with the most substantial labor productivity gains (e.g., ROK, Malaysia) have benefited

from comprehensive strategies that address workforce development, technological adoption, and institutional support for innovation. Countries like Bangladesh, Nepal, and Pakistan have experienced modest productivity growth, reflecting lagging infrastructure, educational challenges, and weaker regulatory environments. This analysis underscores the importance of a multifaceted approach to labor productivity growth, with technology, education, and legal-institutional reforms playing key roles in enhancing workforce efficiency and driving long-term economic expansion.

Productivity and Growth

Labor productivity, which measures the output per hour worked, is a crucial determinant of long-term economic growth. As productivity increases, economies can produce more goods and services with the same amount of labor, leading to higher incomes, improved living standards, and sustainable growth. Conversely, stagnant or declining productivity can constrain growth, making it harder for economies to raise income levels or compete globally.

The graph reveals the trends in labor productivity (based on hours worked) and GDP growth across 10 countries from 2000 to 2021, along with the average trends. In general, countries with consistent labor productivity growth also experience stable or improving GDP growth. This positive correlation suggests that productivity improvements lead to more efficient economies and stronger economic performance. The average labor productivity and GDP growth trends show a steady upward trajectory across the region. However, the rate of growth varies, with some countries experiencing more volatility than others. Both labor productivity and GDP growth trends display resilience following major global economic disruptions such as the 2008 global financial crisis and COVID-19 pandemic. Some countries recovered faster than others, with labor productivity serving as a buffer during slowdowns in economic growth.

The ROK

Labor productivity trend: The ROK has shown strong, consistent growth in labor productivity, driven by its advanced industries such as electronics, semiconductors, and automotive. The ROK's heavy investment in technology, R&D, and innovation has been a key factor.

GDP growth trend: The ROK's GDP growth mirrors the steady rise in productivity, indicating a direct link between productivity improvements and economic expansion. The ROK's ability to continually upgrade its industrial base has resulted in sustained GDP growth.

Malaysia

Labor productivity trend: Malaysia has experienced solid productivity growth, especially in its manufacturing and export-oriented sectors (e.g., electronics and petrochemicals). The country's integration into global supply chains has boosted its productivity gains.

GDP growth trend: Malaysia's GDP growth reflects its productivity improvements, though it has been more volatile due to its reliance on global trade and exports. Malaysia's need to transition to a higher-value, knowledge-based economy is key for future sustained growth.

Thailand

Labor productivity trend: Thailand's productivity growth has been steady but moderate. The country's automotive and electronics sectors have been the primary drivers, though growth has slowed somewhat in recent years.

GDP growth trend: Thailand's GDP growth is closely aligned with its productivity gains, but it has shown more volatility, particularly due to political instability and changes in global demand. The country needs to invest more in technology and education to accelerate productivity growth.

Turkiye

Labor productivity trend: Türkiye has seen moderate productivity growth, supported by its diversified economy, including manufacturing, construction, and textiles. However, political and economic instability has slowed progress.

GDP growth trend: Türkiye's GDP growth has been volatile, reflecting regional political instability, inflation, and currency fluctuations. While productivity improvements have supported growth, further reforms and investments in higher-value sectors are necessary to sustain growth in the long term.

India

Labor productivity trend: India's productivity growth has been driven by the IT and services sectors. However, large segments of the workforce remain in low-productivity sectors like agriculture, limiting overall gains.

GDP growth trend: India's GDP growth has been robust, particularly in the 2000s, though it has not fully translated into uniform productivity gains. The disconnect is due to the slow pace of industrialization and the large share of informal and low-productivity jobs.

Bangladesh

Labor productivity trend: Bangladesh has experienced gradual labor productivity growth, primarily driven by its booming garment industry. However, heavy reliance on this sector has constrained broader productivity gains across the economy.

GDP growth trend: Bangladesh's GDP growth has been impressive, supported by strong export performance in garments. However, without diversifying into higher-value sectors, future productivity growth could be limited, constraining long-term GDP expansion.

Pakistan

Labor productivity trend: Pakistan has shown slow productivity growth, largely due to its reliance on agriculture and the slow pace of industrialization. Poor infrastructure and political instability have further impeded productivity improvements.

GDP growth trend: Pakistan's GDP growth has been relatively volatile, reflecting its low productivity in key sectors like manufacturing and services. The lack of structural reforms and investment in education and infrastructure limit both productivity and GDP growth.

Nepal

Labor productivity trend: Nepal's productivity growth has been among the lowest, mainly due to its heavy reliance on low-productivity agriculture. The country's slow pace of industrialization and poor infrastructure further constrain productivity gains.

GDP growth trend: Nepal's GDP growth has been modest, reflecting the low productivity of its economy. To achieve sustained economic growth, Nepal must diversify away from agriculture and invest in human capital and industrial development.

Mongolia

Labor productivity trend: Mongolia's productivity growth has been driven by its mining sector, which is highly capital-intensive. However, the rest of the economy, particularly manufacturing and services, lags in terms of productivity.

GDP growth trend: Mongolia's GDP growth has been highly volatile, driven by fluctuations in commodity prices. The lack of economic diversification limits the potential for stable productivity growth across the economy.

Philippines

Labor productivity trend: The Philippines has shown steady productivity growth, particularly in its BPO (Business Process Outsourcing) sector and other IT-enabled services. However, productivity in agriculture and manufacturing remains low.

GDP growth trend: The Philippines' GDP growth reflects productivity improvements in services, though underdeveloped manufacturing and agriculture sectors limit broader economic gains. Diversifying and enhancing productivity in all sectors is crucial for sustained economic growth.

Key Takeaways

Positive correlation: In most countries, labor productivity improvements are strongly correlated with GDP growth. Countries that have focused on improving workforce efficiency, technology adoption, and sectoral shifts to high-productivity industries have experienced stronger economic growth.

Resilience and recovery: After economic shocks, such as the global financial crisis and the COVID-19 pandemic, countries with strong productivity foundations recovered more quickly. Economies that lacked diversification or were overly reliant on low-productivity sectors took longer to regain growth momentum.

High performers such as the ROK and Malaysia have achieved strong productivity growth, supported by robust investments in technology, education, and innovation. These factors have translated directly into sustained GDP growth.

Challenging economies including Pakistan, Nepal, and Mongolia show slower productivity growth, largely due to their over-reliance on agriculture or mining and the lack of infrastructure and industrial diversification. Political instability and weak governance further constrain productivity improvements.

Opportunities for improvement in India, Bangladesh, and the Philippines have significant potential to accelerate productivity growth by diversifying their economies, investing in workforce skills, and improving infrastructure. Boosting productivity in underperforming sectors like agriculture and manufacturing is essential for achieving long-term growth.

The analysis shows that labor productivity is a key driver of economic growth across these 10 countries. Countries that have successfully invested in technology, skills, and industrial development have seen stronger and more consistent GDP growth. However, countries that remain dependent on low-productivity sectors, face political instability, or lack strong institutional frameworks face challenges in achieving sustained productivity gains. To continue driving economic growth, these countries must focus on diversifying their economies, upgrading workforce skills, and investing in infrastructure and innovation.

Use Case Examples: Public Sector

Goods and Services Tax Network in India

The Goods and Services Tax Network (GSTN) is a critical digital infrastructure implemented by the Government of India to administer the Goods and Services Tax (GST) since July 2017. The GSTN has transformed India's tax regime, unifying complex and fragmented indirect taxes into a single system while significantly improving productivity, compliance, and transparency in taxation.

Before GST, India's indirect tax system was complicated, with varying taxes across states, leading to inefficiencies and higher compliance costs. The introduction of GST simplified this by consolidating taxes into a single national structure. GSTN was established to manage the IT backbone that supports the filing and processing of GST across India, aiming to simplify tax compliance, enhance transparency, and create a seamless digital taxation experience.

Configuration

The GSTN platform is a comprehensive, cloud-based digital system that facilitates various tax-related processes, including:

- (1) E-filing of returns: Businesses can file their returns online, reducing paperwork and ensuring timely submissions.
- (2) Input credit (ITC) management: The system automates the tracking and verification of input tax credits, improving accuracy and reducing fraud.
- (3) E-invoicing: Through real-time integration of invoices, businesses benefit from smoother transaction processing and error-free tax reporting.
- (4) Data integration: The platform connects businesses, tax authorities, and financial institutions, providing a unified framework for real-time monitoring and analysis.

GSTN supports millions of businesses in managing their tax filings, integrating digital invoicing, and reconciling tax credits, streamlining the entire process.

Outcomes

The implementation of GSTN has resulted in significant improvements in tax compliance and business efficiency. By moving to a digital platform, businesses have reduced manual processes, eliminated delays, and minimized errors in tax filings. The transparency provided by the system has led to better tracking of taxes, contributing to increased government revenues.

GSTN's e-invoicing system has also streamlined supply chains and reduced operational costs for businesses. The automation of tax processes has improved productivity for both the private sector and tax authorities, who now have access to real-time data analytics for better decision-making.

Implications

- (1) Efficiency in tax compliance: Countries with complex tax regimes can adopt similar digital platforms to simplify tax compliance, improve transparency, and reduce errors. GSTN's automated filing and invoicing can serve as a model for tax systems worldwide.

- (2) Increased tax revenue: By enhancing compliance and reducing tax fraud, digital tax platforms like GSTN can increase government revenues while decreasing administrative costs.
- (3) Boost to business productivity: Simplified tax processes and digital invoicing reduce the administrative burden on businesses, helping them focus on growth and improving overall economic productivity.

Government Integrated Office Management in Nepal

Nepal is implementing Digital Nepal Framework that include digital transformation initiatives in major sectors of the Economy. The Government Integrated Office Management System (GIOMS) is a digital platform implemented by the Government of Nepal as an initiative under the Digital Nepal Framework for the digital transformation of public administration and enhancement of the efficiency of government operations. By streamlining workflows, automating administrative tasks, and enabling better coordination among government offices, GIOMS represents a successful example of using technology to enhance productivity within the public sector.

Government agencies can maintain entry and exit registries of letters and files; manage employee details and attendance records; request and approve leave; perform necessary official tasks; track documents and tasks; issue orders, comment, and make decisions through electronic means using digital signatures via the system. The need to improve bureaucratic efficiency, reduce administrative bottlenecks, and enhance overall productivity within government agencies led to the development of GIOMS. GIOMS is a milestone for E-Governance and the Digital Workplace in the Public Sector.

Configuration

GIOMS is designed as an integrated digital platform that facilitates the following functions:

1. Document management: The system digitizes and tracks government documents, reducing reliance on paper-based processes and ensuring quicker access to necessary records.
2. Task automation: Routine administrative tasks, such as approvals, reporting, and workflow management, are automated, speeding up decision-making and reducing delays.
3. Interagency coordination: GIOMS enables real-time communication and data sharing across various ministries, departments and offices, ensuring seamless coordination between different government offices.
4. Performance tracking: The platform includes features that allow for monitoring and measuring the performance of government agencies, enabling data-driven decision-making.
5. Record Management: GIOMS keeps record of the government employees and their attendance across various ministries and departments. This has enabled government agencies to have integrated database of personnel records of the employees including the details of attendances, leaves, transfers and deportation.
6. Digital Signatures: The implementation of digital signatures and Public Key Infrastructure provides a means to authenticate documents, enabling document authorization, verification, and non-repudiation.

The system is deployed across various government ministries and departments.

Outcomes

GIOMS has delivered substantial benefits:

1. **Improved efficiency:** The system has significantly eased coordination and communication within and between organizations, and reduced processing times for government transactions, allowing for faster completion of tasks and services. This has streamlined administrative workflows and reduced paperwork.
2. **Enhanced productivity:** GIOMS enables government employees to manage tasks more effectively, leading to increased productivity across various agencies.
3. **Transparency and accountability:** By tracking the progress of tasks and decisions, GIOMS promotes greater transparency in government operations, which has improved public trust in the administration.
4. **Cost savings:** The automation of manual tasks has reduced operational costs, as fewer resources are required for administrative processes, and errors from manual handling have decreased.
5. **Less Paper Environment:** GIOMS facilitates the transition to a paperless environment by digitizing records, documents, and official correspondence, thereby making document archiving and retrieval faster and more efficient.
6. **Work flexibility:** Tasks can be performed from anywhere whether from the office, the field or working from home. It has reduced the requirement of physical presence for the work and also simplified the processes such as exchange of documents, decision making and record management.

Implications

GIOMS offers several valuable lessons for other countries looking to enhance productivity in government operations:

1. **Efficiency in Service Delivery:** GIOMS has streamlined government operations by digitizing processes. It has helped improve service delivery and organizational efficiency.
2. **Scalable E-Governance Solution:** Countries with complex administrative systems can adopt a similar integrated office management system to streamline workflows and improve coordination among different government agencies.
3. **Productivity Measurement:** The system's ability to track and measure productivity in real-time can help governments implement data-driven reforms to improve efficiency.
4. **Cost Reduction through Automation:** GIOMS showcases how automation can reduce administrative overhead, making it a useful model for countries seeking to improve public service delivery with limited resources.

TESDA Online Program in Philippines

The Technical Education and Skills Development Authority (TESDA) in the Philippines launched the TESDA Online Program (TOP) in 2011 to offer free online technical and vocational courses.

As part of the country's efforts to address gaps in skills and enhance workforce productivity, TOP has become a successful model for digital education and training, helping Filipinos acquire marketable skills and improve their employability.

The Philippines faces challenges in delivering education and vocational training across its more than 7,000 islands, where access to education and skills development can be limited, particularly in remote areas. To address these challenges, TESDA, created under the "Technical Education and Skills Development Act of 1994" (Republic Act No. 7796), launched TOP as a digital learning platform aimed at reaching a wider audience.

TOP provides free access to technical and vocational education through a Massive Open Online Courses (MOOCs) platform, allowing learners to develop skills in fields such as agriculture, information technology, tourism, and more. This program has become an essential tool in improving the productivity of the Filipino workforce.

Configuration

The TESDA Online Program is designed to be user-friendly, flexible, and accessible. Key components of the platform include:

1. **Wide course range:** TOP offers over 100 courses across various industries, allowing individuals to gain skills that align with labor market demands.
2. **Free access:** The courses are provided at no cost, ensuring that even those with limited financial resources can participate.
3. **Flexible learning:** Learners can complete the courses at their own pace, making it accessible to individuals who are employed or have other responsibilities.
4. **Telecom partnerships:** TESDA has partnered with telecom companies like Globe and TM to provide free data access to the platform, ensuring that learners in remote and underserved areas can participate without incurring additional costs.

Outcomes

Since its launch, TOP has delivered significant results:

Widespread enrollment: By 2023, more than 1.4 million learners had enrolled in TESDA's online courses, with over 870,000 earning certifications.

Improved workforce skills: The program has helped participants acquire in-demand skills, increasing their employability and contributing to productivity growth across sectors like tourism, agriculture, and manufacturing.

Accessibility and inclusion: The program has helped bridge the education gap in remote areas by providing accessible and affordable vocational training to underserved populations.

Job creation: Graduates of TESDA's courses are better equipped to find jobs, with certifications recognized by local industries, contributing to reduced unemployment rates and economic growth.

Implications

TESDA's Online Program provides valuable lessons for other nations seeking to enhance workforce skills and productivity:

1. **Scalability:** The free online training model can be replicated in countries with geographically dispersed populations or limited access to traditional educational institutions.
2. **Public-private partnerships:** Collaborations with telecom providers to offer free data access can help remove barriers to education and make online learning accessible to more people.
3. **Lifelong learning:** TESDA's flexible, self-paced learning platform encourages continuous education, enabling individuals to update their skills and remain competitive in a rapidly changing labor market.

Union Digital Center in Bangladesh

The Union Digital Center (UDC) is a key initiative under the Government of Bangladesh's "Digital Bangladesh" agenda, launched in 2009 to bridge the digital divide and improve access to essential services for rural citizens. UDCs serve as community-based digital hubs offering government services, information, and digital literacy tools, empowering rural populations and enhancing public service efficiency.

Bangladesh, with a large rural population, faced significant challenges in providing equitable access to government services. Geographic isolation and limited digital infrastructure left rural communities without easy access to basic services such as birth registration, utility payments, and health information. The UDC program was created to address this gap by digitizing services and making them available at the grassroots level. With the slogan "Service at Doorsteps," the program aligns with Bangladesh's broader goal of inclusive economic growth through digital transformation.

UDCs operate as local service delivery points under a Public-Private-People Partnership (PPPP) model. The centers are equipped with digital tools such as computers, internet connectivity, printers, and scanners, enabling rural citizens to access more than 300 government and private services. Key components include:

1. **Service delivery:** UDCs provide a wide range of services, including online birth and death registration, agricultural and health information, government form submissions, exam results, mobile banking, and more.
2. **Technological setup:** Each center is furnished with the necessary digital infrastructure to ensure efficient service provision. This includes internet-connected computers, printers, scanners, and digital cameras.
3. **Local entrepreneurship:** UDCs are operated by local entrepreneurs, typically one male and one female, fostering local employment, youth empowerment, and gender equality in rural business.
4. **Management structure:** The Local Government Division oversees UDC operations, while the Cabinet Division provides policy direction, ensuring that the program remains accountable and transparent.

Outcomes

The impact of UDCs has been substantial in transforming rural service delivery and improving productivity:

Improved access to services: UDCs have brought government services to the doorsteps of rural citizens, saving them time and money by eliminating the need for long-distance travel to urban centers.

Increased efficiency: Digital service delivery through UDCs has reduced wait times and improved the overall efficiency of government processes, with 76.6% of citizens reporting high satisfaction.

Economic empowerment: By involving local entrepreneurs, UDCs have created job opportunities in rural areas and empowered women, who make up a significant portion of UDC operators.

Cost and time savings: UDC services have saved users up to 16.55% on expenses and reduced travel time by an average of 17.38%, translating into increased productivity for citizens.

Implications

The UDC program presents a replicable model for other countries looking to enhance productivity and expand digital services to rural populations:

1. **Scalable model:** The UDC approach of deploying digital service centers at the community level can be adapted to any country seeking to enhance rural service delivery through technology.
2. **Public-private collaboration:** The PPPP model is a key innovation, leveraging local entrepreneurship to drive digital transformation while ensuring long-term sustainability.
3. **Boosting rural productivity:** UDCs demonstrate how digital platforms can improve productivity by reducing the time and cost associated with accessing government services, leading to a more engaged and productive rural workforce.

E-Mongolian Platform in Mongolia

The E-Mongolia platform, launched in October 2020, is a central pillar of Mongolia's digital transformation strategy, designed to simplify public services and increase government efficiency. By integrating hundreds of government services into a single digital platform, E-Mongolia has improved accessibility, reduced administrative burdens, and enhanced productivity in both the public sector and for citizens.

Mongolia's vast, sparsely populated geography has historically made it challenging for citizens to access public services, particularly in remote areas. The traditional system, characterized by inefficiency and long delays, prompted the government to develop a digital solution. E-Mongolia was introduced to streamline and digitize government services, aligning with the broader "Digital Nation" strategy, which aims to foster a more connected, transparent, and efficient public sector.

Configuration

E-Mongolia is an integrated e-government platform that offers 994 services from 83 government organizations, available through multiple channels to ensure ease of access:

1. Web portal (e-mongolia.mn): This is the main platform where citizens can access government services like applying for passports, driver's licenses, and more.
2. Mobile app: A mobile version of the platform provides easy access for citizens on the go.
3. Kiosk services: Self-service kiosks are available in public centers to cater to those without personal access to the internet.
4. Operator support: Public service centers are equipped with E-Mongolia operators to assist citizens with navigating the platform.
5. Tailored services: Recent enhancements include personalized service offerings based on user behavior, improving the efficiency of interactions.

The platform covers a wide array of services, allowing citizens to perform tasks like paying taxes, applying for benefits, and accessing legal documents, all from one centralized system.

Outcomes

The E-Mongolia platform has produced significant results since its inception:

Increased efficiency: Citizens who previously spent hours navigating bureaucratic procedures now spend an average of five minutes accessing services online, compared to the traditional 1.30 hours. This shift has drastically reduced the time spent on routine government interactions.

Enhanced access: With over 1.64 million registered users, E-Mongolia has become an indispensable tool for nearly half of Mongolia's adult population, providing streamlined services even to remote areas.

Productivity gains: The automation of administrative tasks has freed up government employees to focus on higher-value work, improving overall efficiency within public sector operations.

Cost savings: The platform has resulted in substantial savings for both citizens and the government, reducing time, travel, and manual administrative processes.

Implications

E-Mongolia serves as an exemplary case for other nations, especially those seeking to enhance public sector productivity and citizen engagement through digital solutions:

1. Scalability: The platform's design can be adapted by other countries with large or hard-to-reach populations to deliver public services more efficiently.
2. Time and cost savings: By reducing service times and lowering administrative costs, E-Mongolia offers a blueprint for improving government productivity and reducing operational inefficiencies.
3. Enhanced transparency and accountability: The centralized platform allows for better monitoring and transparency in government service delivery, fostering trust and improving citizen satisfaction.

KOSGEB in Turkiye

KOSGEB (Small and Medium Enterprises Development Organization of Turkiye) is a key government institution established to support the growth and digital transformation of SMEs in Turkiye. Since its founding in 1990, KOSGEB has played a vital role in promoting SME competitiveness and innovation, particularly through digitalization.

SMEs constitute over 99% of Turkish businesses, making them central to the economy. KOSGEB's programs, especially in recent years, have focused on enabling these businesses to adopt advanced digital tools, ensuring they remain competitive in the global market. The organization offers financial, technical, and advisory support, helping SMEs integrate technologies such as AI and cloud computing into their operations.

The SME Digital Transformation Support Program is a KOSGEB initiative designed to support the digital transformation processes of SMEs in Turkiye. The program provides financial assistance for SMEs' digital transformation needs, covering expenses for machinery, equipment, software, and hardware. Support limits range from 1 million TL to 20 million TL per business, with repayment terms up to 36 months and an option for a six-month grace period.

To apply, SMEs must obtain a digital transformation assessment report through consultancy and meet specific financial eligibility criteria. The program aims to enhance the productivity and competitiveness of businesses through digital transformation.

Program Configuration

The KOBIGEL SME Development Support Program is KOSGEB's flagship initiative aimed at supporting digital transformation in sectors like manufacturing. Rather than direct cash payments, the program offers non-cash incentives such as tax reductions and social security benefits. KOSGEB also provides Digital Transformation Consultancy and certifies businesses as Digital Transformation Centers, ensuring they develop the internal capacity for long-term digital sustainability.

Outcomes

KOSGEB's efforts have led to improved productivity, reduced operational costs, and expanded market access for SMEs. Businesses supported by KOSGEB are better equipped to utilize digital tools and data analytics, strengthening their global competitiveness. This has become more effective by combining with the Digital Transformation Support Program of the Ministry of Industry and Technology (MoIT).

Implications

Scalable model for developing economies: KOSGEB's use of non-cash incentives can serve as a model for countries looking to promote SME digitalization without heavy budget burdens.

Building digital expertise: Certifying SMEs as Digital Transformation Centers ensures businesses gain the skills needed for digital growth, a replicable approach for other nations.

Collaborative framework: KOSGEB's emphasis on public-private partnerships offers a useful framework for other countries seeking comprehensive SME support.

KOSGEB's programs provide a blueprint for fostering SME growth through digital transformation. Its model can inspire other countries to adopt similar approaches, promoting SME competitiveness and innovation in a rapidly evolving global economy.

Use Case Examples: Private Sector

Habib Bank Limited in Pakistan

Habib Bank Limited (HBL), founded in 1941, is Pakistan's largest and most established bank and is a leader in digital transformation. By adopting advanced digital technologies, HBL has revolutionized its operations, customer services, and internal productivity. Its transition from traditional banking to a digital-first model serves as a best practice example of how digital workplaces can significantly enhance productivity and efficiency.

As the largest bank in Pakistan, HBL faced the growing need to modernize its services in response to the rising demand for digital solutions and the increasingly competitive financial landscape. Recognizing the shift toward digital banking, HBL embarked on a comprehensive digital transformation strategy to streamline processes, improve customer experiences, and enhance operational efficiency. The bank's focus was not just on customer-facing technology but also on transforming internal workflows to create a more productive and efficient workplace.

Configuration

HBL's digital transformation strategy integrates several key components designed to optimize both external services for customers and internal processes for employees:

1. **Konnect by HBL:** A branchless banking service targeting the underserved population, particularly in rural areas. Konnect allows users to perform transactions, pay bills, and send remittances through their mobile phones, broadening financial inclusion.
2. **HBL mobile app and internet banking:** The mobile and online banking platforms offer customers a wide range of banking services, such as fund transfers, utility bill payments, and account management, all from the convenience of their devices, reducing dependency on physical branches.
3. **HBL Pay:** A digital payment solution enabling contactless transactions, making it easier for businesses and customers to conduct fast, secure transactions, reducing reliance on cash and physical touchpoints.
4. **Internal automation and workflow digitization:** HBL has implemented automation for back-office functions such as loan processing, customer onboarding, and document management. These changes reduce manual intervention, improve accuracy, and speed up service delivery.
5. **Data-driven decision making:** HBL leverages data analytics to enhance decision-making, personalize customer services, and improve operational efficiency. By using big data, the bank gains insights into customer behaviors and optimizes service offerings accordingly.

Outcomes

HBL's digital initiatives have delivered significant productivity gains and customer satisfaction:

Improved efficiency: Automation of internal processes has led to faster transaction processing, reduced errors, and improved overall employee productivity. Employees can now focus on strategic tasks rather than routine administrative work.

Enhanced customer experience: The mobile and online banking platforms have provided customers with the ability to perform essential banking tasks remotely, increasing convenience and reducing branch traffic. This has also enhanced customer satisfaction.

Cost reduction: The digitization of services has reduced operational costs by cutting down on paperwork, manual processes, and the need for physical infrastructure. HBL has been able to scale operations without a corresponding increase in costs.

Financial inclusion: Through Konnect, HBL has expanded financial services to previously unbanked populations, contributing to broader financial inclusion and national economic growth.

Implications

HBL's approach to digital transformation offers valuable insights for financial institutions worldwide, especially in developing countries:

1. **Scalability of branchless banking:** The Konnect model shows how financial services can be extended to rural and underserved areas, improving financial inclusion and providing essential services to remote populations.
2. **Boosting internal productivity:** Automation and digital workflows can streamline internal processes, allowing organizations to reallocate human resources to higher-value tasks, thus improving productivity.
3. **Customer-centric innovations:** HBL's focus on customer convenience through digital platforms highlights the importance of aligning digital strategies with customer needs to drive engagement and loyalty.

Top Glove in Malaysia

Top Glove, the world's largest manufacturer of rubber gloves, showcases how digital transformation can significantly enhance productivity in the manufacturing sector. By adopting Industry 4.0 technologies and digitizing its operations, Top Glove has improved efficiency, increased output, and ensured product quality at scale. This case study illustrates how embracing digital tools can lead to major productivity gains in digital workplaces.

Founded in 1991, Top Glove is a leading global manufacturer, producing billions of gloves annually to meet the world's demand, particularly in healthcare. The COVID-19 pandemic created an unprecedented surge in demand for medical gloves, pushing Top Glove to scale its operations rapidly while maintaining high standards of quality and efficiency. This challenge accelerated the company's digital transformation, positioning it as a best practice case for using technology to enhance productivity.

Configuration

Top Glove's digital transformation focuses on integrating advanced technologies across its operations to enhance productivity and maintain product quality. Key elements of this transformation include:

1. **Automation and robotics:** The company has automated significant parts of its production process, including packaging and inspection, to improve speed and precision. Robots are employed to handle repetitive tasks, increasing output while reducing human error.

2. Real-time monitoring: Top Glove uses real-time data systems to track machine performance, production levels, and equipment efficiency. This monitoring allows immediate detection of issues, ensuring smooth operations and minimizing downtime.
3. Digital quality control: The company has deployed AI-driven quality control systems to detect defects in real time, reducing waste and ensuring consistency in product quality. Automated inspection systems play a key role in maintaining the high standards required in the healthcare industry.
4. Cloud-based collaboration: Top Glove uses cloud-based platforms for communication and collaboration among its global teams. This ensures that decision-making is efficient and that operations are well-coordinated across different locations.

Outcomes

The digital transformation of Top Glove has resulted in notable productivity improvements and operational efficiencies:

Increased output: By implementing automation, Top Glove increased its production capacity by 20%, meeting global demand more effectively without compromising quality.

Reduced downtime: Real-time monitoring systems reduced equipment downtime from 9% to 6%, allowing for continuous production and maximizing operational hours.

Improved quality control: Automated quality control systems have decreased defect rates by 12%, ensuring that the company meets international quality standards despite scaling up production.

Boosted employee productivity: Automation has allowed employees to focus on higher-value tasks, leading to a 17% improvement in the employee productivity index.

Implications

Top Glove's successful digital transformation offers valuable lessons for manufacturers and industries globally:

1. Scalable solution: The use of automation to increase output and maintain quality can be applied across industries, particularly in high-demand sectors where precision and scalability are critical.
2. Real-time data utilization: Real-time monitoring of equipment and operations offers insights that enable immediate corrective actions, improving efficiency and reducing losses.
3. Digital collaboration: Cloud-based tools help global companies improve coordination and decision-making, ensuring that different teams work in sync despite geographical distances.

Line Company in Thailand

Line Company Thailand, part of the global technology firm Line Corporation, is well-known for its popular communication app. As digital transformation became essential, particularly with the rise of remote work during the COVID-19 pandemic, Line Thailand implemented the "Happy Digital

Workplace” model. This initiative aimed to enhance employee productivity while focusing on their well-being, ensuring smooth operations in a hybrid or fully remote work setting.

Line Thailand’s digital workplace strategy is structured around several key elements, designed to improve both operational efficiency and employee satisfaction:

Seamless system and communication: To enable a smooth transition to remote work, Line Thailand provided employees with a robust digital infrastructure. This included a secure intranet system that allowed remote access to work-related information and communication tools, ensuring employees could collaborate effectively regardless of location. These tools supported real-time interaction, fostering continuous teamwork across dispersed teams.

Employee well-being support: Recognizing the importance of physical and mental health, Line Thailand introduced comprehensive well-being programs. Employees were offered health insurance, telemedicine services, and online group exercise classes. These initiatives promoted physical health and helped manage stress, ensuring that employees could stay productive and engaged despite remote work challenges.

Nurturing relationships and team spirit: The company made deliberate efforts to nurture a sense of connection among its employees by organizing regular online social activities. To further foster a sense of community, Line Thailand’s HR team sent thoughtful gifts to employees’ homes, strengthening bonds within teams and maintaining a positive company culture even in a remote setting.

Continuous feedback and development: Line Thailand introduced the “p-talk” system, a performance management tool that enabled real-time feedback between supervisors and team members. This approach allowed employees to continuously improve their performance. Additionally, the company conducted quarterly employee engagement surveys to monitor employee satisfaction and areas of concern. The WOW Sharing Program provided employees with opportunities to enhance their skills through various online training courses, promoting continuous personal and professional development.

The implementation of the “Happy Digital Workplace” model led to positive outcomes for Line Thailand. Employees were able to maintain high levels of productivity despite working remotely, thanks to the seamless communication tools and robust digital infrastructure. The focus on employee well-being and continuous feedback created an engaged, motivated workforce, with enhanced performance. Regular engagement activities kept team morale high, contributing to better collaboration and overall productivity.

Line Thailand’s experience offers valuable insights for other organizations seeking to enhance productivity in a digital or hybrid workplace:

Balanced approach to productivity and well-being: Prioritizing employee well-being alongside digital efficiency helps create a sustainable and productive workforce. Physical and mental health initiatives contribute to higher employee engagement and performance.

Real-time feedback and development: Continuous feedback mechanisms and skill development opportunities ensure employees are constantly improving, which leads to sustained productivity. Encouraging learning through structured programs helps employees stay updated and motivated.

Maintaining connection in remote work: Line's focus on nurturing relationships through virtual activities and thoughtful gestures proved effective in preventing social isolation, a common challenge in remote settings. Strong team dynamics are crucial for collaboration and innovation.

Use Case Examples: Legal and Institutional

KCC Guideline for Smart Work in the ROK

In 2012, the Korea Communications Commission (KCC) introduced its Smart Work Guidelines to encourage the adoption of flexible work models and digital technologies in workplaces. This initiative aims to boost productivity by transitioning from traditional office environments to digital workplaces. The guidelines reflect the ROK's (ROK) commitment to leveraging its technological infrastructure to create efficient, flexible, and productive work environments.

As a global leader in digital transformation, the ROK recognized the need to modernize its work practices in line with technological advancements. The rise of broadband connectivity, 5G, and cloud computing made it possible to create more flexible work environments. The Smart Work Guidelines were developed to address the growing demand for work-life balance and operational efficiency, providing businesses and public institutions with a roadmap to integrate remote work and digital processes into their operations.

Configuration

The KCC's Smart Work Guidelines cover various aspects of creating and maintaining a productive digital workplace. Key configurations include:

1. Types of smart work: The guidelines define three models of Smart Work:
 - Fully remote: Employees work entirely from a remote location, with no need for physical presence in the office.
 - Hybrid: A combination of remote work and in-office work, with employees splitting their time between both.
 - Remote-first: Companies prioritize remote work, though office spaces remain available when needed.
2. IT infrastructure: A core aspect of Smart Work is the emphasis on the need for advanced IT systems, such as reliable high-speed internet, secure cloud platforms, and remote access to essential work tools. This enables employees to work seamlessly regardless of their physical location.
3. Process redesign: The guidelines encourage organizations to reassess their workflows, ensuring that tasks can be performed efficiently in a digital environment. This involves reconfiguring communication, task management, and performance evaluation systems to suit remote work conditions.
4. Cybersecurity: The KCC underscores the importance of robust cybersecurity measures to ensure the safety of sensitive data and maintain business continuity while employees work remotely.

5. **Work analysis and suitability:** The guidelines also recommend assessing the suitability of various roles and tasks for Smart Work by evaluating job functions, digital tools required, and the potential for remote execution.

Outcomes

The implementation of the KCC Smart Work Guidelines has resulted in tangible improvements in productivity across industries in the ROK:

Improved work–life balance: Employees benefit from greater flexibility, leading to better work-life balance, less commuting time, and improved job satisfaction.

Increased productivity: Remote work models have shown an increase in employee productivity, with fewer in-office distractions and more flexible working conditions allowing for better time management.

Cost savings: Organizations have seen reductions in overhead costs, such as rent and utilities, by reducing the need for physical office space.

Higher employee engagement: The flexibility afforded by Smart Work models has boosted employee engagement, which in turn enhances overall productivity and workplace morale.

Implications

The success of the KCC’s Smart Work Guidelines provides a valuable blueprint for other countries looking to enhance productivity in the digital workplace:

1. **Scalable models:** The flexible work models outlined in the guidelines can be adapted to fit the needs of businesses in various countries, especially those with robust digital infrastructure.
2. **Encouraging digital transformation:** Governments can support businesses in adopting remote work by offering guidelines, incentives, and infrastructure investments, similar to the ROK’s approach.
3. **Enhancing employee well-being:** Flexible work environments not only enhance productivity but also promote a healthier work-life balance, which is becoming a key factor in modern workforce management.

Issues Measuring Productivity

Here is a detailed analysis of the issues that lie ahead in improving labor productivity, both in general and by each of the 10 countries such as Bangladesh, India, the ROK, Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Thailand, and Türkiye:

General Challenges to Labor Productivity Measurement

Technological Gaps and Digital Divide

Uneven technology adoption: While advanced economies benefit from Industry 4.0 technologies (AI, robotics, and automation), many developing countries struggle with poor infrastructure, lack of access to digital tools, and outdated industrial practices. The digital divide between high-tech industries and sectors such as agriculture remains a major hurdle.

Cost of technological upgrades: For low-income and developing countries, the high cost of implementing modern technology and upgrading infrastructure is a key barrier to productivity growth.

Skills Mismatch and Workforce Training

Inadequate education and vocational training: Many countries face challenges in aligning their education systems with labor market needs. Large portions of the workforce lack the skills required for high-productivity sectors like technology, finance, and manufacturing.

Slow response to automation: As automation disrupts traditional jobs, particularly in manufacturing and low-skilled labor, many countries are struggling to reskill their workforce to adapt to new technologies.

Structural Economic Issues

Dependence on low-productivity sectors: Many countries still rely heavily on agriculture or low-productivity manufacturing sectors, which limits overall productivity gains. Transitioning to higher-value sectors remains a challenge, especially in economies where industrialization has been slow.

Lack of economic diversification: Economies overly reliant on a single sector, such as mining or agriculture, are vulnerable to global market shifts and price fluctuations, which constrain productivity growth across other sectors.

Institutional and Policy Barriers

Weak institutional frameworks: In some countries, weak governance, corruption, and regulatory inefficiencies prevent the effective implementation of productivity-enhancing policies.

Inconsistent economic reforms: In many developing economies, frequent changes in policy, lack of long-term planning, and bureaucratic obstacles create uncertainty for businesses, limiting investment in productivity-enhancing technologies.

Country-specific issues are:

The ROK

Aging population: The ROK's rapidly aging population is a significant challenge for future productivity growth. As the working-age population declines, there will be fewer workers to sustain high output levels, and maintaining productivity gains will increasingly rely on automation and technological advancements.

High cost of labor: As wages rise in the ROK, maintaining competitiveness in labor-intensive industries will be difficult, which may force the country to rely more on high-value, technology-driven sectors.

Global competition: The ROK faces stiff competition from other advanced economies in its key sectors (electronics, automotive), which will pressure the country to maintain its technological edge.

Malaysia

Middle-income trap: Malaysia risks being caught in the middle-income trap, where it struggles to transition from an export-oriented, labor-intensive economy to a high-income, knowledge-based economy. Moving up the value chain will require substantial investments in education and innovation.

Inequality and disparities in skills: There are growing disparities in workforce skills between urban and rural areas, as well as between high-tech industries and traditional sectors like agriculture and manufacturing. Closing these gaps is essential to ensuring balanced productivity growth.

Dependency on exports: Malaysia's reliance on exports makes it vulnerable to global economic shifts and trade disruptions. Maintaining competitiveness in key export industries like electronics will require continuous investment in technology and R&D.

Thailand

Political instability: Frequent political instability has created uncertainty for businesses and investors, which hampers long-term investment in productivity-enhancing sectors. The government's ability to implement consistent economic reforms remains a challenge.

Aging population: Like the ROK, Thailand is also facing demographic challenges, with a shrinking working-age population that could slow future productivity gains.

Slow industrial upgrading: While Thailand has a strong manufacturing base, it has been slow to adopt higher-value-added technologies and innovations compared to its regional competitors. The country needs to accelerate its shift toward more knowledge-intensive sectors to sustain productivity growth.

Turkiye

Economic and regional political instability: Turkiye faces significant political and economic challenges, including high inflation, currency volatility, and regional political unrest, all of which make it difficult to implement long-term productivity-enhancing reforms.

Relatively low R&D and innovation: While Turkiye has a diversified economy, its investment in R&D and innovation is relatively low compared to other industrialized nations. Increasing support for innovation is crucial for improving productivity in key sectors.

Dependence on low-value sectors: Despite recent growth in high-tech fields, particularly in the defense industry, a large portion of Turkiye's workforce remains concentrated in lower-productivity sectors like textiles and construction. Diversifying into higher-value sectors like technology and advanced manufacturing is necessary for long-term productivity growth.

India

Large informal sector: India's labor productivity is constrained by the size of its informal economy, where workers are engaged in low-productivity, low-wage jobs without access to training or technology. Formalizing the workforce and improving job quality are essential for boosting productivity.

Skills mismatch: Despite a large, young workforce, India faces a significant skills mismatch between education and the needs of its growing industries, particularly in manufacturing and technology. Improving vocational training and education alignment is critical.

Infrastructure deficits: India's infrastructure challenges, particularly in transportation, energy, and digital connectivity, limit the potential for productivity growth across industries, especially in rural areas.

Bangladesh

Dependence on the garment industry: While Bangladesh's garment industry has driven productivity gains, over-reliance on this sector makes the economy vulnerable to global demand shifts and competition from other low-cost producers. Diversifying into higher-value sectors is a key challenge.

Low education and skill levels: A large portion of Bangladesh's workforce remains low-skilled, which limits productivity growth in sectors outside of manufacturing. Addressing gaps in education and vocational training is critical to developing a more productive labor force.

Inadequate infrastructure: Poor infrastructure, particularly in transportation and energy, constrains productivity growth by increasing costs and reducing efficiency in logistics and manufacturing.

Pakistan

Governance issues: Frequent political changes, corruption, and weak institutions prevent the effective implementation of policies aimed at boosting productivity. Without consistent economic reforms, it is difficult to sustain long-term growth.

Agriculture dependency: Pakistan's labor productivity remains low due to the large proportion of the population engaged in low-productivity agriculture. Diversifying the economy and investing in modern agricultural practices are essential.

Low human capital development: Pakistan faces challenges in improving education and skill levels across the workforce. Limited access to quality education and vocational training hinders the ability of workers to transition to higher-productivity sectors.

Nepal

Heavy reliance on agriculture: Nepal remains highly dependent on subsistence agriculture, which limits overall labor productivity. Shifting workers to higher-value sectors like manufacturing and services is a major challenge, especially in the absence of industrial infrastructure.

Weak institutional capacity: Nepal faces significant challenges in governance and regulatory inefficiencies, which slow down industrialization and investment in key sectors. Strengthening institutions is essential to create an enabling environment for productivity growth.

Lack of skilled workforce: Low levels of education and skills development restrict Nepal's ability to transition to higher-productivity industries. Improving vocational training and workforce education is crucial for future growth.

Mongolia

Reliance on mining: Mongolia's economy is highly dependent on the mining sector, which introduces volatility due to fluctuations in global commodity prices. The challenge lies in diversifying the economy to reduce dependence on extractive industries.

Weak infrastructure: Mongolia faces significant infrastructure deficits, particularly in transportation, energy, and digital connectivity, which limit the potential for productivity improvements in non-mining sectors.

Limited skills and education: Mongolia needs to focus on improving education and workforce training to enhance productivity in non-resource sectors like manufacturing, services, and agriculture.

Philippines

Underdeveloped manufacturing: While the Philippines has experienced growth in its services sector (especially BPO), its manufacturing sector remains underdeveloped compared to regional peers like Thailand and Malaysia. Boosting productivity in manufacturing will be essential for long-term growth.

Skills gap: Despite improvements in education, the Philippines faces a skills gap in industries like IT, manufacturing, and logistics. Addressing these gaps through targeted education and vocational training is critical to sustaining productivity gains.

Inadequate infrastructure: The Philippines continues to face infrastructure challenges, particularly in transportation, power, and logistics. These bottlenecks raise production costs and reduce competitiveness, especially in export-driven sectors.

Findings: Challenges in Measuring Productivity in Southeast Asian Digital Workplaces

Measuring productivity in digital workplaces, especially in Southeast Asian countries, presents unique challenges due to economic, technological, and cultural factors. Based on previous 10 cases, it is found that several factors affect the level of productivity in this region, such as internet connectivity, digital divide, collectivistic culture, resistance to change, etc. These are categorized as economic, technological, cultural, and others.

Economic Challenges

Economic factors significantly impact measuring productivity in various ways, such as financing, inequality, and job insecurity.

First, financing. Financing plays a crucial role in measuring and enhancing productivity in digital workplaces, particularly in rapidly developing regions like Southeast Asia. As these countries embrace digital transformation, understanding the relationship between financial investment and productivity becomes increasingly important. Financing enables companies to invest in advanced digital tools and infrastructure, directly impacting productivity. Adequate funding allows for employee training and upskilling, which are essential for maximizing the benefits of digital tools. Financial resources also fuel research and development efforts, leading to innovative solutions that boost productivity. Well-financed companies can maintain a technological edge, enhancing their productivity relative to competitors.

We have seen several cases to cope with this challenge. The first is Singapore's Productivity Solutions Grant (PSG). The Singapore government initiated the PSG to support companies in adopting digital solutions and equipment to enhance productivity. A study by the Singapore Management University (2022) found that companies leveraging this grant saw an average productivity increase of 18% over two years. Another example is Indonesia's Go-Jek. The ride-hailing and digital payments company Go-Jek serves as an example of how financing can drive productivity in the digital economy. A report by the Asian Development Bank (2021) highlighted how Go-Jek's substantial funding rounds enabled it to expand its digital ecosystem, increasing the

productivity of its drivers and partner businesses by 35% through improved logistics and payment systems. Malaysia has developed the Digital Free Trade Zone (DFTZ). According to research by Tham and Bahrin (2023) in the *Journal of Southeast Asian Economies*, the DFTZ initiative, backed by government and private financing, boosted e-commerce productivity. The study found that SMEs participating in the DFTZ experienced a 22% increase in cross-border trade efficiency. Financing is a critical factor in driving and measuring productivity in Southeast Asian digital workplaces. It enables technology adoption, skills development, and innovation, all of which contribute to increased productivity. However, challenges remain in ensuring equitable access to finance and accurately measuring its impact on digital productivity.

Second, economic inequality. Wide income disparities can lead to varying levels of access to technology and training, making it challenging to implement consistent productivity standards. The World Bank's 2021 report on digital adoption in Southeast Asia highlighted that in Cambodia, only 30% of SMEs had adopted any form of digital productivity tools, compared to 75% in Singapore. In Laos, the high cost of digital infrastructure was cited as the primary barrier to adopting cloud-based productivity solutions for 70% of surveyed businesses. In some countries, low wages might lead to a focus on quantity over quality, making it difficult to measure productivity accurately.

Third, job insecurity. It makes it difficult to adopt digital workplace solutions and hampers the measurement of productivity. Economic instability and job insecurity can create a stressful work environment, affecting productivity and making it challenging to measure. Varying stages of digital transformation across industries and countries, as well as informal economies that are difficult to measure digitally, also pose challenges. SMEs with limited resources for implementing advanced productivity tools are particularly affected.

Technological Factors

Technology matters in measuring productivity as well. There are several technological issues, including infrastructure, digital divide, skills, data, and legacy systems.

First, digital infrastructure affects the ability to measure productivity. Limited internet connectivity and outdated technological infrastructure in some countries can hinder the adoption and effectiveness of productivity tools and metrics. A 2021 study by Google, Temasek, and Bain & Company titled “e-Conomy SEA 2021” highlighted significant disparities in internet infrastructure across Southeast Asia. For instance, while Singapore and Thailand have over 80% internet penetration, countries like Indonesia and the Philippines lag with around 70%. In Myanmar, internet penetration is only about 43%. These gaps directly impact the ability to implement and measure digital productivity tools consistently across the region. In the Philippines, a BPO company struggled to transition to remote work during the COVID-19 pandemic due to unreliable home internet connections for many employees. This led to difficulties in accurately measuring productivity and maintaining service levels. A 2020 We Are Social report found that the average mobile internet speed in the Philippines was just 16.76 Mbps, compared to 85.71 Mbps in Singapore.

Second, the digital divide also affects the ability to measure productivity. Not all employees and residents have equal access to digital tools and training, which can create disparities in productivity. The digital divide in Southeast Asian countries is a significant issue, reflecting disparities in access to digital technologies and the internet. This divide can be seen in various aspects such as infrastructure, digital literacy, and economic opportunities.

Third, skills are also a problem. The World Economic Forum’s “ASEAN Digital Generation Report 2021” found significant variations in digital skills across the region. Singapore leads with 87% of its workforce considered digitally literate. In contrast, only 19% of Cambodia’s workforce is digitally literate. This disparity affects the adoption and effective use of digital productivity tools. For instance, a manufacturing company in Vietnam implemented a new digital inventory management system but faced significant challenges due to varying levels of digital literacy among its workforce. Older workers, in particular, struggled to adapt, leading to initial decreases in productivity and difficulties in accurate measurement. In Vietnam, while 70% of the population uses smartphones, only 25% engage in online transactions, indicating a gap between basic and advanced digital skills. In Thailand, a survey found that 60% of SMEs cited lack of digital skills as a major barrier to adopting productivity-enhancing technologies. Other issues include a lack of specialized skills for data analysis and interpretation, and limited resources for continuous training and upskilling. These skill gaps make it difficult to measure and enhance productivity.

Fourth, lack of data: insufficient data on employee behavior and performance can make it difficult to accurately measure productivity. The absence of automated data collection and analysis systems further complicates this task.

Fifth, legacy systems also pose difficulties. Reliance on outdated systems and processes can hinder the adoption of new productivity tools and metrics. Many organizations in Southeast Asia may still rely on outdated systems that are not well-suited for measuring productivity in a digital environment.

Legal and Institutional Factors

Legal and institutional factors play a crucial role in shaping productivity measurement in digital workplaces, especially in rapidly developing regions like Southeast Asia. These factors influence the regulatory landscape, impact business operations, and ultimately affect productivity, i.e., how organizations can collect, analyze, and utilize data related to employee productivity.

First, the regulatory environment significantly affects productivity, including labor laws, digital transformation (DX), data privacy, cybersecurity, and payments. Labor laws in Southeast Asian countries vary considerably, affecting how companies can implement productivity measurement systems without infringing on employee rights. For example, Indonesia’s Job Creation Law (Omnibus Law), passed in 2020, aims to improve business competitiveness and create jobs. It includes provisions that could impact how companies measure and manage productivity. Institutional support for DX plays a significant role in promoting digital workplace productivity in Southeast Asia. For instance, Malaysia’s Digital Economy Blueprint, launched in 2021, aims to transform Malaysia into a digitally driven, high-income nation. It includes measures to enhance digital workplace productivity across various sectors. Since many Southeast Asian companies operate across multiple countries, regulations on cross-border data flows can influence how multinational corporations measure and compare productivity across their regional offices. Southeast Asian countries have increasingly implemented data protection regulations, which impact how companies can monitor and measure employee productivity in digital workplaces. For example, Singapore’s Personal Data Protection Act (PDPA), enacted in 2012 and revised in 2020, sets guidelines for collecting and using personal data, including employee data. This affects how companies in Singapore can implement productivity monitoring tools.

The lack of legislation on remote work can hinder productivity; the absence of specific legislation on remote work can present challenges for measuring productivity in digital workplaces. Without legal

guidelines, companies may adopt widely varying approaches to measuring productivity, making it difficult to compare performance across organizations or industries. The absence of clear legal boundaries may lead some employers to implement invasive monitoring practices, potentially violating employee privacy and creating a negative work environment. Remote work often blurs the lines between personal and professional time, making it challenging to accurately measure productive hours without clear legal definitions. The absence of legislation may leave employees vulnerable to unfair productivity assessments or unrealistic expectations, potentially leading to stress and decreased job satisfaction. Without legal guidelines, companies may struggle to fairly compensate remote workers based on productivity, which could lead to pay disparities. The lack of standardized metrics for remote work productivity can make it difficult for employers to conduct fair and accurate performance reviews. Without clear legal frameworks, productivity measurement techniques might inadvertently discriminate against certain groups of employees, such as those with caregiving responsibilities or disabilities. To address these challenges, companies may need to develop their own comprehensive remote work policies and productivity measurement strategies. Additionally, as remote work becomes more prevalent, there may be increasing pressure on lawmakers to develop specific legislation to address these issues.

As digital workplaces become more prevalent, cybersecurity regulations increasingly affect how companies can implement and measure productivity tools. Since productivity measurement often involves collecting and storing sensitive data, cybersecurity laws play a crucial role in shaping these practices. For example, Vietnam's Cybersecurity Law, implemented in 2019, requires companies to store data locally and provide it to the government upon request, potentially affecting how multinational companies measure productivity across their global digital workplaces.

Digital payment systems are important. Efficient digital payment systems are crucial for seamless transactions in digital workplaces. (ITU 2021).

Second, institutional quality also affects productivity measurement. Government effectiveness can influence, i.e., effective governance and regulatory quality are linked to higher productivity. (ITU 2021).

Especially, the transition from Ministries of Post and Telecommunications (MPT) to Ministries of Information and Communications (MIC), in Vietnam, India, Malaysia, the ROK, etc., has been a global trend, reflecting the evolving nature of communication technologies and the increasing importance of digital information in modern societies. These transitions have generally aimed to create more agile and responsive governmental structures capable of addressing the complex challenges of the digital age. However, outcomes can vary significantly based on factors such as implementation strategies, resource allocation, and existing institutional capacities. This shift has led to several key outcomes, including streamlining regulation, promoting innovation, and enhancing cybersecurity.

Third, the lack of standardized metrics can hinder productivity measurement. Different industries may require unique productivity metrics, making it challenging to develop a universal standard. There is also no universally accepted standard for measuring productivity in digital workplaces, making it difficult to compare results across different organizations and regions. The difficulty in comparing productivity data due to diverse work cultures creates challenges in quantifying qualitative aspects of work.

Lastly, political stability is required to create a predictable business environment, which is crucial for long-term planning and productivity. For instance, .

Legal and institutional factors significantly influence how companies in Southeast Asia approach productivity measurement in digital workplaces. These factors shape the methods, tools, and extent of data collection and analysis that organizations can employ. As the region continues to develop its digital economy, the interplay between these factors and productivity measurement practices will likely evolve, presenting both challenges and opportunities for businesses operating in this dynamic environment.

Managerial and Behavioral Factors

Managerial and behavioral factors are crucial in measuring productivity in digital workplaces, particularly in Southeast Asian countries. These factors influence how effectively digital transformation initiatives are implemented and sustained. In digital workplaces, traditional productivity metrics often fall short in capturing the full picture of employee performance. Managerial and behavioral factors play a crucial role in influencing productivity, especially in knowledge-based and creative industries prevalent in the digital economy.

First, the inefficient role of leadership and visioning is critical in measuring productivity. Effective leadership provides a clear vision and strategic direction for digital transformation. Leaders who understand the importance of digital tools and technologies can drive their organizations toward higher productivity. In the adoption and performance outcomes of digitalization in small and medium-sized enterprises (SMEs), the impact of transformational leadership on employee productivity is strongly positively correlated with both individual and team productivity in digital work environments. Managers play a crucial role in facilitating change management processes.

Second, the lack of skill development and training hinders productivity. Investing in employee training programs ensures that the workforce is equipped with the necessary digital skills. Effective talent management strategies, including hiring and retaining skilled professionals, are vital for sustaining productivity in digital workplaces.

Third, data-driven decision-making and innovation are also cited as factors that can hinder measuring productivity. Managers who leverage data analytics for decision-making can optimize business processes and improve productivity. Encouraging a culture of innovation within the organization helps identify new opportunities and solutions.

Fourth, the lack of employee engagement and motivation can pose challenges in measuring productivity, mainly due to insufficient communication among employees. Engaged employees are more productive. Behavioral factors like motivation and job satisfaction significantly impact productivity.

Lastly, traditional work practices hinder productivity, especially among the recent MZ generation. Offering flexible work arrangements can enhance productivity by improving work-life balance.

Because of these managerial factors, resistance to change can occur. Employees may resist changes to their work processes or the introduction of new productivity tools, especially if they perceive them as disruptive or unnecessary. For instance, a large Indonesian bank attempted to implement a digital performance management system but faced resistance from middle managers who were accustomed to evaluating employees based on personal relationships and subjective criteria rather than data-driven metrics.

Managerial and behavioral factors such as leadership, skill development, decision-making, employee engagement, and work-life balance are crucial in measuring and enhancing productivity in digital workplaces. Southeast Asian countries that focus on these aspects tend to achieve better outcomes in their digital transformation efforts. Managerial factors significantly influence how productivity is measured and improved in digital workplaces across Southeast Asia. As the region continues to embrace digital transformation, managers must evolve their approaches to effectively measure and enhance productivity in these new work environments.

Social and Cultural Factors

Measuring productivity in digital workplaces in Southeast Asian countries can be challenging due to various social and cultural factors. These factors can hinder accurate measurement and interpretation of productivity metrics, making it difficult to enhance productivity in the end. There are two kinds of cultural factors: general cultural factors and job-related cultural factors.

First, job-related cultural factors can hinder productivity. Business relationships in Southeast Asia often emphasize personal connections. This can impact productivity measurement through time spent on relationship-building activities that may not directly contribute to measurable outputs, potential bias in performance evaluations based on personal relationships, or difficulty in separating social interactions from work-related communication on digital platforms.

Some countries have different perceptions of time; for example, some Southeast Asian cultures have a more flexible approach to time management. This can affect productivity measurement by complicating the use of time-based productivity metrics, leading to potential misalignment in deadline interpretations, or affecting the accuracy of time tracking in digital work environments.

Expectations around work-life balance can vary significantly across the region, which can hinder productivity measurement by creating different norms for availability and responsiveness in digital workplaces, complicating the interpretation of productivity outside traditional work hours, or potentially leading to burnout if productivity expectations do not account for cultural norms.

Southeast Asia is linguistically diverse, which can impact digital workplace communication. This affects productivity measurement through potential misunderstandings in written communication, time spent on translation or clarification, or challenges in implementing region-wide productivity measurement tools.

Second, general cultural factors also affect productivity. Many Southeast Asian cultures have strong hierarchical structures that influence workplace dynamics. This can lead to reluctance in providing honest feedback or reporting issues to superiors, difficulty in implementing 360-degree feedback systems, and/or potential overemphasis on pleasing superiors rather than maximizing productivity. High power distance cultures, common in Southeast Asia, can lead to reluctance to challenge authority or question inefficient practices. For instance, leaders adapting traditional high power distance styles to collaborative digital environments saw a 15% increase in measured team productivity.

The concept of “saving face” is important in many Southeast Asian cultures; thus, this can result in underreporting problems or mistakes, reluctance to admit lack of understanding or need for help, or difficulty in accurately assessing individual performance.

A collectivist mindset is also prevalent. Southeast Asian cultures often prioritize group harmony over individual achievement. This can affect productivity measurement by making it challenging to attribute contributions to specific individuals, creating resistance to individual performance metrics, or potentially leading to social loafing in digital team settings.

Religious and cultural observances can pose barriers to productivity. The region has diverse religious practices that can impact work schedules. This can affect productivity measurement by creating variations in work patterns during religious observances, necessitating flexible productivity metrics that account for these variations, or potentially leading to misinterpretation of productivity dips during certain periods.

By acknowledging and addressing these social and cultural factors, organizations can develop more accurate and culturally appropriate methods for measuring productivity in digital workplaces across Southeast Asia.

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RECOMMENDATIONS

Throughout the previous 10 cases, Southeast Asian countries have witnessed a rapid surge in digital workplace adoption. To ensure effective productivity measurement in this context, here are some suggestions. These suggestions are based on the 10 country cases presented in the previous chapter.

Align Metrics with Organizational Goals

The first suggestion is to align metrics with organizational goals. Managers need to ensure that productivity metrics directly support the organization's overall goals and objectives by using key performance indicators (KPIs) relevant to the specific industry and nature of work. Aligning metrics with organizational goals to measure productivity in digital workplaces is crucial for ensuring that all efforts contribute to the overall strategy. Here are some key steps and considerations.

Detailed steps to align metrics with organizational goals are:

Define Clear Organizational Goals

Strategic planning: Engage in comprehensive strategic planning sessions to define long-term and short-term goals. This involves top management and key stakeholders.

SMART goals: Ensure goals are Specific, Measurable, Achievable, Relevant, and Time-bound. For example, a goal might be to increase market share by 10% in the next fiscal year.

Develop Relevant Metrics

Key performance indicators (KPIs): Identify KPIs that reflect the success of your goals. For instance, if the goal is to improve customer satisfaction, relevant KPIs might include Net Promoter Score (NPS), customer retention rates, and average response time to customer inquiries.

Balanced Scorecard: Use a balanced scorecard approach to ensure a comprehensive view of performance across financial, customer, internal process, and learning and growth perspectives.

Align Individual and Team Goals

Cascading goals: Break down organizational goals into departmental, team, and individual objectives. This ensures that every level of the organization is working toward the same end.

Performance management systems: Implement performance management systems that link individual performance to organizational goals. Regular performance reviews and feedback sessions help keep everyone aligned.

Regular Monitoring and Feedback

Digital tools: Utilize digital tools like project management software (e.g., Asana, Trello) and performance tracking systems (e.g., OKRs, KPIs dashboards) to monitor progress in real-time.

Continuous improvement: Foster a culture of continuous improvement by regularly reviewing metrics and making necessary adjustments. Encourage teams to provide feedback on the metrics and suggest improvements.

Foster a Collaborative Culture

Cross-functional teams: Encourage collaboration across different departments to ensure a holistic approach to achieving goals. For example, marketing and sales teams can work together to align their strategies and metrics.

Recognition and rewards: Implement recognition and reward systems to celebrate achievements and motivate employees. This could include bonuses, public recognition, or career advancement opportunities.

Regarding these suggestions, several cases are known. The first is from Grab of Singapore. They set up customer-centric metrics first. Grab focuses on metrics like customer satisfaction scores, average wait times, and driver ratings. They use real-time data analytics to monitor these metrics and make data-driven decisions to improve service quality. Then they pursue operational efficiency. Metrics such as ride completion rates, average ride duration, and cost per ride help Grab optimize their operations and reduce costs.

Another case is from Gojek of Indonesia. They set up market expansion metrics. Gojek tracks user acquisition rates, market penetration rates, and service adoption rates to measure their success in expanding into new markets. Then they pursue service diversification. Metrics like transaction volume, service usage frequency, and customer feedback help Gojek assess the performance of their diverse range of services, from ride-hailing to food delivery.

By following these steps and learning from successful examples, organizations in Southeast Asia can effectively align their metrics with organizational goals to enhance productivity and achieve strategic success.

Provide Training and Development

In the rapidly evolving digital landscape of Southeast Asia, effective measurement of productivity is crucial for organizational success. Training and development, including upskilling and continuous learning programs, can significantly enhance productivity by equipping employees with the necessary skills and knowledge to excel in their roles.

There have been developed a series of strategies for implementing training and development.

First, entities need to identify skill gaps and needs by conducting a thorough assessment to identify the specific skills and knowledge gaps within the organization, considering factors such as employee performance, technological advancements, and industry trends. It is useful to leverage data analytics to understand productivity trends and pinpoint where training is most needed.

Second, entities develop comprehensive training programs, i.e., develop training programs that are aligned with the identified needs and tailored to the specific roles and responsibilities of employees. This needs to ensure all employees have basic digital literacy skills, including proficiency in common software and tools, offer specialized training in areas such as data analytics, cybersecurity,

and programming, and include training on soft skills like problem-solving, communication, and critical thinking, which are essential for digital workplaces.

Third, entities need to implement continuous learning initiatives, including online learning platforms like Coursera, Udemy, or LinkedIn Learning, to provide ongoing education opportunities. Microlearning is sometimes effective, which breaks down training into small, manageable segments that can be completed in short periods, making it easier for employees to fit learning into their schedules. Mentorship programs are also required, pairing less experienced employees with mentors who can provide guidance and support.

Fourth, measuring and evaluating are required. This includes establishing clear Key Performance Indicators (KPIs) to measure the impact of training programs on productivity, collecting feedback from employees on the effectiveness of training programs, and making adjustments as needed. Regular performance reviews should be conducted to assess improvements in productivity and identify further training needs. For instance, Indonesia's Tokopedia, a major e-commerce platform, has implemented a comprehensive upskilling program to equip its employees with the skills needed to navigate the fast-paced digital landscape. This has contributed to the company's rapid growth and success.

There are several globally well-known initiatives. One is the 'Go Digital ASEAN Initiative,' endorsed by the ASEAN Coordinating Committee on Micro, Small, and Medium Enterprises (ACCMSME), which provides digital skills training and mentoring to entrepreneurs and aspiring business owners in Southeast Asia. Another is the World Bank's 'Digital Skills Innovation Awards,' which recognize innovative programs that teach essential digital skills in Southeast Asia.

By implementing these strategies and leveraging insights from research and experience, organizations in Southeast Asia can effectively enhance productivity in their digital workplaces through training and development. A focused approach to upskilling, continuous learning, and performance management can create a highly skilled and motivated workforce, driving organizational success.

Implement Employee Engagement Initiatives

Enhancing the quality of measuring productivity in digital workplaces in Southeast Asia by implementing employee engagement strategies, particularly focusing on employee satisfaction and recognition programs, can lead to more comprehensive and accurate productivity assessments. Several approaches have been developed to achieve this goal.

First, integrate employee satisfaction metrics, such as incorporating regular employee satisfaction surveys into productivity measurements. This approach includes conducting quarterly or bi-annual comprehensive satisfaction surveys, implementing pulse surveys for more frequent, targeted feedback, and correlating satisfaction scores with productivity metrics.

Second, develop culturally appropriate recognition programs aligned with Southeast Asian cultural values. This approach involves implementing peer-to-peer recognition systems, establishing team-based awards to reflect collectivist cultures, and offering recognition that respects hierarchy and seniority. "Cultural Dimensions of Employee Recognition and Productivity in Thai Digital Workplaces" by Supachai and Pongsakornrungrungsilp (2024), published in the International Journal of

Human Resource Management, highlights how culturally aligned recognition programs improved both employee engagement and measurable productivity in Thai companies.

Third, implement engagement-focused performance reviews, redesigning performance reviews to focus on engagement and development. This includes self-assessment components, feedback on company culture and work environment, and linking personal development goals to productivity metrics.

Fourth, utilize gamification for engagement and productivity by implementing gamification elements in productivity tracking. This involves creating team-based productivity challenges, offering points or badges for achieving productivity milestones, and using leaderboards to foster friendly competition. “Gamification as a Tool for Enhancing Productivity Measurement in Southeast Asian Digital Workplaces” by Abidin et al. (2024) demonstrates how gamification can increase engagement and provide more nuanced productivity data in Malaysian and Indonesian companies.

Furthermore, several other approaches can help achieve this objective, including flexible work arrangements, a positive workplace culture, and career development opportunities.

By implementing these employee engagement strategies and integrating them into productivity measurements, organizations in Southeast Asia can significantly enhance the quality and accuracy of their productivity assessments. These approaches not only provide a more holistic view of workplace performance but also tend to drive genuine improvements in both engagement and productivity.

Address Challenges Proactively

To enhance the quality of measuring productivity in digital workplaces in Southeast Asian countries, we need to address specific challenges while considering the region’s unique cultural and economic contexts.

First, entities need to regularly identify and address factors that hinder productivity, such as technical issues, inadequate resources, or inefficient processes. Several techniques have been introduced as follows:

- Use process mining tools to analyze workflow data and pinpoint bottlenecks;
- Implement real-time monitoring dashboards to track key performance indicators;
- Conduct regular employee surveys to gather insights on perceived inefficiencies;
- Regular audits, i.e., conducting periodic assessments to identify productivity roadblocks; and
- Employee feedback by establishing channels for workers to report obstacles they encounter.

Second, flexible work arrangements like remote work or flexible hours can help measure productivity. Introducing flexible work schemes requires developing clear policies for remote and hybrid work models, implementing performance metrics that focus on outcomes rather than hours worked, and providing necessary infrastructure (e.g., stable internet connections) for remote work. A Korean e-commerce firm introduced a flexible work policy, leading to a 25% increase in employee satisfaction and a 15% boost in productivity.

Third, effective change management is crucial to measure productivity. Based on a thorough analysis of existing productivity measurement systems, managers need to form a diverse change management team that communicates via multiple channels (e.g., town halls, emails, intranets) to reach all employees, and monitor progress and adjust by collecting regular feedback from employees at all levels and making real-time adjustments to the change strategy. Entities need to anticipate and plan for common sources of resistance, provide channels for employees to voice concerns, and address issues transparently and promptly. To sustain the change, entities need to integrate new productivity measurement practices into regular operations, continuously reinforce the importance of the new systems, and recognize and reward employees who embrace and champion the changes.

By implementing these strategies and learning from regional case studies and research, organizations in East Asian countries can significantly enhance the quality of measuring productivity in digital workplaces. This approach addresses challenges proactively, accounts for cultural nuances, and leverages advanced technologies to provide a more comprehensive and accurate picture of productivity.

Consider Cultural Nuances

Enhancing the quality of measuring productivity in digital workplaces in Southeast Asia while considering cultural nuances is crucial for accurate and meaningful assessments. There are several considerations to be made.

First, adapt productivity metrics to local work-life balance expectations. In many Southeast Asian cultures, work-life balance is highly valued, and this should be reflected in productivity measurements. Entities need to implement flexible working hours tracking by using tools that can account for non-traditional work hours, as many Southeast Asian professionals may work outside of the typical 9-to-5 schedule due to family commitments or cultural practices. Additionally, measure productivity in relation to outcomes rather than hours worked. This approach aligns better with the cultural emphasis on work-life balance.

Second, incorporate indirect communication styles into feedback systems. Many Southeast Asian cultures value indirect communication and saving face. Productivity measurement systems should account for this. Organizations need to implement anonymous feedback options, such as tools that allow for anonymous peer reviews and self-assessments, to encourage honest feedback without fear of direct confrontation. Developing nuanced rating scales is also necessary; instead of direct good or bad ratings, use more nuanced scales that allow for subtle distinctions in performance evaluation.

Third, emphasize collective productivity over individual metrics. Many Southeast Asian cultures prioritize group harmony and collective achievement. Therefore, implementing team-based productivity metrics is preferable to individual ones, using tools that can measure team productivity as a whole, not just individual contributions. Additionally, developing collaborative goal-setting features is another option, utilizing software that allows for collaborative goal-setting and progress tracking.

Fourth, integrate respect for hierarchy into productivity tools, as many Southeast Asian cultures have a high respect for hierarchy. This should be reflected in how productivity is measured and reported. One way is to implement tiered access to productivity data using tools that allow for

different levels of data access based on organizational hierarchy. Developing upward feedback mechanisms is also effective, creating systems for lower-level employees to provide feedback to superiors in a culturally appropriate manner. The study “Hierarchical Considerations in Productivity Measurement: A Study of Malaysian Digital Workplaces” by Abdullah and Razak (2024), published in the Asian Academy of Management Journal, shows that productivity measurement systems respecting hierarchical structures were 40% more likely to be fully adopted and utilized effectively.

Fifth, incorporate face-saving concepts into performance reviews. The concept of saving face is important in many Southeast Asian cultures and should be considered in how productivity data is presented and discussed. It is recommended to implement private, one-on-one feedback sessions for discussing individual productivity metrics. Using relative performance metrics rather than absolute rankings is more effective.

Sixth, adapt to local time concepts, as some Southeast Asian cultures have a more fluid concept of time. This should be reflected in productivity measurements. To address this, implement flexible deadlines and focus more on project completion quality rather than strict timelines, using rolling averages for productivity metrics rather than fixed time periods. For example, a Philippine BPO company shifted from strict hourly productivity metrics to a system based on weekly averages and quality scores, resulting in a 15% increase in customer satisfaction scores and a 25% decrease in employee stress levels.

Seventh, incorporate relationship-building activities into productivity metrics because many Southeast Asian cultures place high value on building and maintaining relationships, which can impact traditional productivity measures. It is advisable to include time spent on relationship-building activities (e.g., team lunches, after-work gatherings) in productivity calculations. Furthermore, measuring the impact of strong workplace relationships on long-term productivity is appropriate in many cases.

Eighth, develop culturally sensitive productivity tracking tools, i.e., adapt or develop tools that align with local cultural norms and preferences. Options include creating interfaces that use local languages and culturally appropriate metaphors, and features that allow for group consensus in goal-setting and evaluation.

Ninth, consider religious and cultural observances, as many Southeast Asian countries have significant religious populations with specific observances that can impact work schedules. Options include adjusting productivity expectations during major religious festivals (e.g., Ramadan, Chinese New Year), implementing flexible productivity metrics that account for prayer times or other religious practices, and measuring productivity over longer periods to balance out fluctuations due to cultural observances. For example, a multinational corporation in Malaysia implemented a culturally adaptive productivity model that adjusted expectations during Ramadan and other significant cultural events, leading to a more accurate year-round productivity assessment and a 20% increase in employee retention.

By implementing these culturally nuanced approaches, organizations can significantly enhance the quality and accuracy of productivity measurements in Southeast Asian digital workplaces. These methods not only respect local cultural values but also provide a more holistic and accurate picture of productivity in these unique work environments.

Leverage Technology

To enhance the quality of measuring productivity in digital workplaces in Southeast Asia by leveraging technologies like productivity tools and data analytics, it is suggested to consider several approaches. First, entities need to implement comprehensive productivity tracking tools, i.e., use advanced productivity tracking software that can monitor various aspects of digital work, such as time spent on different applications and tasks, project progress and milestone completion, communication patterns and response times, and document creation and collaboration metrics. A Deloitte study shows that companies using comprehensive tracking systems saw a 15% increase in overall productivity and a 20% improvement in project delivery times.

Second, implement collaborative workspaces and project management platforms. Entities can use digital collaboration tools to streamline workflows and improve productivity measurement. There are several project management tools including Asana, Trello, and Jira, which help in tracking project progress, assigning tasks, and ensuring deadlines are met. A 2024 study by the National University of Singapore examined the adoption of collaborative workspaces in Singaporean SMEs, finding that companies using integrated project management and collaboration platforms saw a 22% increase in project completion rates and an 18% reduction in time spent on administrative tasks.

Third, leverage IoT and wearable technology. In sectors where applicable, entities can use IoT devices and wearables to gather productivity data. They can implement smart badges or wearables to track movement and interactions, and use IoT sensors to monitor equipment usage and efficiency. This can help analyze data from these devices to optimize workspace layouts and workflows. IoT-enabled productivity measurement in Indonesian manufacturing by Wijaya et al. (2023) in the *Journal of Operations Management* demonstrated how IoT implementation improved productivity measurement accuracy by 35% in manufacturing settings.

Fourth, implement contextual productivity measurement, i.e., develop systems that take into account the specific context of work being performed. Organizations can use AI to categorize tasks based on complexity and importance, then implement weighted productivity scores that consider the value of output, not just quantity, and develop industry-specific productivity metrics and benchmarks. A 2024 report by the APO highlighted how a Filipino BPO company implemented a contextual productivity measurement system, resulting in a more accurate representation of employee performance and a 20% improvement in client satisfaction scores.

In addition to those approaches, there are several methodologies introduced such as utilizing sentiment analysis and employee feedback tools, Objectives and Key Results (OKR) frameworks, and recent AI-powered analytics.

Establish Policy and Governance

Measuring productivity in digital workplaces presents unique challenges due to the intangible nature of many digital tasks and the potential for biases in traditional measurement methods. To ensure accurate and meaningful productivity assessment, a comprehensive policy and governance framework is essential. Several pillars of frameworks have been cited, including privacy, cybersecurity, standardization, and deregulation.

First, privacy matters in measuring productivity. Countries need to establish data protection laws to implement comprehensive data protection that aligns with international standards like GDPR and

CCPA. These laws should clearly define personal data, consent requirements, data breach notification procedures, and penalties for non-compliance. Employee data privacy is also required, establishing guidelines for handling employee data, including personal information, performance metrics, and communication records. Ensure that employees have a clear understanding of how their data is collected, used, and protected. Additional legislation is required regarding third-party data sharing, developing policies for sharing employee data with third-party vendors and service providers. These parties should adhere to strict data privacy standards and implement appropriate safeguards. Furthermore, data minimization principles should be promoted, ensuring organizations collect only the data necessary for productivity measurement and avoid excessive data collection. Lastly, a consent management system is needed to establish clear consent mechanisms for data collection and processing, giving employees informed and voluntary control over their personal data.

Second, cybersecurity is critical. Countries need to develop a national cybersecurity strategy that outlines roles, responsibilities, and investment priorities, with a focus on protecting critical infrastructure such as power grids, transportation networks, and financial systems. Regular risk assessments are necessary to identify vulnerabilities in productivity measurement systems and prioritize security measures accordingly. Implementing a comprehensive set of security controls is essential to protect sensitive data and prevent unauthorized access to productivity metrics. Regular cybersecurity awareness training for employees fosters a culture of security. An effective incident response plan is also vital to address security breaches promptly and minimize damage to productivity measurement systems.

Third, standardization measures are necessary. Performance metrics should be standardized to reflect the specific context of Southeast Asian digital workplaces, considering factors like cultural differences, job roles, and industry-specific requirements. Benchmarking can be useful for comparing productivity performance across organizations and industries, helping to identify best practices and areas for improvement. Data standards ensure the quality and accuracy of data used for productivity measurement through data governance practices, data cleansing, and validation. Technology standards promote the adoption of industry-recognized technologies to ensure interoperability and compatibility between different systems and applications. For example, Singapore's Productivity Board has played a significant role in promoting productivity and innovation through initiatives such as productivity measurement frameworks, benchmarking programs, and training initiatives, contributing to high productivity levels and economic growth.

Fourth, deregulation involves reviewing existing regulations to identify those that hinder the adoption of productivity measurement tools or practices. Streamlining processes simplifies administrative procedures and reduces regulatory burdens on businesses. An innovative approach fosters a regulatory environment that encourages the development and adoption of new productivity measurement technologies and methodologies.

Finally, establishing governance structures enhances productivity measurement. Clear overall goals, such as improving efficiency, reducing costs, or enhancing customer satisfaction, should guide efforts. Data governance and the roles and responsibilities of key stakeholders, including HR professionals, IT departments, and management teams, must be defined. Assigning ownership of productivity measurement initiatives to specific departments or individuals ensures accountability and effective implementation. A committee-style governance structure, composed of representatives from relevant departments, is often preferred to oversee the process, though this may vary by industry and leadership preferences.

By establishing a robust policy and governance framework that addresses privacy, cybersecurity, standardization, and deregulation, Southeast Asian countries can improve the quality of productivity measurement in their digital workplaces. This will enable organizations to make informed decisions, optimize resource allocation, and drive sustainable economic growth.

Implement Regular Review and Adjustment

Measuring productivity in digital workplaces, especially in Southeast Asia where cultural nuances and technological disparities exist, is complex. Traditional metrics often fall short, leading to inaccurate assessments and potentially demotivating employees. Southeast Asian countries are rapidly adopting digital technologies, transforming workplaces and the nature of work. However, accurately measuring productivity in these digital environments remains a challenge due to several factors. The increasing prevalence of remote work makes traditional metrics like physical presence less relevant. Digital workplaces often involve a wide range of roles and tasks, each requiring unique metrics. And the constant evolution of technology can render existing metrics obsolete. Therefore, regular performance reviews and metric refinement are crucial for ensuring that productivity measurements remain accurate and relevant in digital workplaces.

First, establishing a clear performance framework is required. Based on the mission, entities need to clearly articulate the overall goals and objectives of the organization. Then, key performance indicators (KPIs) can be determined by the specific metrics that align with these objectives and can be measured in a digital environment. Examples include:

- output-based metrics: number of completed tasks, projects, or deliverables;
- efficiency-based metrics: time spent on tasks, turnaround time, and resource utilization;
- quality-based metrics: error rates, customer satisfaction, and product quality; and
- behavioral metrics: collaboration, problem-solving, and adaptability.

Second, regular performance reviews can be conducted based on the framework. There are several factors to be considered:

- frequency: establish a regular schedule for performance reviews, such as quarterly or semi-annually;
- continuous feedback: informal check-ins and formal reviews, 360-degree feedback, open communication;
- leverage technology: utilize digital tools for continuous data gathering (e.g., project management software, time tracking apps);
- feedback mechanisms: implement both top-down and bottom-up feedback mechanisms to ensure comprehensive evaluation;
- goal alignment: ensure that individual goals are aligned with the organization's overall objectives; and

- continuous improvement: use performance reviews as opportunities to identify areas for improvement and provide coaching and support.

Third, refining metrics regularly is crucial. Entities continuously monitor and analyze performance data to identify trends and patterns, and assess whether existing metrics remain relevant in the context of changing technologies and work practices. Afterward, entities modify or introduce new metrics to better capture productivity in the digital age, while involving employees in the process of metric refinement to ensure that they are relevant and meaningful.

During the overall review process, several points are considered:

- cultural sensitivity: be mindful of cultural differences when designing performance reviews and metrics;
- employee engagement: ensure that employees feel valued and motivated to contribute to the organization's success; and
- ethical considerations: use data ethically and avoid practices that could lead to employee burnout or discrimination.

By following this precise approach to regular performance reviews and metric refinement, organizations in Southeast Asian countries can significantly enhance the quality of measuring productivity in digital workplaces. This method addresses the unique cultural and business contexts of the region, promotes continuous improvement, and ensures that productivity measurements remain relevant and effective in a rapidly changing digital landscape, leading to improved performance and competitiveness.

This chapter outlines eight key recommendations to enhance productivity measurement in digital workplaces. These include aligning productivity metrics with strategic goals, utilizing real-time digital tools, fostering cross-departmental collaboration, supporting flexible work arrangements, adopting effective change management strategies, incorporating cultural considerations, proactively addressing challenges, and ensuring regular review and adaptation of productivity systems. Each recommendation aims to address the unique challenges posed by digital transformation, particularly in the context of Southeast Asia's diverse economies.

For practitioners, these recommendations provide a roadmap for implementing effective productivity measures that are adaptable to fast-changing digital environments. The focus on collaboration, flexibility, and continuous improvement enables organizations to remain agile and resilient. For scholars, these recommendations offer a foundation for further research into how digital tools and practices impact productivity measurement, with an emphasis on cultural relevance and real-time adaptability.

This report highlights the growing importance of dynamic and flexible productivity metrics in the digital age. It underscores the need for businesses to continuously evolve their strategies to align with technological advancements and organizational changes. The insights provided here are not only relevant to Southeast Asia but are also applicable to global practices, offering a comprehensive framework for driving productivity and innovation in the digital workplace.

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ANNEXURES

Annexure 1: Dataset by the APO

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Bangladesh	0.65	0.67	0.67	0.69	0.73	0.78	0.85	0.89	0.92	0.96	1.00
India	0.56	0.58	0.59	0.62	0.66	0.71	0.76	0.83	0.85	0.91	1.00
ROK	0.63	0.65	0.69	0.72	0.75	0.79	0.83	0.88	0.92	0.93	1.00
Malaysia	0.76	0.76	0.8	0.82	0.88	0.9	0.93	0.98	1.03	0.96	1.00
Mongolia	0.61	0.61	0.62	0.62	0.69	0.74	0.82	0.85	0.91	0.98	1.00
Nepal	0.75	0.77	0.77	0.79	0.82	0.84	0.86	0.88	0.93	0.96	1.00
Pakistan	0.94	0.95	0.94	0.97	0.98	1.02	1.00	1.02	1.01	1.02	1.00
Philippines	0.79	0.8	0.81	0.83	0.86	0.88	0.92	0.96	0.97	0.96	1.00
Thailand	0.69	0.73	0.76	0.81	0.84	0.89	0.94	0.97	0.96	0.94	1.00
Turkiye	0.79	0.73	0.79	0.84	0.89	0.9	0.96	1	0.99	0.96	1.00
Country	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bangladesh	1.05	1.08	1.13	1.19	1.27	1.36	1.42	1.51	1.58	1.61	1.68
India	1.01	1.06	1.14	1.2	1.29	1.39	1.47	1.55	1.59	1.48	1.62
ROK	1.04	1.04	1.09	1.09	1.09	1.13	1.18	1.25	1.29	1.35	1.41
Malaysia	1.00	1.02	1.02	1.04	1.19	1.23	1.27	1.30	1.31	1.31	1.36
Mongolia	1.14	1.25	1.3	1.38	1.36	1.36	1.37	1.40	1.48	1.43	1.57
Nepal	1.03	1.06	1.07	1.10	1.10	1.05	1.13	1.13	1.22	1.18	1.23
Pakistan	0.99	0.99	1.03	1.06	1.08	1.12	1.13	1.17	1.23	1.19	1.23
Philippines	1.04	1.09	1.12	1.18	1.2	1.26	1.39	1.44	1.48	1.49	1.51
Thailand	0.99	1.08	1.13	1.18	1.27	1.32	1.38	1.43	1.49	1.45	1.52
Turkiye	1.06	1.06	1.16	1.19	1.23	1.25	1.33	1.43	1.52	1.69	1.63

Annexure 2: KCC Guideline for Smart Work

The main contents of the Smart Work Guidelines of the Korea Communications Commission (KCC) in 2012 are as follows:

1. Smart Work Overview
 - Explained the definition, types, current status, and necessity of Smart Work.
2. Smart Work Main Guide
 - Definition of each type of Smart Work;
 - Provided models and underlying technologies;
 - Introduction procedures and operation methods; and
 - Domestic Smart Work introduction cases.
3. Work analysis and suitability evaluation
 - Job suitability: Evaluate whether work can be completed while working remotely, ease of work evaluation, etc.
 - IT connectivity: Check whether IT work environment can be established, usability, etc.
 - Review the possibility of application to the company.
4. Reexamination of Smart Work procedures
 - Reconduct the introduction review work and redesign the work process suitable for Smart Work.
5. Implementation plan for Smart Work introduction
 - Presentation of Smart Work introduction and operation plan suitable for the characteristics of the company

The purpose of this guideline is to provide practical guidance so that companies can successfully introduce and operate Smart Work. In particular, it guides companies to build a Smart Work model optimized for each company through work analysis and suitability evaluation.

Annexure 3: MOIS Guideline

Here is an explanation of the 2022 Smart Work Center Operation Guidelines of the Ministry of the Interior and Safety (MOIS):

Key Contents

- On 30 December 2022, the Ministry of the Interior and Safety partially revised the “Smart Work Center Utilization and Operation Guidelines.”

- These guidelines are intended to support a flexible work environment for civil servants and stipulate details regarding the use and operation of the Smart Work Center.
- The Smart Work Center is a facility established to enhance close communication and administrative efficiency between remote locations and is equipped with a video conference room and a mobile Smart Work Center function.

Key Features

- ‘Flexible Work Environment’: The Smart Work Center provides an environment where civil servants can perform their work remotely.
- ‘Improved Efficiency’: Video conferencing facilities facilitate communication between remote locations and contribute to enhancing administrative efficiency.
- ‘Business Trip Support’: The mobile Smart Work Center allows for business continuity even while on the move.

Personal Information Protection

In relation to the operation of the Smart Work Center, the Ministry of the Interior and Safety is making every effort to protect personal information:

- MOIS has established a personal information processing policy and is regularly updating and applying it.
- MOIS has been recognized for implementing a high level of personal information management by receiving an ‘S’ grade in the 2022 Personal Information Management Level Diagnosis Evaluation.
- Personal information collected when using the Smart Work Center reservation service is strictly managed and destroyed immediately after the purpose is achieved.

Through these guidelines and operating methods, the Ministry of the Interior and Safety is making every effort to protect personal information while increasing the work efficiency of public officials and creating a flexible work environment.

Annexure 4: Government Smart Work Center

Korean government started establishing government smart work centers in 2010. The operational status of these centers is as follows:

1. Nationwide operating centers:
 - A total of 18 smart work centers are currently in operation.
 - They began with the Bundang and Dobong branches in 2010 and have gradually expanded since then.
2. Center types:
 - On-site: 14 locations
 - Residential: 4 locations

3. Major center locations:

- Seoul: Government Complex Seoul, National Assembly, Seoul Station, Gangnam, Suseo, etc.
- Sejong: Sejong Government Complex 1 (Building 4), Sejong Government Complex 2 (Building 11)
- Others: Gwacheon Government Complex, Daejeon Government Complex, Osong Station, etc.

4. Facility composition:

Most centers consist of conference rooms and individual work seats.

For example, the recently opened Yongsan Smart Work Center has 19 work seats and 1 video conference-capable conference room.

5. Usage:

- Number of users in 2022: 116,678 (a 14.3% increase from the previous year)
- Main users: Government ministries, local government officials, and public employees
- Main purposes: Business trips, meetings with related organizations, advisory meetings with private experts, etc.

6. User satisfaction:

- Contributed to improving work efficiency and balancing work and family life.
- Average travel time of 99 minutes and transportation cost savings of 10 USD per use.
- Satisfaction survey results: 89.5% reported improved personal quality of life; 83.4% reported that it helped with pregnancy, health management, and childcare.

7. Future plans:

- The Korean government plans to continuously expand and build smart work centers to implement a digital platform government.
- The government smart work centers play an important role in providing continuity in public work and improving work efficiency, and demand for their use is continuously increasing.

Annexure 5: Provincial Smart Work Centers

The operation status of the Provincial Smart Work Center is as follows:

1. Operating entity

- This is a smart work center operated by 17 provincial governments.

2. Users

- Only civil servants can use it, but recently some centers allow public employees.
- In cases where individuals have not been issued a civil servant ID, they must submit a user approval application through the person in charge of their affiliated organization and receive approval from the person in charge of the Smart Work Center of the Ministry of the Interior and Safety to use it.

3. Work environment

- When using the seat, only access to the business network is allowed. Internet access is not permitted due to security reasons.
- The workspace is equipped with a PC, telephone, copier, shredder, etc.
- The break room is equipped with a drinking fountain, air purifier, etc.

4. Operating hours

- It operates on weekdays from 09:00 to 18:00, but some centers are open 24 hours.

5. Facility management and inquiries

- System inquiry: Smart Work Center (1661-3600)
- Facility management and operation inquiries: Each provincial manager

6. Location and features of major centers

- The Gyeonggi Provincial Office is located on the 2nd floor of the Gyeonggi Provincial Office Northern Office Annex, 1 Cheongsu-ro, Uijeongbu-si.
- The Daegu Metropolitan City Hall is equipped with office space PCs, network solutions, copiers, shredders, etc.

7. Accessibility

- It is conveniently located for access via public transportation. For example, the Gyeonggi Provincial Office is a 10-minute walk from Exit 1 of the Gyeonggi Provincial Office Station on the Uijeongbu Rail Transit.

8. Parking

- Parking availability varies by center; please check before use.
- The provincial office Smart Work Center is operated to increase the work efficiency of civil servants and provide a flexible work environment.

BANGLADESH

Introduction

The digital workplace has emerged as a critical element in enhancing productivity and profitability across various sectors globally, and Bangladesh is no exception. As the nation embarks on a journey of digitization, understanding how these digital transformations influence workplace productivity becomes crucial. The digital workplace encompasses the tools, technologies, and environments that facilitate remote and collaborative work, significantly impacting operational efficiency and employee engagement. In the context of Bangladesh, where rapid technological advancements are reshaping traditional business models, measuring productivity in digital workplaces offers insights into the broader implications of this transformation on economic growth and organizational success.

The Bangladeshi economy has witnessed substantial growth in recent years, largely attributed to its growing digital economy. The government's initiatives to digitalize public services and promote digital literacy have laid the foundation for a more connected workforce. For instance, the digitization of public services by various ministries and departments has reportedly saved citizens billions in costs and time by enhancing overall service delivery and efficiency. This transition not only streamlines processes but also fosters a culture of accountability and transparency, essential for boosting productivity in both public and private sectors.

Among other sectors, telecommunications sector in Bangladesh has been at the forefront of this digital transformation. Studies indicate that digital performance management systems have significantly improved employee performance and sustainability within the industry. The integration of digital tools in performance management has automated numerous functions, leading to enhanced productivity and reduced operational costs. Such advancements show the importance of digital infrastructure in measuring productivity.

However, the shift to digital workplaces is not without challenges. A significant lack of digital literacy within a large part of the workforce, especially in rural areas, prevents the full benefits of digitization from being realized and greatly threatens to widen the 'digital divide.' Targeted training programs are crucial for bridging this digital literacy gap and enabling employees to effectively utilize digital tools. The successful implementation of digital strategies requires strong leadership from the very top of the government and a spontaneous acceptance by the entire workforce.

The profitability of businesses in Bangladesh is increasingly linked to their ability to adapt to digital changes. Research has shown that organizations that embrace digital transformation not only improve operational efficiency but also enhance employee engagement and retention. In the readymade garment sector, for example, the digitalization of human resource management practices has been shown to positively impact employee performance, demonstrating the direct correlation between digital initiatives and productivity outcomes.

The ongoing transition from traditional to digital work environments reveals a critical lacuna in Bangladesh's digitalization process: the absence of established digital/smart workplace guidelines.

To optimize the regulatory framework for the burgeoning digital workplace ecosystem, it is imperative that Bangladesh prioritizes the formulation and rapid implementation of comprehensive guidelines in this domain.

In short, measuring productivity in digital workplaces within the Bangladeshi context is a multifaceted endeavor that encompasses technological, organizational, and human factors. As the nation continues to embrace digitization, it is imperative for businesses to adopt comprehensive strategies that leverage digital tools to enhance productivity and profitability. By investing in digital infrastructure, fostering a culture of continuous learning, and addressing the challenges of digital literacy, Bangladesh can position itself as a leader in the digital economy, ultimately driving sustainable economic growth and development.

In the context of digital transformation (DX) in Bangladesh, several strengths and weaknesses can be identified based on the current drivers. The analysis here breaks down these factors:

Strengths of Digital Transformation in Bangladesh

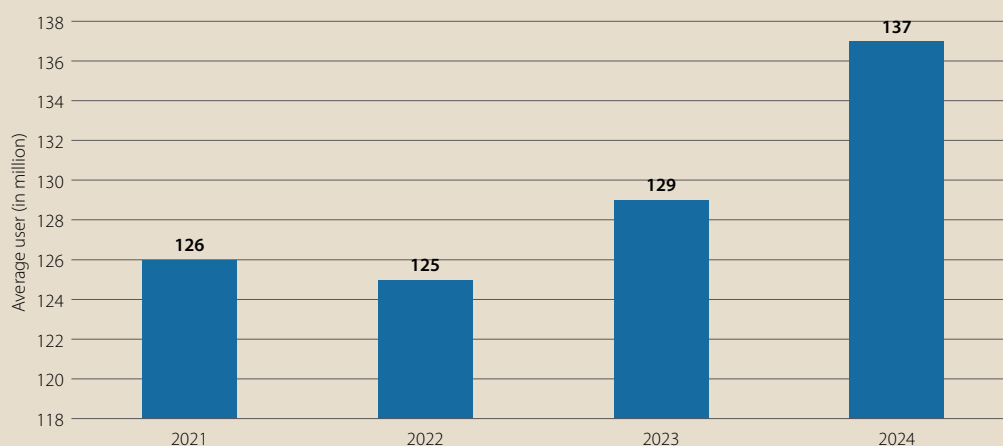
- (1) **Government initiatives and policy support:** The government's vision to digitally advance Bangladesh, along with the related policies, has created a supportive framework for DX. The emphasis on building ICT infrastructure such as Union Digital Centers (UDCs); promoting e-governance; and fostering innovation is a major strength. This approach also encourages both public and private sectors to accelerate DX initiatives.
- (2) **Growing startup ecosystem:** Bangladesh's emerging startup ecosystem, especially in fintech, e-commerce, and health-tech, has significantly contributed to the acceleration of DX. With access to international funding, venture capital, and incubators, local startups are providing innovative solutions tailored to the country's unique challenges, thereby boosting job creation and digital inclusivity. For example, companies like Chaldal (e-commerce) and ShopUp (B2B commerce fintech) are transforming digital marketplaces and supply chains with scalable solutions.
- (3) **Young, tech-savvy population:** Bangladesh boasts of a young and increasingly tech-savvy population that shows significant eagerness in adopting and utilizing digital tools and services. This demographic advantage accelerates the adoption of digital platforms across sectors, thus driving demand for e-learning, digital banking, and e-commerce.

Bangladesh boasts of an estimated 650,000 active online freelancers, the second-highest number in South Asia (Rahman, 2024). This translates into economic opportunities for a segment of the population often facing unemployment, particularly the women and the youth.

- (4) **Expanding internet and mobile connectivity:** With significant mobile and broadband penetration, reaching nearly 140.5 million internet subscribers in August 2024, Bangladesh has built a strong foundation for DX. Affordable data rates and smart phone availability have enabled digital inclusion across urban as well as rural areas, enhancing access to digital services. From Figure 1 we can see the average number of internet subscribers for the four-year period of 2021–24, based on the available data from Bangladesh Telecommunication Regulatory Commission (BTRC).

FIGURE 1

NUMBER OF INTERNET SUBSCRIBERS IN BANGLADESH, 2021–24.



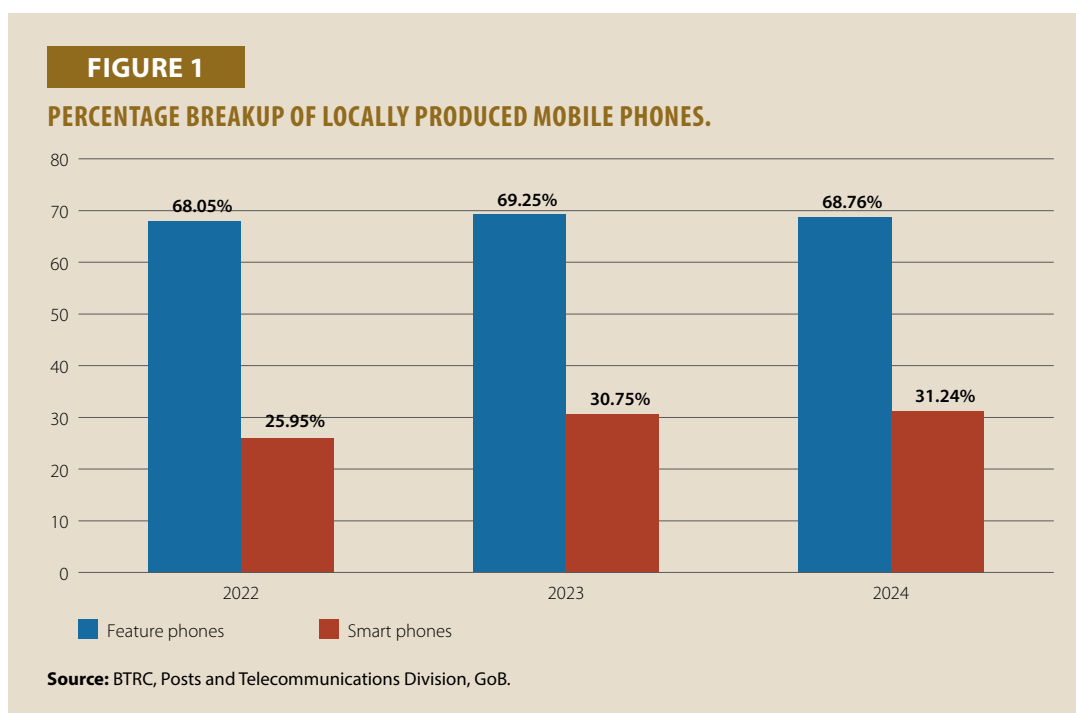
Source: Bangladesh Telecommunication Regulatory Commission (BTRC), Posts and Telecommunications Division, Government of Bangladesh.

- (5) **Booming fintech and digital finance:** The widespread adoption of mobile financial services (MFS) like bKash has made financial services accessible to millions, contributing to a cashless economy. This trend is creating a digitally empowered population and fostering further DX in sectors such as banking, retail, and logistics.
- (6) **Private sector's involvement:** Investments in digital tools, ERP systems, automation, and AI-driven technologies from large corporations and startups alike have enhanced productivity and efficiency across sectors. The involvement of the private sector in embracing cloud solutions, digital commerce, and supply chain management systems is a key strength.
- (7) **Skill development initiatives:** Bangladesh's emphasis on developing a digitally skilled workforce through ICT programs, tech trainings, and university-level curriculums is a significant asset. Public-private partnerships and international collaborations are working toward equipping the younger generation with skills in AI, cloud computing, and cyber security.

Challenges to Rapid Digital Transformation in Bangladesh

- (1) **Inadequate digital infrastructure in rural areas:** Despite improvements in urban areas, rural Bangladesh still faces challenges related to slow internet speeds, inadequate ICT infrastructure, and unreliable electricity. This digital divide between urban and rural areas limits the reach of DX and hampers growth in agriculture and small-scale rural enterprises.
- (2) **Cyber security vulnerabilities:** As digital adoption accelerates, cyber security risks are becoming a major concern in Bangladesh. The country lacks a comprehensive cyber security framework; and frequent incidents of data breaches and frauds, along with occasional cyber attacks, have exposed the vulnerabilities of many digital platforms.

- (3) **Lack of interoperability across systems:** Many public and private digital systems in Bangladesh still function in silos, making data sharing and system integration difficult. This lack of interoperability between government, financial, and corporate digital ecosystems slows down the effectiveness of DX efforts.
- (4) **Digital literacy gaps:** While progress has been made in developing digital skills, a significant portion of the population, especially older generations and those in rural areas, still lack basic digital literacy. This gap prevents large-scale adoption of digital services and poses a challenge to digital inclusivity. According to the data from BTRC, in July 2024, total number of locally produced mobile phones in Bangladesh was around 2.7 million, of which 75.22% were feature phones (basic phones with no internet facilities) while 24.78% were smart phones. Also, according to BTRC, in September 2023, total number of imported mobile phones was 19,109, of which 78.51% were feature phones and only 21.49% were smart phones. So, we can see that the mobile handset market is still being dominated by basic phones with limited or no internet facility at all. The basic phones are majorly used by older generations who critically lack digital skills. Figure 2 provides the average percentage of locally produced feature phones and smart phones in Bangladesh for the period 2022–24.



- (5) **Dependency on imported technology:** Bangladesh remains heavily dependent on imported hardware and software technologies, which creates vulnerability in its digital infrastructure. Limited local capacity for high-tech manufacturing and software development makes the country reliant on external providers, which impacts cost-efficiency and data sovereignty.
- (6) **Regulatory barriers and digital policy gaps:** Although significant strides have been made in terms of the digital policy, certain regulatory barriers and gaps remain. Issues such as data privacy, lack of a comprehensive data protection framework, delays in policy

implementation, and lack of proper guidelines on digital workplaces hinder the growth of DX, especially in sectors like e-commerce and fintech. For example, businesses and digital employees are vulnerable to potential exploitation as Bangladesh is yet to adopt guidelines on digital workplaces.

Digital Governance in Bangladesh

Digital governance in Bangladesh has developed significantly over the past decade, reflecting the country's commitment to integrating technology into public administration and service delivery. The “Digital Bangladesh” initiative, introduced as part of the Vision 2021 framework, has spearheaded efforts to modernize government processes through implementation of digital technologies. Central to these efforts is a well-defined governance structure comprising various governmental agencies, digital frameworks, and policies. Understanding this structure is essential to comprehending how digital services are delivered and managed across sectors.

Overview of the Digital Governance Structure in Bangladesh

The structure of digital governance in Bangladesh is shaped by multiple key governmental bodies, policy frameworks, and institutions working collaboratively to implement digital initiatives. An in-depth note on these components is provided below:

Ministry of Posts, Telecommunications, and Information Technology

This ministry is the primary body overseeing digital governance in Bangladesh. It is responsible for implementing the vision of a digitally enabled country through its following two major divisions:

The ICT Division: This division leads the strategic planning and execution of ICT policies across the country. It is the principal driver of all e-governance and digital transformation activities in Bangladesh. It formulates policies, allocates funds, and ensures alignment with national digital strategies.

The Telecommunications Division: Although it primarily focuses on telecom regulations, this division plays an essential role in ensuring that digital infrastructure, such as broadband internet and mobile networks, supports digital governance initiatives.

Bangladesh Computer Council

Operating under the ICT Division, the Bangladesh Computer Council (BCC) is a pivotal agency for ICT infrastructure development and management in the country. The BCC manages key infrastructure projects such as the National Data Center which provides the backbone for e-governance. The BCC also supports capacity-building initiatives, creating a digitally skilled workforce for public administration.

Aspire to Innovate Program

The Aspire to Innovate (a2i) program, earlier called the Access to Information program, plays a central role in simplifying and digitizing government services. The a2i program promotes e-services across sectors and helps citizens access public services through digital platforms. It oversees the overall digitalization process across various public services, including passports, land registration, and birth certificates.

National ICT Policy 2018

The National ICT Policy 2018 serves as a comprehensive roadmap for digital governance in Bangladesh. It emphasizes the integration of ICT in public service delivery, development of digital infrastructure, and promotion of digital literacy among citizens. The policy outlines strategic goals for e-governance, including enhancing transparency in the public sector, promoting digital inclusion, and encouraging innovation.

E-Government Master Plan

The E-Government Master Plan (EGMP) is a strategic framework designed to ensure seamless integration and interoperability of government systems across ministries and departments. It sets standards for ICT infrastructure and system integration, ensuring that various e-governance platforms work cohesively to provide efficient public services.

Stakeholder Roles and Responsibilities

The digital governance structure in Bangladesh operates through the coordinated efforts of several key stakeholders outlined below:

Government ministries and agencies: The ICT Division is at the forefront of policymaking and implementation, while other ministries integrate digital tools into their service delivery systems. For instance, the Ministry of Land is responsible for digitizing land records, and the Ministry of Finance manages digital taxation and financial services.

Private sector and telecom operators: The private sector, particularly telecom operators such as Grameenphone, Banglalink, etc. play a critical role in providing the necessary infrastructure for digital governance. These companies ensure that mobile networks, internet connectivity, and cloud computing services are available for public administration.

Development partners and international organizations: Agencies like the United Nations Development Programme (UNDP) and the World Bank have supported digital governance initiatives by providing technical assistance, funding, and expertise. They are key partners in capacity-building efforts and designs of e-governance projects.

Citizens: Citizens are increasingly engaging with digital governance platforms as beneficiaries of public services. Their role in adopting and using e-services is crucial to the success of digital transformation, and citizen feedback is often used to improve the services.

In summary, Bangladesh has made significant progress in establishing a robust digital governance structure, driven by key agencies such as the ICT Division and initiatives such as a2i. The government's focus on digitizing public services and promoting citizen engagement has been complemented by support from the private sector and international partners. However, challenges such as the digital divide, cyber security risks, and capacity limitations need to be addressed for fully realizing the potential of digital governance. By strengthening infrastructure, improving regulatory frameworks, and fostering collaboration across sectors, Bangladesh can build a more inclusive, efficient, and secure digital governance ecosystem.

Laws and Guidelines

The boundary of digital workplaces in Bangladesh is evolving rapidly, influenced by technological advancements and changes in work culture. As organizations increasingly adopt digital tools and remote working practices, the need for an updated legal framework to govern these new environments becomes very crucial. Currently, several laws and guidelines exist to address the complexities of digital workplaces, but there remains a significant gap in specific regulations tailored to the unique challenges posed by digital work environments.

One of the very first pieces of legislation relevant to digital workplaces in Bangladesh is the Information and Communication Technology (ICT) Act of 2006. This act provides a legal framework for electronic transactions, digital signatures, and the security of digital records. It aims to facilitate the growth of the digital economy by ensuring that electronic documents and communications are legally recognized. The ICT Act also outlines penalties for violations related to digital transactions, thus establishing a foundation for trust in digital interactions. However, while it addresses some aspects of digital operations, it does not comprehensively cover the rights and protections of digital workers, particularly those engaged in remote or gig work.

In addition to the ICT Act, the Cyber Security Act of 2023 plays a crucial role in the governance of cyber environments. It was enacted to address issues related to cybercrime and data protection. It includes provisions for the protection of personal data and the prevention of unauthorized access to digital systems. However, it does not say anything about digital/remote workplace guidelines.

The Right to Information Act of 2009 also contributes to the regulatory framework governing digital workplaces by promoting transparency and accountability in public administration. This act empowers citizens to request information from public authorities, thereby fostering an environment of openness that is essential for the functioning of a digital economy. However, its application to private sector organizations remains limited, indicating a need for broader guidelines that encompass all digital workplaces.

The e-Government Master Plan for Digital Bangladesh, launched in 2019, serves as a strategic framework aimed at transforming the governance landscape through digital technologies. It seeks to enhance public service delivery, improve transparency, and foster citizen engagement. The master plan outlines key strategies, including the establishment of a strong legal framework, the optimization of government operations, and the development of user-friendly digital services. It identifies over 1,800 specific digital services to be implemented by 2031, focusing on making government processes more efficient and accessible. By prioritizing the integration of emerging technologies such as big data and artificial intelligence, the plan aims to streamline operations across various ministries and enhance the overall user experience. Despite challenges such as gaps in digital literacy and infrastructure, the e-Government Master Plan represents a significant step toward achieving a more efficient, accountable, and inclusive governance system in Bangladesh.

The ICT Master Plan 2041 is a comprehensive roadmap that outlines Bangladesh's vision for becoming a knowledge-based, innovation-driven digital economy by 2041. This long-term plan aims to harness the transformative power of ICT to drive sustainable development and economic growth.

To achieve these goals, the plan focuses on developing a skilled workforce through enhanced education and training programs, encouraging innovation and entrepreneurship, and creating a conducive environment for foreign direct investment in the ICT sector. The plan also emphasizes the

importance of developing a strong digital infrastructure, including high-speed internet connectivity, data centers, and cloud computing services, to support the growth of the digital economy.

The ICT Master Plan 2041 aligns with the government's broader development strategies, such as the Perspective Plan of Bangladesh 2021–41 and the Eighth Five-Year Plan 2021–25, ensuring a coordinated approach to digital transformation across various sectors. By implementing these ambitious plans, Bangladesh aims to establish itself as a regional hub for ICT services and a global leader in the digital economy, ultimately contributing to the country's vision of becoming a developed nation by 2041.

Despite these existing laws, there is a notable absence of specific legislation addressing the rights of digital workers in Bangladesh. As the gig economy expands, with many individuals working through online platforms, a lack of legal recognition for digital workers' rights raises concerns about job security, fair compensation, and working conditions. Research suggests that the establishment of comprehensive legal protections for online workers is critical to ensuring their rights and promoting equitable treatment in the labor market.

The absence of clear guidelines for digital/remote work arrangements poses challenges for both employers and employees. While existing labor laws apply to remote workers, the unique nature of digital work requires specific regulations that address issues such as work hours, compensation, and employee rights in a digital context.

Despite notable advancements in establishing a legal framework pertinent to digital work environments, Bangladesh's digital regulatory landscape continues to exhibit substantive lacunae. The existing laws, such as the ICT Act and the Cyber Security Act, provide a foundation but fall short of addressing the specific needs of digital workers. As the digital economy continues to grow, it is imperative for policymakers to develop comprehensive regulations that protect the rights of digital workers and ensure a fair and equitable work environment. This will not only enhance productivity and innovation but also contribute to the overall growth of the digital economy in Bangladesh.

Best Practices

In Bangladesh, the integration of ICT into various sectors has led to significant advancements, particularly through initiatives like Union Digital Centers (UDCs), mobile financial services (MFSs) like bKash, and electronic filing systems e-Nothi and d-Nothi. UDCs serve as critical access points for rural communities, providing essential digital services and bridging the digital divide. These centers empower citizens by facilitating government services, financial transactions, and digital literacy programs.

Meanwhile, platforms such as bKash have revolutionized MFSs, allowing millions of people to perform transactions seamlessly via their mobile phones, thus greatly enhancing financial inclusion. The introduction of electronic filing systems such as e-Nothi and d-Nothi has further streamlined government operations by digitizing document management and workflows, promoting transparency and efficiency in public administration.

These platforms exemplify best practices in leveraging technology to improve service delivery and governance. By adopting such ICT solutions, Bangladesh not only addresses immediate challenges but also sets a foundation for sustainable development, aligning with the broader vision of a “Smart

Bangladesh.” The ongoing commitment to enhancing ICT infrastructure and policies will be crucial in advancing an inclusive digital economy that benefits all segments of society. As these initiatives continue to evolve, they represent a significant effort toward sustaining the potential of technology for socioeconomic development in Bangladesh.

These initiatives, both from government and private sectors, are discussed below in more detail:

Union Digital Center

A Union Digital Center (UDC) is an advanced information-and-knowledge hub strategically deployed and located at the Union Council level, i.e., the fundamental tier of local governance in Bangladesh. The explicit objective of the UDC is to guarantee accessible information services for grassroots-level populations within their immediate localities (Rajnagar Union Parishad, n.d.). Functioning as a government-established conduit for information dissemination and public service delivery, the UDC effectively provides essential resources and services directly to the rural communities, thereby obviating the complexities associated with traditional access mechanisms (BRAC Institute of Governance and Development, 2018–19).

One of Bangladesh’s oldest local governance bodies and the closest to serving the interests of people is the Union Parishad (Union Council). The creation of the UDC, an IT-based service center that is now an essential component of the Union Parishad, has given the organization new dimensions. On 11 November 2010, a total of 4,501 UDCs were formally opened across the nation. In 2020, there were 6,686 UDCs, which marked a substantial increase in the number of UDCs. The services provided by the UDCs also increased to 270. By November 2021, there were 8,280 UDCs providing more than 300 services across the nation. These UDCs are currently the IT hubs for delivery of agriculture, education, healthcare, and various government and non-government services.

The UDC Setup

A UDC is characterized by a foundational technological infrastructure comprising at least one computer equipped with a power stabilizer, monochrome and color printers, a modem or broadband internet connection, a scanner, and a digital camera. With potential augmentation or reduction based on localized needs, each UDC is established under a Public–Private–People’s Partnership (PPPP) framework (Rajnagar Union Parishad, n.d.). Typically staffed by two local youth entrepreneurs, representing both genders, the UDCs serve as salient platforms for fostering youth engagement and socioeconomic empowerment of women within their respective communities.

UDC Management

UDCs operate under the authority of the Local Government Division, with oversight and direction provided by the Cabinet Division, while the local administration is responsible for managing and supervising their overall activities (Rajnagar Union Parishad, n.d.).

The Government of Bangladesh is actively enhancing public service delivery and promoting e-governance through a range of initiatives, including the a2i program and other e-governance efforts. A key achievement of these efforts is the establishment of UDCs, which, as discussed earlier, provide a wide array of public and private services to people in rural areas and contribute to reducing corruption by optimizing and enhancing the processes of public service delivery.

UDC at a Glance

UDCs provide over 300 services with a user satisfaction rate of 76.6%. The UDCs aim to help those in need locally and offer services to millions of people living in rural areas. With the tagline “Service at Doorsteps,” UDCs have revolutionized public services via digital means and boosted the rural economy. UDCs significantly reduce the time, cost, and number of visits (TCV) required for accessing the services, thereby boosting public trust in e-governance. By the end of November 2022, a high satisfaction rate of 76.6% was reported by service recipients at these centers. Notably, as of January 2022, UDCs had delivered a cumulative total of 625 million service transactions resulting in substantial savings for citizens, including an average of 78.14% in working hours, 16.55% in expenditure, and 17.38% in travel costs (a2i, 2023).

Data from BRAC Institute of Governance & Development (2018–19) has showed that services provided through UDCs offer significant economic value, with every BDT1 spent on birth registration yielding approximately BDT2 in benefits. Examination registration services also deliver nearly double the return on every BDT invested.

Financial Benefits for UDC Entrepreneurs

A UNDP (2023) report shows there is a notable improvement in the financial wellbeing of individuals after becoming UDC entrepreneurs. Before becoming UDC entrepreneurs, their average monthly income was approximately BDT7,000. However, following their engagement as UDC entrepreneurs, this amount increased significantly to BDT31,000 per month, demonstrating the positive economic impact of the initiative.

Services Provided by UDCs

The range of services offered includes essential civil registrations like birth and death certificates, citizen and national identity cards, land-related services such as mutation and e-mutation, Hajj registration, passport applications and fee payments, submission of government service requests, and access to telemedicine and life insurance. Additional services encompass overseas job applications; ticket booking for buses, air, and launches; agent and mobile banking; medical visa assistance; doctor appointments; mobile phone balance top-up; and various ICT-related services such as computer and technical training, email, document composition, printing, photography, photocopying, downloading government forms, checking exam results, university admission applications, online visa processing, e-commerce, and general information services (UNDP, 2023).

Key Achievements at a Glance

UDCs in Bangladesh constitute a significant infrastructure for socioeconomic advancement, demonstrably catalyzing women’s empowerment, youth development, and pervasive digital inclusion. An a2i (2023) analysis reveals that monthly operations across over 4,500 UDCs provide critical livelihood support to approximately 3.91 million marginalized individuals, with a notable 25% representation of women within this beneficiary cohort. Furthermore, these centers have become pivotal in streamlining overseas employment pathways, facilitating the online registration of over 2.2 million prospective migrant laborers, including a substantial contingent of 40,000 women, thereby underscoring their role in labor migration processes. Concurrently, UDCs are instrumental in expanding the frontiers of financial inclusion, extending mobile banking accessibility to over 78,000 individuals, predominantly women (70%). UDCs have enabled transactions exceeding BDT113 million (USD1.39 million), which is indicative of their impact on financial market penetration at the grassroots level.

Beyond economic empowerment, UDCs function as crucial nodes for human capital formation and administrative modernization. The provision of computer literacy and digital skills training to over 45,000 young individuals, with a significant 70% female participation rate, directly enhances their employability and future economic prospects. The UDC blog serves as an emergent mechanism for optimizing administrative efficacy, hosting over 150,000 problem-solving entries that demonstrably expedite issue resolution versus conventional bureaucratic modalities (a2i, 2023). Moreover, the near-ubiquitous presence of dedicated UDC homepages on the national government mega-portal, collectively amassing approximately one million daily page views, underscores their integral role in the national digital ecosystem. The fact that a substantial portion of this digital content is generated by UDC entrepreneurs themselves highlights their active contributions to the ongoing digital transformation at the foundational level of the society.

E-Nothi System

E-Nothi or electronic filing is a digital system developed by the Government of Bangladesh to streamline and automate the management of official documents and correspondences. The system is part of the government's broader e-Governance strategy to enhance transparency, efficiency, and accountability in public administration.

The implementation of the e-Nothi system in government offices, commencing in March 2016, has yielded substantial improvements in operational efficacy and administrative practices, exhibiting a consistent pattern of rapid expansion in its adoption. An in-depth assessment of this digital platform has highlighted several key advantages. First, the system has demonstrably increased the speed of work processes, compared with the prior manual methods, primarily due to the system's capacity to monitor and retrieve files remotely at any given moment through a mobile application, which effectively functions as a 'portable workstation.' Thus, it dissolves traditional the spatial constraints of an office environment (Yesmin, 2020).

This expedited file processing has enabled quicker file disposals, allowing civil servants to devote more time to other crucial responsibilities. Moreover, the ease with which files can be located via the mobile application has done away with the concept of a fixed office boundary within the workflow and further accelerated task completions through more rapid file dispositions. Beyond enhancing efficiency, the e-Nothi system has also fostered greater accountability and transparency within governmental operations, concurrently leading to a reduction in bureaucratic impediments. Finally, the digital nature of the system has diminished the need for frequent physical interactions, particularly decreasing the required number of visits to senior officers for file-related matters.

D-Nothi System

D-Nothi or digital filing is another initiative that complements the e-Nothi system. It is specifically focused on the digitization of the "Nothi" or official files and correspondences within the government.

E-Nothi and d-Nothi both signify noteworthy advancements in the modernization of the Government of Bangladesh's administrative procedures. These programs seek to improve the overall effectiveness of government operations by cutting paperwork, expediting the move to digital technologies, and minimizing bureaucratic delays. By facilitating easier access to and streamlining government procedures, they also aid in promoting greater openness and better citizen service delivery.

E-Nothi and d-Nothi facilitate faster decision-making by allowing online access to official documents across approximately 19,000 government offices and 150,000 officials, thereby promoting a paperless governance model and empowering citizens to communicate with government offices without any hassle (Islam, 2023–24). This initiative supports the Sustainable Development Goal 16.6, which emphasizes effective and transparent institutions. D-Nothi, the upgraded version of e-Nothi, further improves efficiency by utilizing cloud storage for data management. Both systems are part of a broader effort to digitize public services, including training for officials and introduction of mobile applications, ultimately modernizing Bangladesh’s public administration and enhancing service delivery.

Service Process Simplification

One significant government project aimed at revolutionizing public service delivery by making it more effective, accessible, and citizen-friendly is the a2i Bangladesh’s Service Process Simplification (SPS) program. The goal of this program is to make public service delivery less complicated, less expensive, and less time-consuming.

Prior to 2017, the digitalization of public services in Bangladesh was characterized by disparate, decentralized, and fragmented initiatives undertaken by various ministries and governmental organizations. However, the efficacy of these independent efforts in service delivery was often compromised by challenges arising from suboptimal planning and execution strategies. To overcome this, the government came up with a method called Digital Service Design Lab (DSDL), which played a critical role in simplifying government services. It accomplished this by providing digital solutions and streamlining procedures to make it easier and faster for service seekers to access government services. The SPS program is strategically designed to minimize the TCV required to access public services (a2i, 2024).

Research from the United Nations indicates that Bangladesh holds a notable position among the least developed countries, consistently achieving a high E-Government Development Index (EGDI) ranking across multiple surveys (a2i, 2022). Driven by a commitment to improve the effectiveness and capacity of public service delivery, Bangladesh has actively engaged in diverse e-government initiatives. The 2022 UN E-Government Survey conducted by UNDESA further underscores this progress. It ranked Bangladesh 111th among 193 countries with an advancement of eight positions, reflecting substantial development in this domain over the preceding two years (a2i, 2024).

Mobile Financial Service bKash

Founded in the year 2011, bKash is the leading MFS provider in Bangladesh, offering a wide range of digital financial services to people. Operating under the regulatory oversight of the Bangladesh Bank, bKash is a collaborative initiative involving BRAC Bank, Money in Motion LLC, the International Finance Corporation (World Bank Group), the Gates Foundation, Ant International, and SoftBank (bKash, n.d.).

In 2023, bKash had around 70 million registered customers. In the socioeconomic landscape of Bangladesh, a large number of people are out of conventional banking system due to various reasons. It becomes very difficult for people, especially those in rural areas, to access the formal banking service. bKash and other MFSs have played a critical role in alleviating poverty while significantly contributing to financial inclusion. Since its inception, bKash has strategically

developed an exceptionally resilient agent network, encompassing 330,000 personnel, metaphorically termed “Human ATMs,” to ensure a pervasive delivery of mobile financial services to individuals at the foundational levels of society throughout the country (bKash, 2023). The presence of these bKash agents is found in every nook and cranny of Bangladesh. People can very easily avail the services.

bKash offers a comprehensive suite of mobile financial services encompassing fundamental transactional capabilities such as ‘cash in’ and ‘cash out,’ alongside peer-to-peer ‘send money’ transfers. Furthermore, its platform facilitates diverse payment modalities, including bill payments, mobile recharges, merchant payments, remittance services, education fees, savings accounts, loans, insurance premium payments, government services, and donations. This extensive portfolio is underpinned by ‘personal retail accounts’ and extends to specialized functionalities like microfinance payments, thereby positioning bKash as a multifaceted digital financial intermediary catering to a wide spectrum of user needs and financial interactions. As of date, bKash is providing around 15 critical financial services. During COVID-19, when all official banking channels were either fully or nearly closed, bKash emerged as a savior for people who had to do financial transactions. The government of Bangladesh chose the bKash platform to disburse financial support to people living below the poverty line.

Conclusion

The measurement of productivity in digital workplaces in Bangladesh is increasingly critical as the nation embraces digital transformation across various sectors. With the rapid adoption of ICT, organizations are recognizing the need for effective frameworks to assess productivity in digital environments. Recent training initiatives by the government have emphasized upon innovative methods for gauging productivity. These programs highlight the importance of integrating evolving technologies into productivity measurement processes, addressing the unique challenges posed by digital workplaces.

Despite these advancements, the legal framework or effective guidelines surrounding digital workplaces remain limited. The Information and Communication Technology Act of 2006 and the Cyber Security Act of 2023 provide foundational guidelines for digital transactions and data protection. However, they do not comprehensively address the specific rights and protections for digital workers, particularly in terms of regulating the terms, productivity metrics, and performance evaluations. Research indicates that the absence of specific laws protecting online workers’ rights poses significant challenges, as traditional labor laws do not adequately cover the nuances of digital work environments. This gap in legislation can hinder the effective management of productivity, as organizations may lack clear guidelines for evaluating performance in a digital context.

The ICT Master Plan 2041 aims to address some of these challenges by promoting a knowledge-based economy and emphasizing the importance of digital skills development. However, without a strong legal framework, the regulation and management of digital workplaces may be compromised. The lack of clear guidelines on performance metrics and evaluation criteria for digital workers can lead to inconsistencies and inequities in how productivity is assessed across different organizations.

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INDIA

Introduction

This document provides an analysis of productivity in digital workplaces in India, tracing the evolution from early IT adoption to the recent shift toward remote and digital work, accelerated by the COVID-19 pandemic. Through an analysis of how digital tools influence productivity, collaboration, and performance, case studies across the public and private sectors offer valuable insights. Developments in policies and infrastructure by the Government of India have only scaled up this transformation, after all, an employable workforce ready to take on the digital economy.

In this chapter, the impact of technology on workplace productivity through the lens of digital tools usage is analyzed. There are several case studies that document the trends in productivity, commerce, and environmental policies in the countries of both the public and private sectors. The Indian government also plays a significant role in nudging the digital transformation of the country by spearheading “pro digital activism” through infrastructure build-up and upskilling the population for the global economy.

This document is expected to assist business executives, policymakers, and practitioners in understanding the evolving nature of productivity in workplaces and using the insights for better business practices in the future.

Executive Summary

This study provides evidence that digital workplaces can lead to significant productivity gains when implemented effectively. However, realizing these benefits requires meticulous planning, cultural change, and ongoing adaptation. The transition to digital workplaces represents not just a technological shift but a fundamental change in how work is performed and organized.

While challenges remain, particularly in measuring and optimizing productivity in digital environments, the potential benefits in terms of efficiency, flexibility, and sustainability make this an important area for continued research and investment.

As organizations and policymakers continue to explore digital transformation, it is important to balance productivity gains with considerations of employee well-being and societal impact.

Overview

This chapter aims to quantify the productivity benefits of implementing digital workplaces. As organizations seek and adopt more technologies and new ways of working, it becomes essential to understand their effects on productivity, collaboration, and overall performance. By measuring the gains from digital workplaces, this study seeks to provide evidence of their adoption and derive lessons to improve performance.

However, assessing the productivity of such technological advancements has proven to be somewhat challenging.

Research Objective

The workplace has transformed into a digital workspace over the last decade as organizations embrace technology and changing paradigms of work. This shift offers benefits in terms of productivity, collaboration, and organizational culture. However, there are challenges in measuring productivity in the digital workplace that need to be addressed.

This research project measures the growth of digital technologies in the public and private sectors, analyzing how workplaces become further optimized through the integration of efficiency gains brought about by the adoption of technologies, using multiple case studies of the same organization.

We also explore how digital workplaces enhance productivity and support sustainability efforts, including reducing carbon footprints.

History of Digital Workplace Efforts in India

The shift towards a digital workplace in India gained traction in the early 2000s with the establishment of the IT and BPO sectors. Companies began adopting digital tools for communication, collaboration, and process automation. The initial focus was on improving internal efficiencies and reducing operational costs.

There are other notable facts in the history of digital transformation of workplaces in India:

2005–10: Implementation of enterprise resource planning (ERP) systems, core banking solutions (CBS), and customer relationship management (CRM) software by large businesses and banks.

2010–15: Introduction of cloud and mobile computing brought increased flexibility and mobility.

2015–20: Evolution of digital transformation fueled by government initiatives and increased smartphone and internet usage.

2020 and beyond: The outbreak of the COVID-19 pandemic acted as a game changer, forcing organizations to quickly adopt remote working and online collaboration tools.

Government of India's Multipronged Approach to Digitization

The Government of India's multifaceted approach towards the process of digitalization, including policymaking, infrastructure building, and workforce requirements, certainly has a very beneficial impact on the productivity of work in a digital environment and contributes to economic development. The GOI is ensuring that India's competitiveness in today's rapidly growing digital economy is persistent and continuous through the introduction of radical changes and enhancement of skills among workers without disturbing the institutions of inclusiveness, sustainable development, and workforce productivity.

Some of the important policies and implementations are mentioned below:

National e-Governance Plan: e-Governance Framework

The National e-Governance Division (NeGD) is one of the divisions of the Ministry of Electronics and Information Technology (MeitY), Government of India. It aims to provide assistance in

implementing e-Governance schemes across the country. NeGD is involved in the Digital India Programme (Ministry of Electronics and Information Technology, 2023) and specifically in the implementation of e-Governance in India by providing templates, guidelines, and best practices for e-Governance systems at the national, state, and local levels.

The Digital India Act, 2023

The forthcoming Digital India Act of 2023 (Govt of India Gazette, 2023) is intended to repeal the present Information Technology Act of 2000 and develop a legal framework that meets modern-day digital economy demands. The said act shall do more than just control the extent to which technologies such as artificial intelligence (AI), blockchain, data, and security can be used. A solid regulatory framework will be created for India's digital revolution. It will enhance Digital Public Infrastructure (DPI) in the country.

Important Digitization Projects Undertaken by GoI

Goods and Services Tax (GST): The GST Portal is an inclusive step aimed at unifying taxation, primarily due to the complex nature of indirect taxes in India. It has outsourced the collection and management of taxes through its online systems, minimized paperwork, and streamlined business operations across the country.

Aadhaar: The Aadhaar, also known as the digital identity system (alongside the JAM trinity), is the world's largest biometric database. It enables individuals to verify their identity for various services, including banking, welfare services, and mobile services.

DigiLocker: DigiLocker is an online platform for issuing, storing, sharing, and validating documents issued by the Government of India, such as driving licenses, educational certificates, and Aadhaar cards. It eliminates the need for maintaining paper files and storage space, assisting citizens and organizations in managing official documents digitally.

Unified Payments Interface (UPI): UPI is revolutionizing monetary transactions in India by enabling real-time money transfers across multiple platforms, making transactions more accessible for individuals and businesses. It has increased participation in the economy and reduced reliance on cash, thereby streamlining business operations.

BharatNet: BharatNet aims to expand access to the digital economy by connecting rural India through high-speed internet services. By linking approximately 250,000 Gram Panchayats, it enhances access to government services, education, and e-commerce in rural areas, boosting productivity and economic growth.

Emphasis on Skilling Initiatives

Digital literacy curriculum in schools: Infusing digital literacy into education is geared towards students and pertains to the technological impetus being adopted by the government. It involves instilling knowledge of information and technology as a subject, introducing programming as early as possible, and promoting the use of digital means for work in the future. There are also educational policies aimed at improving computer literacy among schools. Educational programs like Sarva Shiksha Abhiyan (SSA) (Department of School Education & Literacy, Government of India, 2019) by the Government of India promote computer-based education to make learning a more enjoyable process for children and are becoming widely prevalent across the globe.

Teacher training programs: In addition to enhancing learners' digital literacy, teacher training programs aimed at equipping teachers with digital and online teaching resources and practices are being implemented.

National Skill Development Corporation (NSDC), IT/ITeS Sector Skill Council: The NSDC, through its IT/ITeS Sector Skill Council, undertakes to address the training of citizens to gain employment opportunities within the IT and ITeS sectors, which are significant enablers in a digital economy. Through skill-building initiatives and accreditation programs, the NSDC sustains a flow of digitally skilled cloud workers capable of working across various industries, including software, data analytics, system engineering, and artificial intelligence.

ISRO satellite for education: ISRO has launched several satellites dedicated to education and communication, such as the GSAT series. These satellites facilitate distance education by providing content via broadband telecommunication networks to schools located in remote areas.

Impact on Digital Workplace Productivity and GDP Growth

The collective impact of these policies and projects is momentous (World Bank, 2023) (Employment to GDP per capita growth, SL.GDP.PCAP.EM.KD). The policies of introducing technology and enhancing the use of technology such as the internet, along with building the necessary infrastructure, are enabling the Government of India to enhance the productivity of its workforce in the digital economy. The ability to work efficiently with digital tools enhances individual and organizational productivity, reducing operational costs and increasing efficiency across sectors.

In addition, the skilling initiatives have addressed employees' skill gaps by ensuring they are up to date with the demands of the digital age. Digital inclusion, along with the development of improved infrastructure, increases the ability of workforces in Indian industries to shift to high-growth opportunities such as IT services, e-commerce, and Fintech. Hence, it is evident that these digital transformations are significant contributors to India's economic growth. The country, therefore, becomes the epicenter of digital invention and economic advancement in the world.

In summary, through a mix of progressive policies, infrastructure projects, and skilling programs, the Government of India is not only digitizing the economy but also creating a digital-first workforce, which in turn enhances productivity, accelerates GDP, and improves the overall competitiveness of the Indian economy. One of the primary hurdles for the country in its digital journey is limited internet penetration (Internet users: 49.14% of the population).

Approach to Measuring Productivity in Digital Workplace

Methodology

This study employs a mixed-methods approach, combining quantitative analysis of productivity metrics with qualitative assessments.

Quantitative Method

Analysis based on GDP per person employed, GDP (PPP) (World Bank, 2023, GDP (PPP, current international dollar) (NY.GDP.MKTP.PP.CD)) in India from 2000 to 2023, labor productivity (Statista, 2022, Labor productivity per hour in India) per hour worked, and growth in Internet users in India.

The purchasing power parity indicator can be used to compare economies regarding their GDP, labor productivity, and actual individual consumption. It can also be used to analyze price convergence and compare the cost of living between places. An international dollar has the same purchasing power over GDP that a US dollar has in the USA.

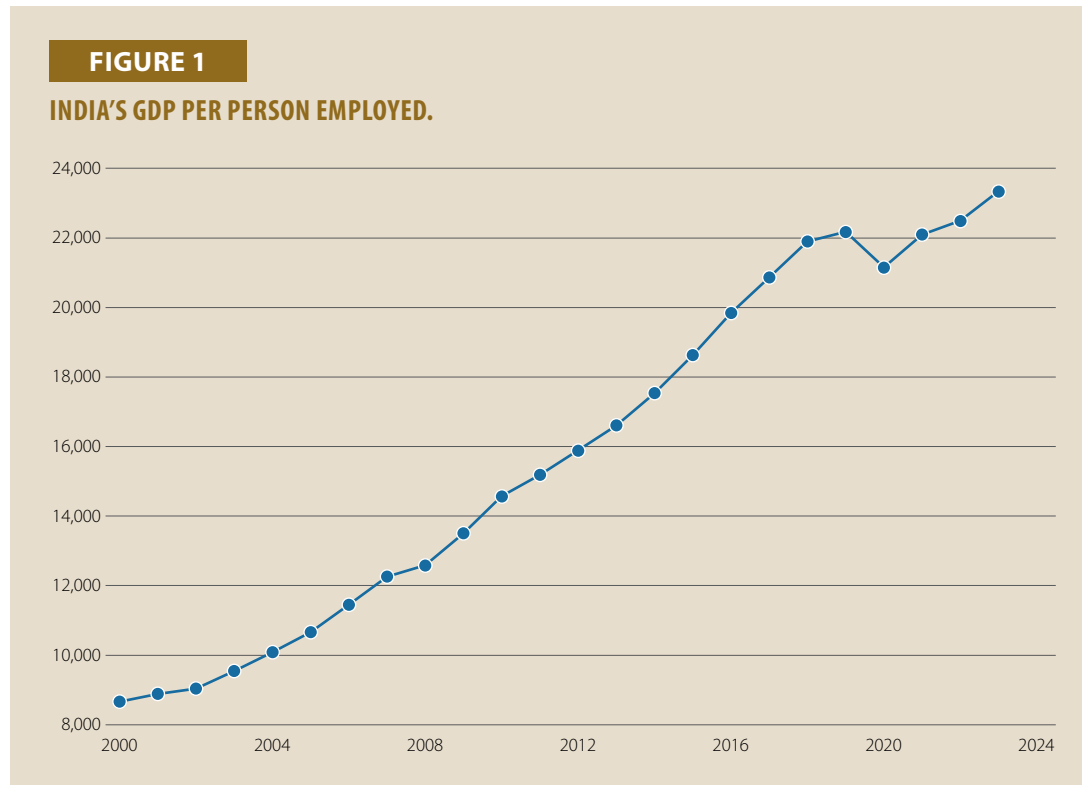


Figure 1 depicts India's GDP per person employed (IGDPPE) over time from 2000 to 2023. This metric measures the average GDP generated per employed person in the economy, which reflects labor productivity.

Key Observations:

1. Steady growth (2000–16):

From 2000 to 2016, the GDP per person employed in India shows a steady and significant upward trend, rising from approximately USD10,000 in 2000 to around USD20,000 by 2016.

- This steady growth reflects the overall improvement in labor productivity during this period, driven by factors such as economic reforms, industrialization, technology adoption, digital interventions, and an increasingly skilled workforce.

2. Peak and decline (2017–20):

Around 2017, the GDP per person employed reached a peak of approximately USD21,000.

- However, there was a noticeable dip around 2020, likely corresponding to the economic impact of the COVID-19 pandemic. The pandemic led to reduced productivity, disruptions in supply chains, and a slowdown in economic activities, which can explain the sharp drop during this period.

3. Recovery and stabilization (2021–24):

Post-2020, Figure 1 shows signs of recovery as GDP per person employed begins to rise again, though at a slower pace. By 2023, productivity seems to stabilize back to around the USD23,150 level.

- This indicates a rebound after the pandemic, as economic activities resumed, but with a possible plateauing effect in productivity growth in the near term.

Interpretation:

- Early 2000s: The rise in labor productivity during this period could be attributed to the liberalization of India's economy, growth in the IT and service sectors, and increased foreign investment.
- Post-2008 financial crisis: India's economy continued to grow steadily through the global financial crisis of 2008, reflecting resilience in labor productivity.
- 2020 dip: The sharp dip around 2020 highlights the negative impact of the pandemic on productivity. This was a period when many industries faced severe disruptions.
- Stabilization post-COVID: There has been a recovery in productivity levels post-pandemic. The increase in internet usage and digital adoption is expected to boost labor productivity.

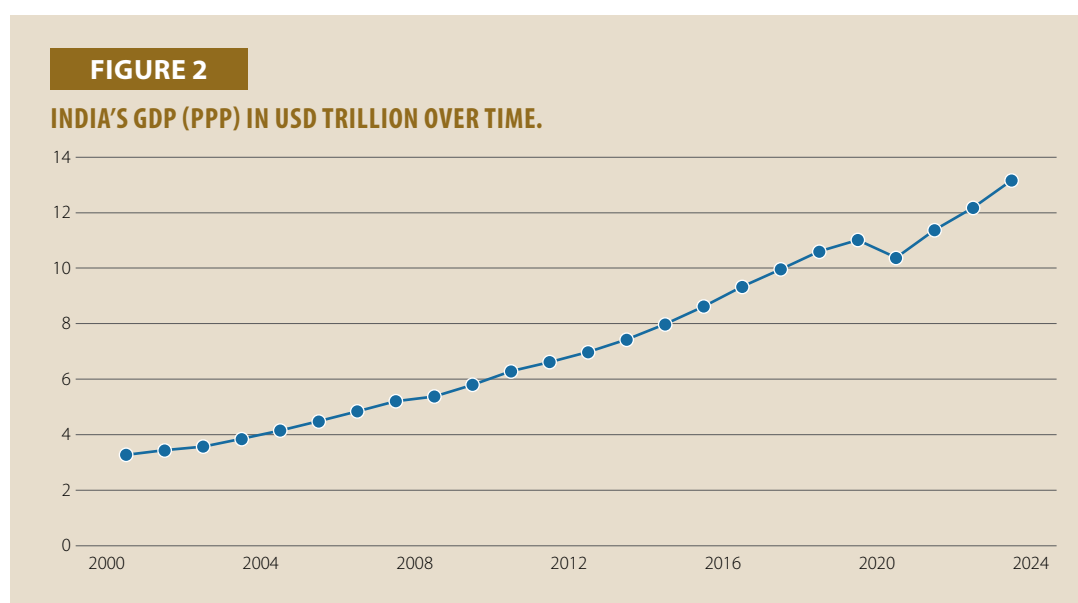


Figure 2 depicts India's GDP in purchasing power parity (PPP) terms over time, from 2000 to 2023. GDP in PPP adjusts for differences in price levels between countries, making it easier to compare economic productivity and living standards globally. The values are expressed in trillions of U.S. dollars.

Key Observations:

1. Steady growth (2000–16):

- From 2000 to 2016, India's GDP (PPP) showed a steady upward trajectory, increasing from USD2.2 trillion in 2000 to approximately USD7.78 trillion by 2016.

- This reflects the rapid expansion of the Indian economy during these years, driven by factors such as industrialization, globalization, and the rise of the services and IT sectors.

2. Sharp Acceleration Post-2016:

- After 2016, the chart shows a notable acceleration in India's GDP, particularly after 2020. The GDP (PPP) jumps from around USD7.78 trillion in 2016 to over USD14 trillion by 2023.
- The sharp upward trajectory suggests stronger economic growth during this period, which could be attributed to factors like economic reforms, digital adoption, increased investment in infrastructure, and growth in sectors like manufacturing and digital services.

Interpretation:

- Sustained economic growth: India's economy has consistently grown in PPP terms, indicating that it is becoming an increasingly significant global economic player.
- Impact of the COVID-19 pandemic: The dip in 2020 is notable, but the recovery is strong, showing the resilience of the Indian economy. Digital adoption and a surge in Digital Public Infrastructure have taken overall productivity to a new level.
- Post-2020 economic rebound: The rapid growth after 2020 reflects India's strong recovery efforts and the potential acceleration of reforms and investments in key sectors like infrastructure, digital economy, and manufacturing.

Digital adoption and the surge in digital public infrastructure have elevated overall productivity to new levels.

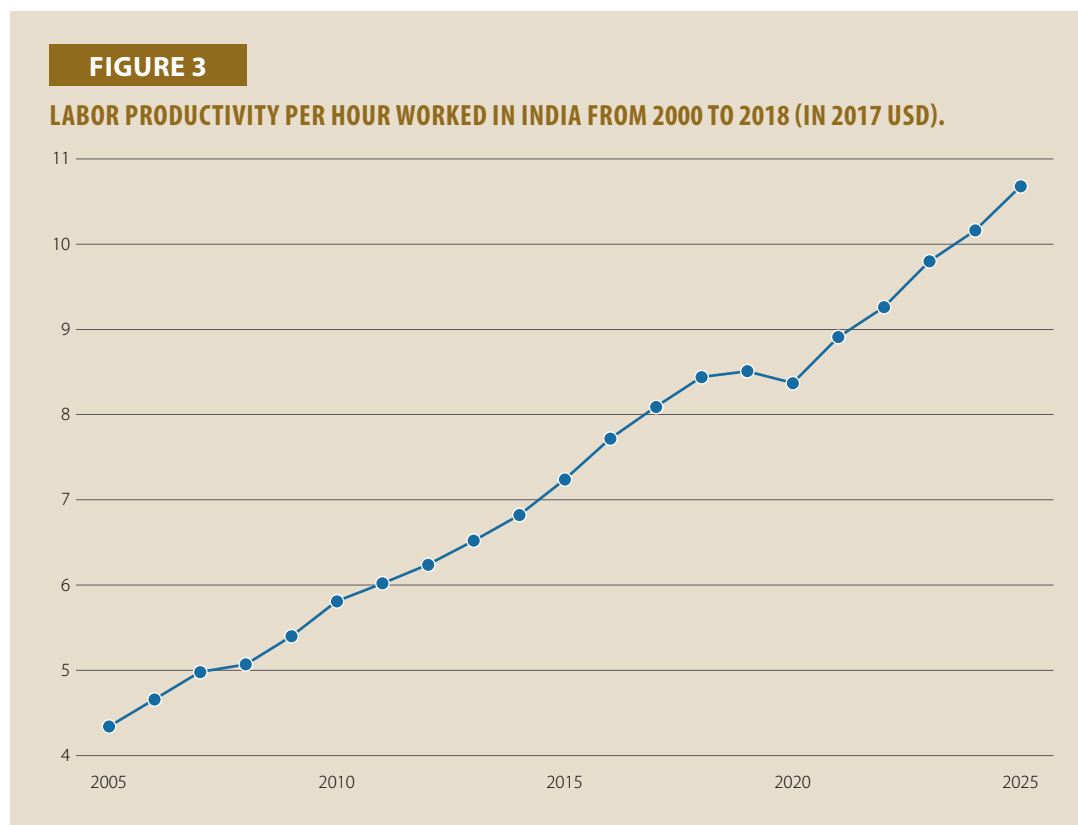


Figure 3 shows labor productivity growth over the years from 2000 to 2018, measured in 2017 U.S. dollars. Digital adoption and the spurt in digital public infrastructure have taken overall productivity to a new level.

Key Observations:

1. Steady growth:

- The labor productivity starts at USD3 in 2000 and shows a gradual increase, stabilizing at around USD4 from 2004 to 2006. This suggests relatively slow productivity growth during these years, possibly due to structural or technological limitations in the economy.
- There is a more pronounced increase during these years, with productivity moving from USD5 in 2007 to USD6 in 2010. This could indicate improved economic efficiency, possibly due to technological advancements or organizational improvements within the workforce.

2. Post-2010 growth:

- 2011–13: Labor productivity remains constant at USD6 for these years, suggesting a period of stabilization following the 2008 financial crisis.
- 2014–16: There's another notable increase, with productivity reaching USD7 by 2014 and then rising to USD8 by 2016. This upward trend could be due to economic recovery after the global financial crisis and the adoption of new technologies and work practices.

3. Sharp growth in 2017 and 2018:

- The most significant growth appears between 2017 and 2018, where productivity jumps from USD8 to USD9. This reflects increased efficiency in the workforce, likely due to enhanced technological integration, digitization, automation, or more effective labor policies.

Interpretation:

- **Overall increase:** From 2000 to 2018, labor productivity tripled, from USD3 to USD9. This steady increase suggests continuous improvements in how efficiently labor is being used in the economy and the adoption of digital workplaces.
- **Skill enhancement, technological, and economic impacts:** The periods of faster growth (2007–10 and 2014–18) likely correspond with broader economic trends, such as the rapid rise of technology and digitization, better capital–labor ratios, and improvements in worker education and skills.

Figure 4 illustrates the growth of internet users (IAMA and KANTAR 2023) from the year 2000 to 2023, showing a significant upward trend over time.

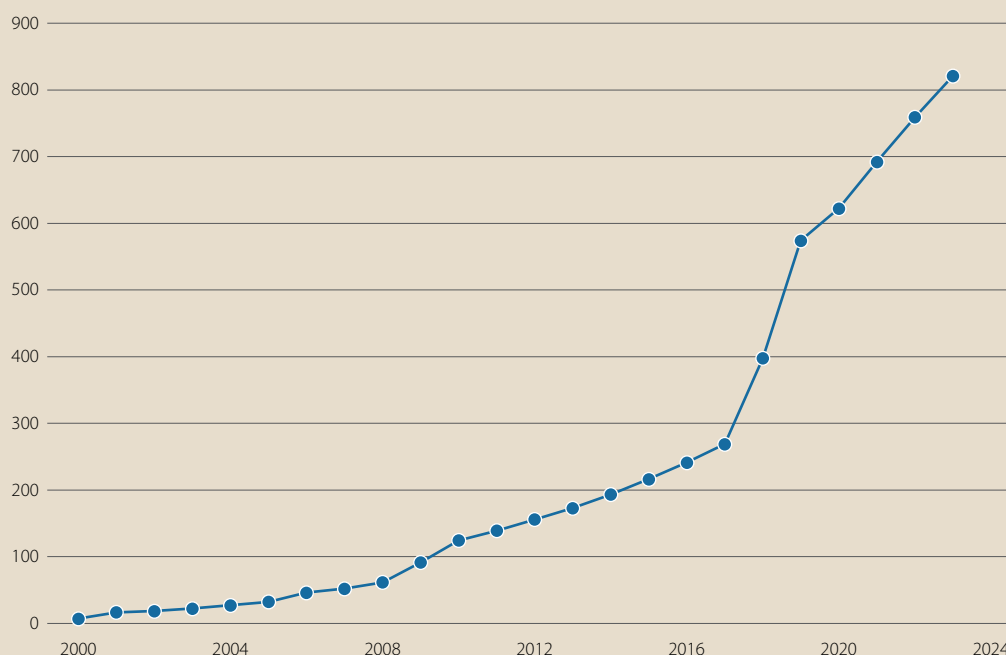
Key Trends:

1. Slow growth (2000–07):

- During the early 2000s, the number of internet users grew at a relatively slow pace, starting from 7 million in 2000 and reaching around 51.8 million by 2007 (Singh, S.K., Singh, V.L., 2023).

FIGURE 4

NUMBER OF INTERNET USERS IN INDIA.



- This period likely corresponds with the initial stages of internet adoption, where infrastructure development, high costs, and limited availability of affordable devices kept growth moderate.

2. Moderate growth (2008–16):

- Between 2008 and 2016, the number of internet users increased at a faster yet steady rate. Internet users grew from 61.5 million in 2008 to around 241.1 million in 2016.
- The rapid rise during this period can be attributed to the proliferation of affordable internet-enabled devices, especially smartphones, growing broadband infrastructure, and the expansion of mobile internet networks.
- This phase likely marked the mass adoption of the internet in urban areas, spurred by the rise of social media, e-commerce, and mobile applications.

3. Exponential growth (2017–23):

- The most significant jump in internet users occurred between 2017 and 2023. The number of users surged from 268.8 million in 2017 to 821 million in 2023.
- This exponential growth was driven by the following factors:
 - Affordable data: In many developing economies, such as India, affordable mobile data plans (like those introduced by companies such as Reliance Jio) led to a massive increase in internet penetration.

- Widespread mobile usage: The increasing availability of low-cost smartphones allowed millions of users to access the internet for the first time.
- Government policies: Initiatives aimed at increasing digital infrastructure and promoting internet use, especially in rural areas, further accelerated growth.
- COVID-19 pandemic: The global pandemic likely catalyzed further adoption, as more people relied on the internet for work, education, and communication during lockdowns and restrictions.

Interpretation

- The number of internet users grew from 7 million in 2000 to 821 million in 2023, representing more than a 100-fold increase.
- The internet has transformed from being a niche technology for a small segment of the population to becoming an essential utility for daily life, with large-scale adoption occurring in the last decade.
- It also helped enhance productivity in the workplace.

Overall Interpretation

Figures 1 through 4 indeed depict a clear connection between digital adoption and the enhancement of workplace productivity in India from 2000 to 2023. Let us understand how digital transformation has contributed to economic and labor productivity, highlighting the role of the internet and technology in shaping India's progress.

Economic Growth Fueled by Digital Transformation

India's GDP (purchasing power parity) growth has continued soaring to impressive figures, having used USD2.2 trillion in 2000 and expanding to over USD14 trillion by 2023. This growth goes hand in hand with the widespread use of digital technologies, especially after 2016. The growing availability of internet services, mobile connectivity, and digital infrastructure has allowed enterprises to increase their efficiency, output, and extend to bigger markets.

As in the previous example, GDP per person employed (IGDPPE) illustrates the increase in productive efficiency of the workforce, from USD10,000 (2000 data) to USD23,100 (2023). This steady improvement suggests that digital tools and technologies are enabling employees to generate more output per person. As seen, the output recovered sharply following the COVID-19 pandemic because the digital economy (such as remote operations, online shopping, and digital marketing) transformed traditional concepts of doing business during economic downturns and expanded productivity output.

Labor Productivity Per Hour Worked Linked to Digital and Technological Advancements

Figure 3 for labor productivity per hour worked indicates a continuous growth from USD3 in 2000 to USD9 in 2018. Figure 1, though enclosed for ease of reference, traces slower growth rates in earlier years, followed by particularly fast growth in productivity post-2010, where changes in the digital space, automation of processes, and advanced technologies began to be adopted within workplaces. Increasing employment of internet tools, digital technologies, as well as mobile technologies in businesses and industries, could be significant factors in the rising productivity of the workforce in this era.

The most significant rise in labor productivity during the period, especially between the years 2010 and 2018, can thus be associated with what was happening outside in the economy, especially in relation to technology introduction, digitalization of the workplace, and automation. This indicates that workers were able to be more productive because of embracing digital systems, leading to increased productivity.

Rapid Internet Growth Driving Productivity

The curve of the number of Internet users in India between 2000 and 2023 showed significant growth, from 7 million users to over 821 million in 2023. The most notable increase occurred after 2017, when affordable data plans such as Reliance Jio's and the widespread availability of smartphones reached their peak.

Thanks to easily accessible internet and mobile devices, digital technologies have transformed the work culture in India. Increased connectivity, real-time collaboration, digital payment systems, and remote working options have all enhanced workplace efficiency.

The increased availability of the internet contributed to the emergence of digital platforms, social media, e-commerce, digital finance, and outsourcing IT services, which enabled enterprises to grow at an amazing rate and venture into new regions, thus furthering productivity in different sectors.

COVID-19 Pandemic as a Catalyst for Digital Productivity

The COVID-19 pandemic was both a hindrance to and a boost for the advancement of the digital world. The decline in productivity and GDP in 2020 due to the COVID pandemic is a natural effect of its outbreaks. However, the swift recovery in 2021 and beyond, shown in both GDP and labor productivity metrics, demonstrates how digital tools, such as remote work, online services, and automation, allowed businesses to recover and thrive even during unprecedented global disruptions.

Conclusion: Digital Adoption and Workplace Productivity

Figures 1–4 clearly show that there has been a remarkable gain in workplace productivity due to digital adoption in India. The trends indicate that:

Digital tools (such as internet-enabled devices, cloud services, and automation) and infrastructure have enabled businesses and workers to be more productive, increase output, and adapt to global economic challenges.

Internet penetration, especially after 2016, facilitated the dissemination of workplace internet, which greatly affected workplaces and productivity as workers were able to communicate, coordinate, and access information in much more productive ways.

Within the growing productivity, technological advancements in sectors including IT, manufacturing, services, and digital finance are equally important as they have made it possible for people to transition from traditional practices to a more digitally enabled environment.

The recovery after the pandemic illustrates how practices of technological innovation have become essential for improved productivity even in the most adverse situations.

Summary

In short, the phenomenal increase in internet users, labor productivity, and GDP bears out the argument that structural transformation in the Indian economy caused by digital adoption has been associated with significant productivity growth. The integration of digital tools, the rise of the digital economy, and government policies aimed at expanding digital infrastructure have collectively transformed India's workplace productivity landscape.

Survey on Impact of Digitalization on Workplace Productivity

With the help of this survey, we have measured how the introduction of digital technologies and various applications/systems has affected employees' ability to work efficiently, manage tasks, collaborate, and overall productivity within the workplace.

Digital officers/IT managers at different companies were given these survey questions.

Survey Questionnaire

Instructions: Please rate the following questions on a scale of 1 to 5, where:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Neutral
- 4 = Agree
- 5 = Strongly Agree

For open-ended questions, provide specific feedback or examples where applicable.

Section 1: Key Performance Indicators

1. Since digitalization, the time taken to complete key business processes has decreased.
 - ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
2. The number of errors or issues in our processes has reduced after digitalization.
 - ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
3. The overall output or productivity of the business has increased post-digitalization.
 - ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Section 2: Return on Investment

4. The cost savings from digitalization have been significant compared to the initial investment.
 - ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
5. Digitalization has provided indirect benefits (e.g., fewer errors, reduced downtime) that justify the investment.
 - ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Section 3: Employee Productivity Metrics

6. The productivity of employees has improved with the introduction of digital tools.
 - ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

7. The time required to complete tasks has decreased for employee's post-digitalization.
- ☐1 ☐2 ☐3 ☐4 ☐5

Section 4: Customer Satisfaction

8. Customers have expressed greater satisfaction with the quality of service post-digitalization.
- ☐1 ☐2 ☐3 ☐4 ☐5
9. Digitalization has led to faster delivery of products or services to customers.
- ☐1 ☐2 ☐3 ☐4 ☐5
10. How likely are you to recommend our digitally transformed services/products to others?
(1 = Not likely, 5 = Very likely)
- ☐1 ☐2 ☐3 ☐4 ☐5

Section 5: Process Efficiency

11. The workflow and processes have become more streamlined after digitalization.
- ☐1 ☐2 ☐3 ☐4 ☐5
12. Manual interventions in business processes have reduced significantly after digitalization.
- ☐1 ☐2 ☐3 ☐4 ☐5

Section 6: Data Quality and Accessibility

13. The accuracy of data used in decision-making has improved after digitalization.
- ☐1 ☐2 ☐3 ☐4 ☐5
14. The time required to retrieve and analyze data has decreased significantly.
- ☐1 ☐2 ☐3 ☐4 ☐5

Section 7: Innovation Metrics

15. Digitalization has enabled the creation of new products or services.
- ☐1 ☐2 ☐3 ☐4 ☐5
16. The time-to-market for new offerings has improved post-digitalization.
- ☐1 ☐2 ☐3 ☐4 ☐5

Section 8: Operational Costs

17. Digitalization has led to a reduction in overall operational costs.
- ☐1 ☐2 ☐3 ☐4 ☐5
18. Material usage or waste has reduced as a result of digital processes.
- ☐1 ☐2 ☐3 ☐4 ☐5

Section 9: Scalability

19. Our business is now able to handle a larger workload without a significant increase in costs.
- ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
20. Digital systems have made it easier for the company to scale operations efficiently.
- ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Section 10: Competitive Advantage

21. The company's market share has improved as a result of digitalization.
- ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
22. Our digital capabilities are ahead of or on par with industry competitors.
- ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Section 11: Digital Workplace Adoption

23. Employees have fully adopted the new digital tools and processes.
- ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
24. How critical do you believe digital workplace adoption is to the organization's long-term success?
- ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Open-ended Questions

- What was the main advantage arising from the digitalization of the company, in your opinion?
- In relation to the use of digital tools, would you mention any dissatisfaction? Kindly explain.
- How has digitalization impacted your day-to-day work?
- What new digital enhancements or features do you think could be added to improve efficiency?

Survey captures quantitative feedback (through scaled questions) and qualitative feedback (through open-ended responses), providing a comprehensive assessment of the digitalization impact across the identified parameters.

Summary of Survey Results

As for the data regarding the influence of digitalization on workplace productivity in India, as asked in the above survey, the main points are:

Improved efficiency: A considerable number of respondents reported that they are now able to carry out their functions more quickly due to a lower volume of tasks that require manual efforts and repetitive actions, thanks to the computerization of processes.

Enhanced collaboration: Several digital officers/IT managers noted that digital tools have improved the way teams work together, share, and process information, particularly when working in offsite and mixed working situations.

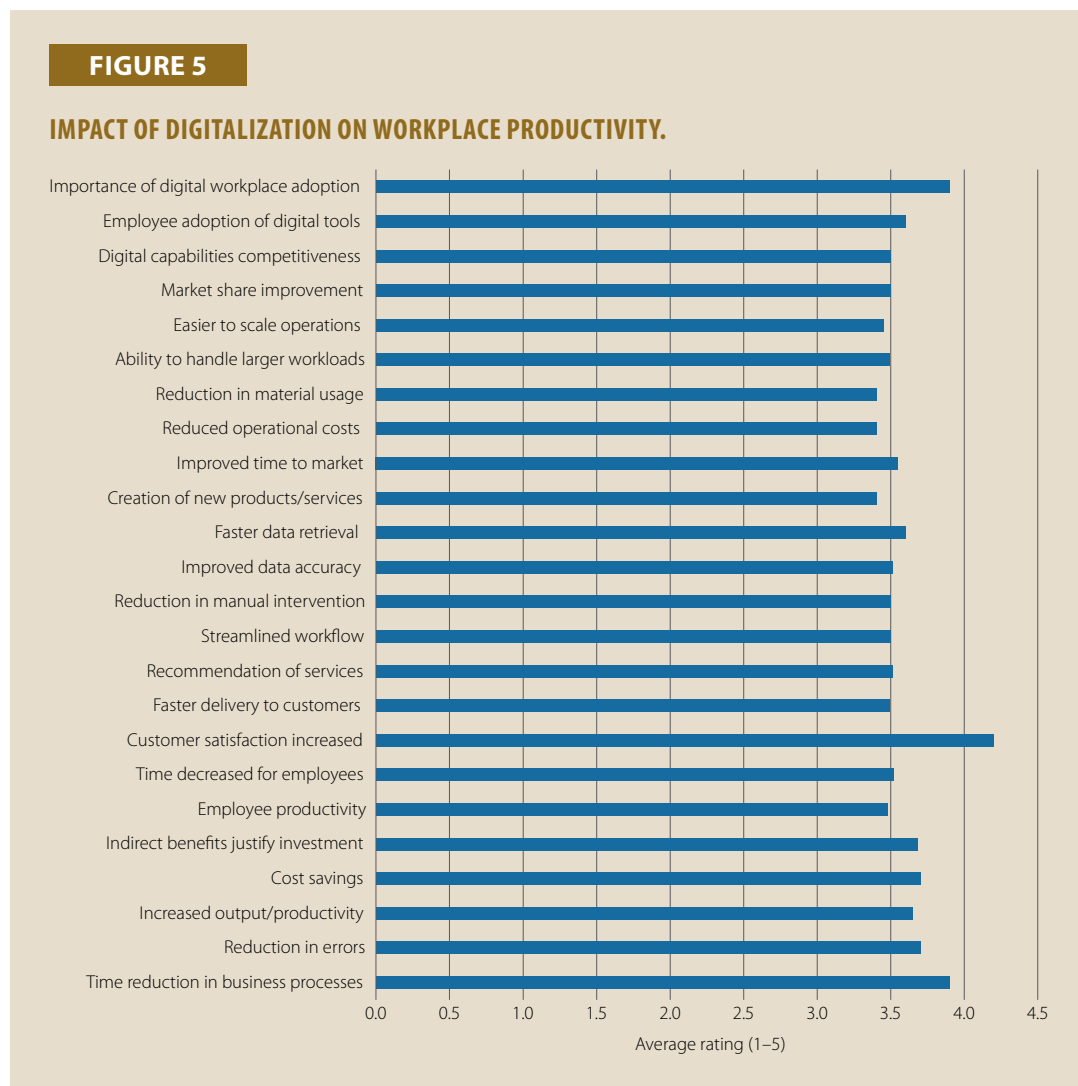
Task and time management: Respondents noted that the implementation of digital technologies has enabled them to be more organized and systematic in carrying out work processes, aiding in the completion of tasks within shorter durations.

Increased employee satisfaction: The survey revealed clear improvements in employee satisfaction, with new digital tools providing additional advantages in flexibility and autonomy for employees. However, some respondents noted that adapting to new tools also presented challenges.

Challenges in implementation: Views from interviews indicate that most people accepted the benefits, yet some digital officers/IT managers mentioned challenges such as lack of required skills, system bugs, or difficulties integrating digital systems across departments.

Increase in productivity: Overall, there was a consensus that digitalization had a noticeable positive impact on workplace productivity, enabling faster decision-making and reducing workflow bottlenecks.

The illustration summary summarizes the key findings, showcasing both the benefits and challenges faced by digital officers/IT managers in India.



AI Policies in India

Being one of the fastest-growing economies and also home to the world's second-most populous country, India has ample reasons to be interested in AI.

National Artificial Intelligence Strategy (NSAI) by NITI Aayog

With great possibilities that AI has to offer, the 2018–19 budget directed NITI Aayog to begin a National Program on AI to lead AI research and development. India is utilizing AI under the #AIforAll initiative towards economic growth, social development, and inclusive progress under five key sectors: healthcare would increase accessibility and affordability; agriculture would increase productivity and reduce wastage; education would improve access and quality; the smart cities sector would increase efficiency; and mobility would enhance transportation and reduce congestion.

AI can truly make its mark in the screening of cancer in India, which has over a million new cases every year. Early detection is, of course, essential, but the quality of pathology services is limited, with only 2,000 trained oncology pathologists in the country. Therefore, AI-based solutions are likely to help pathologists arrive at accurate diagnoses and address this shortfall. NITI Aayog is working on a national repository of annotated pathology images, bringing “digital pathology” closer to improving diagnostic precision.

Digital Personal Data Protection Act and the Data Governance Framework

The Digital Personal Data Protection Act (DPDP) of 2023 regulates the processing of digital personal data in India to balance individual rights protection against business requirements related to data. The law regulates the organization of processes that involve identifying, storing, transferring, and deleting personal data. It provides rights to individuals (data principals) and establishes responsibilities for data processors (data fiduciaries). There are some exemptions under the Act, including but not limited to startups and state data processing, and it closely resembles the European GDPR (although, unlike the EU version, the draft applies to all types of personal data).

National Programme on Artificial Intelligence

The IndiaAI Mission is a national program on artificial intelligence by the Government of India. The mission's goals include:

- **Creating an AI ecosystem:** The mission aims to foster a communal atmosphere that will promote the widespread development of AI, including information and computing resources that facilitate extensive adoption, necessary data quality initiatives, and the efficient inclusion of substantial AI capabilities.
- **Talent attraction:** It attracts high-quality AI talent and enables collaboration within the industry.
- **Risk capital for AI startups:** The mission focuses on supporting AI startups.
- **Encouraging ethical AI:** This mission promotes the ethical use of AI.
- **Attracting large-scale investments:** This mission aims to attract industry-scale AI investments in the country. An image depicting an Indian startup and international investors.

A few of these initiatives supporting the IndiaAI Mission are:

A web portal called IndiaAI was launched in 2022 to promote the AI developments of India.

- **Global Partnership on AI GPAI:** India is a member of the Global Partnership on AI GPAI.
- **US–India Artificial Intelligence Initiative:** The US-India Artificial Intelligence Initiative (USIAI) is a USA–India partnership to cooperate on AI in areas of primary importance to both countries. The objective is to strengthen start-ups in defense production and enhance artificial intelligence (AI).
- **Responsible AI for Youth:** An initiative that started in May 2020, it empowers young people in India to develop human-centric AI solutions to tackle economic and social challenges. Intel is committed to working together with policymakers and academia to democratize AI and build digital readiness among youth, who become change-makers.

AI for All

AI For All is a self-learning online program by CBSE and Intel India: an initiative between the Central Board of Secondary Education (CBSE) and Intel India to introduce AI literacy at the school level and designed to generate mass awareness about Artificial Intelligence.

FutureSkills PRIME

A joint initiative of NASSCOM and the Government of India to develop AI, data science, and emerging technology skills for building an AI-ready workforce.

Digital Personal Data Protection Act, 2023

This law governing data privacy also establishes the framework for AI governance by setting important data privacy norms that not only protect personal data but also ensure the responsible use of such data. This, indirectly, influences AI development and deployment in India as well, and will contain policies regarding data processing, user consent, and data security.

India is exploring policies that can maintain a balance between innovation and safety. This entails balancing the benefits of artificial intelligence, such as job creation and security, with the ethical challenges it poses, along with regulatory structures that encourage the creation of other forms of artificial intelligence while preserving public interest.

Artificial Intelligence and Robotics Technology Park (ARTPARK)

It aims to develop domestic solutions through AI and robotics research, alongside innovation.

It provides a platform for AI and robotics startups, researchers, and industries for collaborative development in the country, with access to resources (mentorship), funding support, and infrastructure for next-generation technologies.

AI Research, Analytics and Knowledge Assimilation Platform (AIRAWAT)

It provides an environment to enable the research community, as well as industry and academia, to collaboratively pursue innovation in AI; at the same time, enabling analytics over those very large datasets. AIRAWAT seeks to strategically further India as an AI ecosystem with use cases in healthcare, agriculture, and education.

INDIA ai Portal

An initiative launched by the government regarding AI advancements in India. It aims to be a one-stop destination for AI resources, policies, and research, and to promote collaboration and make India the global hub of AI innovation.

Case Studies: Digital Interventions and Workplace Productivity in India

In this section, we present real-world examples of Indian organizations that have implemented digital interventions to enhance workplace productivity. Each case study is structured to provide a comprehensive understanding of the initiatives undertaken, challenges faced, best practices adopted, and the impact of these digital transformations.

Case Study 1: Goods and Services Tax

Introduction

The announcement of the Goods and Services Tax (hereafter, GST) on July 1, 2017, marked a notable advancement in the event of taxation in India, as it totally replaced the multifaceted indirect tax regime with a unified tax regime. This restructuring has not only increased tax collection and the efficiency of the operations of firms but also helped in the reasonable implementation of digital technologies. This case study analyzes the relationship between GST, on the one hand, and the factors surrounding present digital economy adoption, including productivity, on the other hand.

This case study focuses on the impact of GST on digital adoption and productivity in India (Grant Thornton Bharat, 2023, Driving digital transformation: Reflecting on six years of GST).

The implementation of GST has greatly enhanced the digitalization of workplaces in India through:

Digitization of Tax Filing

GST introduced an online, centralized platform (GSTN) for tax filing, making it mandatory for businesses to move away from paper-based processes. This shift streamlined compliance, reducing manual errors and processing time, thereby increasing overall productivity in managing tax operations.

Automation of Invoices and Transactions

Businesses are required to generate e-invoices and track input tax credits through the GST portal, encouraging the adoption of digital accounting and ERP systems. Automating these processes has led to faster and more accurate billing, accounting, and reconciliation.

Encouragement of Digital Tools

As a result of the need to be revenue compliant, many businesses have turned to software for tax purposes such as invoicing and stock control since the introduction of GST. This has increased efficiency in the work, as the appropriate workflows do not have unnecessary hold-ups or bottlenecks, since everything is done in real time through electronic means.

Facilitating a New Digital Ecosystem

The introduction of GST compliance has compelled businesses, particularly the small and medium enterprises (SMEs), to digitize their operations. Thus, the digital economy became more integrated because the interaction between business and tax authorities became much simpler and brought in higher productivity levels as chances for needless administration were lowered.

Improved Efficiency of the Supply Chain

With GST eliminating state-based taxes and creating a unified market, businesses can optimize their supply chains. Reduced logistical barriers and integrated digital processes have led to faster movement of goods and more efficient inventory management, directly improving productivity in logistics and operations.

Case Study 2: Flipkart

Introduction and Background

Flipkart, founded in 2007, is one of India's leading e-commerce companies, offering a vast array of products across multiple categories. As the company expanded, managing its extensive supply chain became increasingly complex, impacting operational efficiency and customer satisfaction. This case study focuses on AI-driven supply chain optimization (Flipkart Stories, E-commerce Supply Chain Trends at Flipkart, 2024).

Problem

Complex supply chain management: There were challenges in inventory management, logistics, and delivery optimization due to rapid growth.

Demand forecasting: It was difficult to accurately predict customer demand, leading to overstocking or stockouts.

Operational inefficiencies: Manual processes led to delays and increased costs.

Solution

AI and machine learning implementation: Flipkart deployed machine learning algorithms for demand forecasting and inventory management.

Automation: They have introduced automation in warehousing and logistics to streamline operations.

Route optimization: Flipkart utilized AI to optimize delivery routes to reduce delivery times and costs.

Impact

Improved efficiency: Enhanced supply chain efficiency, leading to faster deliveries and reduced operational costs.

Customer satisfaction: Increased due to timely deliveries and better product availability.

Operational scalability: Able to handle higher order volumes without proportional increases in resources.

Case Study 3: Infosys

Introduction and Background

Infosys, founded in 1981, is a global leader in consulting, technology, and next-generation services. The company recognized the need to continuously upskill its workforce to keep pace with evolving digital technologies. This case study focuses on the digital workforce and skill development (Infosys Learning Lexicon: Insights and Applications, 2020).

Problem

Skill gap: Rapid technological advancements are leading to a mismatch between existing employee skills and emerging technology demands.

Talent retention: It is necessary to retain top talent by providing growth and learning opportunities.

Client expectations: Clients are seeking innovative solutions that leverage the latest technologies.

Solution

Digital Learning Platform (Lex): Launched an AI-powered learning platform offering courses in emerging technologies such as AI, ML, and cloud computing.

Reskilling initiatives: Implemented large-scale reskilling programs to train employees in digital skills.

Partnerships: Collaborated with universities and online education providers to expand learning opportunities.

Impact

Skilled workforce: Enabled over 300,000 employees to gain proficiency in new technologies.

Enhanced service offerings: Improved ability to deliver cutting-edge solutions to clients.

Employee engagement: Increased employee satisfaction and retention rates.

Case Study 4: Tata Motors

Introduction and Background

Tata Motors, part of the Tata Group, is India's largest automobile manufacturer, producing a range of vehicles from commercial to passenger cars. This case study focuses on connected vehicles and predictive maintenance (Tata Motors, 2024, Tata Motors' Fleet Edge: Digitally Connecting 5 Lakh Commercial Vehicles), (Tata Motors, 2024, Press Release: Tata Motors' Fleet Edge Digital Initiative), (Economic Times CIO, 2022, Tata Motors Digitizes Its Manufacturing Ecosystem).

This case study demonstrates how such a large organization manages to instill a digital-focused mindset among its employees. This automobile giant is leveraging Industry 4.0 across its seven manufacturing units in India.

Problem

Vehicle downtime: High maintenance and unexpected breakdowns lead to customer dissatisfaction.

Maintenance costs: Rising costs associated with vehicle servicing and repairs.

Competitive market: The need to differentiate in a competitive automotive industry.

Solution

Connected vehicle technology: Introduced telematics solutions in commercial vehicles for real-time monitoring.

Predictive maintenance: Leveraged data analytics to predict potential failures and schedule maintenance proactively.

Customer portal: Developed platforms for customers to track vehicle performance and receive maintenance alerts.

Impact

Reduced downtime: Improvement in vehicle uptime due to timely maintenance interventions.

Cost efficiency: Lower maintenance costs for customers and the company.

Customer loyalty: Enhanced customer satisfaction leading to increased brand loyalty.

Case Study 5: HDFC Bank

Introduction and Background

HDFC Bank, established in 1994, is one of India's leading private sector banks, known for its focus on technology-driven services. This case study focuses on digital banking and customer experience (PanGrow, 2024. HDFC Bank's digitization strategy).

Problem

Customer expectations: Increasing demand for seamless, 24/7 digital banking services.

Operational costs: Need to reduce costs associated with physical branches and manual processes.

Digital competition: Emergence of fintech companies offering innovative financial solutions.

Solution

Digital platforms: Enhanced mobile banking apps and internet banking with new features and improved user interfaces.

Biometric authentication: Implemented fingerprint and facial recognition for secure and convenient access.

Digital payments: Promoted the use of digital wallets, UPI, and other cashless payment methods.

AI chatbots: Deployed virtual assistants for customer service to handle routine inquiries.

Impact

Increased digital transactions: Significant growth in the number of customers using digital channels.

Operational efficiency: Reduced reliance on physical branches, lowering operational costs. Less paper consumption and a smaller GHG footprint.

Customer satisfaction: Improved due to convenience and enhanced service offerings.

Case Study 6: Aditya Birla Capital Ltd

Introduction and Background

Aditya Birla Capital Limited (ABCL) is the holding company for the financial services businesses of the Aditya Birla Group. This case study focuses on digital transformation during COVID-19 (Aditya Birla Group, 2021, Digital Transformation at Aditya Birla Capital).

Problem

COVID-19 disruption: The pandemic caused a halt in physical transactions, requiring rapid digital transformation to ensure business continuity.

Customer demand: A growing need for zero-contact, paperless, and seamless digital services.

Operational continuity: Ensuring smooth operations and maintaining employee productivity during remote work and lockdowns.

Solution

Accelerated digital transformation: ABCL fast-tracked its digital initiatives, utilizing AI, data analytics, and robotic process automation (RPA) to streamline operations.

Zero-contact onboarding: Deployed technologies such as biometrics, video KYC, and e-contracts for fully virtual customer onboarding and sales.

Employee productivity tools: Provided digital tools, AI assistance, and automation to employees, enabling efficient remote work and reducing manual workloads.

Impact

Increased digital interactions: Digital customer interactions doubled between April and June 2020, with self-service actions increasing by 65%.

Improved customer experience: 92% of health insurance renewals and 75% of personal loans were processed digitally, ensuring seamless services during the lockdown.

Enhanced employee productivity: Automation reduced manual tasks, allowing employees to focus on high-value work, thereby increasing productivity while working remotely.

Business continuity and growth: Over 50,000 new mutual fund investors were onboarded digitally, and the business met key performance targets despite the pandemic, showcasing the success of digital strategies.

The quick adoption of digital technologies at ABCL not only helped cater to customer requirements during the pandemic period but also increased the performance levels of employees by automating processes and enhancing the potential for out-of-office work. This proactive approach ensured that the company remained agile and future-ready in an evolving digital landscape.

Case Study 7: NKDA Shaping Remote Work Facilities

Introduction and Background

In India, the pandemic has significantly accelerated the adoption of remote work and working from home. While challenging, it has prompted a reconsideration of work culture, productivity, and inclusivity within the workforce. The smart city project in New Town, Kolkata, by NKDA, exemplifies how infrastructure and technology can support remote work. It has demonstrated that remote work not only enhances productivity, inclusivity, and innovation but also serves as an effective model for developing a sustainable and resilient workforce in India.

This case study focuses on NKDA's role in establishing remote work facilities in India's Smart City and examines its impact and transformation in both urban and rural areas.

Problems

Digital divide: Inadequate reliable internet access and technological infrastructure in rural areas.

Security issues: Security and privacy of data when working from home.

Workplace culture: Maintaining company culture and employee engagement in a virtual environment.

Solution

Scaling digital infrastructure: NKDA built out high-speed internet and other modern technological resources at New Town's work-from-home facilities, shrinking the urban-rural gap.

Secure workspaces: Established remote hubs with secure networks, VPN access, and collaboration tools to keep data safe.

C-Power spaces: Introduced focused workspaces that are supportive and also nurture active collaboration, promoting well-being and balance in the workplace.

Impact

Boosted efficiency: Better utilization of time with flexible working hours and no need to commute.

Creation of jobs and inclusivity: Allowed rural, women, and differently-abled people to tap into urban job opportunities.

Rural-urban integration: Work-from-anywhere centers enabled seamless collaboration between rural and urban workforces.

Overall Conclusion of Case Studies

These case studies demonstrate how leading Indian organizations have taken further steps with the help of digital tools to achieve greater workplace productivity. The key points include the following:

Strategic adoption of technology: There are considerable productivity improvements when digital activities are synchronized with business objectives.

Employee engagement: There is a return on investment in employees as the organization trains the workforce on new technologies.

Customer-centric approach: Enhancing customer experience drives the adoption of digital services and increases loyalty.

Overcoming challenges: It is important to address issues such as skill gaps, operational inefficiencies, and changing customer expectations for successful digital transformation.

Digital Workplace: Enhancing Productivity and Sustainability

The digital workplace plays a critical role in enhancing productivity while contributing to the broader goals of sustainability, aligning with the "People, Planet, Profit" framework (based on the Triple Bottom Line theory). By leveraging digital tools and processes, organizations can improve operational

efficiency, reduce time-consuming manual tasks, and enhance collaboration across remote (BCG and NASSCOM. (2022) and hybrid teams. The increasing adoption of digital technologies is also contributing to GDP growth by creating new economic opportunities, improving infrastructure, and promoting innovation. These advancements not only enhance employee productivity but also promote a more sustainable work environment. Remote work capabilities reduce the need for physical office spaces and commuting, cutting carbon emissions and resource consumption, thus benefiting the planet. At the same time, streamlined operations and reduced costs contribute to improved profitability. A well-integrated digital workplace helps organizations align their productivity goals with sustainability, ensuring they remain competitive while positively impacting both people and the planet.

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MALAYSIA

Introduction

Digital workspaces have transformed how organizations operate, driven by advancements in cloud computing and artificial intelligence (AI). In Malaysia, the COVID-19 pandemic accelerated this shift, pushing businesses to adopt remote work models and invest in digital infrastructure to maintain operations. This transformation has required organizations to rethink traditional productivity metrics and adopt a more comprehensive approach to assessing employee performance.

Digital workspaces offer several advantages, including enhanced flexibility, reduced operational costs, and improved scalability. Employees benefit from greater autonomy and improved work-life balance. However, the transition to digital workspaces also presents challenges, particularly in managing virtual teams and addressing the digital divide between regions with varying access to technology.

Traditional productivity measures, such as hours worked and task completion rates, are now insufficient. Organizations are increasingly adopting holistic approaches that focus on collaboration, communication, and use of technology. Key performance indicators (KPIs) in digital environments now include metrics such as output per employee, task completion rates, and employee engagement, reflecting the need for effective digital collaboration.

Government initiatives, such as the Malaysia Digital Economy Blueprint (MyDIGITAL), play a crucial role in fostering digital transformation across the country. However, challenges such as the digital divide between urban and rural areas persist, limiting the full potential of digital workspaces. Bridging this gap is essential to ensure that businesses of all sizes can benefit from digital tools and maintain productivity gains.

The future of digital workspaces in Malaysia is promising, with continued investments in digital infrastructure and workforce development. Technologies such as AI, blockchain, and the internet of things (IoT) are expected to further enhance productivity by automating routine tasks and providing real-time insights into operations. However, addressing digital inequality will remain a key challenge in ensuring that all businesses and workers benefit from digital transformation.

Overview of Digital Workspaces

The rise of digital workspaces has marked one of the most transformative shifts in modern organizational management. A digital workspace may be defined as a virtualized environment where employees leverage digital tools and platforms to collaborate, communicate, and perform their tasks remotely. The trend of digital workspaces has been accelerated by advances in technology, such as cloud computing and AI (Dwivedi et al., 2020). These technologies have reshaped how organizations operate, transitioning from traditional office-based settings to flexible digital environments.

In Malaysia, the adoption of digital workspaces was significantly catalyzed by the COVID-19 pandemic. Companies were compelled to adopt remote working models to ensure business continuity during government-mandated lockdowns (Kraus et al., 2022). This shift forced businesses across various sectors, including education, finance, and healthcare, to rethink their operational strategies and invest in digital infrastructure (Priyono et al., 2020). The rapid adoption of remote work tools such as Microsoft Teams, Slack, Zoom, and document-sharing services like Google Drive and Dropbox became essential for maintaining collaboration in a geographically dispersed workforce.

From an organizational perspective, digital workspaces offer several advantages, including increased flexibility, cost reduction, and the potential to scale operations globally. Employees benefit from more autonomy, managing their work schedules more efficiently and achieving better work-life balance (Stofberg et al., 2021). Digital workspaces also present opportunities for greater inclusivity, enabling participation from workers in remote or underserved areas. However, this transition also highlights challenges, such as ensuring digital equity and the ability to manage virtual teams effectively (Kurdy et al., 2023).

Productivity in Digital Workspaces

The measurement of productivity in digital workspaces has evolved beyond traditional metrics such as task completion rates and hours worked. In traditional offices, productivity was typically monitored by tracking physical attendance, task milestones, and employee efficiency. However, in the digital realm, where face-to-face interactions are limited, productivity measurement focuses more on collaboration, communication, and effective use of technology (Vial, 2019).

In the Malaysian context, productivity in digital workspaces is measured by how effectively employees engage with digital tools, share information, and communicate in real time (Kraus et al., 2022). Various tools have emerged to facilitate this, including digital dashboards and automated performance reports, which provide real-time analytics on key performance indicators (KPIs) such as project progress, employee engagement, and collaboration efficiency. These tools allow managers to assess the workforce's productivity more holistically, taking into account not only the quantity of work produced but also the quality of collaboration and innovation.

Nonetheless, the shift to digital workspaces has introduced complexities in monitoring productivity. Remote work environments offer flexibility and autonomy, but they also blur the boundaries between professional and personal life, making it difficult to balance flexibility with accountability (Dwivedi et al., 2020). Additionally, ensuring that employees remain engaged and focused in the absence of direct supervision is another challenge that organizations must address.

The Malaysian Context

The transition to digital workspaces in Malaysia has been shaped by the unique economic and social landscape of the country. Before the pandemic, Malaysia was already undergoing a digital transformation, particularly in urban areas and sectors like information and communication technology (ICT). However, the COVID-19 pandemic significantly accelerated this trend, prompting businesses across sectors, including small and medium-sized enterprises (SMEs), to rapidly adopt digital workspaces to maintain operations during movement control orders (Roba & Milos, 2023).

The Malaysian government's efforts, through initiatives such as the Malaysia Digital Economy Blueprint (MyDIGITAL), aim to transform the country into a digitally driven economy by 2030.

This blueprint outlines key strategies for improving digital infrastructure, fostering innovation, and enhancing the competitiveness of Malaysian businesses on the global stage (Unit, 2021). Digital workspaces are central to this transformation, as they enable businesses to adapt to the growing demands of a global digital economy.

However, challenges remain, particularly regarding the digital divide between urban and rural areas. In Malaysia, businesses in urban centers have been quicker to adopt digital workspaces due to better access to high-speed internet and advanced digital tools. In contrast, businesses in rural regions face significant barriers, including poor internet connectivity and limited access to technology, which hampers their ability to fully leverage digital workspaces (Priyono et al., 2020). Bridging this divide is crucial for ensuring that all sectors of the Malaysian economy can benefit from the productivity gains offered by digital workspaces.

Significance of Measuring Productivity in Digital Workspaces

Understanding how productivity is measured in digital workspaces is critical for organizations seeking to evaluate the effectiveness of remote-work models. Traditional productivity metrics, such as the number of tasks completed or hours worked, may not provide a complete picture in digital environments where collaboration and communication are equally important. The adoption of digital workspaces requires a more holistic approach to measuring productivity, encompassing factors such as employee engagement, communication efficiency, and the ability to innovate (Kraus et al., 2022).

In Malaysia, measuring productivity has become increasingly important as businesses adjust to new operational models. The Malaysian Productivity Corporation (MPC) has, through its Industry4WRD initiative, introduced frameworks that encourage businesses to leverage digital tools and data analytics to track productivity and improve performance (MPC, n.d.). These frameworks emphasize the importance of integrating advanced technologies, such as AI and cloud computing, to enhance productivity across various sectors.

Furthermore, the rise of gig work and freelancing in Malaysia has highlighted the need for more adaptable productivity metrics. With an increasing number of workers operating outside traditional employment models, businesses must develop flexible productivity measurements that reflect the realities of the digital economy. By developing comprehensive productivity metrics tailored to digital workspaces, Malaysian businesses can optimize operations, foster innovation, and remain competitive in a rapidly changing global market.

Theoretical Framework for Digital Workspaces

The adoption of digital workspaces requires an understanding of various theoretical models that guide organizational behavior, leadership, and technology acceptance. These frameworks help organizations evaluate how digital transformation impacts work environments and productivity, providing a foundation for managing transitions from traditional to digital workspaces. In Malaysia, these frameworks play an essential role in the digital transformation of organizations across various sectors. This section delves into key theoretical models, focusing on organizational behavior, leadership, and technology acceptance in the context of digital workspaces.

Organizational Behavior and Leadership in Digital Workspaces

Leadership and organizational behavior are integral to the success of digital workspaces. In traditional work environments, leadership relied heavily on face-to-face communication, direct

oversight, and hierarchical structures. However, digital workspaces necessitate new leadership approaches that accommodate remote work, virtual teams, and integration of collaborative digital tools (Khan et al., 2020).

Transformational leadership has been identified as a critical model in managing remote teams within digital workspaces. Transformational leaders inspire, motivate, and foster innovation by establishing a shared vision, building trust, and encouraging autonomy (Gajendran & Harrison, 2007). In the Malaysian context, leaders in SMEs that embraced digital workspaces during the COVID-19 pandemic were more successful in maintaining productivity, particularly in organizations where leaders promoted a culture of digital innovation (Rozmi et al., 2019).

One of the major challenges in leading digital workspaces is maintaining employee engagement and ensuring that teams remain aligned with organizational goals. In digital environments, where direct supervision is limited, leaders must establish clear communication channels and performance metrics. Additionally, the shift toward flexible work arrangements requires leaders to focus on output and performance rather than physical presence. Studies show that in Malaysia, leaders who adapted to these new demands by using digital tools such as Microsoft Teams and Google Workspace saw significant improvements in team collaboration and productivity (Unit, 2021).

Technology Acceptance Models in Digital Workspaces

The success of digital workspaces heavily depends on employees' acceptance and use of digital tools. The Technology Acceptance Model (TAM), developed by Fred Davis (Davis, 1989), is a widely used framework to explain how individuals adopt new technologies. According to TAM, two key factors influence technology acceptance: perceived usefulness (PU) and perceived ease of use (PEOU). PU refers to an individual's belief that using a specific technology will enhance job performance, while PEOU refers to how easy the individual finds the technology to use.

In the context of digital workspaces in Malaysia, PU has been identified as a significant factor in driving technology adoption, particularly among SMEs. A study conducted on ICT adoption in Malaysian SMEs found that 60% of respondents considered PU as a critical determinant of technology acceptance, with many citing that digital tools allowed them to streamline operations and increase efficiency (Rozmi et al., 2019). However, the lack of technical support and infrastructure posed barriers to adoption, as 45% of participants reported challenges in effectively utilizing digital tools due to inadequate training and resources.

TAM has been extended in various studies, such as the Unified Theory of Acceptance and Use of Technology (UTAUT), which adds factors like social influence and facilitating conditions to explain technology adoption in more complex settings (Venkatesh et al., 2003). Social influence, in particular, plays a significant role in Malaysia's collectivist culture, where peer recommendations and social norms strongly affect technology adoption. A study on digital banking in Malaysia revealed that most of users adopted new digital services based on recommendations from colleagues and peers, underscoring the importance of social influence in digital transformation (Koh et al., 2024).

Digital Workspaces vs. Traditional Workspaces

The transition from traditional to digital workspaces represents a fundamental change in how organizations manage employees and measure productivity. Traditional workspaces are characterized by fixed schedules, physical proximity, and face-to-face interactions, where productivity is often evaluated based on hours worked and task completion. In contrast, digital

workspaces emphasize flexibility, allowing employees to work remotely and use digital tools to manage tasks and collaborate asynchronously (Morganson et al., 2010).

One of the key distinctions between traditional and digital workspaces is how productivity is measured. In traditional environments, managers often rely on physical presence and direct supervision to gauge performance. However, in digital environments, productivity metrics shift toward outcomes such as project completion rates, quality of work, and collaboration efficiency (Gajendran & Harrison, 2007). Digital tools, such as project management software and cloud-based collaboration platforms, enable managers to track work progress in real time, offering greater transparency and accountability.

In Malaysia, the adoption of digital workspaces has been particularly significant in sectors such as finance, education, and public services. A study on ICT adoption in Malaysian public services found that the majority of employees acknowledged the improvement in productivity brought by digital tools. However, concerns about data privacy and security were prevalent, particularly in sectors handling sensitive information (Ambali & Bakar, 2014). These findings highlight the need for robust data security measures in digital workspaces to protect sensitive information and maintain trust in digital tools.

Conclusion of Theoretical Frameworks in Digital Workspaces

The theoretical frameworks discussed in this section provide valuable insights into how leadership, technology acceptance, and workspace structures influence productivity in digital environments. Transformational leadership has emerged as a critical factor in managing remote teams, fostering innovation, and maintaining employee engagement. Additionally, models like TAM and UTAUT offer robust frameworks for understanding how employees accept and use digital tools. The shift from traditional to digital workspaces represents both opportunities and challenges for organizations in Malaysia. By leveraging these theoretical insights, Malaysian businesses can enhance productivity, foster innovation, and successfully navigate the transition to digital workspaces.

Productivity Metrics in Digital Workspaces in Malaysia

Productivity measurement is vital for assessing economic growth and labor efficiency, particularly in today's rapidly evolving digital workspaces. Traditionally, productivity in physical office environments was measured by metrics such as hours worked, task completion rates, and output per employee. However, the shift to digital workspaces necessitates updated productivity metrics that reflect the new dynamics of remote work and digital collaboration.

In Malaysia, the emphasis on digital workspaces is growing, and this shift has compelled businesses to rethink how they measure productivity. The rise of remote working, driven by the COVID-19 pandemic, has highlighted the need for businesses to develop more nuanced ways to measure how effectively employees are performing in digital environments (Vial, 2019). This section explores key productivity metrics within the Malaysian context, discussing how these have evolved with the rise of digital workspaces.

Common Productivity Metrics in Digital Workspaces

In digital workspaces, productivity metrics must encompass more than just task completion or hours worked. Instead, they must include measures related to communication, collaboration, and technology usage (see Table 1).

TABLE 1

COMMON PRODUCTIVITY METRICS IN DIGITAL WORKSPACES.

No.	Aspect	Traditional KPIs	Digital workspace KPIs
1.	Task monitoring	Relies on manual tracking and supervisor oversight to evaluate task completion and accountability.	Uses automated tools like project management software (e.g., Asana, Jira), to monitor task progress in real time.
2.	Collaboration	Collaboration is measured through in-person meetings, physical reports, and shared paper-based workflows.	Digital platforms (e.g., Slack, Microsoft Teams) provide metrics on team interactions, file-sharing activity, and collaborative document editing.
3.	Employee engagement	Evaluated through periodic surveys, one-on-one interviews, and attendance at meetings or events.	Measured through continuous digital metrics, such as tool usage, communication activity logs, and satisfaction surveys integrated into platforms.
4.	Time management	Tracked working hours and task completion using manual time logs or punch-in systems.	Analyzes detailed time tracking and allocation via tools such as RescueTime and Toggl to identify productivity patterns.
5.	System availability	Focused on physical infrastructure, measuring equipment failures or downtime that disrupt workflows.	Monitors uptime and reliability of digital services (e.g., cloud systems, video conferencing) to minimize disruptions.
6.	Technology adoption	Limited to monitoring the use of office tools, such as desktops, e-mails, and printers, with basic assessments.	Tracks digital adoption of tools (e.g., cloud storage or workflow automation) and calculates their impact on performance.
7.	Error reduction	Captured error rates manually through quality control processes, often subjective or prone to inaccuracies.	Uses advanced analytics and AI tools to quantify error reductions and improvements in workflows after automation.
8.	Cost efficiency	Evaluated expenses through traditional budgeting processes, often with a focus on resource savings.	Measures cost reduction through cloud migration, automation savings, and reduced paper and travel expenses.
9.	Knowledge sharing	Based on physical exchanges like meetings, seminars, or shared office resources.	Assessed through data shared in centralized knowledge hubs, collaboration tools, and document repositories.
10.	Employee retention	Relied on turnover rates and exit interviews to identify reasons for leaving and areas of improvement.	Tracks engagement with digital systems and flexibility provided by remote or hybrid work models to analyze retention.

Source: Vial (2019).

These productivity metrics shift the focus from just hours worked to the quality of output, the effectiveness of communication, and the ability to innovate and adapt to changing work conditions.

Measuring Digital Productivity in Malaysia

In Malaysia, organizations have increasingly adopted digital tools to measure productivity in remote work settings. Tools such as Google Workspace, Zoom, and other collaborative platforms allow managers to monitor progress in real time and track employee engagement. Malaysian

businesses, particularly in the finance, healthcare, and education sectors, have embraced these technologies to adapt to remote work and continue operations efficiently (Unit, 2021).

For example, the Malaysian banking sector, which had traditionally relied on face-to-face interactions, adopted digital productivity tools during the pandemic. These tools not only facilitated remote collaboration but also allowed banks to monitor key metrics like customer service efficiency, loan processing time, and overall employee performance from a distance (Priyono et al., 2020).

Case Studies: Productivity Metrics in Malaysia's Financial and Manufacturing Sectors

Financial Sector: CIMB Group

The COVID-19 pandemic dramatically accelerated digital transformation in the Malaysian financial sector, as banks adapted to new customer needs while maintaining operational efficiency. CIMB Group, one of the largest financial institutions in Southeast Asia, quickly integrated digital solutions to meet this demand. CIMB's 2021 Annual Report highlights a shift toward digital transactions, which increased by 47.7% year-on-year from pre-pandemic levels in 2020 (Sustainable & Returns, 2021). This was driven by enhanced mobile and internet banking services, which allowed customers to perform transactions without visiting physical branches.

The company also improved its loan processing efficiency through digital tools. Loan processing times were reduced from 5.8 days in 2019 to 4.1 days in 2021, representing an improvement of 29% (see Table 2). The adoption of AI-powered chatbots and digital customer-service platforms resulted in an increase of 10% in customer satisfaction, as customer service efficiency improved by 20% during the pandemic.

TABLE 2

PRODUCTIVITY METRICS FOR CIMB GROUP.

Metric	Pre-COVID (2019)	During COVID (2020–21)	Improvement (%)
Loan processing time (days)	5.8	4.1	29%
Digital transaction volume (%)	61%	85%	39%
Customer service satisfaction	70%	80%	10%
Employee engagement	60%	75%	25%

Source: Sustainable & Returns (2020).

CIMB's ability to streamline operations through digitalization demonstrates the importance of technology adoption in the financial sector during times of crisis. The use of digital dashboards, remote working tools, and AI allowed the company to maintain a high level of service and customer satisfaction despite the challenges posed by the pandemic.

Manufacturing Sector: Top Glove

The manufacturing sector, particularly the healthcare-related industries, saw a sharp increase in demand during the COVID-19 pandemic. Top Glove, the world's largest manufacturer of rubber gloves, was at the forefront of this surge in demand. The company leveraged digital tools and Industry 4.0 technologies to enhance productivity and ensure operational continuity.

During the pandemic, Top Glove increased its production output by 20%, primarily through the use of automation and real-time monitoring systems (Tg et al., 2021). These technologies allowed the

company to track production in real time, reducing machine downtime from 9% to 6% (see Table 3). Additionally, the company's implementation of automated quality control systems reduced error rates by 12%, ensuring that the surge in demand did not compromise product quality.

TABLE 3**PRODUCTIVITY METRICS FOR TOP GLOVE.**

Metric	Pre-COVID (2019)	During COVID (2020–21)	Improvement (%)
Output per hour (units)	1,100	1,320	20%
Machine downtime (%)	9%	6%	33%
Quality control error rate	4.5%	4%	12%
Employee productivity index	70%	82%	17%

Source: Tg et al. (2021).

The adoption of Industry 4.0 technologies by Top Glove highlights the transformative impact of digitalization in the manufacturing sector. By investing in automation and digital monitoring, the company was able to scale operations rapidly and maintain high productivity levels during one of the most challenging periods for global manufacturing.

Public Sector Case Study: Malaysian Public Services

The Malaysian public sector, led by Malaysian Administrative Modernisation and Management Planning Unit (MAMPU), has undergone significant digital transformation through initiatives such as HRMIS 2.0 and the Public Sector Digitalisation Strategic Plan (PSDSP 2021–25). These efforts have enhanced service efficiency, reducing response times and improving overall productivity. A key success has been the implementation of the Government Online Services (GOS) Gateway, which integrates services from multiple government agencies. This has reduced bureaucracy and service processing times, with 35% faster response times recorded by the 1Malaysia One Call Centre (1MOCC) (Ministry of Science, Technology, n.d.).

Additionally, the Information Exchange Hub has improved communication between departments, leading to a 20% increase in public sector productivity, especially in areas like tax collection and land registration. During the COVID-19 pandemic, the digital infrastructure enabled over 700 federal agencies to maintain operations, demonstrating the resilience of Malaysia's public sector. This contributed to Malaysia improving its rank in the United Nations Online Services Index, moving from 40th place in 2015 to 28th in 2020 (see Table 4).

TABLE 4**PRODUCTIVITY METRICS FOR MALAYSIAN PUBLIC SERVICES.**

Metric	Pre digitalization	Post digitalization
Response time reduction (1MOCC)	N/A	35% reduction
Public sector productivity increase	N/A	20% increase
Number of agencies connected	Few agencies	700+ agencies
UN Online Service Index Rank (2020)	40th (2015)	28th (2020)
Transactions via MyGOV app	N/A	2 million in the first year

Source: Ministry of Science, Technology.

Furthermore, the MyGOV mobile application streamlined public transactions, enabling over 2 million transactions in its first year and improving accessibility to services such as license renewals and tax submissions. The adoption of AI-driven analytics and blockchain technology is expected to drive further efficiency, while automating routine tasks and improving governance.

GDP per Labor Hour and GDP per Worker in Malaysia

The Malaysian government has been proactive in implementing productivity frameworks through initiatives such as Industry4WRD, which has driven substantial improvements in GDP per worker. Between 2018 and 2023, GDP per worker grew by 25%, driven by digital tools, workforce upskilling, and the adoption of Industry 4.0 technologies. The MPC plays a central role in fostering these advancements.

Two essential metrics for understanding the national productivity are GDP per labor hour and GDP per worker. These metrics reflect the economic output produced per hour worked and per worker, respectively, and are critical indicators of labor efficiency in the digital age. Table 5 provides the data for GDP per labor hour and GDP per worker in US dollars, with a preference for purchasing power parity (PPP) where available (Bank, n.d.)(CEIC Data, n.d.).

TABLE 5

PRODUCTIVITY METRICS IN MALAYSIA, 2000–23.

Year	GDP per labor hour (USD, PPP)	GDP per worker (USD, PPP)
2000	USD13.5	USD18,500
2005	USD16.7	USD23,000
2010	USD21.4	USD31,600
2015	USD25.8	USD39,700
2018	USD30.0	USD44,500
2020	USD28.5	USD42,800
2023	USD33.2	USD48,500

Source: Department of Statistics Malaysia (2024).

Between 2000 and 2023, Malaysia's GDP per labor hour increased from USD13.5 to USD33.2, reflecting a steady rise in labor productivity due to the adoption of digital technologies. Similarly, GDP per worker grew from USD18,500 to USD48,500, driven by the increased use of digital tools in high-value industries such as electronics, manufacturing, and services (Department of Statistics Malaysia, 2024).

These trends demonstrate how digital tools, automation, and cloud-based platforms have helped Malaysian workers produce more output per hour and per individual. The integration of digital workspaces into these sectors has allowed companies to streamline operations, reduce downtime, and increase output, thereby leading to substantial gains in productivity.

Key Drivers of Productivity Growth in Digital Workspaces

Several factors have contributed to productivity growth in Malaysia's digital workspaces:

- **Technological advancements:** The adoption of cloud computing, AI, and big data analytics has streamlined operations and increased productivity in multiple sectors. In

manufacturing, AI and robotics have optimized production processes, while in finance, data analytics has improved decision-making (Nagel, 2020).

- **Workforce upskilling:** The Malaysian government has invested in upskilling programs, such as technical and vocational education and training (TVET), to equip workers with the skills required to thrive in digital environments. Workers with a strong understanding of digital tools and technologies are better able to collaborate, innovate, and increase their overall productivity.
- **Government initiatives:** Policies such as the Malaysia Digital Economy Blueprint (MyDIGITAL) and the Industry4WRD initiative have encouraged companies to adopt digital technologies. By providing incentives for businesses to invest in Industry 4.0 technologies, the government has facilitated productivity gains across various sectors (Unit, 2021).

Future Prospects for Measuring Productivity in Digital Workspaces

The future of measuring productivity in Malaysia's digital workspaces looks promising, with continued investments in technology and human capital. As businesses increasingly adopt hybrid working models, combining remote and in-office work, the demand for flexible productivity metrics will grow. Emerging technologies such as blockchain, AI, and the internet of things (IoT) will further transform how organizations measure and improve productivity.

However, challenges remain. The digital divide between urban and rural areas continues to be a significant barrier to productivity improvements, as businesses in rural regions struggle with poor internet connectivity and limited access to digital tools. Addressing these challenges through infrastructure development and continuous workforce training will be critical to ensuring that Malaysia fully capitalizes on the productivity potential of digital workspaces (Fang et al., 2022).

Digital Transformation in Malaysia

While digital transformation is widely regarded as a driver of innovation, its success also hinges on a country's legal infrastructure and governance frameworks. In countries like Malaysia, where technological adoption is prioritized, the development of supportive laws and guidelines is crucial to ensuring that businesses can navigate the complexities of a rapidly digitalizing economy (Vial, 2019).

The role of governance in managing this transformation cannot be understated, as it establishes the rules by which digital tools and platforms operate. Future progress in this field will likely depend on the government's ability to legislate effectively, fostering an environment where technological advancements are securely integrated into the national economy (Priyono et al., 2020).

Malaysia Digital Economy Blueprint (MyDIGITAL)

MyDIGITAL Blueprint, Malaysia's ambitious plan to evolve into a digital-first economy by 2030, is pivotal in driving digital transformation across various sectors. Launched in 2021, MyDIGITAL aims to elevate Malaysia's digital infrastructure, increase digital literacy, and nurture highly skilled digital talent. The Blueprint's emphasis on an inclusive digital society addresses digital inequalities, particularly between urban and rural regions, thereby creating an environment where all citizens can benefit from technological advancements. Its focus on upskilling the workforce is essential to enhance productivity, as a digitally literate workforce can leverage technology more efficiently within digital workspaces (Unit, 2021).

Digital Transformation in Malaysian Workspaces

In Malaysian workspaces, digital transformation has led to a fundamental shift in how businesses operate and measure productivity. The widespread adoption of remote and hybrid work models, particularly during and after the COVID-19 pandemic, has transformed traditional office environments into digital workspaces where employees collaborate using digital tools such as Zoom, Microsoft Teams, and Google Workspace.

For many organizations in Malaysia, this transformation has resulted in significant productivity gains. In industries such as finance, healthcare, and education, digital platforms have enabled employees to work flexibly while maintaining high levels of productivity. A report by PwC (2021) highlighted that many Malaysian businesses encountered difficulties in transitioning to digital workspaces, particularly due to challenges in technology infrastructure and cybersecurity. However, as these challenges were addressed, businesses saw improvements in operational efficiency, cost reductions, and employee satisfaction. The adoption of digital tools has also allowed Malaysian companies to streamline operations, automate routine tasks, and focus more on higher-value work. For instance, in the finance sector, banks that embraced digital transformation have optimized customer service operations and improved data management processes, leading to faster transaction processing times and higher customer satisfaction (Priyono et al., 2020).

Industry 4.0 in Malaysia

Industry4WRD complements the MyDIGITAL Blueprint by targeting the manufacturing sector—a vital contributor to Malaysia's economy. This policy encourages the adoption of Industry 4.0 technologies, including the Internet of Things (IoT), Artificial Intelligence (AI), and big data analytics. By fostering smart manufacturing, Industry4WRD enables Malaysian industries to automate processes, optimize production, and make data-driven decisions, ultimately leading to significant productivity gains. Notably, Industry4WRD provides financial support and technical assistance to small and medium enterprises (SMEs), facilitating their transition into digitally advanced entities capable of competing on a global scale. Together, MyDIGITAL and Industry4WRD form a synergistic policy framework, underpinning Malaysia's drive towards a digitally inclusive and economically resilient future (Malaysia Economic Monitor: Expanding Malaysia's Digital Frontier, February 2023) (Soomro et al., 2021).

Challenges to Digital Transformation in Malaysia

Despite the significant advantages offered by digital transformation, Malaysia faces several challenges in achieving a fully digital economy. One of the most pressing challenges is the digital divide between urban and rural areas. While urban centers like Kuala Lumpur benefit from advanced digital infrastructure and high-speed internet access, rural areas often lack access to basic digital tools and reliable internet connectivity. This divide limits the ability of businesses and workers in these regions to fully participate in the digital economy (Fang et al., 2022).

Another significant challenge is the lack of cohesive digital transformation legislation, which creates regulatory uncertainty for businesses and industries undergoing transformation. Without clear laws governing digital practices, companies may face legal and operational risks when adopting new technologies (Ahmad et al., 2021). Furthermore, the absence of specific governance frameworks related to cybersecurity and data privacy has left gaps that need to be addressed to protect businesses and individuals from digital threats.

Another challenge is the reluctance among certain sectors of the workforce to embrace digital tools, often due to a lack of digital literacy or fears about job displacement caused by automation. Traditional industries such as agriculture and construction, which are less digitized, have been slower to adopt digital transformation initiatives. Moreover, concerns about data privacy, cybersecurity, and job security remain significant barriers to digital adoption in Malaysia (ILO, 2020).

To address these challenges, the Malaysian government has introduced various programs aimed at increasing digital literacy and upskilling workers in sectors that are lagging in digital adoption. Training initiatives, such as the TVET programs, aim to equip workers with the skills needed to thrive in the digital economy. Additionally, government initiatives to expand broadband access in rural areas will be critical to ensuring that all Malaysians can benefit from digital transformation.

The Future of Digital Workspaces in Malaysia

The future of digital workspaces in Malaysia is poised for significant growth. The ongoing investment in digital infrastructure, coupled with strong government support and private-sector innovation, will continue to drive the adoption of digital tools across all sectors. As businesses increasingly embrace hybrid work models, combining remote and in-office work, the demand for digital workspaces is expected to rise.

Technological advancements such as AI, blockchain, and IoT are playing an increasingly significant role in shaping the future of digital workspaces in Malaysia. The Malaysian government has begun integrating these technologies to improve public-sector efficiency, while businesses are leveraging AI to automate tasks and blockchain for secure data management (Kumar et al., 2023). IoT devices will further enable real-time monitoring of operational performance, helping businesses optimize workflows and improve the overall productivity.

However, for Malaysia to fully capitalize on these opportunities, it must address the ongoing challenges related to digital inequality and workforce training. Expanding broadband access to underserved areas and continuing to invest in digital skills development will be crucial to ensuring that all sectors of the society can benefit from the digital economy.

Digital-related Laws and Governance in Malaysia

One critical area that significantly influences the outcome of digital transformation in Malaysia is the legal and regulatory framework surrounding digital policies and governance. At present, Malaysia's digital governance structure is evolving but remains underdeveloped in certain areas, including e-government, cybersecurity, privacy, and the digital workplace. The absence of comprehensive digital transformation-specific legislation poses challenges in ensuring consistency and accountability in how digital technologies are adopted across industries.

Current digital policies, such as the MyDIGITAL Blueprint and Industry4WRD, outline clear objectives for technological progress, but they lack a formalized regulatory environment that can adapt to rapidly advancing technologies. To bridge this gap, additional legislative measures should be introduced. For instance, clearer guidelines on data protection and privacy are needed, especially as digital workplaces increasingly rely on cloud computing and digital communication platforms, which could expose sensitive data to breaches.

The development of robust digital governance frameworks will also be essential in addressing the risks associated with cybersecurity. As Malaysia pushes forward with its digital economy agenda,

there is an increasing need for comprehensive cybersecurity laws that cover all sectors, ensuring that businesses are protected against evolving cyber threats. Furthermore, governance policies that establish clear standards for digital workplace practices, including remote work and employee monitoring, would provide businesses with the necessary guidance to navigate this rapidly changing landscape.

Governance and AI in Malaysia

AI stands as a pivotal enabler of productivity, economic resilience, and innovation in the Fourth Industrial Revolution (4IR). Effective AI governance is essential for fostering ethical implementation and aligning AI deployment with Malaysia's strategic objectives, such as the Shared Prosperity Vision 2030 and Sustainable Development Goals. Malaysia's National Artificial Intelligence Roadmap (AI-Rmap) 2021–25 serves as a strategic guide for leveraging AI to drive economic growth, societal benefit, and global competitiveness (MOSTI, 2021). This subsection explores the importance of AI governance, reviews relevant literature, analyzes Malaysia's current AI governance strategies, and identifies challenges and opportunities for improvement.

AI Governance and Productivity

AI governance encompasses policies, regulations, and ethical guidelines designed to manage the risks and opportunities associated with AI implementation. Robust governance frameworks must address critical concerns such as privacy, security, transparency, and inclusiveness while fostering innovation. Research emphasizes the importance of governance in accelerating AI adoption and improving productivity, particularly through automation, predictive insights, and enhanced decision-making processes (Dwivedi et al., 2020).

Malaysia's AI-Rmap identifies governance as a critical enabler of digital transformation. The roadmap highlights the establishment of the AI Coordination and Implementation Unit (AI-CIU) to oversee policy formulation, ethical compliance, and risk management. Internationally, countries such as Singapore and the UK serve as benchmarks for integrating AI governance into their productivity strategies, focusing on ethical implementation and cross-sector collaboration (OECD, 2021). Empirical studies underscore the significance of AI governance in enhancing productivity. AI systems designed with ethical standards and robust data privacy measures are more likely to gain user trust, fostering widespread adoption and improving operational efficiency (Ghobakhloo et al., 2011). Transparent and accountable AI tools also mitigate employee concerns over workplace surveillance, boosting engagement and productivity (Nagel, 2020).

In Malaysia, AI has been successfully integrated into key sectors, including manufacturing, healthcare, and finance. For instance, PETRONAS implemented predictive maintenance using AI on its Dulang platform, achieving cost savings of MYR15 million (MOSTI, 2021). Similarly, public-sector initiatives, such as chatbots introduced in Kumpulan Wang Simpanan Pekerja (KWSP), Malaysia's employees' provident fund, have streamlined customer service operations. However, challenges such as fragmented governance structures and limited talent availability constrain the broader adoption of AI technologies.

Challenges in AI Governance

Malaysia's fragmented governance landscape poses significant challenges to achieving the full potential of AI-driven productivity. Siloed efforts by various agencies often lead to inefficiencies, duplication of resources, and delayed implementation of AI initiatives. A centralized governance model is critical to streamlining these efforts and foster collaboration across sectors.

The shortage of skilled AI professionals is another pressing issue. According to the Malaysian AI Roadmap Survey (2021), demand for data scientists and AI engineers is projected to increase by 115% by 2025. Addressing this shortage requires targeted upskilling programs, partnerships with academic institutions, and financial incentives to attract and retain talent. Additionally, the lack of standardized guidelines for data sharing and cybersecurity exacerbates these challenges, hindering the scalability of AI adoption across industries.

Opportunities and Future Directions

Despite these challenges, Malaysia's AI governance initiatives present significant opportunities for enhancing productivity. The AI-Rmap emphasizes quadruple helix collaboration, i.e., engaging the government, the academia, the industry, and the society, to align stakeholder efforts and drive innovation. Programs such as the Jalinan Digital Negara (JENDELA), which aims to expand broadband access, and the establishment of AI Centers of Excellence (AI-CoE) are critical steps toward fostering an enabling environment for AI development.

Embedding ethical principles, including fairness, accountability, and transparency, into governance frameworks can enhance public trust and drive wider adoption of AI systems. The adoption of global ethical guidelines, such as those proposed by UNESCO and OECD, can further strengthen Malaysia's governance framework. Promoting standardized data-sharing guidelines and secure platforms can also accelerate innovation, particularly in data-driven sectors such as healthcare and finance. Moreover, leveraging public-private partnerships can address talent shortages and ensure the sustainability of AI-related initiatives.

Conclusion

AI governance is a cornerstone of Malaysia's efforts to become a high-tech nation by 2030. The AI-Rmap provides a strategic blueprint for integrating AI into national development priorities through ethical and inclusive frameworks. By addressing challenges such as fragmented governance and talent shortages and capitalizing on opportunities for collaboration and ethical implementation, Malaysia can maximize the productivity and societal benefits of AI. A robust governance framework, aligned with global best practices, can position Malaysia as a leader in AI-driven innovation and competitiveness.

Recommendations for Enhancing Digital Workspace

The adoption of digital workspaces in Malaysia has transformed how organizations measure productivity and operate, e.g., during the COVID-19 pandemic. Case studies from sectors such as finance and manufacturing demonstrate how digital tools have enhanced productivity and operational efficiency. However, Malaysia still faces challenges such as the digital divide, data privacy, and the need for continuous workforce upskilling.

Some recommendations for enhancing digital workspaces are:

- (1) **Closing the digital divide:** Investing in improved digital infrastructure, particularly in rural areas, is vital for ensuring equitable access to the digital economy. This includes increasing access to affordable high-speed internet and providing incentives for rural businesses to adopt digital tools (Ghobakhloo et al., 2011).
- (2) **Enhancing cybersecurity and data privacy:** As organizations increasingly rely on digital platforms, the risk of cyberattacks rises. Companies need to implement robust

cybersecurity strategies, including data encryption and regular security audits, to protect sensitive information and build trust in digital tools (Trenerry et al., 2021).

- (3) **Continuous workforce upskilling:** Ongoing training programs are crucial to ensure that employees adapt to new digital tools. Collaborations between the government, educational institutions, and the private sector are needed to deliver upskilling initiatives in areas like AI and data analytics (Unit, 2021).
- (4) **Fostering a digital culture:** Leadership plays a key role in guiding organizations through digital transformation. Transformational leadership that emphasizes innovation and flexibility is essential for fostering a digital culture (Ghobakhloo et al., 2011).
- (5) **Supporting SMEs in digital transformation:** SMEs often face barriers in adopting digital technologies due to financial and resource constraints. Providing financial incentives and access to digital advisory services will help SMEs implement digital tools (Ghobakhloo et al., 2011).

The future of digital workspaces in Malaysia is promising, driven by continued investments in infrastructure and workforce development. Organizations that embrace digital tools, prioritize employee training, and strengthen cybersecurity will be better positioned to compete globally. Addressing the digital divide and fostering a digital culture will be crucial for ensuring that all sectors benefit from digital transformation.

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MONGOLIA

Executive Summary

Mongolia is a landlocked country situated in Central Asia, bordered on the north by Russia and on the south by the PR China. The total land area is 1,564.1 thousand sq km. The total population of Mongolia was 3,504.7 thousand in 2023 (Strategies for Enhancing SME Business Continuity in APO Developing Economies, 2024).

Mongolia's economic growth is rising steadily. It attained a three-fold increase in GDP over the last three decades, with its GDP per capita reaching USD5,033 in 2022. The country's economy is mostly based on mineral commodities, which accounted for 22% of the GDP and 61% of the industrial value added (NSO, 2023).

Mongolia, being one of the most sparsely populated countries with a rich history and nomadic culture, has been challenged to accelerate its economic and social development in the age of information technology (IT) and digitalization. Over the last 10 years, the IT goods and services sector has expanded significantly, and Mongolia's young and adaptable population has embraced IT products for both personal and professional use. Disruptive technologies, including artificial intelligence (AI), blockchain, and advanced data analytics, have already been introduced to Mongolia (Access solutions LLC, 2019, p. 6).

We are living in a technology-dependent era. Technology allows us to save time and provides us with the opportunity to complete each task faster and more efficiently (MONTSAME, Digitalization is an opportunity to develop collectively, and win together, 2022). According to the International Telecommunications Union (ITU), Mongolia boasts of higher overall internet connectivity than the global and regional averages. In Mongolia, digital technology is being introduced into the financial sector, public services, the mining industry, the automotive industry and other major economic sectors.

The Government of Mongolia has identified information and communication technologies (ICT) as one of the leading sectors of the economy and is aiming to become a "Digital Nation" over the next five years. Major policy and structural changes are required to accelerate Mongolia's digital transformation (Tumen-Ulzii, N; UNESCAP, 2022).

In this context, a number of systemic and structural changes have been made. For example, to accelerate digital transformation, the erstwhile Communication and Information Technology Authority was reorganized into the Ministry of Digital Development and Communications. Also, the E-Mongolia platform has successfully launched an integrated e-government system (Telecom Review, 2022).

In recent years, the capital city, which is home to almost half of the country's population, has increasingly adopted digital technologies to solve various urban challenges. This trend reflects a larger global shift, where cities around the world are turning to ICT to improve transparency, enhance public involvement, and streamline governmental processes.

In Mongolia, digital transformation is being driven by the telecommunications sector, which plays a key role in implementing emerging technologies. A notable rise in high-speed internet usage has been observed in recent years, primarily as a result of enhanced infrastructure and expanded network capabilities.

Legal Environment

The main legislations for the ICT sector include the Technology Law (1998); the Science and Technology Master Plan 2007–2020; the Law on Science and Technology (2006); the Telecommunications Law (2001); the Law on Radio Frequency; the Law on Postal Services; the Law on Digital Signature; and the Law on Violations. The key strategic document for the ICT sector is the State Policy on the Development of Information and Communications Technology (2017–25) that was enacted within the framework of the Sustainable Development Goal 2030 (Ministry of Digital Development, Innovation and Communications, 2023).

Major Policy and Structural Changes

The Government of Mongolia has announced ICT as one of the leading sectors of the economy and is aiming to become a “Digital Nation” over the next five years. Major policy and structural changes are required to accelerate Mongolia's digital transformation. These are (Tumen-Ulzii, N; UNESCAP, 2022):

- VISION 2050 Long Term Development Policy of Mongolia, ratified by the Parliament of Mongolia in May 2020;
- The Standing Committee on Innovation and e-Policy, established within the Parliament, 2020;
- E Mongolia System and Government online Platform October 2020 (covered more than 994 public services from 83 government organizations, as of 2023);
- The E Mongolia Academy, established in January 2022, to digitalize public services, develop the main and sub systems of e-government, enhance the digital skills of civil servants, and improve the overall digital readiness of the nation;
- The Ministry of Digital Development and Communications, established by the Government of Mongolia in January 2022; and
- The Communications Regulatory Commission (CRC).

The CRC, an independent Mongolian government regulatory authority, has plans to achieve the Digital Nation Mongolia and digital transformation goals (Tumen-Ulzii, N; UNESCAP, 2022):

- The regulatory framework and decisions made by the CRC should be regularly updated, flexible in terms of licensing and spectrum management, and designed to be transparent, fair, and aligned with market demands. These factors are crucial for supporting and accelerating digital transformation across various sectors.
- The parliament has approved a set of laws aimed at advancing the country's digital progress. A key focus will be on ensuring that these laws are effectively implemented, alongside the development of compliance guidelines, technical specifications, and approval processes for new technologies.

- Mongolia faces challenges in the e-commerce space, primarily due to a lack of comprehensive regulations, underdeveloped logistics infrastructure, inconsistent addressing systems, and an insufficiently integrated payment system.
- The Ministry of Digital Development and Communications has approved the procedure for providing services by organizations responsible for the state electronic databases (see Annexure 6).

Law

In recent years, the Parliament of Mongolia has ratified new laws to support digital transformation and Digital Nation Mongolia (Tumen-Ulzii, N; UNESCAP, 2022):

- Basic Sector Legislation Law on Communications Sector 1995, 2001 Radio Wave Law in 1999, and Postal Service Law 2003 were amended by the Parliament in 2019; and
- new legislation for radio and TV broadcasting, Law on Broadcasting, was approved by the Parliament in 2020.

To intensify work on digital transformation and implementation of Digital Nation, IT-related legal environment was improved and four new laws were approved by the Parliament in 2022 (in effect since May 2022). These are:

- Law on Public Information and Transparency;
- Law on Digital Signatures;
- Law on Cyber Security; and
- Law on Personal Data Protection.

Mid-term Policy Targets

In order to achieve the Digital Nation goal, the ICT Sector Medium Term Development Policy document to be implemented during 2022–27 was approved by the Government of Mongolia. This policy document emphasizes on the following aspects (Tumen-Ulzii, N; UNESCAP, 2022):

- Digital infrastructure: Ensure the availability of main infrastructure to meet the growing needs of ICT;
- E-Governance: Create unbureaucratic and transparent e-government;
- Cybersecurity: Establish a national security system in the cyber environment;
- Digital Literacy: Improve digital skills for all;
- Innovation and production: Develop information technology, big data, AI, blockchain-based platforms, national digital content and support to increase the share of economy; and
- National Development Accelerator: The Ministry of Digital Development and Communications aims to introduce ICT products and services to increase competitiveness and efficiency.

TABLE 1

GDP PER EMPLOYED PERSON PER HOUR.

Year	At 2005 constant prices	At 2010 constant prices	At 2015 constant prices	GDP per employed person, USD	GDP per hour 2005	GDP per hour 2010	GDP per hour 2015	1 USD = MNT
2000	2,593.40			2.41	1.39			1,076.47
2001	2,595.20			2.36	1.35			1,097.75
2002	2,598.10			2.34	1.31			1,110.32
2003	2,617.00			2.28	1.24			1,146.53
2004	2,833.10			2.39	1.31			1,185.20
2005	2,988.10			2.48	1.36			1,205.30
2006	3,116.00			2.64	1.36			1,179.60
2007	3,400.10			2.91	1.47			1,170.40
2008	3,622.20			3.11	1.54			1,166.10
2009	3,714.50			2.58	1.48			1,437.90
2010	3,858.70	8,785.30		6.48	1.53			1,356.44
2011	4,567.50	10,394.30		8.21	1.85			1,265.53
2012	5,100.20	11,563.00		8.51	2.01	9.65		1,359.40
2013		12,424.70		8.14		10.3		1,525.72
2014		13,338.10		7.34		10.7		1,818.28
2015		13,099.30	18,633.80	9.46		10.2	14.99	1,970.66
2016		13,281.20	18,980.50	8.84		9.78	14.88	2,147.74
2017		13,011.50	18,517.60	7.59		9.58	13.65	2,440.63
2018		13,751.50	19,759.30	7.99		10.79	14.55	2,472.67
2019		15,824.70	22,980.70	8.63		12.65	18.04	2,663.94
2020			21,578.90	7.67			17.26	2,813.53
2021			22,716.30	7.97			18.54	2,849.29
2022			22,809.10	7.25			18.03	3,144.83
2023			23,859.80	6.88			18.56	3,465.78

Best Practices in Digital Transformation

Public Sector: E-Mongolia Platform

The E-Mongolia system was introduced on 1 October 2020 to make government services accessible online (ADB, 2023). The main achievement is that today it has become a large system that includes 994 services from 83 government organizations. In total, more than 31.7 million services/

frequencies have been provided online through this system. The system currently has 1.64 million users. This means that half of the adult population in Mongolia uses the E-Mongolia platform. A total of 994 most-demanded public services can be availed through this system, e.g., applying for a driving license and applying for a passport. Features such as offering services based on the user's behavior have recently been added (Telecom Review, 2022).

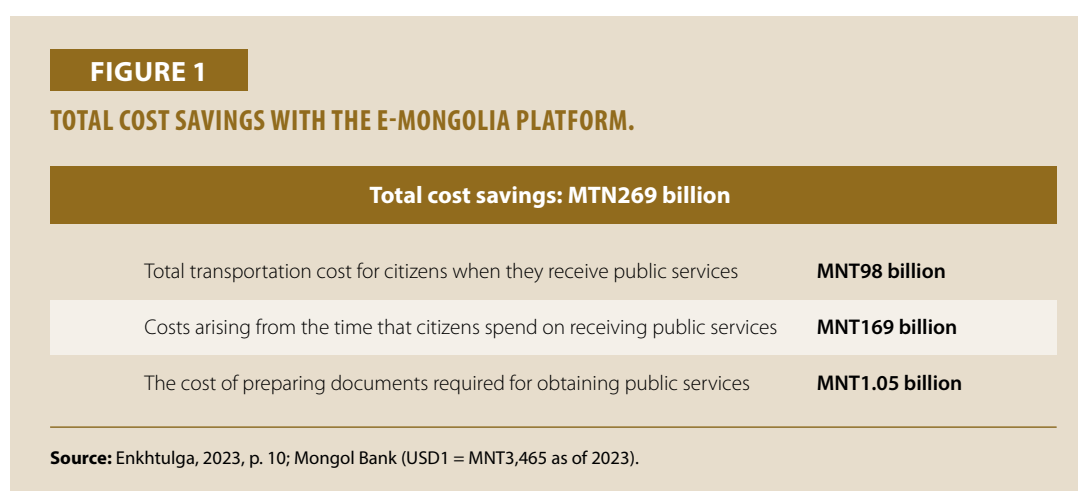
E-Mongolia has broadened its services in six main directions (Enkhtulga, 2023, p. 10):

- (1) e-mongolia.mn (citizens);
- (2) e-business.mn (legal entities);
- (3) lavlagaa.e-mongolia.mn (service providers);
- (4) operator.e-mongolia.mn (Khurdan public service center);
- (5) kiosk.e-mongolia.mn (Khurdan public service machine); and
- (6) Mobile apps.

A total of 670 public services provided with enterprises 24,999 times.

Historically, as per statistics, a citizen spent 1.30 hours on an average to receive a state service. Introduction of E-Mongolia system has many advantages including saving of citizens' time and money (see Figure 1) and balancing the workload of civil servants. Today, citizens spend only five minutes on an average to receive a state service from the E-Mongolia system (MONTSAME, "Digital Nation" forum discusses challenges and solutions of digital transition, 2020).

In the near future, the Mongolian government has to conduct a reengineering of public organizations to improve the quality of public services, organizational capabilities, and productivity; increase the satisfaction of citizens and civil servants; and strengthen process-based, rational, and effective governance.



A total of 115 multi-option public service centers (see Figure 2) are located at the national level, which is a key achievement of the digital transition in Mongolia.

FIGURE 2
PUBLIC SERVICE CENTERS.

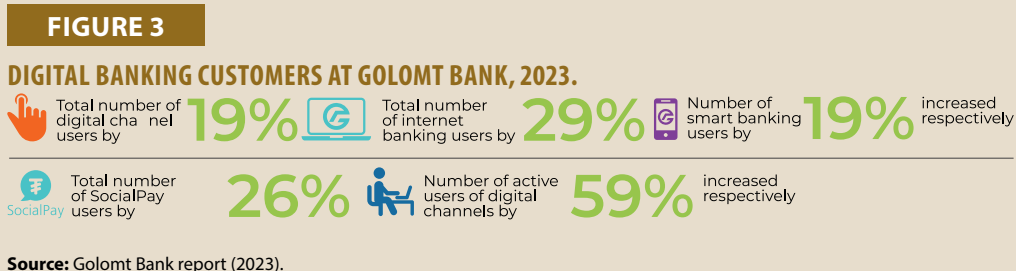


Private Sector: Banking

In Mongolia, many private organizations are implementing digital transformation in business processes and production. The banking sector in Mongolia is successfully implementing the digital transition.

Golomt Bank

Golomt Bank was established on 6 March 1995 as a subsidiary of Bodi International LLC, a major player in the social and economic sector of Mongolia (Golomt Bank, 2022). A systemically important banks in Mongolia, Golomt Bank is a leader in making the shift to digital and information technology-based services, with significant investments in this area. The history of digital transformation in Golomt Bank is provided in Figure 3 (Golomt bank, 2023).



Golomt Bank also caters to those who do not have access to smartphones, ensuring that branches and CDMs/ATMs are available to serve their needs.

In 2023, the bank made around 320 developments in its digital channels, of which 85% were innovations and improvements, while the remaining 15% were repairs carried out within the framework of error-free digital banking (Golomt Bank, 2023).

FIGURE 4**STATISTICS OF DIGITAL BANKING AT GOLOMT BANK, 2022.**

Digital banking	2022	Unit of measurement
Total number of digital channel/internet bank/smart bank users	714,329	Number of customers
Total number of Social Pay users	714,336,328	Number of customers
Number of digital channels	328,887	Number of customers
Number of Digital channels transactions	53,078,617	Number of transactions
Number of CDM (ATM with smart functionality)	411	Number of CDM
Growth rate of internet banking active users	127	Percent
Number of active users of smart banking	131	Number of transactions
Number of digital channel services	845,738	Number of services
Growth rate of digital channel services	152	Percent

Source: Golomt Bank report, 2022.

The new features and opportunities provided by Golomt Bank through its digital channels (Golomt bank, 2023) are:

- Since 2021, Golomt Bank has been using a robotic process automation to increase the speed of operations and reduce the manual work of employees. By automating 43 processes with robots, the bank has saved more than 16,000 man-hours a year. The robotically performed actions include reporting, preparing files, moving files, sending e-mails, making transactions, and handling settings in the system.
- In 2023, three data centers of the bank were updated by installing electrical and cooling equipment as per international standards. These renovations helped optimally increase the efficiency of servers and reduce the data centers costs.
- In 2023, the digital loan project was implemented, enabling quick access to salaries, consumer loans, POS secured loans, and pension loans through digital channels. As a result, 25% of salary and consumer loans have been transitioned to digital channels.
- Package transactions and Visa B2B were enabled on corporate internet banking platforms.

Survey Report and Papers

The share of the digital economy in Mongolia's GDP cannot yet be determined. This is largely due to the early stage of the country's transition to the digital economy, with digital technologies not yet fully integrated across all sectors. Furthermore, there is a lack of available data in official reports and research publications regarding the impact of digital technologies on workplace productivity.

Some international and national organizations have conducted research on digital transformation in Mongolia. We have tried to do a SWOT analysis of Mongolia's digital transition in Table 2, based on these research reports and other sources related to Mongolia's digitalization.

TABLE 2

SWOT ANALYSIS OF DIGITAL TRANSFORMATION IN MONGOLIA.

Strengths	Weaknesses
<ul style="list-style-type: none"> • The government has announced that IT is one of the priorities of the economy. Mongolia has a huge potential to develop digital strategies based on its core sectoral advantages, including mobile subscriptions and mobile broadband subscriptions, which are comparatively higher than the world and Asia-Pacific averages (ICT Development index, 2017). • Smartphone possession is high. • High-tech exports are increasing. • Investment in telecommunications is high. 	<ul style="list-style-type: none"> • Lack of skilled workforce: There is a shortage of professionals skilled in IT and digital marketing, which can hinder the growth of the digital economy. • Infrastructure challenges: Limited internet infrastructure in rural areas can lead to connectivity issues, making access uneven. • Legal environment is not sufficiently developed. • Knowledge and technology transfer is low. • Mobile broadband subscribers are inadequate. • Laws and regulations on intellectual property rights are not sufficient. • IT integration is complicated. • Digital literacy: A lack of digital skills among the population can lead to an uneven participation in the digital economy. • Some segments of the population may resist adopting new technologies due to traditional values or mistrust.
Opportunities	Threats
<ul style="list-style-type: none"> • Economic empowerment: Digital tools enable small businesses and entrepreneurs to reach broader markets, facilitating e-commerce and access to global supply chains. • Education access: Online learning platforms can provide quality education to remote areas, bridging gaps in educational resources and expertise. • Agricultural innovation: Digital technologies can enhance agricultural practices through access to information, markets, and modern farming techniques. • Government services: E-governance can improve service delivery, transparency, and citizen engagement, making government services more accessible. • Healthcare improvements: Telemedicine and digital health initiatives can enhance access to healthcare services, especially in underserved regions. • There is enough scope for enhancing Mongolia's cybersecurity capacity. 	<ul style="list-style-type: none"> • Cost is high to provide electricity infrastructure for each family in rural areas. • Digital infrastructure and internet connectedness between rural and urban areas is insufficient. • Innovation and advanced technology development are limited. • Infrastructure challenges: Limited access to high-speed internet and technological infrastructure, especially in rural areas, hampers digital adoption. • Cybersecurity risks: Increasing cyber threats, including hacking and data breaches, pose significant risks to individuals and businesses. • Regulatory issues: Inconsistent regulations and lack of clear policies can create uncertainties for businesses and investors. • Economic factors: Economic instability and reliance on a few key industries can limit funding for digital initiatives. • Data privacy concerns: Growing concerns about data protection and privacy can hinder user engagement with digital platforms.

According to the Global Digital Competitiveness Ranking (WDCR) released by IMD every year, Mongolia was ranked 63rd out of 64 countries in 2023, which indicates that the penetration and adoption of information technology, as well as the knowledge and skills required for it, are very weak (see Annexure 4, Global Digital Competitiveness Ranking). Research shows Mongolia's digital future trends by last 5 years (see Annexure 5, Mongolian digital trend)

Mongolian Chamber of Commerce conducted a survey that compares infrastructure and technology environment with other factors (see Table 3) (Mongolian Chamber of Commerce, 2017).

TABLE 3

MAIN FACTORS OF TECHNOLOGICAL ENVIRONMENT.

Indicators	Coefficient out of 7	Evaluation
Electricity usage	4.103	Satisfactory
Internet usage	4.176	Satisfactory
Postal service	4.133	Satisfactory
Government support on new technology	2.717	Unsatisfactory
High-tech penetration	2.96	Unsatisfactory
Possibility to collaborate with academic and research institutions	3.202	Moderate
Feasibility of patent, trademark registration process	3.317	Moderate

Source: Survey results, Mongolian Business Environment 2017, Mongolian Chamber of Commerce (Mongolian Chamber of Commerce, 2017).

The findings from the studies suggest the need to boost investments and establish favorable conditions that encourage the influx of foreign capital and advanced technology at the national level.

Conclusion and Recommendations

While there are numerous instances of digital technology being quickly and effectively introduced across various sectors in Mongolia's economy, a clear measure of the digital economy's contribution to the nation's GDP is still unavailable. This data is not included in Mongolia's statistical reports, likely because the shift to a digital economy is still in its early stages, and digital technologies have not yet reached all businesses in each sector.

Currently, both traditional and modern technologies are being used in parallel in Mongolia. It is expected that the full transition to new digital technologies will take some time.

As part of its strategy to build a more diversified and balanced economy, Mongolia is incorporating not only IT but also cutting-edge emerging technologies into key sectors.

Agriculture, which is the second-largest contributor to the economy and the most labor-intensive industry in the country, has begun adopting technological innovations. These include advanced systems for registering livestock, developing a genetic bank, and implementing a comprehensive monitoring procedure to track animal health.

With the economy experiencing a slowdown, partly due to falling mining prices, agriculture and processing industries have become focal points for economic diversification. By embracing

technology in these areas, Mongolia aims to reduce its reliance on the mining sector and foster a more sustainable and diverse economic landscape.

In 2022, Mongolia's Ministry of Digital Development and Communications initiated a five-year plan known as the Digital Nation program. This national strategy, running from 2022 to 2027, is designed to accelerate the country's digital transformation and establish Mongolia as a leader in digital governance within the region.

The key goals of the program are:

- **Expanding digital infrastructure:** The program aims to improve access to reliable internet and ICT services across the country, to ensure that even remote communities can participate in the digital economy.
- **Enhancing e-government services:** Through platforms like E-Mongolia, the government is working to digitalize thousands of public services, thereby making processes like renewing passports or registering businesses faster and more accessible.
- **Boosting cybersecurity:** A core focus is on developing a national cybersecurity framework to protect citizens' data and build public trust in digital services. Laws on data protection and information security have been introduced as part of this effort.
- **Promoting digital literacy:** The initiative emphasizes improving digital skills for all citizens, especially in underserved areas, to make sure that everybody can benefit from digital tools and services. Besides, it is important to update and enhance academic programs at higher education institutions to prepare future professionals with the necessary expertise in digital technologies, along with the ability to apply this knowledge in practical situations. Moreover, the government should provide scholarships to young people who are interested in studying digital technologies and the digital economy at renowned international universities. This approach will help develop a skilled workforce capable of contributing to Mongolia's digital growth.
- **Investment:** It is vital to improve domestic funding sources and cultivate an environment that attracts international investment and facilitates the introduction of innovative technologies. This approach will foster economic development and technological progress.

Additionally, the agricultural sector needs to create a more sustainable production-and-supply chain that operates efficiently throughout the year, including during winter months. Enhancing productivity across the sector is also crucial. At present, challenges such as inefficient livestock processing, outdated processing methods, limited access to distribution networks, and absence of clear market data continue to hinder growth and disrupt the value chains. Nevertheless, technological progress is providing new avenues for improvement. By integrating IoT and AI technologies to gather and analyze data from agricultural practices and environmental conditions, farmers can improve their operational efficiency and significantly boost productivity.

Furthermore, Mongolia has the potential to boost productivity in the mining sector by implementing digital solutions for key processes and fostering the adoption of cutting-edge technologies and innovations throughout the industry. This will help optimize operations, improve efficiency, and drive overall sector growth

Finally, digital identification has advanced significantly in recent years. The rollout of electronic ID cards and e-government services is a notable achievement for Mongolia in its digital development. These innovations have enabled sectors like banking, telecommunications, and other private industries to adopt digital identification, improving both accessibility and cost-effectiveness of services.

The absence of a strong legal framework for online payment systems and integrated gateways continues to be a major concern that needs to be resolved promptly. It is crucial to implement the required measures to enhance cybersecurity and safeguard digital transactions.

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Annexure

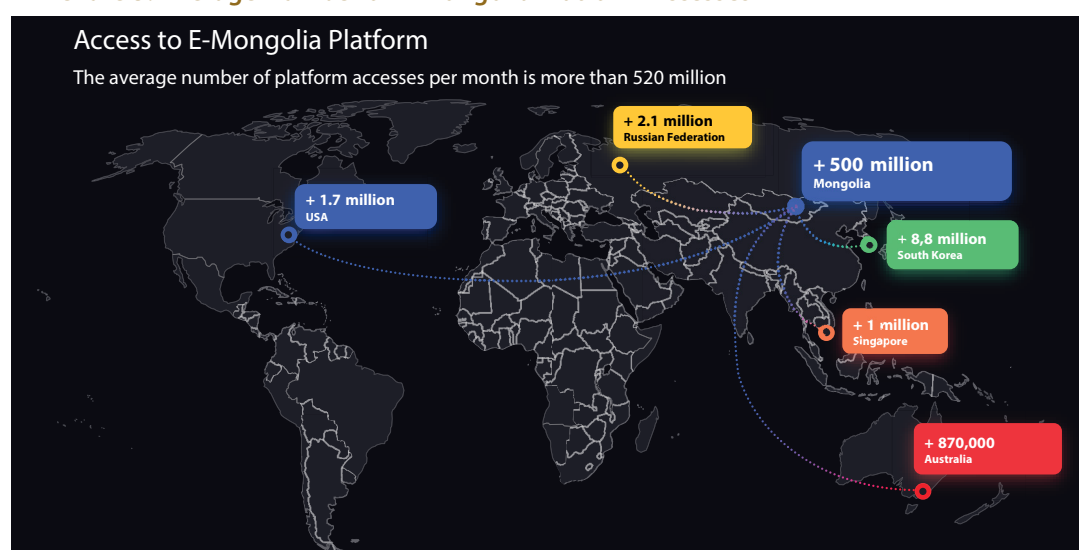
Annexure 1: Total Investment in the Information and Communication Sector (bn. MNT)

Industry	2008	2009	2010	2011	2012	2013	2014	2015
Information and communication	29.4	34.9	60.4	82.3	181.6	181.8	254.8	233.3
	2016	2017	2018	2019	2020	2021	2022	2023
	191.8	184.5	257.3	296.3	249.9	269.8	386.8	479.6

Annexure 2: Foreign Direct Investment in the Information and Communication Sector (in million USD)

Industry	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Information and communication	36.5	19.4	8.6	19.4	30.7	10.5	4.8	7.6	6.2	6.0	7.3	15.6	30.4

Annexure 3: Average Number of E-Mongolia Platform Accesses



Annexure 4: Mongolia's Digital Competitiveness Rank as of 2023

- Overall top strengths
▷ Overall top weaknesses

KNOWLEDGE

Sub-factors	2019	2020	2021	2022	2023
Talent	60	60	60	60	63
Training and education	45	41	39	47	37
Scientific concentration	60	61	61	61	61

Talent	Rank	Training and education	Rank	Scientific concentration	Rank
Educational assessment PISA - Math	–	Employee training	26	Total expenditure on R&D (%)	59
International experience	62	Total public expenditure on education	47	Total R&D personnel per capita	45
Foreign highly skilled personnel	60	► Higher education achievement	15	► Female researchers	01
▷ Management of cities	63	Pupil-teacher ratio (tertiary education)	52	R&D productivity by publication	57
Digital/technological skills	50	Graduates in Sciences	32	Scientific and technical employment	56
Net flow of international students	59	Women with degrees	22	High-tech patent grants	61
				Robots in education and R&D	–

TECHNOLOGY

Sub-factors	2019	2020	2021	2022	2023
Regulatory framework	62	58	58	60	61
Capital	58	60	62	59	61
Technological framework	58	60	60	57	58

Regulatory framework	Rank	Capital	Rank	Technological framework	Rank
Starting a business	43	IT and media stock market capitalization	–	Communications technology	53
Enforcing contracts	44	Funding for technological development	61	▷ Mobile broadband subscribers	63
Immigration laws	56	Banking and financial services	62	Wireless broadband	48
Development and application of technology	63	Country credit rating	61	Internet users	53
Scientific research legislation	63	Venture capital	62	Internet bandwidth speed	58
▷ Intellectual property rights	63	► Investment in telecommunications	11	► High-tech exports (%)	15

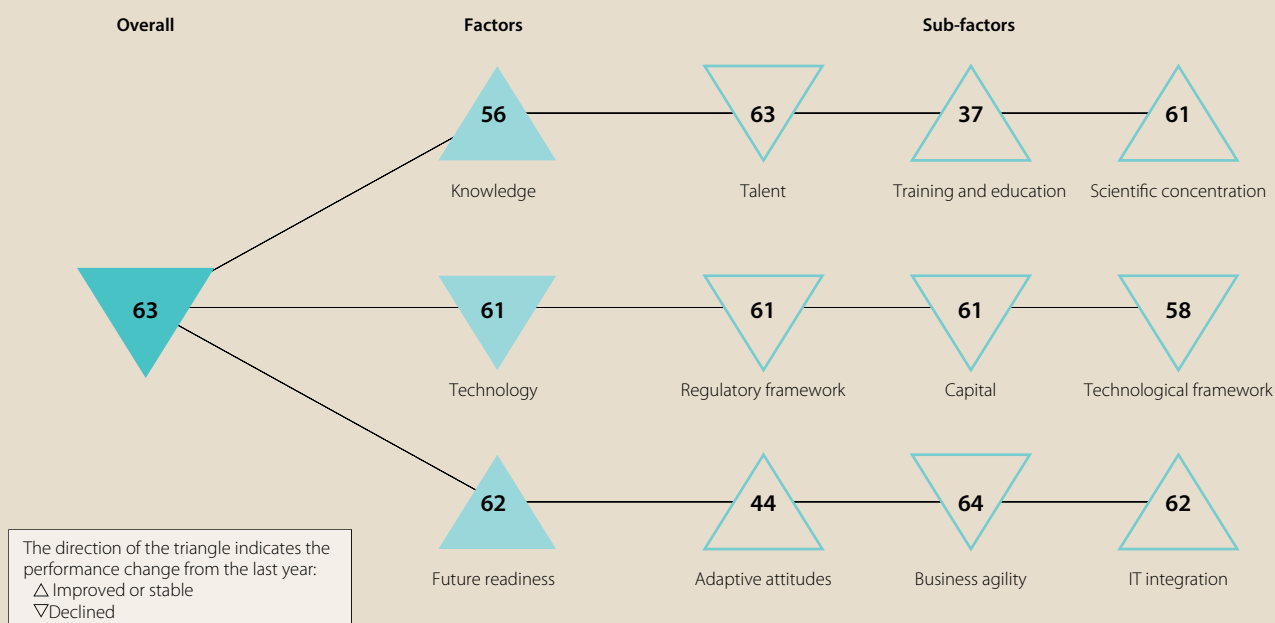
FUTURE READINESS

Sub-factors	2019	2020	2021	2022	2023
Adaptive attitudes	31	40	37	51	44
Business agility	63	61	63	63	64
IT integration	62	61	62	62	62

Adaptive attitudes	Rank	Business agility	Rank	IT integration	Rank
E-participation	48	▷ Opportunities and threats	64	E-government	55
Internet retailing	60	World robots distribution	–	Public-private partnerships	63
Tablet possession	–	Agility of companies	63	Cyber security	63
► Smartphone possession	05	Use of big data and analytics	62	Software piracy	–
Attitudes toward globalization	48	▷ Knowledge transfer	64	Government cyber security capacity	56
		Entrepreneurial fear of failure	–	Privacy protection by law content	44

Annexure 5: Mongolian Digital Trends

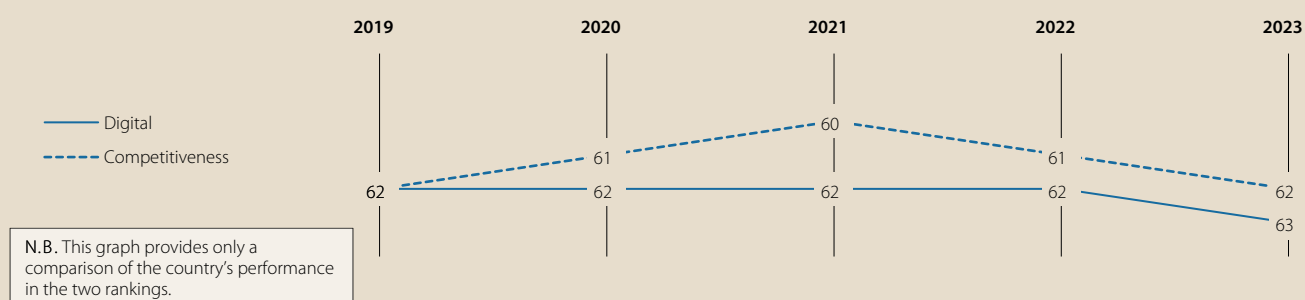
OVERALL PERFORMANCE (64 countries)



OVERALL FACTORS: 5 years

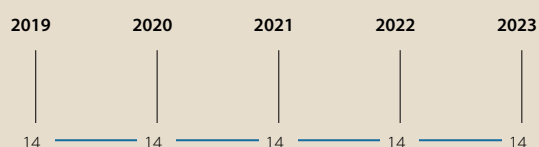
	2019	2020	2021	2022	2023
OVERALL	62	62	62	62	63
Knowledge	62	58	58	61	56
Technology	62	60	61	60	61
Future readiness	61	59	62	62	62

COMPETITIVENESS AND DIGITAL RANKINGS

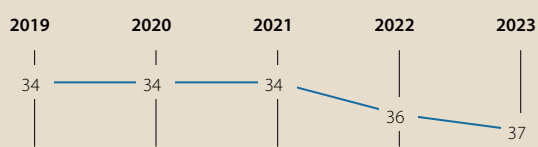


PEER GROUPS RANKINGS

ASIA-PACIFIC (14 countries)



POPULATIONS < 20 MILLION (37 countries)



Annexure 6: Procedure for Providing Services by Organizations Responsible for the State Electronic Databases

Annexure to Order No. A/35 of 2022 of the Minister of Digital Development and Communications:

One. General

- 1.1. The purpose of this regulation is to define the services provided by the government electronic database organization to individuals and legal entities, and to regulate relations arising in connection with the delivery of services.
- 1.2. The organization responsible for the state electronic database is “National Data Center” UTUG (hereinafter referred to as “National Data Center”).
- 1.3. Other relations not regulated by this regulation can be regulated in detail by the service contract concluded between the National Data Center and individuals and legal entities.
- 1.4. The National Data Center will provide the following services:
 - 1.4.1. granting a domain name to a government organization;
 - 1.4.2. uploading the website of the government organization;
 - 1.4.3. providing e-mail addresses of government organizations;
 - 1.4.4. uploading the database of the government organization;
 - 1.4.5. services provided to government organizations and legal entities through public service electronic (kiosk) machines;
 - 1.4.6. virtual server rental service of government organizations;
 - 1.4.7. parking space rental service;
 - 1.4.8. “State information exchange system” connection service;
 - 1.4.9. services related to “Recognition Login System”;
 - 1.4.10. “Notice delivery system” service; and
 - 1.4.11. internet internal interconnection service.
- 1.5. The services specified in Sections 1.4.8, 1.4.9, and 1.4.10 of this regulation shall be regulated in accordance with the regulations specified in Section 18.10 of the Law on Transparency of Public Information.
- 1.6. The director of the National Data Center shall approve the model of service contract and technical conditions, except for those specified in 1.4.8, 1.4.9, and 1.4.10 of this regulation.

- 1.7. Requests made by individuals and legal entities to receive services will be investigated within five working days, and relevant requests will be answered.
- 1.8. A person or legal entity shall conduct an information security risk assessment upon the request of the National Data Center after receiving the services specified in Section 1.3 of this regulation.
- 1.9. In the event that the service is suspended for a certain period of time due to a planned technical inspection, the National Data Center will notify the person or the legal entity 48 hours in advance in electronic form or in writing.
- 1.10. The National Data Center shall not be responsible for damages caused to people or legal entities due to damage, delays, or service failure due to force majeure in the infrastructure of the National Data Center.
- 1.11. The services provided by the National Data Center will be terminated in the following cases:
 - 1.11.1. based on the decision of the authorized organization stipulated by the law;
 - 1.11.2. the person or legal entity receiving the service does not meet the technical conditions and requirements for the service specified in section 1.4 of this regulation;
 - 1.11.3. failed to comply with clause 1.8 of this regulation and did not take relevant measures according to the risk assessment report;
 - 1.11.4. in the event that there is a risk of information security in the system of a person or legal entity, suspicious access is detected, it is used for purposes other than those specified in the contract, or in the event of non-fulfillment of obligations under the service contract, during the period until the violation is resolved; and
 - 1.11.5. if the National Data Center considers that the cyber security of a person or a legal entity has been compromised within the framework of this regulation, until the violation is normalized.
- 1.12. The technical capacity and limitations required for the provision of services shall be determined in accordance with this regulation, and in case of exceeding it, it shall be resolved by making amendments to the contract based on requests made by persons or legal entities, information security risk assessment, and the status of the implementation of the contract.

Two. Domain Name Service for Government Organizations

- 2.1. The domain name (gov.mn) will be granted to the government organization.
- 2.2. The domain name is a word that expresses the main direction of the organization's activities, or an abbreviation of the Mongolian or English name of the organization, and it can be an abbreviated or transliterated name of a region or region.

2.3. Domain names for use in organizations are classified into the following levels:

1st level	2nd level	3rd level	4th level
The top-level domain name assigned to Mongolia by the international organization ICANN	The top-level domain name to be assigned to the public administrative organization	The domain name owned by the public administrative organization	The sub-domain name assigned to the unit's affiliated organization
.mn	.gov.mn	\assigned name\gov.mn	\location\.\ assigned name \gov.mn

2.4. The National Data Center will grant third and fourth level domain names in the following cases:

- 2.4.1. the third-level domain name for the central state administrative organization and the governor's office of the province and capital, and the fourth-level domain name for the state administrative organization directly affiliated to them;
 - 2.4.2. third-level domain names for organizations that operate nationwide despite belonging to the central state administrative organization;
 - 2.4.3. fourth-level domain names that reflect the local jurisdiction of state administrative and service organizations located in localities operating at the state level; and
 - 2.4.4. the domain name of the fourth level of the domain name of the higher-level management organization of the state organization belonging to the administrative unit of the capital, or the domain name with the abbreviation of the local or regional name;
- 2.5. An additional domain name may be granted to the organization, taking into account the specifics of its activities and services.
- 2.6. The National Data Center shall be responsible for the security and reliability of the domain name (gov.mn) system.
- 2.7. If the domain name is changed at the request of the organization, the previous domain name will be revoked.

Three. Website Hosting Services of Government Organizations

- 3.1. If the website of the government organization ensures the security of information, the website hosting service will be provided.
- 3.2. The government organization has an employee authorized to change, delete, or update the website and its content, information, and database in the management section of the website.
- 3.3. In the area of uploading electronic pages, do not upload electronic pages and systems with purposes other than ensuring the openness and transparency of government organizations, and information that is not the main function.

- 3.4. The backup of the website will be done once a month, and the backup of the last 3 months will be saved.
- 3.5. The state organization is responsible for meeting the technical conditions and requirements for receiving services, access rights and confidentiality of the website, development, updating and improvement of the website.
- 3.6. After 30 calendar days from the date of termination of the contract with the state organization, the information (e-mail) located on the website hosting server will be deleted along with the backup.
- 3.7. The state organization selects capacity with the following parameters:
 - 3.7.1. up to 1 GB;
 - 3.7.2. up to 20 GB; and
 - 3.7.3. Up to 50 GB.

Four. The Service of Issuing an E-mail Addresses for Government Organizations

- 4.1. The National Data Center shall grant administrative rights to government organizations.
- 4.2. The government organization shall immediately notify the relevant Cyber Attack and Violation Control Center about any suspicious or malicious code e-mail received at its e-mail address.
- 4.3. It is prohibited to use the e-mail of the government organization for the purpose of sending a large amount of e-mail or mass mail at the same time, or for storing and transmitting personal information.
- 4.4. E-mail service with the following parameters will be provided to the government organization:
 - 4.4.1. up to 5 GB; and
 - 4.4.2. up to 50 GB.

Five. Database Hosting Services of Government Organizations

- 5.1. The base database, and main and supporting system databases will be placed in the main database system of the National Data Center.
- 5.2. Databases other than those specified in clause 5.1 of this regulation can be uploaded using the services specified in clauses 1.4.6 and 1.4.7 of this regulation.
- 5.3. The uploaded database is accessed through the integrated state information network or through a network (VPN) that meets privacy and security requirements.

Six. Providing Services through the State Service Electronic (Kiosk) Machine

- 6.1. Services of public and private organizations will be provided through kiosks.
- 6.2. The director of the National Data Center will approve the service provided by the kiosk.

- 6.3. The data controller responsible for the service is responsible for the authenticity of the service provided by the kiosk.
- 6.4. To establish a network of kiosks, receive recommendations from the Intelligence Organization.
- 6.5. The director of the National Data Center will decide on changing the location of the kiosk based on usage, user requests and research.

Seven. Fictitious Server Rental Service for Government Organizations

- 7.1. The artificial server created by programmatically dividing the resources of physical server devices connected to the network shall be leased and used by the government organization.
- 7.2. The state organization will select the service calculator (CPU), RAM, hard disk capacity (Hard drive), and IP address specified in clause 7.1 of this regulation.
- 7.3. The client's data and information located on the virtual server will be deleted along with the backup after 30 days from the date of termination of the contract with the government organization.
- 7.4. The purpose of the system to work on the artificial server shall be clearly reflected in the service contract.

Eight. Rent for Server Room

- 8.1. The equipment of government organizations, people, and legal entities will be placed in the designated server room, and the rental service will be provided to ensure the uninterrupted operation of the network and electricity supply, and the stability of the ambient temperature and humidity.
- 8.2. The system of the state organization will be connected through the unified state information network and the security network equipment of the National Data Center.
- 8.3. The person or legal entity who applied for the service has the right to refuse to provide the service if the technical conditions and requirements defined by the National Data Center are not met.
- 8.4. The purpose of the system to work on the equipment placed by a person or a legal entity shall be clearly reflected in the service contract.

Nine. Internal Internet Interconnection Service

- 9.1. The legal entity to receive internal Internet interconnection services has received a special license from the Telecommunications Regulatory Commission.
- 9.2. Legal entities applying for internal Internet interconnection services shall meet the technical conditions and requirements defined by the National Data Center.
- 9.3. Based on the formal request of the legal entity that has obtained the special license specified in Clause 9.1 of this regulation, a service contract will be concluded and the connection will be made.

Ten. Service Charges

10.1. The services provided by the National Data Center to individuals and legal entities are subject to payment.

10.2. Persons and legal entities receiving services specified in clauses 1.4.4, 1.4.5, and 1.4.11 of this regulation shall pay the connection fee.

10.3. The fees for services other than those specified in clauses 1.4.8, 1.4.9, and 1.4.10 of this regulation shall be determined by the National Data Center based on the methodology specified in clause 9.1.5 of the Law on Telecommunications, and the central state administrative organization in charge of electronic development and communications shall monitor put.

Eleven. Control

11.1. The National Data Center prepares reports for each service and submits the reports quarterly to the central state administrative organization in charge of electronic development and communications.

11.2. The National Data Center will resolve suggestions, requests and complaints made by people and legal entities.

NEPAL

Introduction

Nepal is a landlocked country in South Asia. A large proportion of the population is involved in subsistence farming. The economy of Nepal is gradually shifting towards services, trade, and remittances. According to data from Nepal Rastra Bank, the central bank of Nepal, the share of agriculture, industry, and service sectors in GDP stands at 24.10%, 13.00%, and 62.90%, respectively in 2023/24 (Nepal Rastra Bank, 2024). The service sector now plays a pivotal role in the economy, while the contributions of the industry and agriculture sectors are declining annually. Banking, telecommunications, education, tourism, and IT services are the leading sub-sectors in the services sector.

The APO has published Nepal’s productivity data in the Productivity Databook 2023 (APO, 2023). Based on the data, Nepal’s labor productivity level increased by 24.36% between 2010 and 2021. This indicates that the average worker in Nepal produced more goods and services in 2021 compared to 2010. This improvement is due to various factors, such as advancements in technology, improved education and skills of the workforce, better digital infrastructure and adoption of digital workplace

However, Nepal still faces many challenges in adopting digital workplaces due to a lack of clear policies and guidelines for digital workplaces, technology integration and data security. This is particularly concerning given the country’s low ranking in cyber safety and economic safety components of the Global Remote Work Index 2023 (My Republica, 2023). Nepal’s position declined by 24 places in the 2023 Remote Work Index compared to the previous year, ranking 89th out of 108 countries with a Remote Work Index of 0.513 (Nordlayer, 2023). These factors highlight the current status of the digital workplace scenario in Nepal and limited progress in this sector.

TABLE 1
E-GOVERNMENT DEVELOPMENT INDEX OF NEPAL, 2012–24.

Year	2012	2016	2020	2024
E-Government Development Index	0.2664 (ranked 164th out of 193)	0.3458 (ranked 135th out of 193)	0.4699 (ranked 132th out of 193)	0.5781 (ranked 119th out of 193)

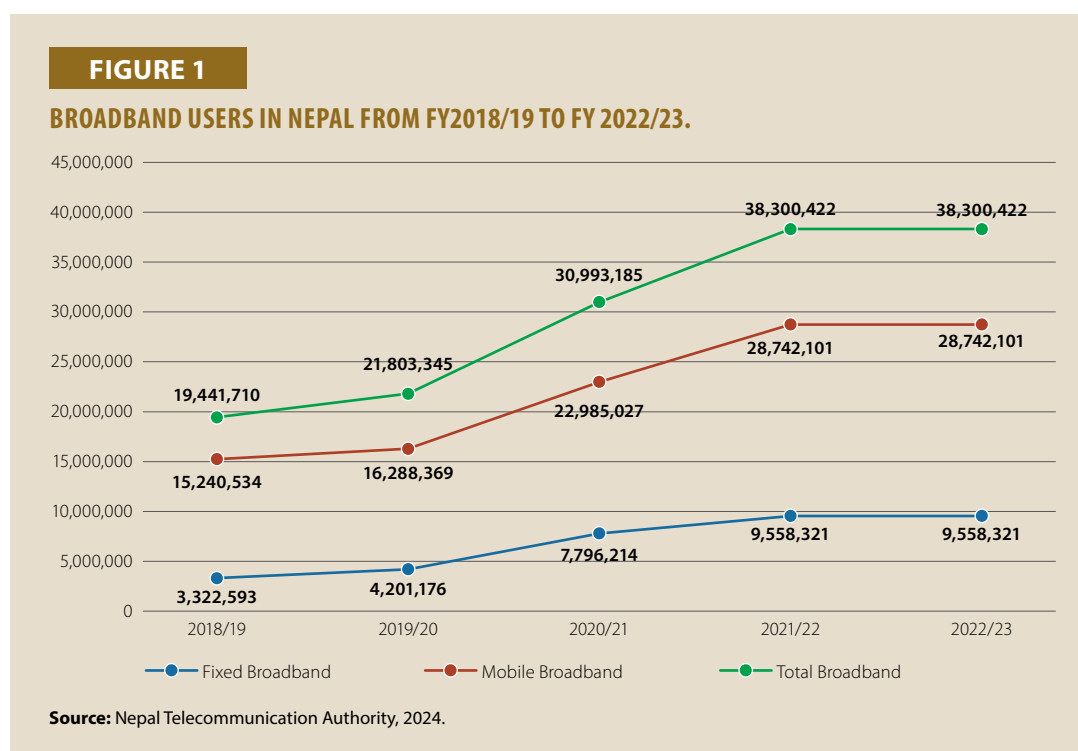
Source: UN.

Key Drivers of Change

Nepal’s digital transformation journey has been propelled by internet connectivity and widespread adoption of mobile phones, leading to increased access to digital services and communication. This has fueled broader digital infrastructure development, attracting investments in the telecommunications and information technology sectors (LogicaBeans, 2023). The resulting improvements in connectivity have empowered citizens to connect, access information, and engage with digital platforms, fostering a more digitally connected society. Nepal’s digital infrastructure

development is one of the critical components of the country's digital transformation path. Some of the key drivers of change are:

- (1) Expansion of digital connectivity: Nepal has made significant progress in establishing basic digital connectivity. According to the Nepal Telecommunications Authority (NTA), Nepal has over 95% mobile broadband and nearly 49% fixed broadband penetration as of April 2024 (NTA, 2024). Smartphones and 4G services have also supported the adoption of digital tools and increased productivity in digital workplaces. The government has collaborated with private companies to expand internet access and improve broadband services. They have installed fiber optic cables to connect different areas, making the internet more widely available (LogicaBeans, 2023).



- (2) Data center and cloud infrastructure: In recent years, data centers and cloud services have been established and operated by both public and private sectors in Nepal, which have offered storage, processing, and hosting services to businesses with improved data security, scalability, and accessibility. They cater to diverse needs, from driving government efficiency through digital governance platforms and e-governance applications, to providing scalable infrastructure and secure data storage, empowering startups and businesses with computational power, rapid application deployment, and innovation. This eliminated upfront costs and enhances security and individual experiences across various sectors. Data centers, cloud services, and on-demand infrastructure services have enabled both public and private enterprises to transform their traditional work environments into digital workplaces.

G-Cloud Services from the Department of Information Technology were initiated with the consent of the Office of the Prime Minister and the Council of Ministers, the Ministry of Finance, and the then Ministry of Science and Technology to minimize expenditure on

infrastructure development and to provide virtual resources immediately as per the requirements of government agencies. Government agencies must contact the Department of Information Technology by filling out the Administrator Form and Request Letter available on the website for government cloud services. As of the fiscal year 2080/81 (July 15, 2024), 345 government offices are using G-Cloud Services from DOIT (Department of IT, 2024).

Government Integrated Data Center (GIDC) is an internationally standard government data center providing services exclusively to government organizations. The types of cloud services provided by GIDC are mainly infrastructure as a service (IaaS) and platform as a service (PaaS) (Sharma, 2017). Access World (AWT) Nepal is the first complete cloud service provider in Nepal, operating the largest data center in the country, supported by redundant data centers worldwide. It focuses on website hosting for businesses, cloud hosting (VPS), enterprise secure email, and platform hosting (Sharma, 2017).

There are many data centers and cloud service providers in Nepal that are privately owned, such as Data Space Pvt Ltd, Clouds Services Nepal, CAS Infra, U Cloud, Syntegrate (system integrators), Cloud Himalaya, Ncell Data Center, Nepal Telecom (NTC) Data Center, Data Hub Pvt Ltd., OHM Data Center, Silver Lining, and AccessWorld (GTN, 2024; Yoho Cloud, n.d.). According to the IIDS survey (IIDS, 2023), 46.9% of the companies surveyed utilize data infrastructure services within Nepal, while the remaining 53.1% depend on services from abroad. Among the companies relying on data infrastructure services outside the country, a significant portion comes from the USA, India, and Europe. Of the surveyed companies, 58.8% emphasized the importance of having a dependable data center within Nepal, disaster recovery centers, cloud services, and a high-capacity information highway. For Nepal's digital transformation journey, among various foundational elements, data centers and cloud services are important and critical but are often overlooked (The Himalayan Times, 2024).

- (3) COVID-19 and the acceleration of digital workplace adoption: The COVID-19 pandemic further accelerated Nepal's digital transformation by pushing companies to embrace remote work through platforms like Zoom, Microsoft Teams, WhatsApp, and Viber for communication and collaboration. Many public and private enterprises have developed management information systems to automate their business processes. Along with the disruption in the normal work environment, work-from-home modes started to emerge. Businesses began to adopt digitalization, develop and use specialized apps or digital platforms, and switch to online appointments and virtual office meetings for business purposes. In Nepal, remote working emerged as the most viable alternative for organizations (HRM, 2021).

Since the COVID-19 pandemic, the government has focused on using technology to improve the efficiency and performance of public services through e-governance initiatives (Rai & Gupta, 2023). Furthermore, the pandemic has accelerated digital payment adoption in Nepal (Pandey, Maharjan, & Aryal, 2021). After COVID-19, online payments became more common, and the number of digital payment users increased rapidly (The Kathmandu Post, 2022). Digital payout transactions have seen exponential growth, from NPR 3.1 billion during the fiscal year 2016/17 to NPR 221.1 billion in the fiscal year 2019/20. During the COVID-19 lockdown period, from mid-July to mid-October 2020 (the first

quarter of the fiscal year 2020/21), the volume of government transactions (payout and revenue collection) increased by 943% compared to the same quarter last fiscal year (United Nations Development Programme, n.d.).

- (4) **Digital initiatives of the government:** Government agencies have been developing software applications to provide various public services. Some of these programs are used to manage government operations and deliver services to the public (Sharma, 2020). The government has launched several initiatives to promote digital inclusion and bridge the digital divide by offering training programs and equipping individuals with the skills needed to utilize digital technology. Additionally, both public and private institutions are investing in training programs focused on digital skill development, such as software development, data analytics, and digital marketing, which help address the skill gap in the workforce. These programs are essential for preparing workers to operate effectively in the digital workplace. Public services are being digitized not only to increase accessibility for citizens but also to improve public sector efficiency, enhance administrative productivity, and reduce corruption.
- (5) **Artificial intelligence - driven digital transformation:** Artificial intelligence (AI) has emerged as transformative power in global economies, driving innovation, enhancing productivity and improving efficiency. However, Nepal is still in early stage of AI adoption due to limited government-led AI initiatives and research, and lack of government funding. In Nepal, private sector has significantly contributed in the AI development for the digital transformation such as automation, data analytics and AI-driven chatbot development. Specially, banking and finance sector, healthcare industry and ecommerce platforms are using AI for increasing work productivity (Mahat et al., 2025). In banking and finance sector, use of AI technologies has contributed significantly in automating processes, strengthening strategic decision-making processes, enhancing productivity, quality of service and also enhancing client satisfaction (Gurung and Parajuli (2024; Khadka et al. 2024).

Overview of National Policies

Several national policies, laws, regulations, and initiatives are envisioned by the Government of Nepal to accelerate the growth of digital workplaces and economic development in the ICT sector.

The Nepal government has implemented various policies to regulate the telecommunications sector. These policies include the Telecommunications Policy (2004) and the Long-Term Vision of the Communications Sector (2002). These policies have provided a framework for the development and regulation of the telecommunications industry in Nepal (Sharma, 2020).

Electronic Transactions Act, 2006 and Electronic Transactions Rules, 2007 have ensured the reliability and security of electronic transactions, including the control of unauthorized use of electronic records or alterations in such records through illegal means (Government of Nepal, 2008). This law has made electronic records and digital signatures legal in Nepal for communication and transactions. It includes rules about electronic records and digital signatures, computer networks and service providers, computer-related crimes and punishments, and the IT tribunal as the initial court for hearing and appealing cases related to technology (Acharya & Dahal, 2021).

National ICT Policy 2015 has also played a vital role in advancing Nepal's digital transformation. This policy aims to integrate information and communication technology (ICT) across various sectors, promoting the growth of the IT industry and digital literacy. It outlines the government's vision, goals, and strategies for promoting ICT as a key driver of economic development, social inclusion, and good governance (Government of Nepal, 2015). It focuses on how to use ICT and digital technology to improve development, governance, and services, and to create a favorable environment for investments in communication infrastructure, ICT, and ICT-related industries and services to help Nepal become a digital economy (Bhattarai, 2021). The ICT policy of 2015 aimed to make ICT technology more accessible to everyone and to use it to improve development efforts and to create "Digital Nepal" (Acharya & Dahal, 2021).

Nepal recognizes importance of AI integration in increasing automation, leading to higher productivity, efficiency and innovation thus, government has formulated the draft of the National AI Policy 2081 which is still in the approval process. The policy has clear long-term vision for the AI-driven digital transformation of economy by integrating AI and it can be regarded as significant step towards digital transformation of Nepal. If implemented effectively, it has potential to drive country towards sustainable economic growth, public service efficiency, and innovation with the proper utilization of transformative power of AI. The policy focuses on the promotion of AI research, investment in AI entrepreneurship, AI-driven digital transformation, and application of AI in key economic sectors critical to accelerate economic development (Government of Nepal, 2025).

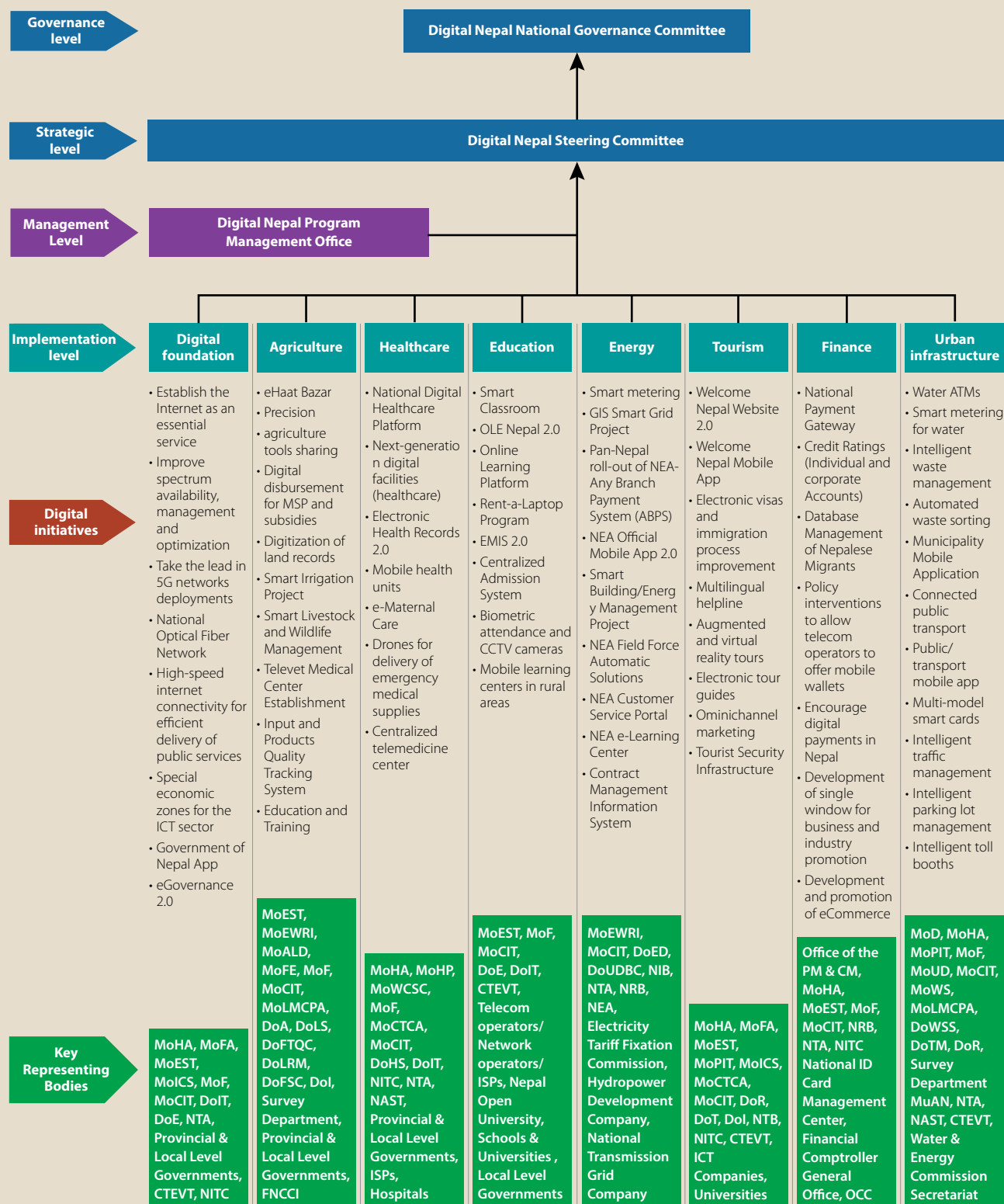
Digital Nepal Framework, 2019 is one of the government initiatives as an integrated strategy to drive digital projects that contribute to economic growth, solve major challenges with innovation and technology, and create opportunities for Nepal to participate in the global economy (DRC, 2022). It focuses on eight areas including infrastructure, governance, education, health, and finance, and consists of a total of 80 major initiatives. The Digital Nepal Framework is a comprehensive framework outlining a broad set of activities across a number of domains; it offers an opportunity to provide much-needed traction to Nepal's digital agenda (Bhattarai, 2021).

Figure 2 outlines the structure for the Digital Nepal Framework. A National Steering Committee, chaired by the Prime Minister, provides overall leadership and oversight. The Minister for Communication and Information Technology serves as the Vice-Chair. The Secretary of the Ministry of Communication and Information Technology acts as the Member Secretary of the Steering Committee. This committee includes high-level government representatives and ensures that the Digital Nepal program aligns with national development goals. The National Implementation Committee (NIC), chaired by the Secretary of the Ministry of Communication and Information Technology, supports the Steering Committee. The IT Division Chief serves as the Member Secretary of the NIC. The NIC is responsible for implementing and coordinating projects and activities under the Digital Nepal program and report regularly to the Steering Committee. The NIC oversees sector-specific sub-committees that will be formed within various government agencies. These sub-committees meet quarterly to discuss progress, address issues, and explore opportunities for collaboration (DRC, 2022).

Government is working on updated version (Digital Nepal Framework 2.0) building upon the success of Digital Nepal Framework to accelerate Nepal's digital transformation, improve digital service delivery and unlock new opportunities in the digital industry.

FIGURE 2

GOVERNANCE FRAMEWORK FOR DIGITAL NEPAL.



Source: Digital Nepal Framework, 2019 (page 157), Department of IT (<https://drc.gov.np/storage/backup/pages/resources/others/D8lp6S0TBu0kqwXB7V90hB9aodF4v6qTLGzUvN7M.pdf>).

Key Stakeholders in DX

Ministry of Communication and Information Technology (MoCIT) is the key institution in the digital landscape with a vision of achieving prosperity through the maximum use of cutting-edge communication and information technology. MoCIT aims to develop and expand the information and communication sector up to the rural level in the form of infrastructure for social and economic development through widespread participation of the private sector, with an emphasis on the dissemination of information and communication technology (MoCIT, n.d.).

Department of Information Technology (DoIT) is another important agency with a vision of expanding the use of information technology for the economic development of Nepal to keep pace with the rapid worldwide development and use in the field of information technology (DoIT, n.d.).

E-Governance Commission (EGC) is a high-level commission chaired by the Prime Minister of Nepal, as per the E-Governance Commission (Formation and Operation) Order, 2022. The commission aims to promote the use of e-services in government for good governance, make e-governance more reliable, secure, and convenient, and formulate integrated policies related to cybersecurity.

Digital Workplace Initiatives in Nepal

Most of the government agencies in Nepal have digitalized their business processes through web-based applications and mobile applications. Some such initiatives are:

National Identification (NID) Card is a federal-level identity card with a chip that can store demographic data alongside the biometrics of an individual. The NID system has provided a basis for the digital identification of every citizen, minor, non-resident Nepalese, as well as other resident foreigners. The NID is used for authentication and verification of individual identification and is extensively used in digital public service delivery by major public service providers. Currently, the NID is provided to citizens of Nepal, and massive enrollment of citizens is being conducted by the Department of National Identification and Civil Registration. The NID is integrated with the Vital Registration System, Citizenship Information Management System, Passport System, and Social Security System. It is also being integrated with the Integrated Tax System, Driving License System, Company Registration System, and the MIS of Banking and Financial Institutions.

Nepal National Single Window System (NNSW) by the Department of Customs (DoC) brings the DoC and more than 40 trade-related government agencies into a single electronic platform for the exchange of cross-border documents and data used in Nepal's international trade. Further, making the current administration of paperless trade seamless and expanding it to cover paperless trade will require legislative reforms, institutional strengthening, harmonization, and proactive engagement in bilateral and regional forums to develop cross-border paperless trade systems (Sharma & Dahal, 2023).

Public Service Recruitment Management System (PSRMS) of the Public Service Commission (PSC) is a web-based application that has improved transparency, internal efficiency, and effectiveness of the PSC, with improved public access to government employment opportunities through an online application facility allowing its integration with other government IT systems. The PSC is a constitutional body in Nepal responsible for selecting and recommending qualified candidates for recruitment in government service by conducting examinations. PSRMS has played a significant role in creating a digital workplace in the PSC by simplifying administrative processes,

reducing recruitment processing time, effort, and cost through digitalizing application collection, exam fee collection, managing candidates' information, exam scheduling, exam center allocation, admit card distribution, result processing, and interviews. It has also assisted in the planning process by providing relevant and timely information. The PSRMS system broadly consists of two parts: a citizen-centric services portal as the external portal and a back-office automation portal as the internal portal. According to the Asian Development Bank (2021), PSRMS has the highest economic internal rate of return (EIRR) at 30%, computed based on four components: e-government interconnectivity, e-government applications, ICT network, and HRD component.

Local Government App is the integrated mobile app developed by the Department of Information Technology (DoIT) for maintaining good governance at the local level, which is used for all 753 local levels, including services provided to local citizens. Citizens can access the services provided by the respective local level, programs and projects, laws and rules, details of the wards, important places, emergency numbers, submit suggestions and complaints, register problems, express public opinion; and access other notices and information, including two-way dialogue (Department of IT, 2024).

Nagarik App (Single App for All Government Services) was released by the Department of Information Technology. It registers citizens through their certified details such as citizenship, passport, or voter identity card and offers the facility to view one's details in the Citizens Investment Fund, Employees Provident Fund, Social Security Fund, educational certificates, health insurance information, and many others, since it is bothersome to visit different sites and applications to view details or access services. Through the app, one can obtain a permanent account (PAN) number, open a bank account, pay vehicle tax, update KYC details of the bank, get a police clearance report, and other services (Himalayan News Service, 2021; Khatri, 2021).

Similarly, there are other systems such as the Land Records Information Management System by the Department of Land Management and Archive; the Online Immigration System, Citizenship Information Management System by the Ministry of Home Affairs and its departments; and the Single Point Service Center for Industry and Investment by the Department of Industry, among others, which are regarded as significant steps towards the digital transformation of government offices for efficient service delivery.

There are also some initiatives from the private sector, including core banking, internet banking, mobile banking, and digital payment services by banking and financial institutions; work-from-home initiatives in many businesses; and remote IT support and maintenance services in the corporate sector, information technology/business process outsourcing (BPO) support, utility services, and digital marketplaces. IT service exports have made a significant contribution to Nepal's economy. In 2020, they accounted for 1% of GDP and 2.9% of foreign currency reserves. IT companies contributed 0.3% of GDP and 0.8% of foreign currency reserves, while freelancers contributed 0.7% of GDP and 2.0% of foreign currency reserves. By 2022, these contributions had increased. IT companies contributed 0.5% of GDP and 2.2% of foreign currency reserves, while freelancers contributed 0.8% of GDP and 3.4% of foreign currency reserves. Interestingly, freelancers contributed slightly more to both GDP and foreign currency reserves than IT companies (IIDS, 2023).

Two of the best practices in the digital workplace in the public sector and one from the private sector are described in the next sections.

Government Integrated Office Management System

The Department of Information Technology has developed the Government Integrated Office Management System (GIOMS) as an initiative under the Digital Nepal Framework 2019. Government agencies can maintain entry and exit registries of letters, attendance records, approve leave, and perform necessary official tasks, issue orders, comment, and make decisions through electronic means using digital signatures via this system (Department of IT, 2023). Thus, it provides a way of performing the tasks of government agencies in a simple, easy, fast, economical, transparent, and effective manner through a single platform. GIOMS is a milestone for E-Governance and the Digital Workplace in the Public Sector. For the smooth operation of GIOMS, the "Government Agencies Operation Related Integrated Electronic System Directives" have been approved by the Government of Nepal in 2022 (Government of Nepal, 2022).

Government offices were heavily dependent on paper documents and manual processes, leading to inefficiencies such as delays in processing, physical storage issues, difficulty in tracking the status of files, tasks, or requests, and the risk of document loss, which created bottlenecks in service delivery, approvals, and decision-making processes. Maintaining and retrieving important documents was time-consuming, leading to delays in decision-making and an overall decrease in operational efficiency. The costs associated with printing, handling, and storing paper documents were considerable. The manual processes required physical presence and also required more human resources, increasing administrative costs and making operations less sustainable in the long run. Furthermore, government departments operated in silos, with little or no coordination between them, resulting in significant delays in communication, duplication of work, and mismanagement. This lack of transparency often led to bureaucratic inefficiencies, limited accountability, and, at times, opportunities for corruption.

The government recognized the need for an integrated digital system to overcome the limitations of the previous manual processes and create a more transparent, efficient, and technology-driven public administration. The development of GIOMS started with the realization that the public administration system needed a comprehensive overhaul. The vision was to digitize internal workflows, reduce paper dependence, and establish a platform that could interlink various government departments. The government undertook feasibility studies and consultations with IT experts to assess the best possible design for the system. GIOMS was designed with a focus on user-friendliness, scalability, and security. The system architecture was planned to support multiple departments and offices, integrating various workflows into one platform. It was envisioned as a solution that would eventually replace traditional processes and enable paperless offices.

The system was piloted in selected government offices to test its functionality, identify areas for improvement, and assess its impact on daily operations. During the pilot phase, feedback from government employees and users helped refine the system for broader deployment. After successful testing, GIOMS was gradually rolled out across government departments and agencies. Training programs were conducted for government employees to familiarize them with the system, ensuring a smooth transition from manual to digital workflows. As more offices adopted GIOMS, the government also expanded the system's functionalities, integrating it with other digital platforms used for e-governance and public service delivery. This ongoing development ensures that GIOMS remains relevant and capable of supporting new administrative requirements.

Key Features and Innovations Introduced by GIOMS:

GIOMS integrates various government offices, departments, and agencies, allowing for seamless communication and document sharing. Government employees can share information, collaborate

on projects, and make faster decisions, reducing the time spent on interdepartmental coordination. Initially, GIOMS was operationalized as an initiative of the Ministry of Communication and Information Technology and its subordinate departments. Subsequently, the Department of Information Technology began providing training for other ministries and government agencies, and the onboarding process has been ongoing since FY 2022/23. As of fiscal year 2023/24, GIOMS is operational in 77 government offices (Department of IT, 2024).

GIOMS has introduced automation into daily administrative tasks such as letter and file tracking, approvals, and document processing, significantly reducing delays and improving efficiency in government offices. Additionally, it serves as a unified platform for managing internal workflows, reducing the need for multiple disconnected systems. By the end of fiscal year 2023/24, a total of 271,062 entry and 54,555 exit registries of letters/documents, along with 5,519 decisions (Tippani), have been processed through the system (Department of IT, 2024).

The implementation of digital signatures and Public Key Infrastructure provides a means to authenticate documents, enabling document authorization, verification, and non-repudiation.

GIOMS facilitates the transition to a paperless environment by digitizing records, documents, and official correspondence, thereby making document archiving and retrieval faster and more efficient.

GIOMS offers real-time assignment, tracking, and monitoring of tasks and documents, providing full visibility into their status, which promotes transparency and accountability.

GIOMS maintains records of employees, including general information, attendance, and transfers. By fiscal year 2023/24, a total of 24,607 employee records are stored in the central e-attendance system (Department of IT, 2024).

The key impacts of GIOMS are listed below:

- (1) GIOMS has streamlined government operations by digitizing processes. It has helped improve service delivery and organizational efficiency.
- (2) The system has reduced the need for paper, physical storage, and manual labor, lowering administrative costs and saving time.
- (3) GIOMS has enhanced transparency by enabling digital tracking of documents and tasks. This system has also improved employee accountability for delays in document processing and decision-making.
- (4) GIOMS has laid the foundation for broader e-governance initiatives in Nepal. By digitizing internal government workflows, the system serves as a stepping stone toward fully digitizing public services and citizen interactions.
- (5) GIOMS has digitalized many daily operations of government agencies. It has developed a robust digital workplace for employees, significantly enhancing the productivity of government officials.
- (6) GIOMS offers work flexibility since tasks can be performed from anywhere. Whether in the field or working from home, employees are not required to use official letterhead paper,

official stamps, physically visit supervisors, or exchange documents. It also simplifies processes like requesting leave. Overall, it has eased coordination and communication within and between organizations.

Although many government agencies, including federal ministries and departments, have already operationalized GIOMS for their regular tasks, GIOMS faces several challenges that hinder its full implementation and effectiveness. There are some key challenges:

- (1) Limited digital infrastructure and internet connectivity in rural and remote regions still remain major challenges to implementing GIOMS.
- (2) Integrating GIOMS with existing legacy systems used by various government offices is complex.
- (3) Cybersecurity concerns, including data breaches and weak cybersecurity measures, are significant challenges for the full operationalization of the system.
- (4) Many government employees lack the necessary digital skills to use the system effectively, resulting in slower adoption and potential errors in system operation.
- (5) There is often resistance and hesitation among government employees to adopt new digital tools due to a preference for traditional, paper-based methods or fear of technology, which slows down the system's implementation.
- (6) Inconsistent implementation across various government offices creates challenges for the overall operationalization of the digital workplace.
- (7) The system requires continuous technical support and upgrades to remain effective, but limited budgets and resource constraints affect regular maintenance.
- (8) Implementing a digital workplace system across multiple government bodies requires strong coordination. However, poor communication between departments can lead to delays and inconsistent use of the platform.

Integrated Tax System

The Inland Revenue Department (IRD) is responsible for the administration of Income Tax, Value Added Tax, Excise, Digital Service Tax, and other federal tax revenues in Nepal. IRD developed E-Systems for Income Tax, VAT, and Excise management with a self-assessment facility; Revenue Accounting System (RAS) with a bank reconciliation facility; Taxpayer Registration Systems with an online application facility; TDS Management System with payment reconciliation provisions; and Internal Monitoring System with performance management systems in the late 2000s. However, these systems were running in silos; hence, a dozen or more small systems were integrated into one Integrated Tax System (ITS) in 2012, which automated the overall tax administration of Nepal. The business processes of the IRD were significantly improved and enhanced with the development of the Integrated Tax System. Initially, tax systems were fragmented, with various tax authorities managing different types of taxes (e.g., income, corporate, VAT). This created inefficiencies, loopholes, and opportunities for tax evasion. ITS emerged as a response to the increasing complexity of tax collection and management.

Along with the department, there are 85 tax offices, including Large Taxpayer Office (LTO), Medium Level Taxpayer Office (MLTO), Inland Revenue Office, and Taxpayer Service Offices (TSO) throughout the country. All offices use web-based ITS to perform tasks related to tax administration, and all taxpayers must use the same system to access all the services provided by the Tax Administration. The system has two main interfaces: Office Portal and Taxpayer Portal, and also has a mobile application for the same. Both portals and mobile applications are based on the same database and platform. With the development and use of the Integrated Tax System, the revenue collection cost per thousand is decreasing subsequently after the application of ICT (Adhikari, 2022).

The ITS has the following major features:

- (1) A single platform for all tax-related processes, such as filing returns, paying taxes, and receiving refunds.
- (2) A self-service Taxpayer Portal where taxpayers can manage their tax affairs, view tax liabilities, make payments, and track refunds. The Taxpayer Portal provides a digital workplace for taxpayers to carry out the following activities:
 - taxpayer registration;
 - permit registration and renewal;
 - tax return filing;
 - tax payment;
 - tax assessments;
 - tax refund;
 - tax deduction at source;
 - central billing information (real time invoice collection from merchants);
 - appeal against tax assessment; and
 - close of the business and deregistration.
- (3) Another interface for tax officials, Officer Portal, provides an integrated digital workplace to carry out all the administrative tasks.
- (4) The system interacts with other government and financial institutions to gather information and provide a digital workplace for all concerned authorities. ITS is integrated with:
 - Revenue Management Information System and Computerized Government Accounting System of Financial Comptroller General Office;
 - ASYCUDA World system of Department of Customs;

- Vehicle Consignment Tracking System of Department of Revenue Investigation;
 - National ID system of Department of National ID; and
 - Company Registration System of Office of Company Registrar, etc.
- (5) Commercial Banks, the Supreme Auditor General of Nepal, and other government agencies and financial institutions have access to ITS for tax-related information sharing.
 - (6) The system sends reminders and automatically calculates penalties for late submissions or payments. It also automatically calculates all liabilities and outstanding tax obligations for each taxpayer.
 - (7) Administration of VAT, income tax, digital service tax, and excise duties is done from a single integrated platform.
 - (8) Taxpayers can access the system via mobile apps or online portals.

The impact of ITS with regard to Digital Workplaces can be summarized as:

- (1) The use of the ITS has improved compliance. Automated processes have reduced the workload on tax officials, leading to quicker processing of tax returns and audits.
- (2) With the Digital Workplace for tax administration, tax officials no longer need to visit taxpayers' business premises for most tasks. Real-time invoices and other information collection have also helped the government to remotely monitor taxpayers' activities without conducting tax raids and physical inspections.
- (3) With centralized taxation data, ITS has increased transparency in tax administration. It has also facilitated better data-driven decision-making.
- (4) A single platform for taxpayers to access all services has simplified tax filing and payments. Taxpayers no longer need to visit the tax office for registration, tax return filing, tax payments, and tax refunds.
- (5) Taxpayers have achieved conformity with their tax liabilities, reducing the risk of penalties. ITS has also lowered the costs for taxpayers to comply with tax regulations.

The ITS has proven to be a significant step towards streamlining tax administration. However, it faces several challenges related to digital workplaces. These challenges stem from the unique nature of digital workplaces, the digital ecosystem of Nepal, the digital literacy situation, and the digital divide. The major key challenges are:

- (1) Although it has digitized most of the tasks related to tax administration, unreliable internet, connectivity issues, and electricity disruptions pose significant challenges for implementation.
- (2) The digital workplaces platform of ITS generates a large volume of electronic data. Ensuring proper record-keeping and documentation is challenging.

- (3) As the volume and complexity of tax-related data and documents exponentially increase in Nepal, it is becoming more challenging for the Inland Revenue Department to provide adequate infrastructure for the smooth operation of the ITS.
- (4) Building the competency of tax officials to fully utilize the digital workplace platform of ITS is also crucial for successful implementation.
- (5) The digital and financial literacy of taxpayers is another challenge for the full operationalization of the ITS digital workplace.

The ITS is focused on providing services to citizens, so the functionality and reliability of the application are well executed. However, the efficiency, usability, and portability of the system should be improved to enhance the maturity level of e-governance (Maharjan, De Chang, & Shrestha, n.d.).

eSewa

eSewa is one of the leading digital wallets and payment gateway services in Nepal. eSewa is a subsidiary company of F1Soft International. It was launched in 2009. eSewa allows users to make online transactions, including mobile top-ups, utility bill payments, airline ticket purchases, fund transfers, and online shopping. The platform facilitates both individual users and businesses by providing secure, real-time transactions without the need for physical cash or banking access, as it is integrated with multiple banks and financial institutions. eSewa offers easy fund transfers and digital banking services, contributing to Nepal's growing digital economy and promoting cashless transactions.

eSewa, a venture from the private sector, is licensed by Nepal Rastra Bank (Central Bank of Nepal) as a payment service provider (PSP). Customers can make a full range of transactions from web and mobile applications. eSewa enables timely payments by allowing users to schedule recurring payments and set reminders, helping avoid late fees. Customers also benefit from discounts and cashback offers for prompt payments, depending on the scheme. By providing secure and convenient payment solutions, eSewa plays a vital role in boosting Nepal's digital economy and supporting e-commerce businesses (Regmi, 2021). The mobile wallet eSewa has significantly replaced traditional leather wallets, minimizing the need to carry cash or credit cards regularly. It offers users a more accessible, reliable, and secure way to perform transactions, saving time and reducing business risks. With encrypted data transmission, eSewa ensures the safety of user and transaction information. Additionally, it has improved economic data collection by securely storing transaction records, making it easier to track and analyze the country's economic activity (Belbase, 2021).

As a developing nation, Nepal has struggled to establish a strong presence in most fields outside tourism, primarily due to political instability, corruption, and nepotism. However, eSewa, launched a decade ago, has made strides toward supporting the country's economy by promoting digital payments. Digital payments play a crucial role in the digital workplace. Digital payments are the foundation for all digital transactions, and eSewa and other digital payment services have created a sound ecosystem for digital payments in Nepal.

eSewa faces several challenges in Nepal's competitive digital payment landscape. Gaining the trust of banks and financial institutions was initially a significant hurdle. Additionally, expanding features and ensuring user engagement, especially as other payment systems emerge, remains crucial for eSewa to maintain its leading position in Nepal's growing digital economy (Regmi, 2021). Digital literacy is another challenge for digital payment services in Nepal.

Key Challenges in Establishing Digital Workplaces

The productivity paradox is relevant in Nepal, as digital initiatives do not immediately translate into increased productivity. Despite initiatives from the government and private sector, the overall economic output has not seen much rise. Nepal still faces challenges that hinder the full potential of a digital workplace. Some of the key challenges include a lack of robust digital infrastructure, insufficient policies, a shortage of skilled workers, and a failure to fully utilize Nepal's digital capabilities. Other challenges are limited payment options, poor organizational structures, and broader social factors (IIDS, 2023).

- **Technical factors and digital skills gap:** Limited digital infrastructure, lack of energy supply, low ICT literacy, digital readiness, and privacy concerns are significant obstacles. Human resource shortages and a lack of government awareness about the importance of human capital in digital transformation are also pressing issues. The gap in digital skills, particularly in rural areas, remains a significant barrier to fully realizing the potential of digital workplaces in Nepal. Training and awareness initiatives are needed to address the public sector's limited understanding of digital technologies and the lack of training opportunities (Rai & Gupta, 2023).
- **Political and policy factors:** Another major challenge in Nepal's digital landscape is the lack of clear and robust policies that specifically address its needs. Nepal's policies are not well-designed to support the growth of the IT sector. The study (IIDS, 2023) found that insufficient protection of intellectual property, inadequate regulations for data privacy and security, and potential restrictions on data movement between countries in proposed IT laws are some of the main concerns that need to be addressed. Although the government announced a detailed plan for a "Digital Nepal" that covers many areas, there is still a lot of work to be done to make it fully and realistically achievable. For example, the necessary organizations and structures to lead the Digital Nepal initiative are not yet in place. Additionally, specific investment plans for each of the 80 activities listed in the framework need to be developed to ensure its complete implementation. Given the past failures of similar plans like the e-Government Masterplan, a careful evaluation of capabilities will be necessary to guarantee that the Digital Nepal framework is based on an effective implementation strategy (Bhattarai, 2021). Political instability, inadequate regulations, and shifting government priorities create uncertainty.
- **Technological reluctance and resistance to change:** Cultural factors like employee resistance to change and corruption pose additional challenges. Due to a lack of digital literacy and fear of technological disruption, many workers tend to resist new technology adoption and follow outdated work practices.
- **Cybersecurity concerns:** Cyberattacks have affected various sectors in Nepal, making cybersecurity audits essential for all public and private organizations. However, banks and government organizations are not prioritizing cybersecurity. IT experts believe that Nepalese banks and government organizations are more focused on cost advantages than on protecting critical systems from cyber threats (Giri & Shakya, 2020).

Despite the challenges, government policies aim to enhance the country's digital infrastructure, encourage technological adoption, and promote digitization across various sectors.

Conclusion and Policy Recommendations

The enhancement of digital infrastructure and connectivity is a prerequisite for the development of the digital workplace in both the public and private sectors. High-speed broadband Internet connectivity is necessary for rural and remote areas of Nepal to utilize digital workplace services. A consistent supply of electricity and stable internet connectivity are very critical requirements in Nepal. With the increase in demand for IT services, IT infrastructure improvement should be a key priority. It will require a joint effort from various stakeholders, including the government, regulatory bodies, and telecommunications companies. Collaboration to identify infrastructural shortcomings, prioritize investments, and create effective strategies for development will be essential from all stakeholders. Nepal also needs to increase the number of data centers to ensure secure data storage and management, facilitate remote access, support disaster recovery, and enhance energy efficiency. The government should focus on establishing and developing IT parks, incubation centers, and innovation hubs. These will improve physical and digital infrastructure and will enable competitive pricing in this sector. This will also help to create vibrant ecosystems for startups, providing essential resources, mentorship, and networking opportunities. By promoting the growth of startups and supporting freelancers, digital workplace initiatives will significantly boost the country's overall economy. The GIDC and Disaster Recovery Center (DRC) of the government should also be enhanced to cope with current requirements and challenges. The government should put more emphasis on utilization of transformative power of AI to foster economic growth, enhance efficiency, and productivity.

The government of Nepal should upgrade its ICT policy, cybersecurity policies, and tax and incentive regimes for digital initiatives from private sectors. The government should also enhance the existing Electronic Transaction Act with new emerging issues and a vision for digital Nepal. The Digital Nepal Framework should be revised and strengthened with adequate budget allocation and delegated authority to MoICS and DoIT to carry out the initiatives. Government policies and regulations play a central role in supporting and fostering the growth of the IT industry. Furthermore, detailed implementation roadmap, proper implementation and governance are crucial.

Expansion of digital literacy and skill improvement initiatives from both the public and private sectors should be undertaken to reduce the digital divide and equip the workforce with the necessary tools to work in digital environments.

Cybersecurity measures should be strengthened for safeguarding sensitive data and maintaining the integrity of digital systems. Robust security systems should be developed for public and private digital workplace platforms. Regular security audits and vulnerability and penetration testing (VAPT) should be conducted for digital systems. The government should implement initiatives for digital literacy and digital skills development to reduce the digital divide and enhance digital productivity. Standard operating procedures and best practices for digital workplace adoption should be developed to ensure uniformity in implementation.

Sufficient resource allocation by the government should be made to support the long-term success of digital workplace initiatives in Nepal. The government must invest in IT infrastructure, system maintenance, and employee training to enhance digital workplace functionality and employee productivity. Another policy recommendation is to develop a more user-friendly digital platform to accommodate users with varying levels of technical expertise. Designing digital systems with intuitive interfaces and incorporating accessibility features will make it easier for all employees, including those with disabilities.

Finally, strong interdepartmental coordination should be developed to successfully implement and operationalize digital workplace initiatives in Nepal. Government and private sector collaboration should be promoted to drive innovation in productivity measurement and digital workplace practices.

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PAKISTAN

Introduction

The advent of the information age has significantly transformed the modern world. This, however, does not mean that the entire world, particularly the developing nations, is ready to reap the full harvests of this digital transformation. This disparity became very evident during the COVID-19 pandemic, which alerted the world to go for targeted emergency overhauls. Pakistan, a lower-middle-income developing country, faces significant challenges and immense possibilities for rapid socioeconomic development, which can become manifold by reaping the benefits of digitalization in the workplace. With a population of 241.49 million, the country possesses a huge human capital, which, if equipped with the traits and skills of digital technologies, can substantially enhance its socioeconomic outlook.

Pakistan faces socioeconomic challenges, including gender disparities and limited digital access, which hinder its growth. The country ranks 164th out of 193 in the Human Development Index and 135th in the Gender Inequality Index. However, digital transformation offers opportunities to overcome these challenges. With 87.35 million internet users and widespread mobile connectivity, digital platforms can enhance economic participation, governance efficiency, and social inclusion. Careful and strategic investments in human capital, by equipping people with digital technologies, tools, and infrastructure, can foster sustainable development and resilience.

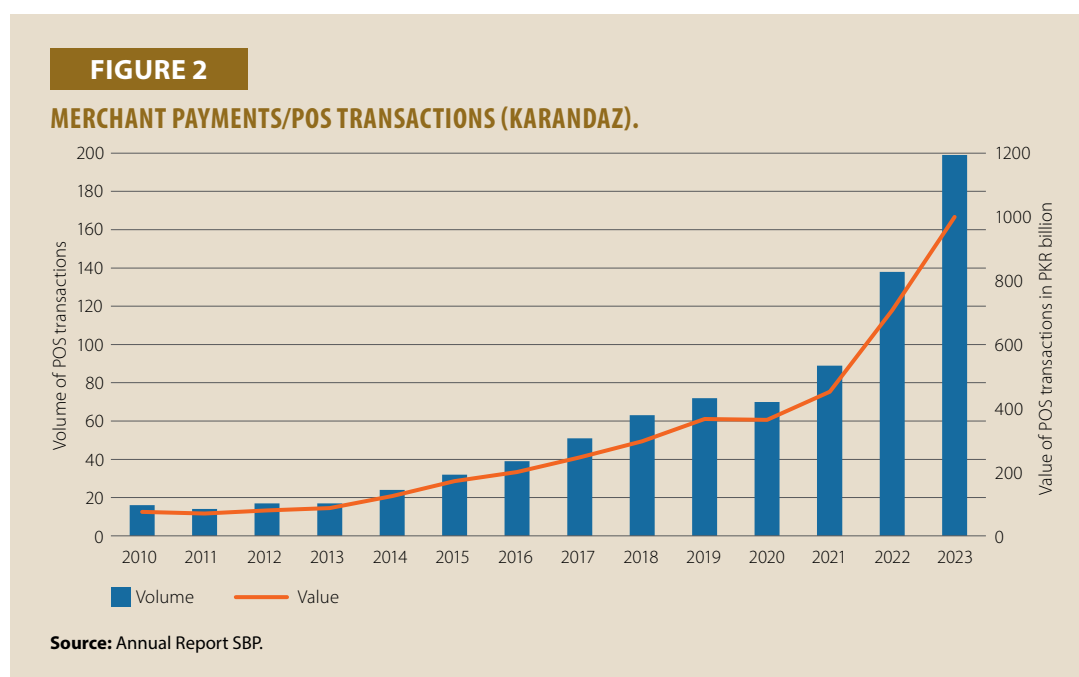
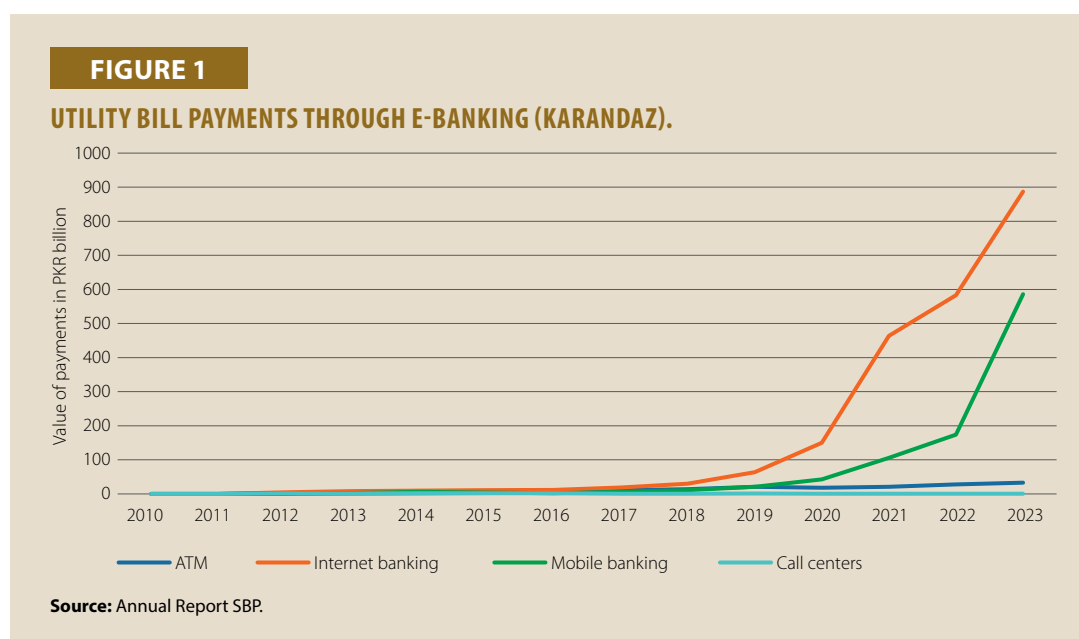
In the first quarter of this century, the birth, adoption, and boom of social media and related apps have transformed the interface between the state and the society in unprecedented ways. This is because digital entry points enable effective, efficient, and quick policy making, and provide support, absorption, and audit that help in engaging actors and institutions (Pakistan, 2023/2024). Digital technologies are permeating all aspects of our daily lives, which necessitates that we update our means of production, transaction, and value derivation to align with the digitally changing world.

The rising use of smart phones in the last decade-and-a-half has enabled the outreach of digitalization to a much wider audience. Many users are now using the digital channel for accessing financial services in the country.

Figures 1 and 2 depict some interesting trends in the growth of digitization in the country. Figure 1 shows the trend of increased use of digital banking channels for payment of utility bills in the country. It can be seen that there is a steady rise in internet banking and mobile banking payments after the years 2019 and 2020, respectively, which indicates growth in the number of users switching to digital banking for their day-to-day needs. Likewise, in Figure 2, the value and volume of merchant payments (POS transactions) are plotted. Again, one sees a pattern similar to Figure 1, as there is a steady rise in the value and volume of POS transactions 2019 onwards. This is also indicative of the growing trend of consumers switching to digital forms of payments.

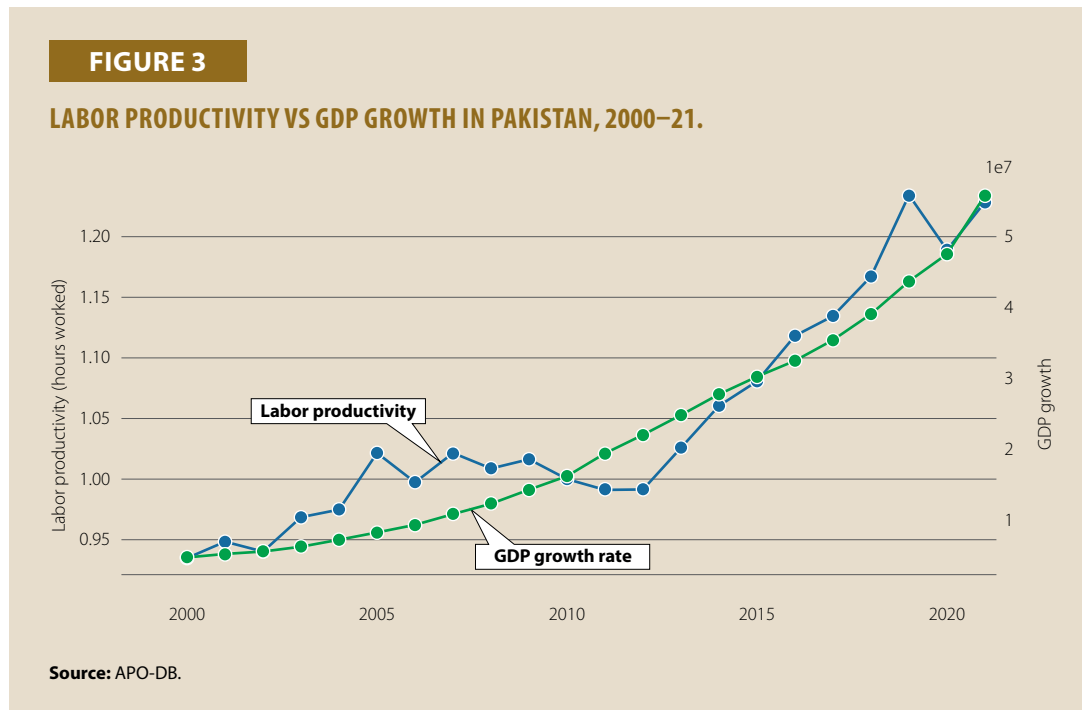
Thus, there is a need to study the impact of digitalization in workplaces in Pakistan. This will enable us to find the useful trends and provide suggestions for further enhancing the productivity

of businesses using digitalization as well as of the consumers who want to use the products and services of such businesses. This report is a step in the direction of finding some interesting insights in this context. In the next section, we will review some papers that were published in the context of digitalization in Pakistan. We present two cases: one about digital trade and the other about a qualitative analysis of digital projects carried out by government of Khyber Pakhtunkhwa province of Pakistan. Next, we provide a timeline of different policies framed from time to time by different governments in Pakistan. The timeline provides policies from the year 1991 to 2024. Thereafter, we present best practices of digitalization adopted by providing two cases in the context of Pakistan. One is from the public sector, namely the Punjab Information Technology Board (PITB), and the second is that of Habib Bank Limited, which is the largest private bank functioning in Pakistan. Finally, we provide a summary and conclusion of this report.



Productivity and Labor Statistics for Pakistan

Labor productivity in Pakistan from 2000 to 2020 shows notable fluctuations with periods of growth, decline, and stagnation, driven by structural shifts in key sectors, external economic factors, and political challenges (see Figure 3).



In 2000, labor productivity stood at 0.045 units of GDP per hour worked. This figure fluctuated through the early 2000s, slightly increasing to 0.79 units by 2004, showing signs of instability. Labor productivity experienced modest gains during this period, particularly in the mid-2000s. By 2010, labor productivity had improved, with sporadic gains reaching 0.87 units in 2002 and around 1.0 units in 2010. The period from 2011 to 2015 saw stagnation in labor productivity, with values fluctuating between 0.970 and 1.0755 units of GDP per hour worked. By 2020, labor productivity saw modest recovery, reaching approximately 1.18 unit of GDP per hour worked, which was a sign of improvement following years of stagnation.

In 2020, the COVID-19 pandemic disrupted economic activity, particularly in services and manufacturing sectors. The lockdowns and disruptions to global trade affected industrial output, slowing productivity growth. However, the impact was somewhat cushioned by ongoing infrastructure projects.

Survey of Papers on Digital Workplaces

In this section, we review selected papers on digital workplaces, smart working, and AI, focusing on their qualitatively and quantitatively findings in the context of Pakistan post 2000. The papers were retrieved from “Google Scholar” using search keywords such as “digital workplace Pakistan,” “smart work Pakistan,” “impact of digitization in Pakistan,” and “Digital Productivity Study in Pakistan.” Google Scholar listed several results in response to the research queries, out of which we filtered the most relevant studies pertaining to digitization and smart work in Pakistan. The following paragraphs present a review of these papers.

In (Muhammad Ittefaq, 2018), the authors carried out a study of digitization of the health sector in Pakistan. They did so in the context of online health communication by analyzing the MARHAM social and mobile media. They did a thematic analysis of MARHAM's Facebook group and page, Twitter (now X) handle, and its mobile and web apps. The sample of analysis consisted of 6,083 group posts, 1,724 tweets, and 1,123 Facebook posts. Findings showed that their Facebook page mostly received user inquiries, which included women's health (43.23%); kids' health issues (16.63%); psychological issues (15.45%); dental issues (9.5%); skin-related problems (5.93%); obesity (4.19%); and others (5.04%). MARHAM's Facebook page and Twitter/X handle were mainly used for educating users about health issues. Its mobile and web apps were used by healthcare professionals and users for registration. Results indicate that digital media is playing a crucial role in this case by educating users and spreading awareness about various health issues, primarily those concerning women and children. MARHAM, however, face challenges because of the country's insufficient literacy rate and limited internet access in remote areas, as this restricts the outreach to a much wider audience.

In (Danish Ali, Adoption of autonomous mining system in Pakistan – Policy, skillset, awareness and preparedness of stakeholders, 2020), the authors carried out a study on the adoption of autonomous mining system in terms of the skillset and technical knowledge of the labor force. They also focused on the awareness and preparedness of the concerned stakeholders. Autonomous mining is designed to improve the productivity of mining, along with enhancing efficiency and ensuring workplace safety. It comprises the use of latest, and automated technology for enhancing the throughput of the involved workforce. Such systems are already in vogue in developed countries. Even studies in African nations have been carried out about the adoption of such systems. In (Danish Ali, Adoption of autonomous mining system in Pakistan – Policy, skillset, awareness and preparedness of stakeholders, 2020), the authors have done a novel study in an effort to assess the current state of mining engineers working in Pakistan's mining industry, the government sector, and the academia in terms of their knowledge and skills.

The study consisted of closed and open-ended questionnaires distributed electronically among the participants. Results were analyzed both qualitatively and quantitatively. Substantial evidence appeared showing the existence of a knowledge gap, lackluster planning, and gaps in enforcement of policy decisions to adopt autonomous mining systems in the country. Results show that more than 74% of the respondents, mostly from industry and academia, were willing to adopt autonomous mining due to its potential benefits in safety and productivity. Not surprisingly, government agencies expressed diversified views in resisting the new technology, with the primary concern being the fear of increased unemployment. A major chunk (60.35%) of the graduate mining engineers expressed dissatisfaction with the undergraduate and graduate coursework in equipping them with the skills needed to work with autonomous systems. The study in (Danish Ali, Adoption of autonomous mining system in Pakistan – Policy, skillset, awareness and preparedness of stakeholders, 2020), therefore, recommends a revision of the mining curriculum so as to impart relevant skills in autonomous mining to the graduating engineers. It also recommends an enhanced government–industry–academia collaboration to fund and develop the required infrastructure and facilities that can bridge the existing knowledge gap and drive an early adoption of autonomous mining in Pakistan.

In (Mubarak, 2019), the authors investigated the impact of Industry 4.0 technologies like big data, cyber–physical systems (CPS), internet of things (IoT), and interoperability, on the business performance of small and medium-sized enterprises (SMEs) in Pakistan. They developed a questionnaire for this purpose and distributed it randomly to SMEs in six major cities of Pakistan. The results depict that big data, CPS, and interoperability positively impact business performance.

However, IoT was found to have an insignificant. They suggest that adopting Industry 4.0 technologies can help boost productivity and competitiveness of SMEs in Pakistan. Recommendations of the study include the government facilitating an extensive adoption of advanced technologies by SMEs in their operations. It also recommends equipping a sizable human resource with modern skills to effectively harvest the benefits of Industry 4.0.

In (Razia Gul, 2024), the authors have investigated the impact of using data analytics on the productivity of commercial banks in Pakistan. They made use of the two-step system of generalized methods of moments (GMM) for analyzing the impact on banks' productivity using data analytics tools. The report found that, in the case of Pakistan, a productivity increase of around 6% resulted because of investments targeted at data analytics rather than just software. The findings further revealed that the moderating role of dynamic capabilities on the relationship between data analytics and banks' productivity was insignificant. This brought into question the need for human capital development through investment in research and development. The study recommended the banks to invest in analytics that exhibited predictive, visualizing, and analytical features. The use of such innovative technologies should be complemented by staff training and human capital development to ensure sustainable performance.

Authors in (Mehreen Malik, 2022) have investigated the role of digital leadership in the gig economy. They have also provided the case of Pakistan in this context. Pakistan is facing challenges in the context of digitalization. While the concept of digitalization is largely linked with the developed world, firms in developing countries are also trying to compete in this space. Pakistan holds significant potential owing to its large services sector, which is increasingly adopting e-commerce, fintech, and e-governance. However, these technologies are still in an early stage of adoption. The WEF's Networked Readiness Index ranks Pakistan 110th out of 139 countries in terms of its readiness for digitalization. This low ranking is mainly because of low adoption of digitalization in operations and processes of different sectors of the economy. A report by the McKinsey Global Institute (MGI) estimates that digital financial services alone can increase the GDP of Pakistan by approximately 7 points, which can contribute around USD36 billion to its economy and create around 4 million new jobs by the year 2025. Likewise, theoretical research about digitalization is lacking, particularly regarding the actions and roles of leaders and managers in the context of digitalization and the gig economy. Most of the existing literature is based on Western contexts, which may contrast significantly with Pakistan's context. Notably, Pakistan has a collectivistic society, and research grounded in its economic and cultural environment may potentially offer distinct insights into digital leadership and digitalization.

AI in Digital Workplaces and Smart Work

Some literature on the use of AI in digital workplaces and smart work was also explored, as AI has become a buzzword these days. If utilized properly in any field, the benefits of AI and its accompanying utility can be manifold. Owing to this, the Pakistan government has planned to announce its first AI policy in the year 2025 (Siddiqui, 2024). A key takeaway of the policy, as shared by a member of the IT ministry, is to improve the country's ranking in the Global Cybersecurity Index to the top 10–15, compared with its current position within the top 40. The government has already launched the national Computer/Cyber Emergency Response Team (CERT), and sector-specific CERTs are being considered for areas such as telecom, banking, and education. Likewise, there is a plan to establish provincial CERTs as well. The policy is aimed at strengthening the capabilities of institutions to detect and thwart cyber threats in real time, thereby enabling them to prevent data breaches and consequently boost the digital economy and transform the country into a more digitized nation.

In (Sara Nazeer, 2023), the authors have carried out a study to identify the challenges in adoption of AI in public-sector organizations of Pakistan. While both public- and private-sector organizations are keen to adopt AI for optimizing the gains from their day-to-day operations, the public-sector organizations face several challenges and gaps in terms of costs, technology awareness, R&D, red tape, and cloud and ICT readiness.

In (Sohail Raza Chohan, 2021), authors have performed a systematic literature review (SLR) to analyze existing data and recommend a solution for AI-oriented e-government services in Pakistan. They have recommended to make use of AI citizen to government (C2G) services in various sectors like health, police, local governments, and finance. They have based and recommended their findings on existing ICT infrastructure and its stability. In the next few sections, we identify and present a few cases from the surveyed papers.

Cases from the Surveyed Papers

We provide two cases in the context of digital workplace/smart work in Pakistan. These have been taken from studies on digital trade prospects and challenges in (Asif Javed, 2022) and digitization of government projects in Khyber Pakhtunkhwa province of Pakistan in (Salman Ahmad, 2021). In the latter, the authors did a qualitative survey and identified some factors that positively support digitalization of government projects or have a negative impact on their completion.

Case 1: Digital Trade Prospects and Challenges

In a study in (Asif Javed, 2022), the authors reviewed digital trade in Pakistan as per the World Trade Organization (WTO) and United States International Trade Commission (USITC) definitions. The study considered items that came under this definition and analyzed the digital trade volume in Pakistan from 2010 to 2020. They used a three-step methodology: the first step was about digital trade of items using a six-digit-level Harmonized System (HS); the second step identified top ten import and export items; and the third step identified the top ten digital trade markets. A finding of the study was that favorable government policies and measures have helped promote digital trade in the country. However, the country needs to reduce the fiscal and trade barriers to attract foreign investments in the digital domain, lower data and information costs, and define and strengthen measures to ensure data security, privacy, and protection to further digital trade integration. Table 1 lists the top ten digital export and import items for the years 2010–20 by HS codes and dollar values. The highest imports, worth USD1,300 million, are for HS Code 490700, which pertains to unused postage, revenue, or similar stamps. On the other hand, the highest exports, worth USD21.8 million, are for HS Code 490199, which is for printed matter, books, and brochures.

TABLE 1

TOP 10 IMPORT AND EXPORT ITEMS IN DIGITAL TRADE, 2010–20.

Exports		Imports	
HS code	Value (in USD million)	HS code	Value (in USD million)
490199	21.8	490700	1300.0
482110	13.5	854212	301.2
491199	8.9	490199	300.7

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Exports		Imports	
HS code	Value (in USD million)	HS code	Value (in USD million)
490110	4.3	852439	149.8
490810	3.3	482110	47.3
950490	2.7	491199	42.5
852439	2.3	490600	35..0
490599	2.2	491110	20.8
490290	0.8	854150	11.8

Source: WITS.

Table 2 lists the top ten digital trade markets for Pakistan during the years 2010–20.

TABLE 2

TOP 10 DIGITAL TRADE MARKETS, 2010–20.

Country	Exports (in USD million)	Country	Imports (in USD million)
Saudi Arabia	10.2	PR China	361.7
UK	7.3	USA	255.5
USA	6.6	UK	109.9
Bangladesh	3.0	UAE	93.8
Germany	2.2	India	43.2
Kuwait	2.1	Hong Kong	41.1
India	2.0	Singapore	31.6
Qatar	1.9	Saudi Arabia	16.4
Jordan	1.8	Poland	14.6

Source: WITS.

Table 2 provides the statistics for top ten digital trade markets for Pakistan during the years 2010–20. The top export market was Saudi Arabia with an export volume of USD10.2 million and the top import market was PR China with an import volume of USD361.7 million.

A very essential and basic requirement for digital trade to flourish is the existence of basic infrastructure for carrying out the digital trade. It is the responsibility of the Director General Trade Organization (DGTO) in Pakistan to regulate organizations doing trade in the digital space and otherwise. Table 3 shows the steady growth in cellular tele density and broadband penetration in Pakistan during the years 2016–21. Table 4 shows the growth in e-commerce merchants registered with banks in the country during 2017–20. Table 5 shows the growth in the number and value of e-commerce transactions carried out in the country during the period 2017–21. We can see a ten-fold increase in the number of transactions during this period and almost four times increase in the value of the transactions.

TABLE 3

BROADBAND AND TELE DENSITY STATISTICS.

Description	2016–17	2017–18	2018–19	2019–20	2020–21
Cellular tele density (%)	72.4	73.6	76.5	78.57	85.3
Broadband penetration (in million)	322.2	445.9	583.4	710.3	–

Source: Pakistan Telecommunication Authority.

TABLE 4

NUMBER OF E-COMMERCE MERCHANTS REGISTERED WITH BANKS.

	2017	2018	2019	2020
E-commerce merchants	571	1094	1362	1707

Source: State Bank of Pakistan.

TABLE 5

E-COMMERCE TRANSACTIONS DURING 2017–21.

Description	2017–18	2018–19	2019–20	2020–21
Transactions	1,217	3,422	5,657	10,205
Amount	9,397	18,677	26,088	34,871

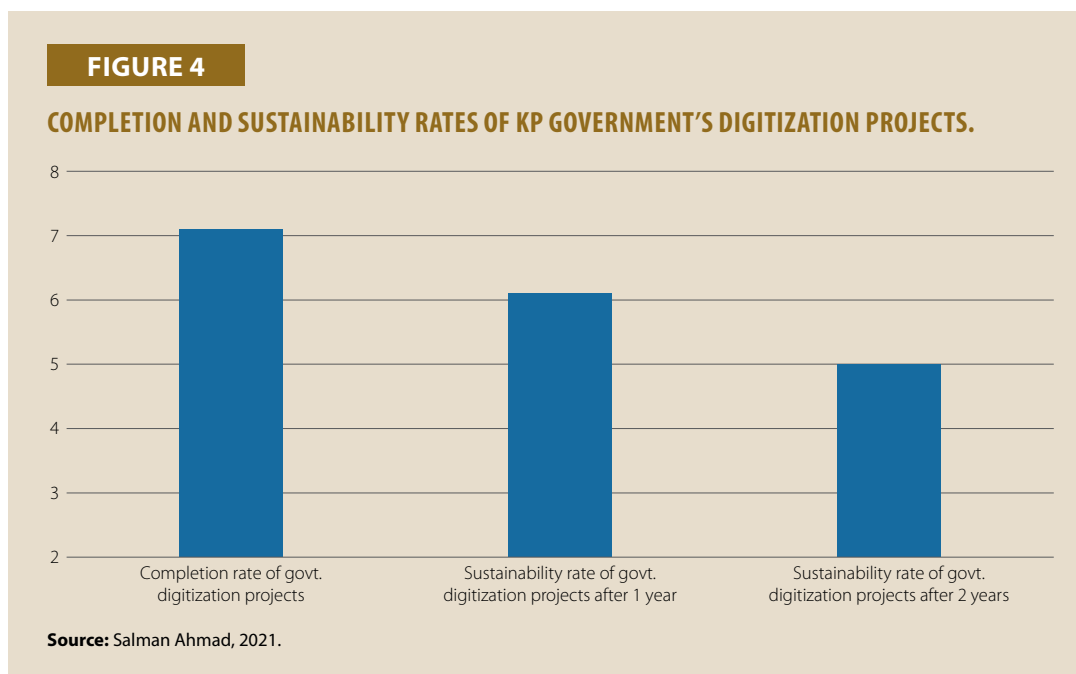
Source: State Bank of Pakistan.

The study in (Asif Javed, 2022), recommends that Pakistan can enhance digital trade by taking measures to improve the infrastructure and develop the human resource for digital trade. Another recommendation is to reduce fiscal restrictions in terms of taxes and tariffs. The State Bank of Pakistan (SBP) should further ease the processes and documentation for firms aspiring to do digital trade. Another recommendation is for the Ministry of Information Technology and Telecommunications (MoITT) for devising a framework that supports digital ecosystem for IoT in licensed and unlicensed brands. Pakistan Telecommunication Authority (PTA) should take measures that increase the penetration of broadband to a wider spectrum of users, especially those who are willing to do digital trade. Regional and bilateral digital trade agreements should be encouraged and developed with regional partners on the lines of Trans-Pacific Partnership Agreement (CPTPP) and North American Free Trade Agreement (NAFTA). Digital trade agreements can be made part of the existing Free Trade Agreements (FTAs) with neighboring countries or those involved in regional alliances.

Case 2: A Qualitative Study of Digitization of Government Projects

In (Salman Ahmad, 2021), authors have carried out a study in the Khyber Pakhtunkhwa (KP) province of Pakistan to determine different factors that accelerate or impede the process of digitization of government projects at the provincial level. The study conducted a qualitative analysis of responses to a questionnaire developed from existing literature on the subject. The questionnaire was distributed to 25 senior government officials via Google Forms, and 18 of them provided complete responses. A validation was performed by conducting meetings with the officials. Based on the responses, the intensity of each factor was computed and plotted in the form of graphs to identify the most relevant factors contributing to the success or failure of government's digitization projects.

The findings of the study in (Salman Ahmad, 2021), suggested that the completion rate of the Government of KP's ICT projects was around 70%. The projects delivered on time were also 70% while the remaining 30% experienced schedule slips owing to unplanned or unforeseen circumstances. Of these projects, around 60% remained active one year after completion but only 45% sustained after two years of completion. This means that half of the projects became unsustainable after two years of completion (see Figure 4).



An interesting finding of the study was that most ideas for government digitization projects came from international organizations and donors (See Figure 5).

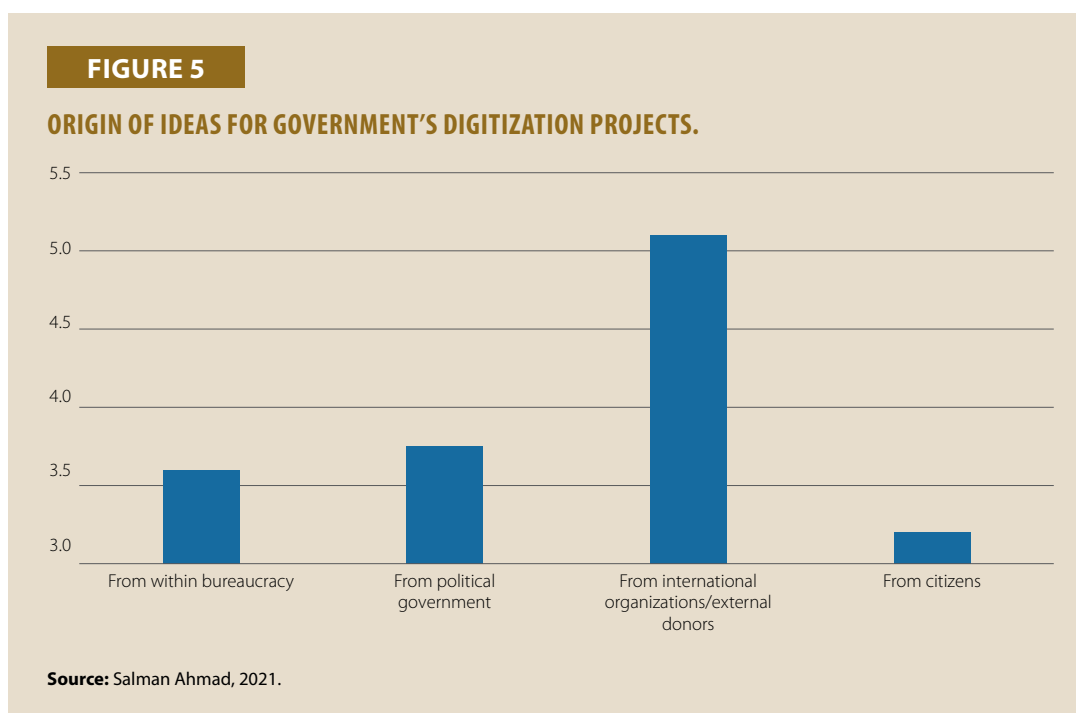
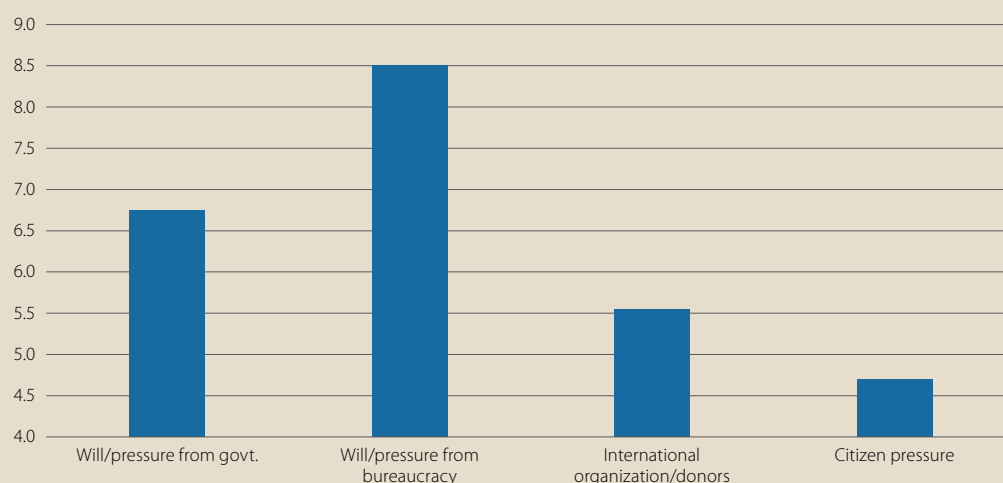
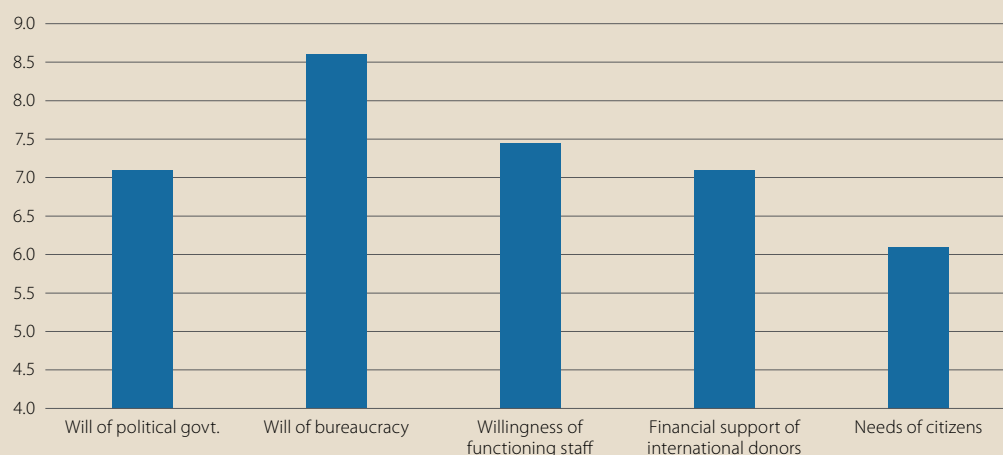


FIGURE 6**FACTORS AFFECTING COMPLETION OF KP GOVERNMENT'S DIGITIZATION PROJECTS.**

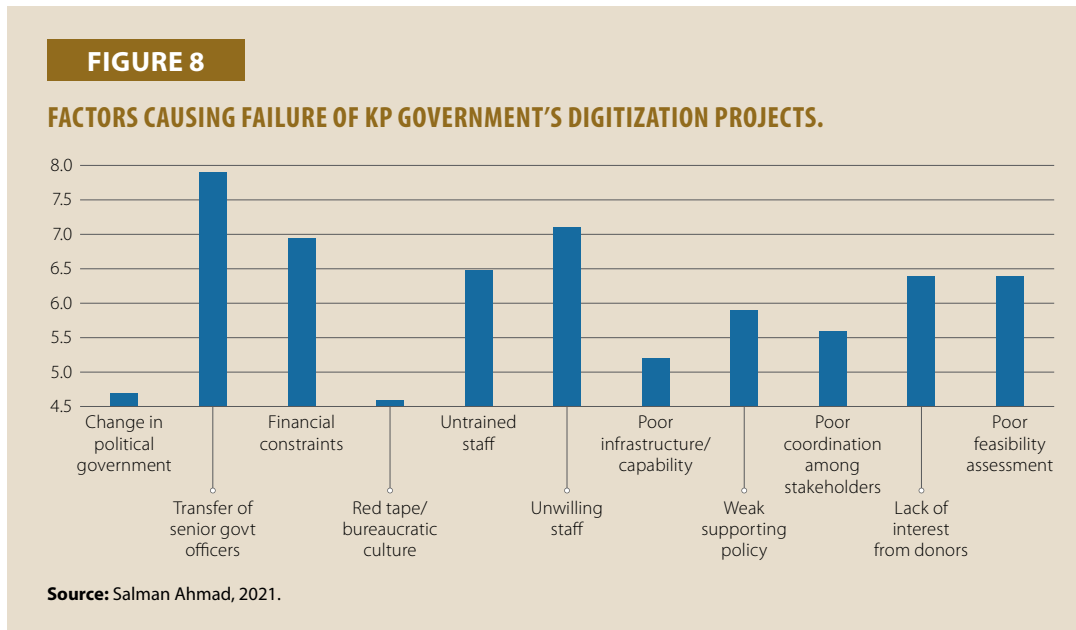
Source: Salman Ahmad, 2021.

The influence and will of both the bureaucracy and the political leadership were key contributing factors to the 'completion only' status of government digitization projects. This implies that changes in political leadership and reshuffling of the bureaucracy, whether due to a change in the government or by the same government, did affect the completion of these projects (see Figure 6).

The study identified the will of the political leadership and the bureaucracy, the support of the functioning staff, continued financial support from international donors, and the needs of citizens as the most influential factors determining the sustainability of digitization projects of the KP government (see Figure 7).

FIGURE 7**FACTORS DETERMINING THE SUSTAINABILITY OF KP GOVERNMENT'S DIGITIZATION PROJECTS.**

Source: Salman Ahmad, 2021.



According to the findings of this study, contrary to the more general belief that political instability is the leading factor contributing to the failure of government digitalization projects, it is the reshuffling of the bureaucracy that affects the success of the projects the most (see Figure 8).

Likewise, the study found that the chief factor contributing to the success of KP government's digitization projects was the will of the executive body (bureaucracy) (see Figure 9).

To conclude, the study found several interesting factors contributing to the success of digitization projects in the KP government. The major factors were the political leadership, the bureaucracy, and the funding from donors. So, if the political government identifies the right ideas and donors, and the implementation is done diligently by the bureaucracy, then the success rates of the projects will increase significantly.



Laws, Regulations, and Guidelines for Digital Productivity

There have been several efforts in terms of policies and laws introduced for digital adoption in Pakistan by the federal and provincial governments for different federating units of Pakistan. Table 6 lists the laws, policies and regulations introduced by the Pakistan government to enhance and streamline digitalization in the country over the last three decades, from 1991 to 2024. It is to be noted that the ministry of Information Technology and Telecommunication at the federal level frames policies and regulations for the IT sector in the country for the federating units (Punjab, Sindh, KP, and Baluchistan). As is evident from Table 6, some policies and regulations, e.g., 1999(1), 2018(1), 2018(2), and 2022(1), are about a specific federating unit.

TABLE 6

TIMELINE OF POLICIES, LAWS, AND REGULATIONS FOR DIGITAL PRODUCTIVITY IN PAKISTAN.

Year	Law/regulation/policy
1991	Pakistan Telecommunication Corporation (PTC) established (GOP, 1991)
1993	Arrival of Internet and e-mail through dial-up connections in Pakistan
1994	Pakistan Telecommunication Authority established through an ordinance
1995	Broadband commenced in Pakistan
1996	PTC dissolved and PTA established as a regulatory body (GoP, 1996) National Telecommunication Corporation established to providing telecom services and infrastructure to public and private entities
1999	Punjab Information Technology Board established 2nd generation mobile technology introduction by Mobilink
2000	National IT Policy and Action Plan launched National Database and Registration Authority formed
2003	Deregulation Policy for the telecommunication sector Privatization of Pakistan Telecommunication Company Limited
2004	Mobile Cellular and Broadband policy launched for increasing affordability
2006	Universal Service Fund established for increasing outreach of internet to the underserved
2011	Khyber Pakhtunkhwa Information Technology Board established
2012	NADRA introduced computerized smart national identity cards (SNIC)
2014	Planning Ministry launched Pakistan vision 2025 anticipating that digitalization is critical to human development and SDGs
2015	Telecommunication Policy introduced as the first holistic legislation to harness Pakistan's digital ecosystem
2016	The Prevention of Electronic Crimes Act 2016 introduced IGNITE-National Technology Fund Setup to support digital skills and technology startups IGNITE launches first incubation centers in Lahore and Peshawar
2018	Punjab IT Policy launched KP IT Policy launched IGNITE launched incubation center in Quetta Ministry of IT launched Digital Pakistan Policy, which focused on digital strategy on emerging technology, entrepreneurship, innovation, and youth IGNITE launched the largest online digital skills program for youth increasing outreach to 300,000

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Year	Law/regulation/policy
2022	Sindh Digital Technology Board formed
	IGNITE launched incubation centers in Hyderabad and Faisalabad.
	State Bank of Pakistan (SBP) launched the RAAST payment system to enable real-time payments
	Ministry of IT introduced National Data Protection Regulations policy, setting framework for data protection and privacy
	Ministry of IT moved government services to the cloud under the Cloud First Policy
2024	NADRA launched National Digital Wallet

From Table 6, we can identify the establishment of Punjab Information Technology Board (PITB) in 1999, National Database Registration Authority (NADRA) in 2000, and the IGNITE National Technology Fund in 2016 as the major sources of policies and regulations on digitization introduced in the country in 2000. However, Pakistan does not have a specific legislation that governs teleworking. Already promulgated labor laws such as The Employment Act, 1923 and The West Pakistan Shops and Establishments Ordinance, 1965 do provide the essential framework for addressing such a scenario. These laws have clauses for fundamental rights of employees, conditions at work, hours of work, policy of leave and some other workplace matters that can be customized for telework. It is pertinent to mention that Pakistan has not yet ratified the International Labour Organization (ILO) Convention C177 on Telework, but that is not an obstacle in implementing policies for telework in the existing legal framework (Rivermate).

A white paper/position paper published by Pakistan Software Houses Association (PASHA) has identified the current problems in taxation pertaining to remote workers, especially those working for overseas entities. They generally do not have to face the same tax deduction rates as those who work for in-country software companies (Pakistan Software Houses Association (PASHA), 2024). This paper proposes reducing tax rates for employees of Pakistani digital companies, especially those registered with PASHA or Pakistan Software Export Board (PSEB). The paper suggests that even if the government loses tax revenues, it stands to gain by retaining the workforce of in-country software companies and the resulting increase in exports of such companies.

Best Practices for Digital Workplaces or Smart Work

In this section, we will review some best practices from digital workplaces in Pakistan. We will use cases from both the public and private sectors of Pakistan.

Public Sector Case: The Punjab Information Technology Board

The Punjab Information Technology Board (PITB) is a standout example of a public sector entity in Pakistan that has implemented digital workplace practices with great success. It has been instrumental in the digitalization of government services and the development of digital infrastructure in the Punjab province of Pakistan, fostering smart work environments in the public sector. The drivers for the PITB include: (1) improving governance and transparency through e-governance; (2) providing citizen-centric services through e-khidmat centers or mobile apps; (3) enhancing digital learning through programs like eLearn Punjab, which contributes through online availability and accessibility of textbooks and resources, apart from enabling skills development among the youth through the e-Rozgar program; (4) making efforts for the digitization of land and

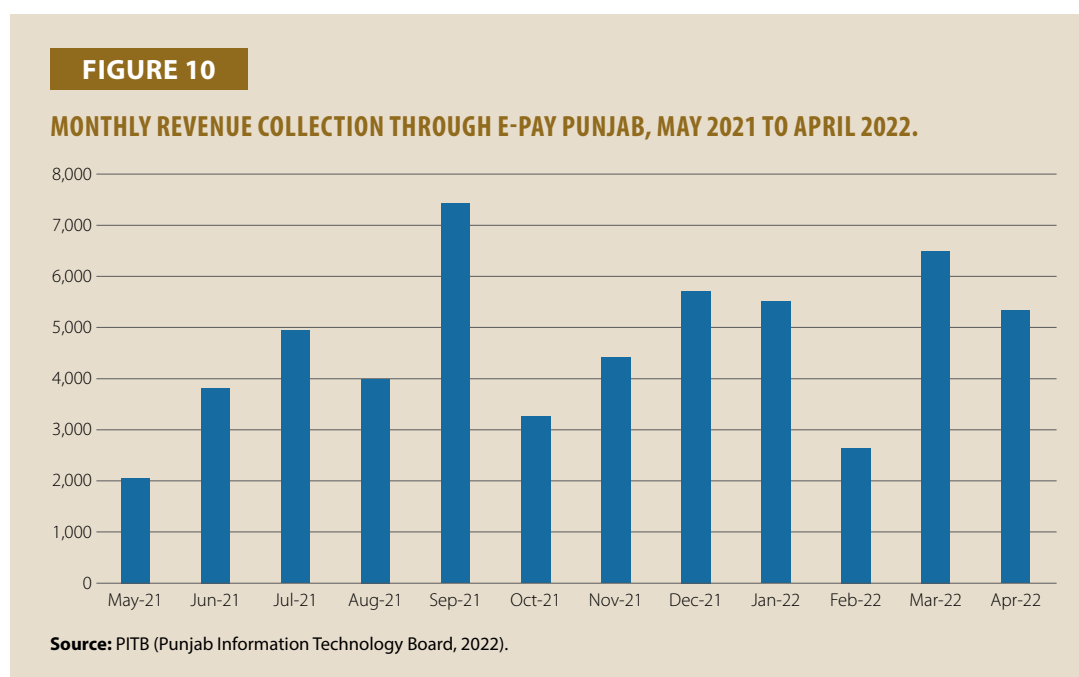
police records, resulting in efficient service delivery, better decision making, and monitoring of public services; (5) striving to play a crucial role in public health and crisis management as was evident during the COVID-19 pandemic when the PITB implemented platforms for digital tracking of health services and spreading public-safety awareness through digital means.

The success of the PITB is based on the following key practices adopted by it:

(1) **E-government initiatives:** The PITB has successfully initiated and implemented several e-government initiatives, including:

- **e-Pay Punjab:** This is an online payment gateway for public services. It enables citizens to pay taxes, utility bills, and other government fees online. It eliminates the need to pay physical visits to government offices and reduces paperwork, thereby contributing to a greener environment. Moreover, the automation it provides increases productivity by getting work done in lesser time with fewer errors, compared with the manual processes (PITB, 2024).

e-Pay Punjab surpassed 15 million transactions worth more than PKR70 billion of revenues in 30 months in 2022 (Punjab Information Technology Board, 2022). Figure 10 provides the statistics for the revenue generated through e-Pay Punjab during the period from May 2021 to April 2022.



(2) **Automation of workflows:** PITB has automated several government workflows, such as the Land Record Management Information System (LRMIS) and e-Filing and Automation System (e-FOAS) for the Punjab Board of Revenue (Government, Punjab Land Records Authority-PLRA (<https://www.punjab-zameen.gov.pk/>) Last visited August 24, 2024, 2024), (Government, e-Filing and Automation System (https://bor.punjab.gov.pk/e_filing_office_automation_system) last visited August 22, 2024, 2024). The LRMIS digitizes land records in the Punjab Province while the e-FOAS is a step toward having a

citizen-centric e-governance system for constructive engagement with government departments. Such automation frameworks have not only streamlined processes but also resulted in reduction of corruption and improved service delivery to citizens.

- (3) **School Information System (SIS):** SIS is a project of the PITB and the Government of Punjab, developed for real-time monitoring of public-sector schools in Punjab. It provides real-time statistics of teachers and students attending schools in Punjab, along with other statistics such as the qualifications of teachers, transfer of teachers from one station to another, etc. All statistics can also be viewed at the tehsil and district levels for the entire province (Punjab, 2024). Figure 11 show the real-time data on students' and teachers' attendance, respectively, on 22 August 2024, from the SIS dashboard.

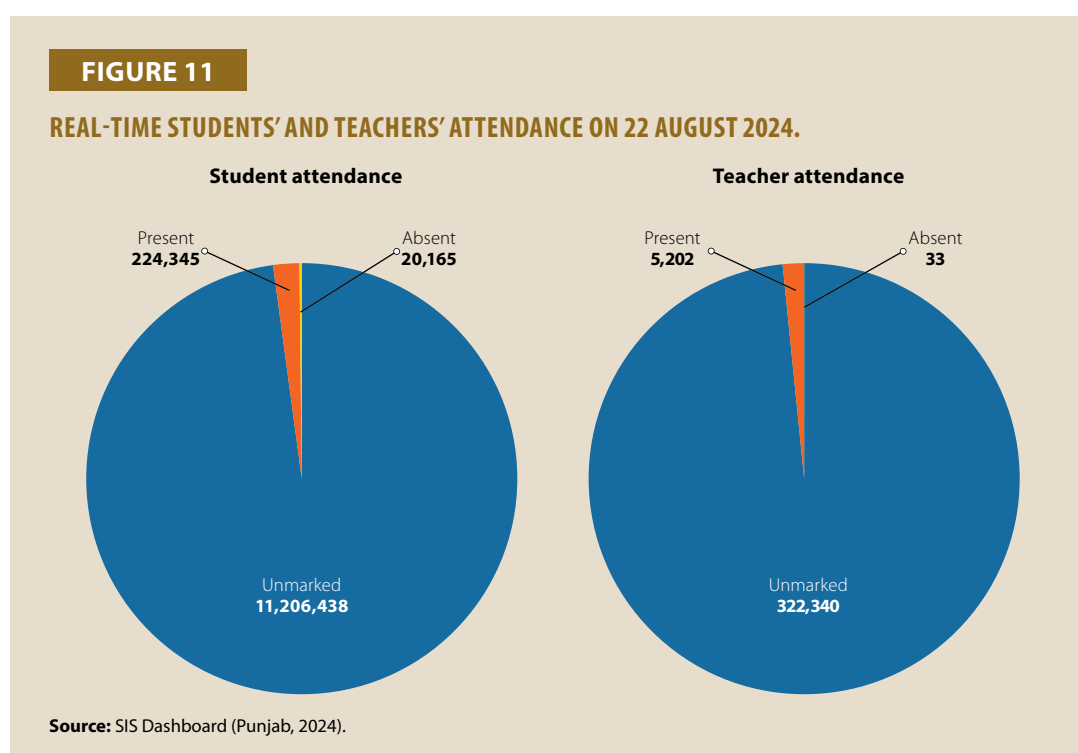


TABLE 7

MONTHLY INDICATORS FOR PUNJAB PROVINCE SCHOOLS, MAY 2024.

Province	Teachers' presence	Non-teachers' presence	SA (all grades)	Retention (all grades)	Head teacher's presence	Availability of boundary wall	Availability of drinking water	Availability of furniture	Sufficiency of toilets	School hygiene
Punjab	90.8%	89.2%	40.1%	98.65%	89.82%	97.78%	98.71%	89.91%	88.64%	77.52%

Source: SIS Dashboard (Punjab, 2024).

Table 7 provides different indicators for the month of May 2024 for public-sector schools in the Punjab province.

The PITB has also been instrumental in automating processes in several government sectors of Punjab, including education, health, support services, transport, citizen-centric services, law and order, agriculture, livestock, and food.

These steps have significantly enhanced the efficiency of public service delivery, reduced administrative costs, increased transparency and accountability, and reduced paperwork, thereby contributing to a greener environment, in alignment with a UN SDG.

Private-sector Case: Habib Bank Limited

Habib Bank Limited (HBL) is one of the oldest and largest commercial banks in Pakistan (Habib Bank Limited, 2024). It has consistently been at the forefront of adopting digital transformation strategies to enhance workplace productivity and customer service efficiency. Since its inception in 1947, it has evolved from a traditional banking institution into a modern financial services provider, leading other commercial banks in the country in embracing digital innovation as a key driver of growth and efficiency. In the following paragraphs, we provide some key practices that have been instrumental in ensuring that HBL is ahead of the pack in digital workplace productivity and efficiency.

The drivers for HBL's digitization include: (1) meeting changing customer expectations as per their convenience; (2) providing 24/7 mobile and internet banking services to customers; (3) inclusion of unbanked sectors of the society through digital platforms like the HBL Kconnect; (4) increased competition from other banks have pushed HBL to invest in its digital solutions to keep ahead of the pack; and (5) cutting down on operational costs through digitization by streamlining processes and strengthening the cybersecurity measures to further protect the customer and bank data.

Digital banking platform: HBL has gradually and consistently worked on its digital transformation by developing and continuously improving its digital banking platform called HBL Mobile. This app was launched by HBL anticipating the growing demand for online banking in the country. The app enables the customers to perform a variety of transactions directly from their smartphones. These include transferring funds, paying utility bills, topping up their mobile phone balance, donating to charitable organizations registered with the bank, paying government taxes like the vehicle excise tax, and more. This has resulted in significantly reducing customers' visits to physical branches of the bank, which in turn has contributed to less pressure on branch operations and improved the overall efficiency of the bank. As of 2023, HBL Mobile boasted of 4 million active users, with transaction volumes growing exponentially each year. This paradigm shift to digital banking has resulted in improved customer satisfaction while also enabling HBL to operate more efficiently by diverting resources to more strategic areas of its business. Table 8 shows the steady increase in HBL's customer base, particularly the increase in the number of its mobile and internet banking subscribers during the period 2018–23 (Habib Bank Limited, 2024). This pattern is also reflected in the increasing number of debit and credit cards, which are also conduits for digital banking, during the period.

TABLE 8

HBL'S CUSTOMER BASE DURING THE PERIOD 2018–23.

	2018	2019	2020	2021	2022	2023
No. of customers in million	15.4	19.6	22.3	26.9	33.4	37.0
Female customers (% of total)	32%	34%	37%	40%	48%	47%
No. of mobile and internet banking subscribers ('000)	773	1,154	1,782	2,490	3,234	3,935

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	2018	2019	2020	2021	2022	2023
No. of debit cards ('000)	5,168	5,516	5,860	6,223	6,573	7,126
No. of credit cards ('000)	162	193	224	229	268	309

Source: Habib Bank Limited, 2024.

Digital training programs for employees: To make its workforce cognizant of the digital landscape in the banking sector, HBL invests a sizable chunk of its revenue to keep its employees abreast with the latest digital tools and cybersecurity practices. This skill development-centric approach enables the workforce to remain well-equipped for handling the challenges of a digital workplace (Habib Bank Limited, 2024).

Data analytics for consumer behavior insights: HBL increasingly makes use of advanced technologies, including data analytics and robotics process automation for improving its operational efficiencies, increasing the scalability of its operations, and further strengthening the control environment. With analytics, HBL analyzes the transaction patterns, spending behaviors, and customer feedback to effectively tailor its products and services for the diverse financial services needs of its growing consumer base. For example, the bank has launched Islamic banking products in response to growing customer demand. Likewise, the bank has offered personalized financial planning services to meet the need for such services. The use of data analytics has also enabled the bank to further enhance its risk management capabilities. It also helps in better assessment of credit risks and more efficient detection of fraudulent activities (Habib Bank Limited, 2024).

Investment in IT infrastructure: HBL has also invested in modernizing its IT infrastructure through adoption of cloud computing technologies. By migrating various services to the cloud, HBL has improved its operational efficiency, reduced costs, and enhanced the ability to scale services according to demand. Cloud computing has also facilitated better planning for disaster recovery and business continuity, thereby ensuring that the bank's services remain uninterrupted in the event of technical failures or natural disasters (Habib Bank Limited, 2024).

Customer-centric policy innovations: HBL's digital transformation has been guided by a customer-centric approach, which prioritizes the delivery of value through innovative services. In 2023, HBL became the first organization in Pakistan to implement Scaled Agile Framework (SAF). This working methodology provides a set of principles and values that help deliver customer-centric, innovative solutions efficiently and rapidly (Habib Bank Limited, 2024).

Use of AI at HBL

As the leading commercial bank in the country, HBL has taken many initiatives for utilizing AI and integrating it into its day-to-day operations, particularly for enhancing customer experience. These include the adoption of AI-driven core banking transformation provided by leading bank software company Temenos with which HBL has entered into an agreement (Futures, 2022). This new system has enabled HBL to quickly process large volumes of data and transactions with low latency and reduced operational degradation.

Further, HBL has implemented AI-powered chatbots with virtual assistants to provide instant support to its customers worldwide. The chatbots help resolve queries in real time without banking officials' intervention. This has also resulted in reduced wait times and increased customer satisfaction. The use of AI also enables the bank to understand customer behavior in a better way and provide more personalized services tailored to their needs.

In conclusion, HBL's digital transformation efforts have not only revolutionized its internal operations but also set new benchmarks for customer service in Pakistan's banking sector. Through the adoption of digital banking platforms, employee training programs, data analytics, and modern IT infrastructure, HBL has significantly enhanced its productivity and efficiency, ensuring its continued success in an increasingly digital world.

Further, the bank has leveraged AI for a very crucial task faced by third-world countries, i.e., to detect money laundering and online frauds. The bank has deployed AI algorithms to detect and analyze transaction patterns and fraudulent activities resulting from them. AI has enabled HBL to analyze large volumes of data in real time, which helps thwart financial crimes and reduce risks for the bank.

Additionally, the bank uses AI to predict market trends and analyze risks for data-based decision-making. Automation of tasks such as document processing, reporting, and customer onboarding has not resulted in speeding up service delivery but also resulted in fewer errors and greater accuracy in daily operations.

Conclusion and Recommendations

In this report, literature on “productivity gains due to digitalization in workplaces” was surveyed in the context of Pakistan. The report provides cases from both public and private sectors. It also discusses the laws, regulations, and policies introduced in the country to promote digitalization and safeguard users from any inadvertent effects or malpractices resulting from its use. The last part of the report provides cases for best practices adopted for digitalization in Pakistan. These include the cases of PITB in the public sector and HBL in the private sector. Literature on the use of AI in both public and private sectors was also surveyed and specific details were provided on how HBL has incorporated AI in its business operations. Overall, on the basis of this study, the following recommendations are proposed for improving productivity in digital workplaces in Pakistan.

Investment in digital infrastructure: To enhance productivity in digital workplaces, Pakistan needs to make substantial investments in digital infrastructure, particularly in rural and underserved areas. Improving internet accessibility and broadband penetration is critical for extending the benefits of digitalization to all parts of the country. In addition, the expansion of 4G and 5G networks can improve connectivity and enable real-time digital transactions and remote work.

Upskilling the workforce: A key challenge identified in the report is the lack of digital literacy and technical skills. To overcome this, both public and private sectors must invest in upskilling programs that focus on developing expertise in Industry 4.0 technologies, such as big data, IoT, and AI. Collaborative programs between the academia, the government, and the industry should focus on equipping the workforce with skills necessary for autonomous systems, digital trade, and fintech.

Strengthening legal and regulatory frameworks: The government must continue to develop and enforce policies that promote digital adoption while ensuring data privacy and security. The

National Data Protection Regulations, introduced in 2024, are a step in the right direction, but more needs to be done to protect consumer data and ensure compliance with global standards. Clearer regulations around digital trade and e-commerce can also help attract foreign investment and foster a competitive digital economy.

Encouraging public–private partnerships (PPPs): To drive digital innovation, the government should foster stronger public–private partnerships. Successful examples, such as PITB’s collaboration with local and international organizations, show that PPPs can play a critical role in implementing large-scale digitization projects. Private-sector players, such as HBL, have shown that investments in technology can lead to significant productivity gains, and similar collaborations can benefit other sectors as well.

Incentivizing digital transformation in SMEs: SMEs form the backbone of Pakistan’s economy, and adoption of digital technologies by SMEs can significantly enhance productivity. The government should offer incentives such as tax breaks, grants, or low-interest loans to encourage SMEs to invest in digital tools and technologies. These incentives should be coupled with training programs to ensure that SMEs can effectively use digital tools to optimize their operations.

Promoting digital leadership and governance: To sustain productivity gains, organizations need strong digital leadership. The report notes that leadership and governance are key to the success of digitization projects. Training programs aimed at developing digital leadership skills within government agencies and businesses should be a priority. Leaders who understand the potential of digital technologies can drive cultural and operational shifts that lead to enhanced productivity.

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PHILIPPINES

Introduction

As of 2024, the Philippines had a population of 119 million, reflecting a growth rate of 1.51% from the previous year (Macrotrends, 2024). The country is characterized as one of the fastest-growing economies in Southeast Asia, with an economic growth rate of 5.6% in 2023. However, the inflation rate in 2023 was reported at 6%, which exceeded the government's target rate of 4% (Canto, Renz, & Villanueva, 2024).

The Philippines first established internet connectivity in 1994, marking a significant milestone in the nation's digital transformation (Mangaluz, 2024). Following this, the enactment of the Public Telecommunications Policy Act of 1995 played a crucial role in liberalizing the telecommunications sector by fostering a more competitive environment. This legislation allowed value-added service providers to operate without requiring a franchise, resulting in a notable increase in the number of internet service providers (ISPs). While this deregulation posed financial challenges for major telecommunications companies such as PLDT (formerly known as Philippine Long Distance Telephone Company) and Globe, it ultimately benefited consumers in terms of more competitive pricing and enhanced service availability (Cayanan, 2016).

The digital economy in the Philippines experienced significant growth as a result of the COVID-19 pandemic. The restrictions imposed by lockdowns compelled consumers to shift to purchasing goods and services online. Consequently, internet service became an essential requirement for households, particularly due to the increased need for online education. By 2022, approximately 64.5 million people in the Philippines had access to internet (Statista, 2024). Internet usage is primarily focused on accessing social media platforms and participating in e-commerce activities. Filipino consumers are increasingly engaged in online shopping, which offers a broader array of choices and the opportunity to compare prices from different vendors. As a result, marketers are leveraging the widespread availability of internet access to promote their products and expand their online business presence. Nevertheless, despite the extensive adoption of the internet across the country, Azcarraga and Pena (2019) note that micro, small, and medium enterprises (MSMEs) still demonstrate relatively low levels of digital adoption.

Digital Transformation in the Philippines

The Philippines has enacted legislation to encourage the adoption of digital workplaces. The Republic Act No. 11165, known as the Telecommuting Act in 2018, institutionalizes telecommuting as an alternative work arrangement for employees in the private sector. Under this law, employees may opt to telecommute based on mutually agreed-upon terms, ensuring that the arrangement aligns with existing labor laws. Furthermore, the act mandates that employees be fully informed of their rights and entitlements under such work arrangements, thereby promoting transparency and fairness in the implementation of telecommuting policies.

In recognition of the need for digitalization in multiple sectors of the economy, the Republic Act No. 11927, called the Philippine Digital Workforce Competitiveness Act, was passed by the Senate in 2022 to ensure that Filipinos are equipped with digital skills and competencies that are comparable with global standards. Such knowledge aims to promote digital innovation and business. With this act, the skills and competitiveness of digital workers are expected to increase so that the workers can become more employable and competitive. The law also supported the employees' need for shared service facilities or co-working spaces ("Telecommuting Act," 2018).

Acknowledging the imperative for digitalization across various sectors of the economy, the Philippine Senate enacted the Republic Act No. 11927, known as the Philippine Digital Workforce Competitiveness Act, in 2022 ("Philippine Digital Workforce Competitiveness Act," 2022). This legislation aims to equip Filipinos with digital skills and competencies that meet or exceed global standards, thus fostering digital innovation and enhancing business processes. By cultivating a digitally skilled workforce, the act seeks to increase the employability and competitiveness of Filipino workers in the global market. Additionally, the law supports the provision of shared service facilities and co-working spaces to meet the needs of employees in the digital economy.

In alignment with the vision of the Marcos Administration, the Department of Budget and Management (DBM) proposed a budget allocation of P12.47 billion for the transformation and digitalization of government processes and transactions in 2023. The 2023 National Budget underscored the critical role of information and communications technology (ICT) in adapting to the new normal. Additionally, the budget included a specific focus on digital payments for government financial transactions, which was linked to Executive Order No. 170, signed by former President Duterte, aimed at adopting digital payment systems for government disbursements and collections (de la Pena, 2022).

The growing presence of software companies in the Philippines reflects an emerging trend toward digital workplaces. Over 400 companies from the USA and Europe currently offer enterprise applications to local businesses, including financial institutions, hospitals, and large corporations, including software solutions for various business processes such as payroll, human resources, and data management. In addition, the Philippines is home to more than one million MSMEs that also seek digital solutions to enhance business operations (International Trade Administration, 2024b). However, due to financial constraints, these enterprises may not be able to afford the services of large software companies. Consequently, there is a proliferation of low-cost consultancy services that specialize in systems integration tailored to the needs of MSMEs (International Trade Administration, 2024b).

The e-commerce sector has heavily benefited from the use of digital workplaces. Its growth was driven by the pandemic and has sustained until recently. In 2021, the Philippine's digital economy reached USD20 billion, a significant portion of which was contributed by e-commerce (Ricoh Philippines, 2024). Popular online platforms such as Lazada and Shopee have managed to effectively sell their goods through the internet and saved on the cost of maintaining physical stores. The platforms have also achieved a greater customer reach that is not possible in traditional sales models.

The rapid growth of e-commerce has driven a parallel expansion in the financial technology industry, which provides the means for online payments. The need for contactless payments during the pandemic accelerated the adoption of e-wallets, pushing even those unfamiliar with the technology to use them. Today, digital payment platforms such as Gcash and Paymaya are widely

used for online purchases and financial transactions, including fund transfers, savings, and bill payments (Raon, De Leon, & Dui, 2021). These e-payment systems are highly accessible, as they can be easily downloaded as mobile apps and do not require a bank account. Additionally, they allow users to save money and earn interest at rates higher than those offered by traditional banks.

In 2023, the Bangko Sentral ng Pilipinas (BSP) launched the Digital Payments Transformation Roadmap. This initiative aims to develop digital payment streams to encourage widespread adoption, build the necessary financial infrastructure, and implement standards to safeguard user data through proper regulation and governance (Bangko Sentral ng Pilipinas, 2020).

While these industries have benefited from digital transformation, the Philippines still faces challenges such as low digital adoption among MSMEs, lack of awareness of existing programs and policies, gaps in access to digital tools, and a digital skills gap in the workforce (Alphabeta, 2021). Addressing these challenges will be crucial for the Philippines to fully capitalize on the opportunities presented by the digital economy.

Measuring the Productivity Paradox

In 1987, economist Robert Solow asserted, “You can see the computer age everywhere but in the productivity statistics”. This statement highlights a significant concern regarding the impact of digitalization on productivity, which was originally anticipated to be positive. Despite the widespread use of digital technologies, it is unknown how digitalization genuinely enhances productivity. This conundrum has sparked considerable academic interest, leading to numerous studies aimed at determining the existence and implications of what is now referred to as the Solow’s Productivity Paradox (SPP). The productivity paradox refers to the seeming or observed disconnect between investments in information technology and the lack of corresponding increases in productivity metrics. In recent history, specifically in western European countries, a decrease in labor productivity was recorded over the period 1973–2006. The growth of labor productivity in the USA decreased from an average of 2.73% per year from 2000 through 2010 to an average of 1.06% per year between 2010 and 2018 (van Ark, O’Mahony, & Timmer, 2008). The situation in the Philippines was better at 2.32% during 1992–2023 (CEIC, 2024). The ongoing discourse surrounding this paradox continues to be the focal point in economic research and has become increasingly pertinent as more countries invest in digital infrastructure, particularly in workplace settings.

One of the challenges to prove that the SPP exists is the measurement of labor productivity. In simplest terms, productivity is defined as the ratio between output and input. Increase in productivity happens as the output increases at constant input or vice versa. Investigation of the causes of the SPP prompted researchers to identify relevant measures of productivity. Capello, Lenzi, and Perucca (2022) identified mismeasurement of productivity as one of the causes of the SPP. Three causes of mismeasurement were identified: compensation mechanisms, labor displacement, and measurement issues.

When new technologies are introduced, both the value of goods and services and employment increase. As these two factors balance out each other, the productivity remains unchanged. As companies replace workers with machines, workers may go to less productive areas such that the productivity gains realized are offset. It is also difficult to accurately measure the effect of machines in the workplace because quality improvement and improvement of reputation are not accounted for in the statistics.

A review conducted by Schweikl and Obermaier (2020) showed two methods of estimating productivity as a result of ICT adoption. The first is the Cobb–Douglas function (see Equation 1) that describes the relationship between inputs and outputs (Cardona, Kretschmer, & Strobel, 2013) where Y is the output, A is the total factor productivity (TFP), K is the capital, and L is the labor input.

$$Y = A * K^{\alpha} * L^{\beta} \quad \text{Equation 1}$$

TFP represents the variation in the efficiency of creating outputs due to unobservable factors (Syverson, 2010). Labor input can be quantified by employee hours, taking into consideration the variation in skills or the quality of output. Capital the capital stock of the company or the capital services (Cardona et al., 2013). α and β represent the percentage change in output resulting from 1% increase in the use of an input factor. The capital can be divided into digital and non-digital capital to determine how digitalization affects productivity. A more detailed discussion of the equations can be found in (Stiroh, 2005).

Information technology (IT) investment is quantitatively assessed by aggregating various expenditures associated with hardware, software, maintenance and support services, as well as training costs. These components collectively represent the financial commitment of an organization toward enhancing its technological capabilities. Conversely, output is evaluated in terms of the value added to the organization as a direct consequence of these IT investments. Specifically, value added refers to the enhancement of a firm's overall productivity and efficiency resulting from the deployment of advanced technological solutions. The SPP is analyzed by calculating productivity metrics over time, thereby establishing a correlation between IT investment and subsequent changes in productivity levels. This assessment involves longitudinal studies that track productivity growth relative to the scale of IT investments, allowing for a comprehensive understanding of the impact of technology on organizational performance. By employing such methodologies, researchers can elucidate the dynamics of IT investments and their effects on productivity, thereby contributing to the discourse surrounding the SPP (Schweikl & Obermaier, 2020).

Philippines Labor Productivity, 2012–22

The labor productivity of the Philippines as documented by various sources is summarized in Table 1 for the period 2012–18 (Philippine Statistics Authority, 2019). Labor productivity is measured by dividing GDP by the total number of persons employed. The GDP per hour worked is also given in the last column of the table.

TABLE 1

GDP PER CAPITA AND PER HOUR WORKED.

	GDP per capita PPP ¹	GDP per hour worked ²
2012	6,351	7.96
2013	6,666	8.15
2014	6,973	8.37
2015	7,300	8.69
2016	7,705	8.85
2017	8,120	9.45

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	GDP per capita PPP ¹	GDP per hour worked ²
2018	8,516	9.84
2019	8,914	9.93
2020	7,958	11.4*
2021	8,301	10.5*
2022	8,723	10.3*

Notes: (1) 2017 constant prices (International dollar) (World Economics, 2024);

(2) International dollar at 2017 prices per hour (Our World in Data, 2020);

*ILO modelled estimates (International Labour Organization, 2024).

It is evident from Table 1 that labor productivity is increasing. IBON Foundation reported that the productivity of the Philippine workforce drives the growth of Philippine economy and it increased by 28.9% from 2012 to 2022 (IBON Foundation, 2023). Measured in real terms, the economic growth was recorded at 60.2%, with the GDP increasing from PHP12.4 trillion in 2012 to PHP19.9 trillion in 2022 (Philippine Statistics Authority, 2019).

In 2018, the World Bank reported the following important drivers of productivity in the Philippines (World Bank, 2018):

- (1) **Investment-friendly policies:** A conducive policy environment that promotes exports and encourages foreign direct investment can indirectly enhance productivity by generating employment opportunities. In the Philippines, over 99% of businesses are classified as MSMEs, each employing fewer than 20 workers. Due to limited capital, these MSMEs are unable to significantly drive economic growth. The inflow of foreign capital, however, can enable these enterprises to invest in advanced technologies, facilitating their potential transition into larger, more competitive businesses.
- (2) **Efficient allocation of manufacturing resources:** The misallocation of resources within the manufacturing sector hinders the industry-wide productivity. Productive manufacturing firms often lack access to the necessary tools and resources required to optimize their production processes, a challenge that can be linked to inefficiencies in the banking and trade sectors. To address this, the government implemented reforms between 2010 and 2016 aimed at reallocating resources more efficiently, which resulted in a notable increase in TFP.
- (3) **Market competition:** An economy that fosters competition can enhance productivity by compelling firms to improve their performance in order to avoid business failures. Competition drives companies to innovate, reduce costs, improve product quality, and streamline business processes. These improvements contribute to greater overall efficiency and help firms attract more customers. Prior to economic reforms that deregulated business operations in the Philippines, industries with high capital investment, such as air transport and telecommunications, were dominated by a few key players. These firms, secure in their market positions, had little incentives to pursue operational excellence. However, the removal of government-imposed restrictions allowed new entrants into these industries, forcing the incumbent firms to either enhance their performance or risk being displaced by competitors.

- (4) **Trade policies.** Promotion of exports from the Philippines has significant implications for both employment and the organizational culture. Export-oriented policies contribute to lower unemployment rates by stimulating the demand for labor in exporting firms. Additionally, the need to meet the quality standards of international markets encourages a culture of quality within exporting companies, as they must produce goods that comply with the requirements of foreign countries. Export companies in the Philippines tend to be more productive than their domestic counterparts. This can be attributed to the pressure to meet international quality standards, which often exceed the requirements of the local market. Exporting companies are thus incentivized to invest in more efficient production processes and technologies to remain competitive in global markets. Government regulations and customs procedures can create obstacles for potential investors, limiting the number of firms engaged in export activities. This regulatory environment may contribute to the observed decline in export activities in recent years.

Felipe, Estrada, and Lanzafame (2022) also found that employment in the manufacturing sector is a strong determinant of potential labor productivity growth unlike employment in services that is more volatile.

Digitalization and Productivity

E-governance in the Philippines

The primary government agency that drives digital transformation in the Philippines is the Department of Information and Communications Technology (DICT). It was given the mandate for planning, developing, and promoting the country's ICT agenda through the EGovernment Masterplan (EGMP). The Republic Act 10844, known as the Department of Information and Communications Technology Act of 2015, mandates the DICT to develop, implement, and improve the use of ICT to provide public service and digitally empower the public. The digitization aims to improve the quality and efficiency of government services and help promote transparency in doing business in the government and private sectors. The EGMP 2022 took off from the EGMP 2013–16 that envisioned a digitally empowered and integrated government, delivering responsive and transparent online services for its citizens. The plan is expected to improve the global competitiveness of the Philippines (Department of Information and Communications Technology, 2019). The EGMP 2022 envisions to bring government, citizens, business, community organizations, and other societal groups together in the governance process (Department of Information and Communications Technology, 2019). The EGMP is aligned with the Philippine Development Plan of 2022 and the ASEAN ICT Masterplan (AIM) 2020.

To support the EGMP, the government enacted the Republic Act No. 11032, also known as the Ease of Doing Business and Efficient Government Service Delivery Act of 2018 ("Ease of Doing Business and Efficient Government Service Delivery Act of 2018," 2018). This legislation seeks to streamline bureaucratic processes and enhance the efficiency of government transactions across agencies. Prior to the implementation of digitalization initiatives, government agencies such as the Land Transportation Office (LTO); Bureau of Internal Revenue (BIR); and Securities and Exchange Commission (SEC) were characterized by significant inefficiencies, resulting in excessive delays and long waiting times for individuals and businesses.

While certain regulatory measures in the Philippines, particularly those concerning the provision of public goods, are necessary, many businesses still encounter undue difficulties when interacting

with government agencies at different stages of operations. The process of starting a business, for instance, requires the acquisition of permits and licenses, with requirements varying across local government units (LGUs). The complexity of this process often depends on the degree of digitalization within the respective LGU (Frias, 2015). Moreover, businesses are subject to frequent reporting requirements from various agencies, which adds to the regulatory burden. Such stringent regulations deter potential investors, thus limiting business activity and the overall productivity in the country.

In addition to regulatory challenges, the high cost of doing business has been identified by the World Bank as a key factor inhibiting productivity in the Philippines. Exporters, for example, often lack sufficient knowledge about international trade agreements, thereby making their products less competitive compared with those of other nations. Furthermore, logistics and energy costs in the Philippines are significantly higher than in neighboring countries. The nation's reliance on imported fuel, coupled with rising coal prices, has led to increased electricity generation costs (Lopez, 2023). Unlike neighboring countries, the Philippine government does not subsidize power companies, thus leaving consumers to bear the full brunt of elevated electricity rates. Despite the passage of the Electric Power Industry Reform Act (EPIRA) of 2001, which sought to foster competition by unbundling the generation, transmission, and distribution functions, electricity prices have not seen a corresponding decline (Bondoc, 2024).

Productivity Impact of Digital Transformation

The Philippine Statistics Authority (PSA) reported that in 2023, the digital economy reached approximately USD35.4 billion, accounting for 8.4% of the country's GDP, which was a 7.7% increase from the USD33.6 billion recorded in 2022. Moreover, the digital economy contributed 11% to the GDP worth around USD33 billion in 2021, encompassing various digital transactions attributable to digital-enabling infrastructure, e-commerce, and digital media/content. Digital-enabling infrastructure was the largest segment, contributing roughly USD28 billion or 77.2% of the total. This figure reflects a 7.5% increase from the USD26 billion recorded in 2021, with telecommunications and professional services being the primary contributors (International Trade Administration, 2024a).

A survey conducted by the Department of Trade and Industry (DTI) assessed the level of digitalization of MSMEs in the Philippines in 2020 (Department of Trade and Industry, 2021). The result of the survey aims to help government formulate programs that will help MSMEs succeed in the digital environment. The survey was answered by business owners, CEOs, or personnel knowledgeable about business operations from the highly urbanized regions in the Philippines such as National Capital Region, Region III and Region IV-A.

The survey revealed that only 56% of MSMEs utilize basic digital tools, with the most commonly used options being e-mail and messaging services like WhatsApp, accessed primarily through mobile phones or personal computers. Additionally, only 34% of these businesses have established an online presence through a website or social media platforms. A mere 6% of respondents reported advanced usage of digital tools, indicating that only a small fraction of MSMEs operate purely online or employ sophisticated technologies such as enterprise resource planning (ERP), customer relationship management (CRM), and data analytics (Department of Trade and Industry, 2021).

In terms of acceptance, 26% of MSMEs are aware of the digitalization programs provided by the government and other organizations. Approximately 73% of the respondents expressed a need for

capacity building, particularly in areas such as financial management, customer development, and content management. More than half (54%) of MSMEs do not require delivery services; nearly one-third (35%) handle their own deliveries; and only 18% utilize third-party delivery agencies. The preferred delivery partners among MSMEs include Lalamove (67%), Grab (49%), and LBC (33%).

While digitalization is expected to enhance labor productivity in the Philippines, significant challenges remain, particularly in relation to skills development and cybersecurity (Tsang, 2024). The rapid pace of technological advancements in software and hardware necessitates continuous investment in training and infrastructure. Moreover, the country has experienced several instances of data breach in government agencies, highlighting the vulnerabilities in its cybersecurity framework (Cruz, Ordoñez, & Atienza, 2024). The lack of reliable and high-speed internet connectivity in remote areas further impedes the achievement of economic development objectives.

Advances in Artificial Intelligence in the Philippines

The Philippine government recognized the potential of artificial intelligence (AI) in the industry that prompted it to improve the regulatory environment. The Philippine Innovation Act of 1993 (Republic Act No. 11293) aims to enhance the competitiveness of companies in the Philippines by promoting a culture of innovation that is expected to help economic and social development. The law paves the way for more investment in research and development as well as creating a dynamic environment that supports innovation. In the context of digital transformation, this act acts a guide on the use of new technologies and digital solutions to help companies improve their performance, especially in areas like e-commerce, digital finance, and tech startups.

The Philippines also launched the National Artificial Intelligence Roadmap in 2019 to transform the country into an AI hub within the ASEAN region. The roadmap defines strategic priorities and identifies the key contributions of the government, the industry, and the academia. One of the recommendations focused on the establishment of the National Center for A.I. Research (N-CAIR), to be led by the private sector and serve as a collaborative hub for AI research. N-CAIR is expected to help the digital transformation of the Philippine industry. The USA, a close ally of the Philippines, can help in the implementation of this roadmap by providing technology and services essential for connectivity and research and development.

Effects of Digitalization in Public and Private Sectors

The COVID-19 pandemic brought about an increased awareness about technology in the Philippines because even those who belonged to low-income groups had to purchase devices to continue the education of their children or to purchase products online. Public school teachers were forced by the situation to deliver instructions online, which could only be done if the learners had the necessary devices and internet connections. The learning plan of the Department of Education ensured that learning progressed among students despite the absence of face-to-face classes due to the threat of COVID-19. Teachers and learners were given can also access it free of data charges by all mobile subscribers of Globe, TM, Smart, Sun, and TNT (Montemayor, 2020).

The service provided by the government improved as a result of digitalization. A survey conducted by the Development Academy of the Philippines (DAP) in 2020 showed that offices that have established online portals, automated channels, and phone services received a high satisfaction rating. Specifically, the use of online methods such as websites, apps, e-mails, and social media was positively received by the users.

The SEC's digital transformation initiatives have significantly enhanced the ease of doing business in the Philippines. By automating company registration processes through the launch of eSPARC in April 2021 and OneSEC in September 2021, the SEC streamlined and expedited the incorporation of new businesses. As a result, the Philippines witnessed a remarkable surge in company registrations in 2023, with a total of 49,501 new firms registered by the end of the year. This marked a 15% increase compared with the previous year, showcasing the success and impact of the SEC's digitalization efforts (Securities and Exchange Commission, 2024).

The eSPARC and OneSEC systems have improved the way companies are registered in the country. Through these digital platforms, entrepreneurs can now submit their applications and complete the registration process more efficiently, thus reducing the time and resources required. Moreover, the SEC has integrated its online payment system, eSPAYSEC, with eSPARC and OneSEC, thereby enabling seamless and secure financial transactions. This integration has further streamlined the incorporation process, contributing to the increase in stakeholder engagement (First Circle, 2024).

By embracing digital technologies, the SEC has not only improved the ease of doing business but also ensured the prompt delivery of services to the people. The commission's commitment to digitalization has positioned it as a leader in leveraging technology to enhance the country's corporate sector and drive economic growth.

The government has also initiated innovative approaches toward enhancing transparency in public financial management. The Philippines joined the Open Government Partnership (OGP), which is a global initiative to solicit the help of the citizenry to improve development outcomes and build trust. The OGP seeks to promote transparency, empower citizens, fight corruption, and use new technologies for governance (Open Government Partnership, 2024).

President Marcos passed relevant directives such as the Executive Order No. 29 that requires the full adoption of the Integrated Financial Management Information Systems (IFMIS) and the Executive Order No. 31 that has institutionalized the PH-OGP. Together, these executive orders will propel the country toward bureaucratic efficiency and fiscal transparency (Department of Budget and Management, 2023).

In the private sector, the greatest gain of digitalization is in the field of services such as travel and insurance, customer support, and telehealth. Online services can be easily delivered by people working from home if they have access to the Internet. The need for responsiveness in customer service can be easily provided by solutions that employ online workers.

With the establishment of online selling platforms, many Filipinos have started doing business virtually because of its convenience. Online businesses do not need physical space and require small number of staff. Customers can access the online store anytime and anywhere in the world. The online platform does not only provide an avenue for selling but also for interacting with customers easily using the chat function. The online platform's analytics function can also help gain better understanding of the customers to generate new business ideas.

Aside from that, the main source of employment information was also online. The Department of Labor and Employment provides a facility for disseminating labor market information called the PhilJobNet, along with a centralized database maintained by the Bureau of Local Employment. It partners with the private sector to help businesses with their manpower needs. It provides

information on job vacancies as well as on careers. Notably, employment growth in the service sector was found to be influenced by the number of cellular mobile subscriptions (per 100 people), which is indicative of the complementary relationship between ICT and employment growth. The service value added as a component of GDP growth is influenced by ICT, which creates job opportunities (Mercado, Granadino, Pasco, & Rosete, 2022).

Rey, Villaluz, and Rey (2024) identified several key drivers of digital transformation in the Philippines, including government policies, technological advancements, evolving consumer behavior, and the roles of businesses. Government-enacted legislation aimed at supporting digital transformation serves as a catalyst for nationwide adoption, facilitating the acquisition and utilization of technology within various workplaces. As consumers increasingly engage with the digital economy via the internet, they become aware of the technological advancements and begin to expect similar services from businesses. The demand articulated by consumers compels organizations to pursue digitalization, despite initial challenges. To sustain the Philippines' competitive edge in the global market, ongoing innovation in this domain is imperative.

Digital transformation in the Philippines faces several significant obstacles such as limitations in infrastructure, cybersecurity concerns, issues with digital literacy, and various economic challenges. Together, these factors complicate the country's efforts to fully embrace and leverage digital technologies.

The Philippines has a relatively underdeveloped digital infrastructure, characterized by limited internet access and slow connection speeds, especially in the provinces (Kanehira, Abdon, & Mirandilla-Santos, 2024). This impedes the effective adoption of digital technologies by both businesses and individuals. In addition to infrastructure issues, cybersecurity concerns present a considerable challenge. The nation is susceptible to cyberattacks, which can deter organizations and individuals from embracing digital solutions for fear of security breaches. Even government agencies in the country have fallen victim to hackers.

A substantial number of Filipinos lack the necessary digital skills to use technology effectively, which hinders the overall process of digital transformation. A 2021 report from the Philippine Institute for Development Studies revealed that Filipinos aged 65 and above had some of the lowest digital literacy rates across six ICT indicators of the United Nations Sustainable Development Goals. Among this age group, only around 18% possessed at least one ICT skill (Albert, 2021).

Economic challenges also play a role: the costs associated with acquiring and implementing digital technologies can be prohibitive, particularly for small businesses and low-income individuals. Other factors, such as cultural resistance to change, a lack of awareness regarding the benefits of digital transformation, and insufficient support for technology adoption, further complicate the landscape. Recognizing these challenges, the Philippine government has initiated programs aimed at enhancing digital infrastructure, raising awareness about cybersecurity risks, and providing digital literacy training. However, more comprehensive efforts are needed from the government, businesses, and individuals to effectively address these barriers and accelerate the country's digital transformation initiatives (Rey et al., 2024).

Best Practices in Digitalization

Through the Digital Transformation Development Policy Loan (DPL) supported by the World Bank, the Philippines is undergoing digital transformation. This program aims to enhance

government operations, strengthen digital infrastructure, and promote financial inclusion through technology. It primarily aims to improve government services via digitalization such as expanding digital finance access and fostering business growth in the digital sector.

One of the key targets is the transition to digital payments, which offers significant advantages over cash-based transactions, such as increased efficiency, enhanced transparency, and reduced fraud. The DPL also addresses the challenges of high internet costs, particularly for small businesses, by investing in broadband to enhance access and affordability. Additionally, the initiative seeks to empower underserved populations, including women, by increasing the adoption of digital financial services (Sharon, 2023).

UnionBank Philippines

UnionBank (UB) of the Philippines leads the country's digital transformation in the banking industry. The initiative started as early as 2015; and by 2023, 10 million customers were recorded. The early transformation made the bank ready for the pandemic of 2020. UB's strategy of continuous innovation by introducing new digital apps and platforms led to fully digital banking services that helped it stay competitive and address the evolving needs of its customers. During the COVID-19 pandemic, the bank accelerated its digital transformation, investing heavily in cloud-based solutions and AI-driven platforms such as blockchain, and cloud computing. As a result, it realized significant improvements in customer engagement and operational efficiency, thereby cementing its position as a key player in both local and international digital banking (Manning, 2023). By automating processes and enhancing online customer experiences, UB improved efficiency, accessibility, and reduced operational costs. Its digital value transfer innovations also helped in reaching underserved communities, promoting financial inclusion, and enabling faster and safer transactions (Unionbank, 2023).

In 2023, UB planned to use the metaverse technology to create virtual branches and customer service centers to allow customers to interact with bank representatives in an immersive, virtual environment. This technology offers a more personalized and convenient banking experience as customers can easily access financial services and products.

UB's focus on technological innovation is evident in its strategic investments in AI and digital banking platforms. The bank has also launched products like the Miles+ and Reserve credit cards, designed to cater to diverse customer needs. UB has modernized its technology infrastructure, migrating to a cloud-native, microservices-based architecture, which has reduced platform costs by 60% (Foo, 2024).

TESDA Online Program

In the Philippines, Technical and Vocational Education and Training (TVET) is overseen by the Technical Education and Skills Development Authority (TESDA). As of 2023, TESDA has seen an enrollment of 1,414,267 individuals, with 935,978 applying for certification and 872,016 successfully certified as skilled workers (Arayata, 2024). TESDA was established under the Technical Education and Skills Development Act of 1994 (Republic Act No. 7796), with the mandate of enhancing the nation's human resource capabilities through collaboration with industry, labor, and local government units. It serves as the government's primary agency for boosting labor skills, enhancing productivity, and promoting employment growth.

TESDA offers its programs through three main delivery modes: community-based, industry-based, and TESDA-center-based learning. Despite its widespread reach, a major challenge faced by

TESDA is ensuring access to its programs for individuals in remote areas of the country, given that the Philippines is an archipelago of over 7,100 islands. This geographical spread makes it difficult to establish TVET institutions in all areas. To address this issue, TESDA introduced eLearning solutions through ICT.

In 2011, TESDA launched its Online Program (TOP), becoming the first institution to offer massive open online courses (MOOCs) in the Philippines (Cabauatan, Calizo, Quimba, & Pacio, 2018). By 2019, there were 16,125 TESDA-registered programs nationwide (AB), with tourism-related programs representing over 27% of the total, followed by metals and engineering programs at 9%.

The effectiveness of TESDA's flexible program delivery was evaluated by Rhey, Pallado, Navarra, and Tenedero (2022), focusing on courses such as Barista NC II, Bartending NC II, English Language, Japanese Language, Domestic Work NC II, EIM NC II/III, and SMAW NC III. A survey of 10 trainers and 350 scholars/graduates in the national capital region (NCR) found that the online learning program was generally viewed as effective in supporting learners and achieving course objectives. The participants rated the program highly (at least 4.5 out of 5) in areas including communication, e-learning materials, learning management systems, administration, and technical support.

The partnership of TESDA with the two largest telecommunications companies in the Philippines has boosted participation in the programs. In August 2020, all Globe and TM mobile phone subscribers got free data access to the TOP. TESDA also partnered with Bizooku Philippines to help TESDA graduates find suitable jobs (Asian Development Bank, 2021). A focused group discussion on TOP in 2018 showed that the participants found the programs productive because they could complete them at home. However, internet connectivity remained a challenge.

Bureau of Internal Revenue E-filing and Payment System

The Republic Act No. 10963, also known as the Tax Reform for Acceleration and Social Inclusion (TRAIN), mandated large taxpayers and exporters to implement e-invoicing and receipt issuance while reporting sales data to the Bureau of Internal Revenue (BIR) at the point of sale. Passed in 2017, the TRAIN law enabled the government to achieve 108% of its revenue collection target by 2018. The collected funds were allocated, as outlined in the law, to vital infrastructure projects and social welfare programs. Increased infrastructure investment led to the creation of approximately 300,000 jobs in the construction sector. Additionally, by the first quarter of 2019, PHP22 billion was distributed to low-income households through the Unconditional Cash Transfer program, and PHP500 million was provided to qualifying jeepney operators through the Pantawid Pasada program (Bernardo, 2019). Further boosting its efficiency, the BIR's digitalization efforts and stricter enforcement against delinquent taxpayers allowed the agency to surpass its collection target in 2020. Of the PHP1.94 trillion total taxes collected, PHP1.67 trillion (86%) came through electronic payment channels, including PHP4.98 billion via PayMaya. Online tax filing also surged, with 94% of tax returns submitted digitally. Despite a lower overall collection compared with 2019, the BIR exceeded its revised 2020 target by 15.14%. Additionally, 4.37 million new business taxpayers registered with the BIR in 2020, marking a 6.15% increase from the previous year (Department of Finance, 2021)

Taxpayers in the Philippines can pay either manually or online. Online payment can be done via electronic payment gateways such as PayMaya or Gcash, which are very popular. Manual payments may be made through any authorized agent banks. If there are no accredited banks, the tax due should be paid to the revenue collection officer at any revenue district office.

The payment systems being implemented by the BIR have proven to be effective in tax collection in this age of digital economy. Aside from saving time, it had become easy for both the government and the citizens to keep track of the payments. The innovations made by the BIR has made tax payments easier and quicker for tax payers through removal of many manual processes that have been automated using the e-filing system (De Castro et al., 2015).

Conclusion and Policy Implications

The overall productivity, especially within the government sector, has been significantly influenced by the adoption of digital workplaces. The integration of digital tools and platforms was able to streamline operations, enhance efficiency, and improve public service delivery. The laws that were established to promote digital transformation signaled a national commitment to leveraging technology for better governance.

However, several challenges hinder the full realization of these benefits. Inconsistent access to reliable internet connectivity, particularly in rural and remote areas, limits the reach and effectiveness of digital platforms and diminishes the benefits of digital workplaces. Additionally, varying levels of digital literacy among government employees can impede the smooth adoption of new technologies. Bureaucratic hurdles and resistance to organizational change also pose significant obstacles to digital transformation.

The shift toward digital workplaces in the Philippine government carries several important policy implications:

- (1) **Investment in digital infrastructure:** The speed and quality of internet in the Philippines ranks lower than its neighboring countries despite improvements. There is a need for stronger government investment in the nationwide digital infrastructure, particularly in rural and underserved areas. Policymakers must prioritize expanding reliable internet access and digital resources to bridge the urban–rural digital divide. This can be achieved through public–private partnerships.
- (2) **Digital literacy and capacity building:** Government and private agencies should implement policies that promote continuous training and capacity-building programs to constantly retool employees. This will ensure that employees are equipped to effectively use new digital tools and platforms, thus improving productivity and service delivery.
- (3) **Data security and privacy:** Many companies in the Philippines had been victimized by hacking. The digital transformation of the country raises concerns about data security and privacy in both government and private institutions. Policymakers need to establish comprehensive frameworks and regulations that safeguard sensitive information while ensuring compliance with international standards.
- (4) **Culture of innovation:** The government should institute policies that encourage innovation and flexibility. Rigid bureaucratic processes may slow the adoption of new technologies, especially in the public sector. A more agile regulatory environment would allow for easier experimentation with digital solutions and faster response to emerging technologies.

- (5) **Monitoring and evaluation:** Policies should include mechanisms for regularly monitoring and evaluating the implementation of digital transformation initiatives. This ensures continuous improvement and adaptability to address inefficiencies toward ensuring long-term success in government productivity.

In conclusion, while the Philippines has made commendable strides toward digitalizing its government operations, concerted efforts are needed to address existing challenges. By tackling these issues head-on, the country can fully harness the advantages of digital workplaces to enhance productivity and offer improved services to its citizens.

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THAILAND

National Productivity

Thailand's GDP per capita, adjusted for purchasing power parity (PPP), declined by 6.27% in 2000 due to the impact of the COVID-19 pandemic and had not yet returned to the level observed in 2019. Similarly, GDP per labor hour in 2022 was only 95% of the level recorded in 2019, and GDP per worker in 2022 remained lower than pre-pandemic levels (see Table 1). This indicates potential structural alterations to economic fundamentals. These may include permanent business closures, skills mismatches in the labor market, or persistent supply chain realignments that have fundamentally altered productivity dynamics.

During the pandemic, GDP per worker increased significantly by 5% in 2020, rising from 163.48 to 171.61, but then experienced a notable decline in 2021. In contrast, GDP per labor hour decreased by 2% in 2020 but rebounded in 2021 (see Table 2 and Figure 1). However, GDP per labor hour subsequently fell from 183.86 in 2021 to 176.54 in 2022, representing a decline of approximately 4%. This reflects adaptation to pandemic conditions, including remote work arrangements and technological adoption, which may have temporarily boosted output per employee while simultaneously reducing efficiency per hour worked.

TABLE 1

THAILAND'S GDP PER CAPITA IN PPP, 2012–22.

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
GDP per capita	17,941.1	18,311.7	18,390.9	18,877.3	19,439.3	20,168.2	20,952.0	21,341.1	20,002.8	20,280.9	20,752.6

Note: GDP per capita, PPP (constant 2021 international dollar), NY.GDP.PCAP.PP.KD

Source: Data from World Bank Group (<https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?locations=TH>).

TABLE 2

THAILAND'S GDP PER LABOR HOUR AND GDP PER WORKER, 2012–22.

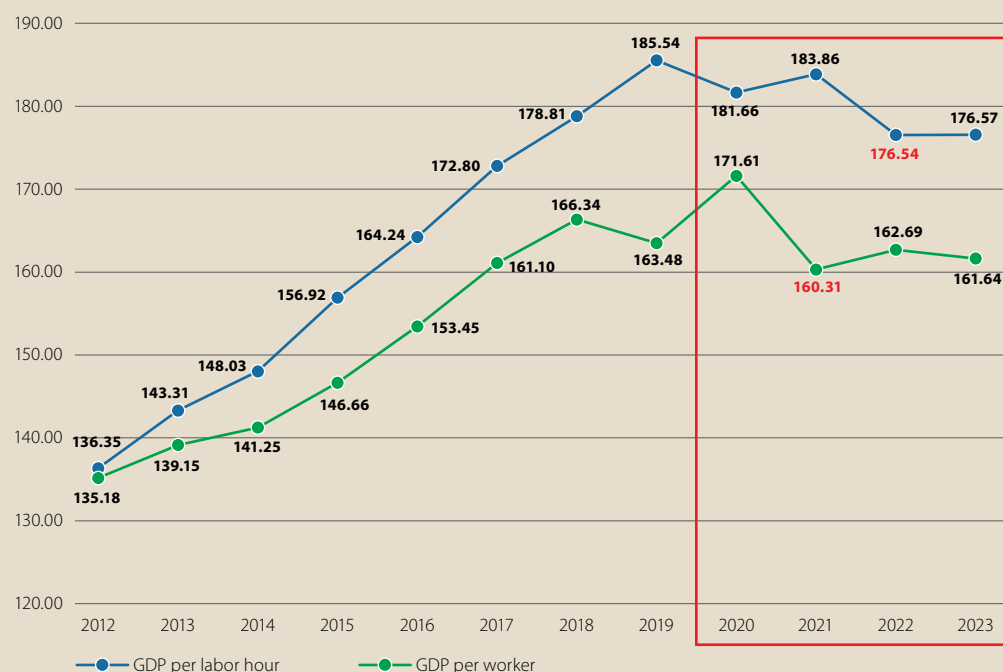
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
GDP per labor hour	136.35	143.31	148.03	156.92	164.24	172.80	178.81	185.54	181.66	183.86	176.54
GDP per worker	135.18	139.15	141.25	146.66	153.45	161.10	166.34	163.48	171.61	160.31	162.69

Note: Base year 2001.

Source: Bank of Thailand (<https://www.bot.or.th/en/statistics/economic-and-financial-index-and-indicators.html>).

FIGURE 1

THAILAND'S GDP PER LABOR HOUR AND GDP PER WORKER, 2012–22.



Survey Report on Digital Workplace

Digital workplace is a technology-driven platform that enables employees to access and collaborate on work-related tasks, information and tools from anywhere using various devices. To investigate the digital workplace landscape in Thailand, this study explores key factors including the country's IT infrastructure, ICT readiness and adoption, as well as government policies and organizational culture and policies.

Thailand Digital Landscape

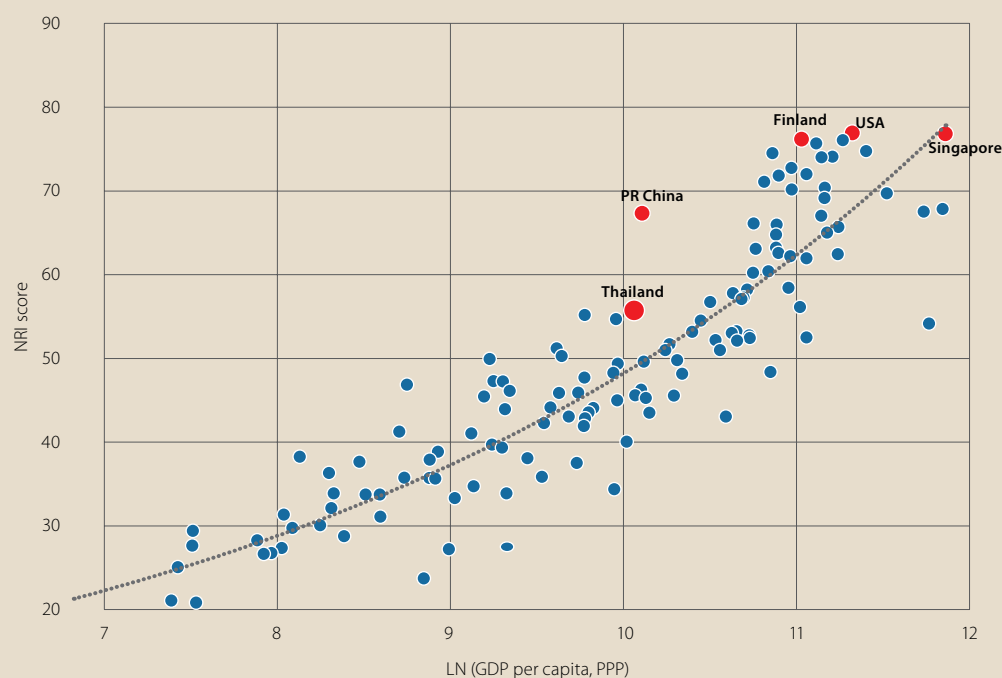
IT Infrastructure

The Network Readiness Index (NRI) is recognized as a leading global benchmark for assessing how effectively economies utilize information and communication technology (ICT) to drive development and competitiveness. According to the 2023 NRI report, 134 countries were evaluated across four foundational pillars of technology, people, governance, and impact, with Thailand ranking 42nd overall. Figure 2 illustrates a positive correlation between NRI scores and GDP per capita (PPP), indicating that higher network readiness is typically associated with higher income levels. Thailand's position above the trend line indicates that its level of network readiness surpasses expectations relative to its income level, reflecting either advanced ICT capabilities or opportunities to translate digital readiness into broader economic gains.

Table 3 indicates that Thailand's overall NRI score is slightly above the regional average for three of the four pillars, except for the technology pillar, where it falls marginally below the regional benchmark. As an upper-middle-income country, Thailand notably outperforms its income group peers across all four pillars. The best performer in the Asia-Pacific region is Singapore. The best performer among upper-middle-income countries is PR China.

FIGURE 2

NRI SCORE AND GDP PER CAPITA PPP (NATURAL LOG).



Source: Network Readiness Index (2023) and World Bank Group (<https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>).

Note: USA (rank 1), Singapore (rank 2), Finland (rank 3), PR China (rank: 20).

TABLE 3

THAILAND'S RANKS AND SCORES VS. ITS INCOME-GROUP AVERAGE AND REGION, OVERALL AND BY PILLARS.

Dimension	Rank	Score		
		Thailand	Upper-middle-income countries	Asia-Pacific
NRI score	42	55.73	47.35	53.28
Pillar 1: Technology	50	44.73	38.48	47.34
1.1 Access	32	74.07		
1.2 Content	68	22.73		
1.3 Future technology	52	37.39		
Pillar 2: People	34	53.79	42.59	48.95
2.1 Individuals	11	60.49		
2.2 Businesses	43	53.04		
2.3 Governments	41	47.84		
Pillar 3: Governance	46	66.67	55.90	59.22
3.1 Trust	50	56.85		
3.2 Regulation	56	68.21		
3.3 Inclusion	37	74.95		

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Dimension	Rank	Score		
		Thailand	Upper-middle-income countries	Asia-Pacific
Pillar 4: Impact	45	57.72	52.43	57.62
4.1 Economy	34	38.68		
4.2 Quality of life	39	75.69		
4.3 SDG contribution	87	58.78		

Source: Network Readiness Index (2023).

ICT Adoption in Business

National Statistics Office (2022) reveals that approximately 41.2% of Thai establishments, totaling 1,053,845 out of 2,555,303, utilized computers in 2022. This translates to around 3.5 million employees incorporating computer use into their daily work routines, averaging 3.3 users per establishment. Additionally, a significant 69.5% of total, or 1,776,223 establishments, reported utilizing the internet for various business activities. These statistics indicate a notable degree of technological integration with the Thai workforce, highlighting the importance of computers and internet access in facilitating business operations.

Table 4 presents an overview of the adoption of various digital technologies by businesses, and the utilization of public services online. The highest adoption rate is seen in business websites, with 75.20% of establishments utilizing this technology, indicating a strong online presence among Thai businesses. Following closely, 69.89% of businesses employ data analytics, suggesting a growing recognition of the importance of data-driven decision-making. Further, 47.46% of businesses have integrated cloud services, reflecting a moderate level of cloud adoption that enables flexible and scalable IT solutions, while 44.48% of establishments have utilized artificial intelligence (AI) technologies. This demonstrates a willingness to innovate through advanced technologies, although there is still room for growth.

Almost all respondents in the private sector utilize online tax filing services and 92.81% of establishments pay utility bills online, showcasing the convenience and efficiency of digital payment systems and high level of digital engagement with government processes. More than half of the businesses utilize online data submission, permission/certificate request form, as well as e-procurement. Although the data shows a clear trend toward digital technology adoption among businesses in Thailand, particularly in areas that enhance operational efficiency and regulatory compliance, there remains significant potential for growth in advanced technologies such as IoT, 5G, and robotics, which could further transform both business practices and public service delivery.

Table 5 reveals access and usage of digital technologies within primary public agencies, based on data from 1,470 schools and primary care hospitals, reveals significant insights. Cloud technology leads in access at 88.78%, yet its usage remains low at 14.29%, indicating underutilization despite widespread adoption. Similarly, 5G technology demonstrates a moderate access rate of 50.68% with even lower usage at 10.00%, suggesting barriers to leveraging high-speed connectivity for improved services. Data analytics show a more balanced profile, with access at 21.29% and usage at 16.39%, highlighting some integration into decision-making processes. In contrast, AI and blockchain technology exhibit low access (19.32% and 12.38%, respectively) and minimal usage,

pointing to significant implementation challenges. The Internet of Things (IoT) and robotics also show limited access and no recorded usage, reflecting their nascent stage within these environments. Overall, while access to these digital technologies is present, the low rates of actual usage indicate a critical gap in effective integration and application, presenting substantial opportunities for enhanced training, infrastructure development, and strategic implementation to maximize the potential benefits of these technologies.

TABLE 4**ACCESS AND USAGE OF DIGITAL TECHNOLOGY IN PRIVATE SECTOR.**

Digital technology	%	Public services	%
Business websites/home pages	75.20%	Tax filing	99.30%
Data analytics	69.89%	Utilities bills	92.81%
Cloud services	47.46%	Submit employment data	78.97%
AI	44.48%	Fee/fare online payment	63.18%
IoT	13.22%	Request for investment benefit	61.82%
5G	10.34%	Request for permission/certification	60.16%
Robotics	7.10%	Request for tax benefit	57.49%
		Business registration certificate services	55.43%
		Electronic government procurement	47.28%

Source: Thailand Digital Outlook, 2023, Office of the National Digital Economy and Society Commission.

TABLE 5**ACCESS AND USAGE OF DIGITAL TECHNOLOGY IN PRIMARY PUBLIC AGENCIES.**

Digital technology	Access	Usage
Cloud technology	88.78%	14.29%
5G	50.68%	10.00%
Data analytics	21.29%	16.39%
AI	19.32%	6.67%
Blockchain	12.38%	
Internet of things	11.56%	
Robotics	10.20%	

Source: Thailand Digital Outlook, 2023, Office of the National Digital Economy and Society Commission.

The Thailand Digital Technology Foresight 2035 Report (Frost & Sullivan, 2023) highlights that many companies in the private sector and some government agencies are developing plans for digital integration into their business processes. IT, business intelligence (BI), and customer relationship management (CRM) are the top functions adopting the technologies, followed by operations, sales and marketing, and customer service. Technological advancements in AI, cloud infrastructure, big data, cybersecurity, and CRM systems play a critical role in the business domain, serving as key enablers of high-skill tasks, enhancing operational efficiency, reducing maintenance costs, and fostering improved customer engagement through personalized experiences. In operations, integrating AI, robotics, automation, and data analytics is expected

to significantly lower manual labor requirements and related expenses. Sales and marketing benefit from digital marketing, data analytics, and CRM tools like Salesforce, which enhance outreach, improve conversion rates, and streamline complex processes. In customer service, technologies including AI, blockchain, chatbots, and mobile applications are pivotal for delivering superior customer experiences while also minimizing costs and inefficiencies through self-service solutions. Stakeholders prioritize revenue generation, business process efficiency, and competitive advantage as the top three factors influencing their decisions to implement or procure new technologies.

The ICT Sector's Post-COVID Boost to the Thai Economy

The ICT sector has been instrumental in supporting Thailand's economic recovery after the COVID-19 pandemic. The crisis served as a catalyst for the accelerated adoption of digital technologies across multiple industries, positioning the ICT sector as a primary engine of growth. Its contributions to the expansion of e-commerce, the facilitation of remote work, and the advancement of digital transformation and innovation have played a significant role in driving economic development, job creation, and enhancing the country's global competitiveness.

E-commerce Boom

The growth of Thailand's e-commerce sector has been driven by increased internet and mobile phone penetration, alongside advancements in logistics and electronic payment systems, which have collectively enhanced convenience and strengthened consumer confidence in online shopping. According to the E-Commerce Association of Thailand (U.S. Department of Commerce, 2024), the market value of e-commerce was estimated to reach USD26.5 billion in 2023, up from USD23.4 billion in 2022, with projections indicating further growth to USD32 billion by 2025. Mobile devices account for over 80% of total online sales, while mobile wallets represent 23% of all transactions. Mobile wallet adoption in Thailand is expected to rise significantly, reaching 63% by 2025.

Telecommunication

The growing demand for telecommunications services in Thailand, highlighted by an increase in mobile subscribers (Krungsri Research, 2024), is largely driven by the rapid adoption of 5G technology, which is key to the digital transformation of businesses and industries. This transformation includes innovations like automated retail systems, digital health services, and the increasing use of smart devices in everyday life. Significant investments in broadband and 5G networks have improved connectivity, making digital services more accessible to a wider population. Industry revenues have surged as more businesses embrace online activities and enterprise clients increase their demand for reliable telecom services.

Remote Work and Digital Collaboration

The growth of digital services in Thailand is primarily driven by the emergence of new service delivery models via digital platforms that integrate data with online providers to offer targeted, demand-responsive digital solutions, further supported by the ongoing recovery in business activities. According to International Data Corporation's Worldwide Semiannual Software Tracker 1H2023 (IDC, 2023), software vendor revenue in Thailand reached THB36.5 billion in the first half of 2023, representing a 14.1% year-on-year increase in local currency. As Thailand advances toward a strategic adoption of deep learning-based data management systems, with AI-enabled cloud software as a central enabler, expenditure on software and software-related services within the business sector continues to expand.

Video Conferencing

Over the past few years, the workplace landscape has undergone significant changes in response to the pandemic, with a growing portion of the workforce and beyond shifting to remote or hybrid work. This shift has driven a heightened reliance on video conferencing platforms. Zoom has emerged as a leading global tool, on account of its user-friendly interface and features such as screen sharing, recording, and virtual backgrounds. However, Román and Brandl (2023) reveal in their survey data that in the year 2022 Zoom's market share in Thailand was 34.76%, trailing behind Google Meet, which led with 42.53%. Meanwhile, Microsoft Teams, favored by organizations utilizing Microsoft 365's integrated tools like chat, file sharing, and project management, held 15.55% of the market share.

Productivity Tools and CRM

The pandemic sped up the shift to cloud-based productivity tools like Google Workspace and Microsoft 365 in Thailand. As businesses, schools, and individuals adapted to working and studying from home, these platforms became essential for collaboration and communication. Google Workspace and Microsoft 365 quickly became the go-to solutions, enabling organizations to stay connected, share files, and manage projects remotely. The education sector saw a particularly high uptake, with platforms like Google Classroom and Microsoft Teams widely used for online learning.

Additionally, many Thai businesses, especially the SMEs, accelerated their digital transformation by adopting cloud tools for tasks like project management and communication. Government initiatives played a key role, offering resources and incentives to help businesses and individuals transition smoothly to digital platforms.

In the CRM space, Salesforce leads among large enterprises, with about 30% of them using it. Meanwhile, Zoho CRM, a more affordable option, is growing in popularity among SMEs, with approximately 25% of Thai businesses using it in 2023 according to a report by Mordor Intelligence (2024).

Project Management

In the realm of project management, cloud-based tools like ClickUp and Asana have become popular choices due to their intuitive interfaces and customizable features, enabling teams to effectively track tasks and assign deadlines. Trello, known for its visual kanban board design, is particularly favored by small teams and freelancers, with many of Thai businesses adopting it for project management. Traditional project management software like Microsoft Project remains an available choice, although specific project management tools like Jira designed for software development projects, might be preferred. However, the choice of project management tools often depends on factors such as project size, team size, industry, and specific requirements. Many companies in Thailand may also use a combination of tools to address different needs.

Digital Services and Software

According to the Digital Economy Promotion Agency (DEPA, 2023), the value of Thailand's digital industry has experienced consistent growth of approximately 30% since 2020, as illustrated in Table 6, driven by strong government initiatives aimed at promoting the sector. The digital industry is composed of four major sub-industries:

- **Hardware and smart devices:** This segment includes the manufacturing and development of computer hardware, telecommunications equipment, IoT devices, and other smart technologies.

- Software, platforms, and applications: These cover the creation and management of operating systems, software solutions, cloud platforms, and mobile and web applications.
- Digital services: This is a broad segment involving digital content, fintech services, e-commerce, and other technology-driven service solutions that enhance both B2B and B2C interactions.
- Digital infrastructure: This comprises the development and enhancement of data centers, cloud services, and broadband networks, which support the backbone of digital services and technologies across the country.

TABLE 6**THE VALUE OF DIGITAL INDUSTRY AND GROWTH RATE AS PER THE IMC SURVEY (IN THB MILLION).**

Digital industry	2020	2021	2022	2023
Software and software services	144,978	160,872	190,766	215,191
Hardware and smart devices	1,021,442	1,218,588	1,431,980	1,457,116
Digital service	162,357	233,088	281,515	307,630
Digital content	39,332	42,065	44,230	44,236
Total (in THB million)	1,368,109	1,654,613	1,948,491	2,024,173
Total (in USD million)	43,709.55	51,706.66	55,620.95	58,216.08

Source: Digital Industry 2023, DEPA.

Key Drivers, Law, and Guidelines

Government Policies

The 12th National Economic and Social Development Plan (2017-2021)

One of the key objectives outlined in the plan is to strengthen the national economy and enhance competitiveness in an increasingly dynamic global landscape by transforming the economic structure toward a service-oriented and digitally driven model. To achieve this, the plan emphasizes the expansion of high-quality telecommunications infrastructure and the widespread adoption of digital technologies across industries as critical drivers of innovation and value creation.

Thailand 4.0 Policy, 2018

As part of national strategy, the plan outlines key performance targets, including a minimum 4.5% annual growth in industrial GDP, 10% growth in industrial investment, 8% growth in exports, and a 2% increase in total factor productivity every year. Meeting these benchmarks is considered essential for Thailand's transition to a high-income economy by 2036 (UNCTAD, 2021).

Thailand's National Strategy (2018–37), National Master Plan for Digital Development

The digital industry, including data technology and AI, is one of the ten Thai S-curve Industries to attain the Thailand 4.0 policy.

Thailand Digital Economy Promotion Master Plan

Thailand's Digital Economy Promotion Master Plan Phase I (2018–22), formulated and proposed by the Ministry of Digital Economy and Society (MDES), formerly the Ministry of Information and Communication Technology (MICT), aims to tackle national challenges and enhance the

quality of life through a strategic application of digital technologies. Table 7 outlines the departments, companies, and organizations operating under the ministry's oversight. In alignment with the Digital Economic and Society Development Plan, MDES is focused on transforming Thailand into a technology-driven society, fostering new business opportunities, and empowering both the public and private sectors to promote sustainable and prosperous growth.

TABLE 7**DEPARTMENTS, COMPANIES, AND ORGANIZATION UNDER MINISTRY OF DIGITAL ECONOMY AND SOCIETY.**

Dependent departments	Thai Meteorological Department
	National Statistical Office of Thailand
	Office of the National Digital Economy (ONDE)
Public companies	National Telecom Public Company Limited
	Thailand Post Co., Ltd
Public organizations	Electronic Transactions Development Agency (ETDA)
	Digital Economy Promotion Agency (DEPA)
	National Cyber Security Agency (NCSA)
	Office of the Personal Data Protection Commission

The DEPA was tasked with developing a strategic plan to promote the digital economy, aligned with the Thai Digital Economy and Society Development Plan. Phase 1 of the Thailand Digital Economy Promotion Master Plan (2018–22) outlines a strategic framework for accelerating the country's digital transformation. Key objectives include fostering digital infrastructure development, promoting digital innovation and entrepreneurship, and enhancing digital literacy and skills. The plan emphasizes the importance of leveraging digital technologies to drive economic growth, improve public services, and enhance social development. Specific initiatives focus on expanding broadband connectivity, supporting the development of digital startups, and promoting digital government services. The plan has been implemented, with its achievements detailed in Table 8. Building on these outcomes, DEPA has proposed Phase 2 of the plan (2023–27), with objectives centered on developing a digitally skilled workforce, transforming the traditional economy into a high-value digital economy by increasing the value and investment in the digital industry, and optimizing the use of digital infrastructure.

TABLE 8**ACHIEVEMENTS OF THE DIGITAL ECONOMY PROMOTION MASTER PLAN PHASE 1, 2018–22.**

Strategy	Target	Achievement
1: Build manpower for digital age		
• Digital manpower (people)	500,000	682,000
• Digital citizens (people)	30,000,000	20,588,000
2: Transform economy toward Digital Thailand		
• Digitalized businesses (businesses)	25,000	155,700
• Digital startups market value (times)	10	7.8

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Strategy	Target	Achievement
3: Empower communities for digital future		
• Digitalized communities (communities)	24,700	9,800
4: Build digital innovation ecosystems		
• Smart cities in key economic zones (cities)	7	15
• Digital investment value (%)	10%	14%

Source: Digital Economy Promotion Master Plan Phase 2, 2023–27.

Thailand Cloud First Policy

The Thailand Cloud First Policy is a key initiative designed to drive technological advancement and digital transformation, reflecting the government's strong commitment to using cloud computing as a foundation for economic growth. The policy outlines a comprehensive framework that encourages the adoption of cloud-based solutions across various sectors, from public administration to private enterprises. Key objectives include enhancing efficiency, reducing costs, promoting innovation through the utilization of cloud technologies, managing supply and demand of local cloud services, and improving the cloud ecosystem and service procurement through cooperation between public and private sectors. The policy also emphasizes the importance of data privacy and security, outlining measures to safeguard sensitive information and ensure compliance with relevant regulations. The policy mandates that government agencies prioritize cloud services for their IT infrastructure needs.

This commitment aligns with global trends where governments are increasingly adopting cloud technologies to enhance operations and improve service delivery to citizens. For Thailand, with its rapidly growing digital economy, the cloud-first approach is not only modernizing government operations but also lays a foundation for future growth. It is expected to attract foreign investment and strengthen the country's position in the global digital economy.

Thailand National AI Strategy and Action Plan (2022–27)

The initiative proposed by the Ministry of Digital Economy and Society (MDES) and the Ministry of Higher Education, Science, Research and Innovation (MHESI) outlines five key strategies: (1) preparing Thailand's readiness in social, ethics, law, and regulation for AI application; (2) developing national infrastructure for sustainable AI development; (3) increasing human capability and improving AI education; (4) driving AI technology and innovation development; and (5) promoting the use of AI in public and private sectors. This plan targets to leverage AI skills for the academic sector, increase productivity and AI innovation, and bridge income, education, and healthcare gaps as well as enhance national security and safety.

Law and Regulations

Development of Digital for Economy and Society Act, B.E.2560 (2017)

Section 21 of the Development of Digital for Economy and Society Act mandates that, following the promulgation of the national policy and plan for digital development in accordance with Section 5, all state agencies are required to undertake activities that align with the implementation of this policy and plan. Furthermore, the Bureau of the Budget is instructed to allocate the necessary budgetary resources to these agencies to support their compliance with the established digital development framework (Ministry of Digital Economy and Society, 2017).

Cybersecurity Act, B.E.2562 (2019)

The Cybersecurity Act outlines the rationale for imposing restrictions on individual rights and freedoms to effectively safeguard cybersecurity. The Act establishes measures to protect against, respond to, and mitigate the risks associated with cyber threats that could impact national security and public order. Its enactment is in accordance with the criteria set forth in Section 26 of the Constitution of Thailand, thereby ensuring legal consistency and adherence to constitutional principles (Ministry of Digital Economy and Society, 2019).

Electronic Transaction Act B.E.2544 (4th Amendment) B.E.2562 (2019)

The 4th amendment to the Electronic Transactions Act (ETA), which took effect on 23 May 2019 (Electronic Transactions Development Agency, 2019), introduces significant provisions concerning digital identification and authentication systems.

Section 34/3 stipulates that the identification and authentication of individuals may be conducted through a digital identification and authentication system.

Section 34/4 establishes that, in scenarios where financial and commercial security must be preserved, and to enhance the trustworthiness of digital identification systems or prevent public losses, a Royal Decree will regulate businesses providing services related to these systems. Such businesses will be classified as providers of electronic transaction services, subject to licensing requirements and the provisions of Chapter III of the ETA.

Section 7 provides a transitional provision for businesses operating digital identification and authentication services prior to the enactment of this amendment, allowing them to continue operations until the Royal Decree is issued. Upon the decree's enactment, these businesses must apply for a license within 90 days to maintain their operations legally, with continued service permitted until a licensing decision is made.

The Act also acknowledges the concept of digital identity verification and outlines the government's initiative to promote this through the development of a National Digital ID (NDID), which was launched later.

Emergency Decree on Electronic Meetings, B.E.2563 (2020)

The Emergency Decree on Electronic Meetings (B.E. 2563), enacted in 2020, serves as a fundamental legal framework to facilitate virtual meetings conducted via electronic means, referred to as "e-meetings." The Decree stipulates that, when a meeting is mandated by law, the chairman is authorized to conduct the meeting through electronic mediums. Additionally, it allows for the issuance and dissemination of electronic meeting notices via e-mail, with a requirement to retain a copy of such notices in electronic form as evidence. This legislation reflects an adaptation to evolving communication technologies and the need for flexibility in conducting meetings under various circumstances.

The Labor Protection Act (No. 8) B.E. 2566 (2023)

The Labor Protection Act (No. 8), enacted in 2023, amends the Labor Protection Act B.E. 2541 (1998) to promote remote work arrangements between employers and employees. Section 23/1 aims to enhance employees' work-life balance, alleviate traffic congestion, and reduce energy and fuel consumption, thereby alleviating burdens on employers. The section allows for negotiation regarding work locations, including employees' residences and coworking spaces, as well as

various aspects of employment such as working hours, holidays, break times, job descriptions, and associated expenses. Furthermore, the Act stipulates that employees may decline communication from their superiors outside of designated working hours unless prior consent has been given. It is important to note that Section 23/1 does not mandate employers to permit remote work, nor does it impose penalties on employers who do not establish work-from-home agreements with employees (Tilleke & Gibbins, 2023).

Cloud Cybersecurity Standards

The Thailand National Cyber Security Committee (NCSC) has proposed draft Cloud Cybersecurity Standards to guide the country's cloud-first policy. These standards aim to mitigate cyber risks for government agencies, regulatory bodies, and critical information infrastructure organizations. The standards focus on cloud security governance and infrastructure operations. By implementing these standards, Thailand can promote a safe and secure adoption of cloud technologies, thereby driving digital transformation while protecting sensitive data (Tilleke & Gibbins, 2024).

Thai Payment Development

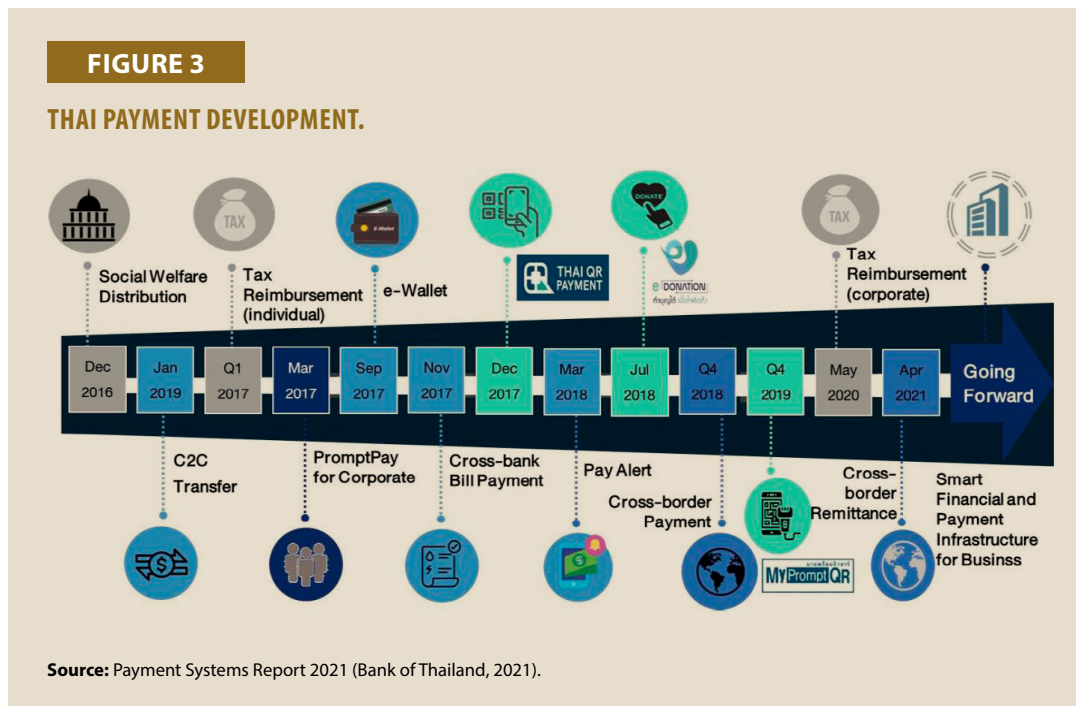
According to the Payment Systems Report (Bank of Thailand, 2021), payment systems play a vital role in facilitating smooth and efficient economic and financial transactions, thereby supporting overall economic development. From 2019 to 2021, the Bank of Thailand (BOT), in collaboration with key stakeholders from the banking, government, and private sectors, carried out initiatives aimed at improving the country's payment systems, as part of the Payment Systems Roadmap No. 4. This roadmap emphasizes five key areas for development, known as the 5Is: Interoperable Infrastructure, Innovation, Inclusion, Immunity, and Information. These focus areas are designed to create a more robust, accessible, and secure payment system in Thailand. Major initiatives include expanding the PromptPay service to accommodate business transactions and enabling cross-border payment connectivity, while promoting infrastructural development and adoption of financial technology. The BOT's overarching goal is to improve access to payment services and broaden service options, leading to a significant evolution in Thailand's payment landscape, especially in the realm of digital payments, with enhanced service coverage and a variety of alternatives.

Additionally, the BOT has upgraded payment system infrastructures to ensure stability, security, and compliance with international standards, along with the ability to support a rapid growth of transactions, innovation, interoperability, and cross-border connectivity. Key actions include:

- implementing the ISO 20022 messaging standard in the PromptPay system;
- developing Smart Financial and Payment Infrastructure for Business (PromptBiz); and
- building the NDID infrastructure.

Data Governance Framework

The Data Governance Framework, proposed by the Digital Government Development Agency (public organization), is a key part of Thailand's effort to modernize and improve public service delivery through digital transformation, as outlined in The Digitalization of Public Administration & Services Delivery Act (2019). This framework establishes key principles, including transparency, accountability, data minimization, and security, addressing critical aspects of data governance. It



encompasses the entire data lifecycle, from collection and storage to sharing and destruction, while also emphasizing the importance of data quality, integrity, and privacy.

The framework is designed to encourage responsible data management practices, ensuring that personal data is protected while also supporting the growth of Thailand's digital economy. All entities that collect, process, or store personal data, whether government bodies or private-sector organizations, are required to follow these guidelines. This comprehensive approach ensures consistency in data governance across different sectors, helping to create a secure, transparent, and efficient digital ecosystem. The framework is expected to be a key factor in shaping Thailand's data governance landscape, driving technological growth, and safeguarding individual rights for the future.

Case Studies

Case 1: Ajinomoto Thailand

Industry: Manufacturing Tool: UiPath RPA

Ajinomoto, a Japanese multinational food manufacturer established in 1909, has operated in Thailand since 1960 and currently employs around 7,000 individuals. In 2019, the company enrolled 7–10 employees from the finance and accounting (F&A) department in the Robotic Process Automation (RPA) Developer Foundation course offered by NCT, a partner of UiPath. The objective was to empower internal staff to independently develop and maintain automated processes. Prior to automation, F&A employees were heavily engaged in repetitive and time-consuming tasks, including the manual transfer, conversion, and verification of large volumes of financial data, such as cash flow reports and transaction records. After eight weeks of development, the F&A department successfully implemented a core automation system utilizing three key UiPath platforms: UiPath Automation Developer, UiPath Orchestrator, and UiPath Unattended Robot. As part of its automation efforts, the F&A department streamlined several routine processes, including the recording and exporting of impairment data prior to its import into

financial management software (Record Impairment Fixed Asset). Additional automated tasks included generating backup server reports by extracting data from the SolarWinds web application and transferring it into Microsoft Excel, as well as exporting data from PDF documents to compile Net Backup Reports in Excel. These automation initiatives significantly reduced manual workload and improved data accuracy and efficiency.

Since 2019, Ajinomoto Thailand has implemented 20 automation processes, with seven to ten of them being run daily. Automation had saved its employees a total of 14,000 minutes per month, as at the end of 2021. Employees spent 95% and 98% less time on the “daily cash flow report” and “record impairment fixed asset” processes, respectively (UiPath, 2023)

Case 2: Food Project (Siam) Co., Ltd.

Industry: Trading (Food and Beverage) Tool: Power Automate, Power Platform

Food Project (Siam) Co., Ltd., a comprehensive food service provider established in 1988, leverages over 30 years of industry experience to supply a wide range of imported frozen foods to various sectors, including restaurants, hotels, airlines, fresh markets, SMEs, and industrial operations.

Danupob Sattroolee, Deputy Management Information System Director at Food Project (Siam), highlighted the challenges their sales team faced, managing over 1,500 food products with varying delivery schedules and shelf lives. “Our sales team had to travel frequently and rely on physical documents,” said Sattroolee. To enhance efficiency, the company partnered with Fusion Solution to optimize the existing Microsoft 365 tools, including Power BI for data analytics and Power Apps to build custom applications. By quickly developing and refining these apps based on internal feedback, Food Project (Siam) created solutions that enhanced operational efficiency and better met the needs of their sales teams.

Sales staff now have real-time access to inventory, sales, and customer information through a mobile application developed by Food Project. The application streamlines communication processes that previously involved multiple departments, thereby enhancing operational efficiency and accelerating the sales cycle. This integration not only minimizes communication errors and redundancies but also facilitates quicker deal closures. Additionally, Power BI is employed to continuously monitor and visualize up-to-date data, providing instant insights into current business conditions. Notably, these digital enhancements were successfully implemented within a span of less than one year (Microsoft Thailand News Center, 2021).

Case 3: Siam Commercial Bank

Industry: Finance Tool: Blue Prism (RPA), AI, Big Data Analytics and Cloud Infrastructure

Siam Commercial Bank (SCB), Thailand’s oldest financial institution, has achieved comprehensive organizational transformation and productivity enhancement through a series of innovation-driven initiatives. The bank established a centralized center of excellence and adopted the Robotic Operating Model (Blue Prism). An integrated team composed of members from Operational Excellence and Transformation was formed to serve as a specialized unit capable of scaling automation across the organization. A notable outcome of this initiative was the innovative resolution of ATM transaction errors using coordinated digital workers. In this automated process, three distinct digital workers function in sequence: the first verifies the customer’s transaction by reviewing the ATM log, the second issues the refund, and the third deposits the refund into the customer’s account. This streamlined, end-to-end solution, completed in less than five minutes, demonstrates an effective agile collaboration among the call center, operations, and finance teams (Blue Prism, n.d.).

SCB has positioned itself at the forefront of digital transformation in Thailand, marked by substantial investments in technology, an emphasis on enhancing customer experience, and a strategic pivot toward a digital-first approach. Guided by its vision to become “The Most Admired Bank,” SCB launched a strategic initiative in 2016 known as the SCB Transformation. This comprehensive plan was designed to significantly modernize the bank’s infrastructure and strengthen its long-term competitiveness. The initiative reflects SCB’s proactive response to the rapidly evolving financial services landscape, which is being reshaped by advances in digital technology, shifting regulatory frameworks, and changing consumer behavior. In 2018, SCB implemented its transformative “Going Upside Down” strategy as part of a comprehensive initiative to transition from traditional banking methodologies to a more agile, customer-centric model. This strategic shift focused on leveraging advanced technologies and innovative solutions to enhance operational efficiency, elevate customer experience, and enable SCB to transform from a traditional banking service provider to a digital finance platform provider.

Key outcomes:

- **Enhanced customer experience:** This has been a key focus of SCB’s digital transformation strategy, with an emphasis on delivering personalized products and services. SCB Easy, the bank’s flagship mobile application, provides a comprehensive suite of banking services, including payments, fund transfers, investments, and loan management. By incorporating customer feedback into its agile development processes, SCB has continuously enhanced the usability and functionality of its digital platforms, thereby strengthening customer engagement and satisfaction.
- **Operational efficiency gains:** The deployment of digital tools and automation technologies have streamlined workflows, reduced transaction processing times, and improved overall service delivery. A prime example is the automated resolution process for ATM transaction errors, wherein digital workers promptly validate, refund, and process transactions, demonstrating a strong commitment to operational excellence and customer-centric service.
- **Growth in digital banking adoption:** SCB has experienced substantial growth in its digital banking segment, evidenced by a notable increase in active users on its online and mobile platforms. This growth reflects the bank’s effective transition to a digital-first banking paradigm.
- **Strategic technological investments:** The “Going Upside Down” strategy has catalyzed significant investments in cutting-edge technologies, including AI, big data analytics, and cloud infrastructure. These advancements have enhanced SCB’s operational capabilities and enabled the development of innovative financial solutions.
- **Competitive market positioning:** By adopting a digital-first strategy, SCB has reinforced its competitive edge within the financial sector. The bank has established itself as a leader in digital transformation in Thailand, appealing to tech-savvy consumers and capturing a larger market share.
- **Positive financial performance:** The bank has reported favorable financial results in subsequent years, driven by increased transaction volumes and heightened customer engagement.

Case 4: Line Company (Thailand)

Industry: Software Company Tool: Employee Experience drive productivity

Line Company (Thailand) (LINE Corporation, 2021) has implemented the Happy Digital Workplace, Line Thailand Model to enhance productivity as well as to equally emphasize employee well-being and the capacity to respond to evolving work environments. It includes the following:

- **Seamless system, comprehensive communication:**
The company has equipped employees with the necessary tools to seamlessly transition to a work-from-home arrangement. Additionally, a secure intranet system has been implemented to ensure that employees could access work-related information remotely.
- **Caring for mind and body (well-being):**
The company has provided sufficient health insurance as well as telemedicine services and online group exercise classes.
- **Nurturing relationships:**
The HR team organizes regular online social activities and sends thoughtful gifts to employees' homes to foster a sense of connection and belonging.
- **Continuous evaluation and feedback:**
The “p-talk” system was introduced within the LINER’s Continuous Performance Management framework, enabling employees to receive real-time feedback from peers and supervisors. Additionally, quarterly employee engagement surveys were conducted to measure satisfaction levels and identify areas for improvement.
- **Ongoing skills development:**
The company’s commitment to employee development was evident through the WOW sharing program, which offered a variety of online training courses.

Case 5: Siriraj Hospital

Industry: Healthcare Tool: 5G, AR, and Cloud technology

Siriraj Hospital, the oldest and largest public hospital in Bangkok, serves over three million patients annually with a capacity exceeding 2,000 beds, making it one of Southeast Asia’s largest and busiest medical institutions. In 2020, Siriraj Hospital partnered with True Corporation and Huawei to launch a five-year plan to become Thailand’s first 5G-powered smart hospital. As part of the “Siriraj 5G Smart Hospital” initiative, Huawei deployed a MEC-based 5G private network, a hybrid cloud infrastructure, and integrated 5G + Wi-Fi solution to support advanced medical applications. The 5G network serves as the core infrastructure, addressing latency and security limitations (of 4G), critical for handling sensitive medical data. In response to the COVID-19 pandemic, Siriraj further leveraged cloud technologies and AI-assisted diagnostic tools, such as computer vision and medical image analysis, to enhance clinical efficiency. Additionally, 5G-enabled autonomous vehicles were deployed to facilitate contactless delivery of medical supplies, underscoring the hospital’s commitment to innovation and safety in healthcare delivery.

The hospital has enhanced healthcare efficiency by leveraging standalone 5G networks and edge computing to improve critical care, particularly in emergency scenarios. Given that one-third of critically ill patients do not survive the journey to the hospital, 5G-enabled ambulances now transmit real-time data, including vital signs, video, and medical records, to hospital teams prior to arrival. This

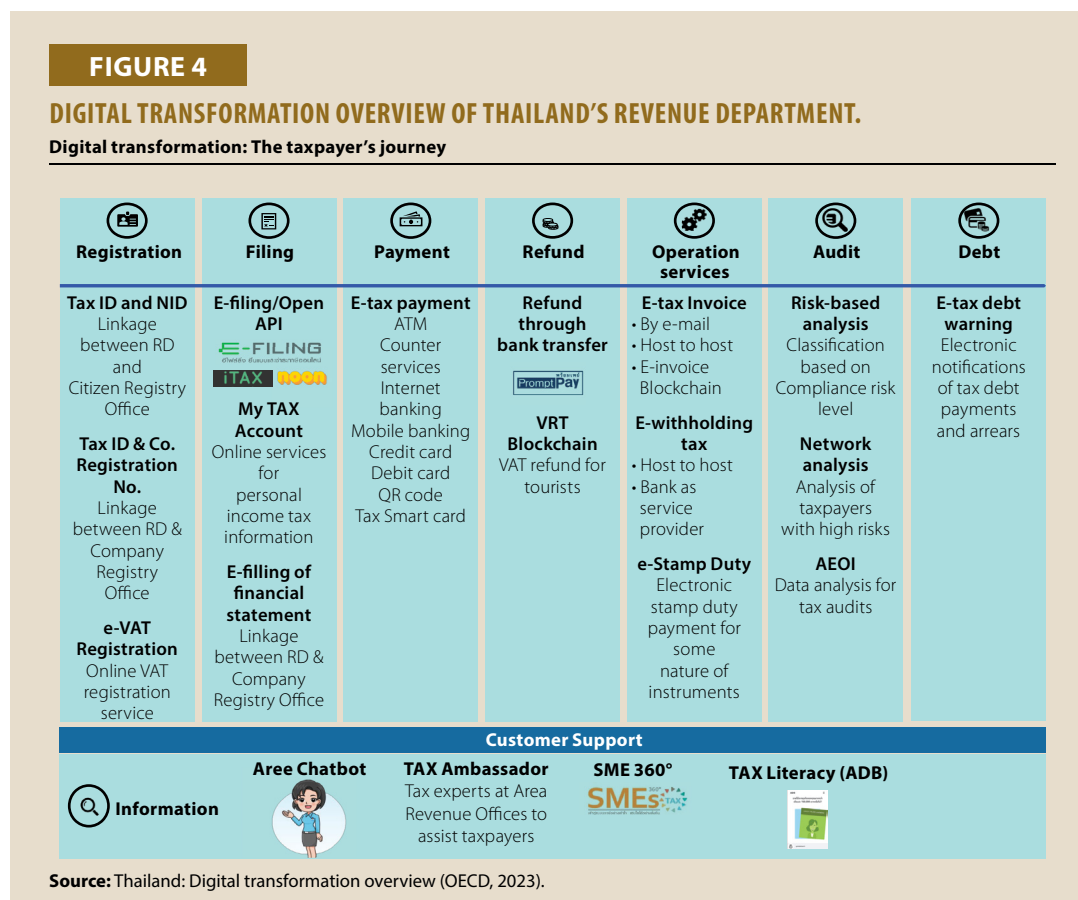
allows the medical staff to prepare in advance and facilitates remote consultations with specialists. Equipped with high-definition cameras and augmented reality (AR) glasses, these ambulances support rapid emergency assessments, with each case evaluated in just 25 seconds (Siriraj Hospital, 2021).

Case 6: Revenue Department, Ministry of Finance

Industry: Government Agency Tool: Digital Payment

In 2015, Thailand's Ministry of Finance introduced the National e-Payment Master Plan as part of a broader strategy to enhance the country's digital economy. The Revenue Department has played a key role in this initiative, particularly in enhancing process efficiency and service delivery. Since 2017, the department has utilized the PromptPay system to streamline personal income tax refunds.

The Revenue Department (2021) highlighted its digital transformation journey in its 2020 annual report, noting that in 2018, it significantly revamped its strategy to achieve its goals. This new strategy, named D₂RIVE, focuses on digital transformation, data analytics, revenue collection, innovation, value, and efficiency. The main objective of D₂RIVE is to digitalize the department's operations, making tax compliance more convenient and less complex. It also emphasizes using data analytics to enhance tax administration and encourages innovation to support both tax administration and taxpayer services. The implementation of the D₂RIVE strategy proved invaluable during the COVID-19 pandemic, when measures such as facility shutdowns, remote work, and social distancing were required. The department launched the Tax from Home program, enabling online tax transactions such as e-Registration, e-Filing, e-Payment, and e-Refund, along with other electronic services like My Tax Account, e-Withholding Tax, e-Tax Invoice and e-Receipt, e-Stamp Duty, and VRT on Blockchain.



The Revenue Department's digital transformation efforts have garnered substantial support from foreign governments and international organizations, including the International Cooperation Administration (ICA), the USA government's foreign aid agency, and the International Monetary Fund (IMF), as well as local partners, especially taxpayers. The success of this initiative is clearly demonstrated by the increasing number of electronic service users and the numerous awards received.

Opportunities, Challenges, and Recommendations

Digital Economy Hub Opportunities

Thailand has emerged as a key destination for data center and cloud service investments, with the Board of Investment (BOI) approving 37 projects totaling over USD2.8 billion (The Nation Thailand, 2024). Major global players like AWS, Alibaba Cloud, and Huawei Technologies have already committed to establishing their infrastructure in the country, while further investments from Google and Microsoft are on the horizon. This inflow of investment is set to accelerate AI development and digital services, bolstering Thailand's position as a growing hub in the regional digital economy.

Several factors contribute to Thailand's attractiveness for such investments. Its prime geographical location at the center of ASEAN, connecting to CLMVT markets with 250 million people, offers businesses access to a broad and interconnected region. Thailand also provides a stable, secure environment with robust data protection regulations, including the PDPA and Cyber Security Act, ensuring international compliance. Additionally, the country's advanced infrastructure, clean energy potential, and high-speed internet capabilities support large-scale data center operations. The expanding domestic digital market, supported by government initiatives like the Cloud First Policy, further strengthens this momentum. Complementary BOI incentives, such as VAT deductions, land tenure rights, and tax mitigation measures, make Thailand an attractive choice for global digital infrastructure investments.

Remote Work Challenges

Srianomai and Savetpanuvong (2023) observed a rise in employee satisfaction (measured by Net Promoter Score) during the pandemic, though this satisfaction decreased post-pandemic. Tanpipat et al. (2021) explored how organizational norms and job motivation influence perceived productivity and commitment in remote work contexts, suggesting that employees' motivation sustains commitment even under high work demands.

Technical issues: Internet connectivity, device compatibility, and technical difficulties can sometimes hinder the effective use of digital collaboration tools. Nakavachara (2020) highlighted the productivity benefits of broadband connectivity, finding that micro, small, and medium-sized enterprises (MSMEs) could increase productivity by up to 54% with broadband adoption. However, Jithitikulchai (2020) warned that low-income and low-skill workers face heightened risks of automation, as AI and robots are likely to replace roles in this segment of the workforce. Siddoo et al. (2019) conducted interviews and surveys with IT experts, identifying key competencies valued by industries. Professional skills and IT knowledge were found to be the most critical, with the top desired skills being lifelong learning, personal attitude, teamwork, dependability, and IT foundations.

Security concerns: Data privacy and security are important considerations when using cloud-based tools. Businesses need to implement appropriate measures to protect sensitive information.

Social isolation: While digital collaboration tools facilitate communication, they cannot fully replace face-to-face interactions. It is important to find ways to maintain social connections and prevent feelings of isolation. Phocharoen et al. (2022) highlighted the significance of asynchronous communication in design agencies, asserting that effective communication practices can enhance work productivity by reducing misunderstandings during the design process. In contrast, Ekpanyaskul et al. (2023) emphasized the impact of work conditions and occupational stress on work performance, noting that employee well-being was a critical factor in boosting productivity.

Hybrid Work Challenge

Diana Khaitova, Head of Client Development (APAC) at the Center for Creative Leadership, presented key insights from the Asia-Pacific study titled “WORK 3.0 Reimagining Leadership in a Hybrid World.” One major challenge highlighted in her findings was proximity bias, where supervisors tend to believe that in-office employees are more productive simply because they are physically visible, while remote workers may be perceived as less diligent. This bias extends to employees, who may assume that being in sight of their supervisors enhances their standing within the organization.

Khaitova emphasized that overcoming such biases requires a shift in workplace culture, led by proactive leadership. Leaders must foster an inclusive culture that supports the hybrid work model, ensuring that both in-office and remote employees are equally valued. She further noted that the success of hybrid work lies in the collective mindset of the organization, referring to the shared beliefs and collaborative approach that define how employees work together in this new era (Sasin School of Management, 2023).

Digital Transformation Challenges

Digital transformation, adoption, and implementation in Thailand encounter many ongoing challenges at both the organizational and national levels:

- At the organizational level, Thai companies are facing challenges with regards to lack of talented workforce, lack of budget to invest in new digital technologies and skillsets, ineffective usage of data, concerns regarding security and data privacy, as well as the integration of new technologies into current workflow and processes.
- At the country level, the lack of ecosystem is Thailand’s greatest obstacle in achieving the desirable digital transformation and adoption, including lack of promotions and push on new technologies and talent from the government, lack of talented workforce, limited digital education and training, as well as difficulties in integrating new technologies.

Lack of Talented Workforce

The Thailand Social Outlook Q1/2024 report by the Office of the National Economic and Social Development Council (NESDC) identifies a critical skills gap that presents long-term risks to the Thai economy. It was reported in The Nation Thailand (2024) that 64.7% of Thai workers fall below international literacy standards, and 74.1% lack adequate digital skills, despite widespread internet access. Thailand ranks 39th out of 63 countries in digital skills proficiency, a deficit projected to result in economic losses of up to 3.3 trillion baht annually due to lower labor productivity, limited innovation capacity, and reduced foreign investment. Findings from PwC’s 27th Annual Global CEO Survey – Thailand (PwC Thailand, 2024) highlights that while 36% of Thai CEOs have adopted Generative AI (GenAI) and 24% have revised their strategies accordingly, 58% recognize the pressing need to upskill their workforce to fully leverage this technology.

Workforce data from Thailand's digital industry, as shown in Table 9, indicates only a modest overall increase in personnel despite the rising demand for digital expertise. Particularly concerning is the decline in workforce numbers in sectors such as software services and digital content. As Table 10 illustrates, key roles, including business analysts, software analysts, and software architects, have declined by 30% since 2021, posing a significant barrier to digital transformation across industries.

The International Institute for Management Development (IMD) reveals that Thailand has only 0.58 million individuals with digital skills at Level 4 (expert level), accounting for only 1% of the total population. Moreover, Thailand's total proportion of individuals with digital skills across levels 1 through 4 is only 28%, while for Singapore it is around 74%. For Hong Kong, the Republic of Korea, and Malaysia, the share surpasses 70%. This highlights a significant gap in the availability of individuals with basic- to expert-level digital skills in Thailand. Furthermore, the country is projected to require an additional 177,606 highly skilled digital professionals over the next three years, while only 3,500 new IT graduates enter the industry annually (The Nation Thailand, 2023).

TABLE 9**PERSONNEL IN DIGITAL INDUSTRY, THAILAND 2021–23.**

Industry	2021	2022	2023	% Change
Software and software services	138,917	144,672	144,598	–2.12%
Hardware and smart devices	311,051	324,760	322,145	–0.01%
Digital services	79,115	73,782	81,120	+9.95%
Digital content	5,951	7,904	7,742	–2.05%
Total	535,034	551,118	555,605	+0.81%

Source: Digital Industry 2023 by IMC Institute for DEPA.

TABLE 10**PERSONNEL IN DIGITAL SERVICE INDUSTRY 2023.**

IT and digital personnels	2021	2022	2023	% Change
• Software • IT project manager	2,515	2,462	4,600	+86.84%
• Business analyst • Software analyst and designer • Software architect	5,029	4,925	3,358	–31.82%
• Programmer • Software developer • Tester	13,830	13,542	17,717	+30.83%
• System engineer (SE) • Network engineer (NE)	3,772	3,693	6,619	+79.23%
• Digital platform development	–	–	1,622	
• Data marketing	–	–	4,056	

(Continued on next page)

(Continued from the previous page)

IT and digital personnels	2021	2022	2023	% Change
• Data visualization designer	–	–	2,434	
Total IT and digital personnels	25,145	24,622	40,406	+64.11%
Others	53,970	49,160	40,714	–17.18%
Total	79,115	73,782	81,120	+9.95%

Source: Digital Industry 2023 by IMC Institute for DEPA.

Ineffective Use of Data, and Concerns Regarding Security and Data Privacy

The public sector has consistently failed to safeguard the personal data of the citizens it is meant to serve, with multiple incidences of personal data leaks involving government agencies since the peak of the pandemic. These breaches have exposed sensitive information, including health records. In addition to these external breaches, the government faces allegations of violating public privacy by using spyware to track and monitor the activities of activists and journalists. This spyware, which is exclusively available to governments, allows authorities to hack into mobile phones, raising concerns about the misuse of such tools (ISEAS - Yusof Ishak Institute, 2024).

On 5 July 2022, the cabinet approved a draft royal decree proposed by the Ministry of Digital Economy and Society, which exempts government agencies from adhering to the Personal Data Protection Act (PDPA). This exemption applies if the data is used for purposes such as public service, national security, or investigating crimes, including narcotics offenses, human trafficking, and money laundering. This decision has raised significant concerns about the balance between privacy protection and state authority, with many questioning the potential for misuse of data and the weakening of citizen safeguards under the PDPA. The exemption underscores a growing divide between the stringent data privacy expectations placed on the private sector and the leniency granted to government bodies.

These alleged privacy violations have sparked debate around the government's accountability and responsibility. The exemption of the state from the PDPA has intensified public anxiety regarding potential abuse of power and political persecution. This lack of accountability fosters a culture of impunity, further enabling state overreach and aggravating fears of state violence against its citizens.

Household Debt, Digital Divide, and Aging Society

Household debt continues to pose a significant challenge for Thailand, creating notable vulnerabilities within the national economy. Recent data indicates a slight decline in household debt, reflecting the ongoing economic recovery; however, many households remain reliant on unproductive loans that do not yield future income or wealth. This reliance primarily stems from the need to finance current consumption, suggesting a troubling trend where households are borrowing for immediate needs rather than investing in assets that could enhance their long-term financial stability.

Bank of Thailand (2024) has revealed that household debt in Thailand reached 94.6% of the GDP during the pandemic and has remained around 90% since then. This increase has been primarily driven by the growth of consumer loans and housing debt. The rise in non-performing loans (NPLs)

associated with consumer loans and real estate purchases has been significant since the onset of the COVID-19 pandemic. Krungsri Research (2024) reports that Thailand's household debt-to-GDP ratio is one of the highest globally, with a debt-service coverage ratio (DSCR) of 22.3%, significantly higher than the average of 9.8% in major countries. The policy interest rate, currently at a decade-high of 2.5%, combined with persistently high levels of household debt and DSCR, raises concerns about potential vulnerabilities in financial stability and the broader economy. This is particularly alarming as much of the household debt comprises nonproductive loans, such as personal and credit card loans, which do not directly contribute to increasing income. Although household debt increased by 9.5% year-on-year in consumer loans (especially credit cards and personal loans) and 4.3% in real estate loans, auto loans saw a slight decrease of 0.6% year-on-year. Low-income groups, especially those earning below THB10,000 per month, continue to struggle with debt repayment, highlighting the need for targeted policy interventions to address these financial challenges.

Aging Society

Thailand has already entered an ageing-society phase, with approximately 13 million individuals aged 60 and above out of a total population of 66.05 million, according to data from the Department of Older Persons (2023). Senior citizens are at risk of being left behind due to a lack of digital literacy, making it challenging for them to engage fully in an increasingly digital world. This gap can restrict their access to essential services, information, and opportunities, thus further isolating them from modern conveniences and resources. Moreover, the growing prevalence of online scams has contributed to reduced confidence among older adults in using digital devices, as many are concerned about fraud and misleading information.

AI Challenge

AI is reshaping the future of work by enabling greater operational agility, enhancing decision-making processes, and improving the efficiency of workforce management. The PwC (2023) conducted a survey on Asia-Pacific workforce in 2023 and revealed that 61% of Thai CEOs anticipated that GenAI would significantly impact companies, employees, and market sectors over the next three years. Despite the increasing adoption of GenAI, Thai businesses do not plan to reduce headcounts. This aligns with the PwC survey, which found that over half of the CEOs (52%) believed GenAI would have little to no effect on workforce size, anticipating only a 5% change in headcount. This indicates that while GenAI is expected to reshape business processes and market dynamics, it is not perceived to be a direct threat to jobs in the immediate future.

Recommendations

Thailand faces significant challenges in enhancing its digital talent pool. A key concern is the lack of practical digital skills and limited integration of such skills into educational curriculums. To address this, there is a need for more practical digital knowledge-sharing sessions, the incorporation of digital skills into formal education, and the provision of free public training courses to elevate local competencies. Many local talents lack awareness and understanding of emerging technologies, which restricts their ability to adapt to rapid technological advancements. Events, road shows, and real-time updates via websites and social media could help bridge this knowledge gap and foster a more digitally literate workforce.

Robust digital infrastructure is crucial for supporting advanced technologies like 5G, which serve as the backbone for driving digital transformation and enabling innovations such as AI, hyper-automation, and cloud security. These technologies require high-speed, reliable networks. However,

without adequate investment in infrastructure, many businesses and establishments risk being left behind in the rapidly evolving digital landscape. To fully realize the potential of digital transformation and emerging technologies, continuous development and investment in digital infrastructure are critical. This includes upgrading network capabilities, expanding access, and ensuring that organizations of all sizes can take advantage of these technologies to remain competitive and sustainable in the future.

A supportive digital ecosystem necessitates coherent government policies and regulations. However, many stakeholders assert that current policies often contradict the objective of fostering a Digital Thailand. Issues such as inconsistent policy frameworks, overlapping regulations, and coordination failures among government agencies hinder effective budget utilization, potentially delaying digital development outcomes and complicating efforts to monitor progress in the country's digital transformation.

Established rules and regulations, including those related to data security, privacy, consumer protection, competition policy, and restrictions on cross-border data flows, require continuous monitoring and modernization to address public concerns adequately. By enhancing these regulations and providing accessible knowledge and resources, especially for startups, SMEs, and low-income groups, Thailand can promote innovation and attract investment in the digital sector, ultimately advancing its digital economy.

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TURKIYE

Introduction

Digital workplaces, in their simplest form, refer to an approach that digitalizes business processes and supports working on online platforms. As technology advances, communication tools find broader applications, thus digital workplaces are becoming increasingly widespread.

Digital workplaces offer employers and employees several advantages by digitalizing traditional business processes. Since digital workplaces are spaces where employees perform their tasks through digital tools and technologies, independent of physical locations, businesses can collaborate with a more qualified workforce globally, reduce costs, and make business processes more efficient. These workplaces enable business processes to be managed more efficiently and flexibly, while also allowing employees to collaborate from different geographical regions. Technological tools such as computers, smartphones, cloud-based software, and communication platforms form the fundamental building blocks of digital workplaces.

In recent years, several significant reasons have contributed to the widespread adoption of digital workplaces. Chief among them is the rapid development of internet infrastructure and the spread of digital transformation across all sectors. On the other hand, the COVID-19 pandemic has highlighted the necessity of remote work and the importance of digital tools. The pandemic forced many businesses to adapt to digital solutions more quickly, leading to the remote work model becoming permanent. Additionally, the pursuit of flexibility by employees and efforts by businesses to reduce costs have increased the appeal of digital workplaces.

The use of digital workplaces and tools has rapidly increased in Türkiye in recent years. Particularly in major cities, the rise in internet access and digital literacy has popularized digital business models. With its young and dynamic population, Türkiye holds great potential for digital transformation. Digital workplaces have become quite common in areas such as e-commerce, software development, and digital marketing. Furthermore, digitalization projects and incentives led by the government contribute to the widespread adoption of digital business models.

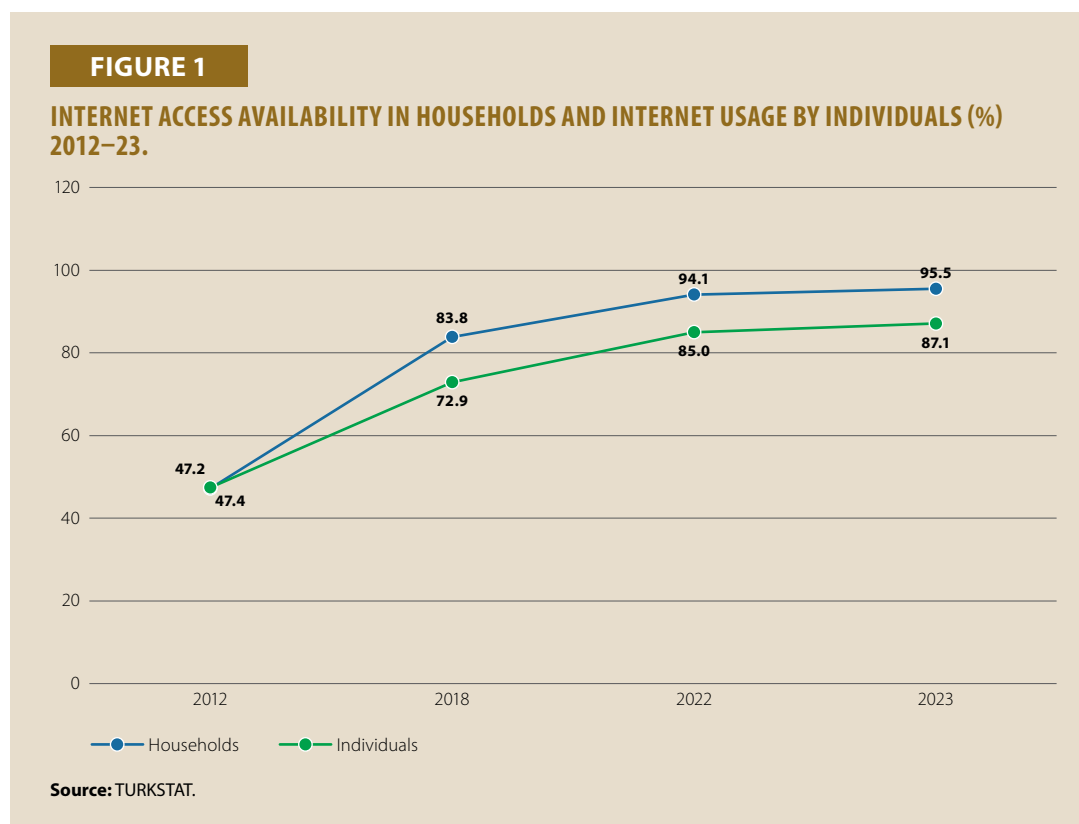
To understand the proliferation of digital workplaces in Türkiye, it would be beneficial to examine some digitalization indicators and statistics. These indicators will help shed light on Türkiye's journey towards digital transformation and how widely digital workplaces have been adopted.

Key Indicators Regarding Digitalization in Türkiye

Internet Use

First, internet access in Türkiye stands out as one of the most fundamental indicators of digitalization. According to the Household Information Technologies Usage Survey, the proportion of households with internet access at home increased by 1.4 percentage points compared with the previous year, reaching 95.5% in 2023 (see Figure 1). This indicates that the necessary

infrastructure for digital workplaces to reach a wide audience is in place. On the other hand, the internet usage rate among individuals aged 16–74 years was 85.0% in 2022, increasing to 87.1% in 2023. In terms of gender, the internet usage rate in 2023 was 90.9% for men and 83.3% for women (TURKSTAT, 2023).



The rate at which businesses use digital technologies is also an important indicator for understanding Türkiye's level of digitalization. In 2022, 97% of businesses in Türkiye had internet access, while 70% had their own website or online presence. E-commerce activities are also rapidly increasing; according to 2022 data, 43% of businesses in Türkiye were engaged in online sales. Additionally, more than 50% of businesses use cloud computing solutions, and 35% actively use big data analytics in their business processes. These rates clearly demonstrate the speed at which businesses in Türkiye are adopting digital technologies and adapting to digital workplaces (TURKSTAT, 2022).

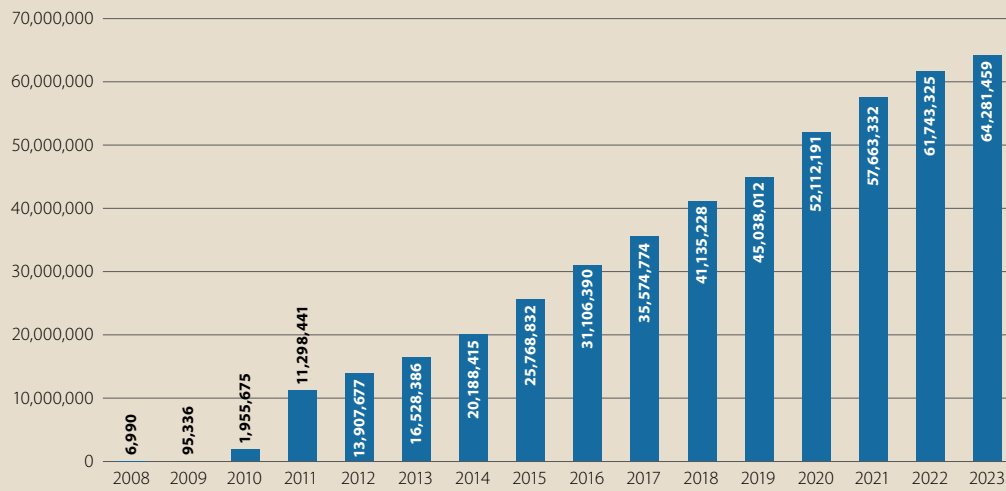
e-Government Statistics

Another indicator of digitalization is the provision of public services in electronic formats. In Türkiye, the number of e-Government Portal users reached 64,281,459 in 2023 (see Figure 2), representing a 4% increase compared with 61,743,325 users in 2022 (DTO, 2022).

An additional 987 services were added to the e-Government Portal compared with 2022, bringing the total number of services offered in 2023 to 7,741 (see Figure 3). In 2023, the number of institutions providing services on the e-Government Portal increased by 9% compared with the previous year. Of the institutions providing services, 196 were central government institutions, 204 were universities, 470 were municipalities, 30 were water and sewerage administrations, and 126 were private institutions (DTO, 2022).

FIGURE 2

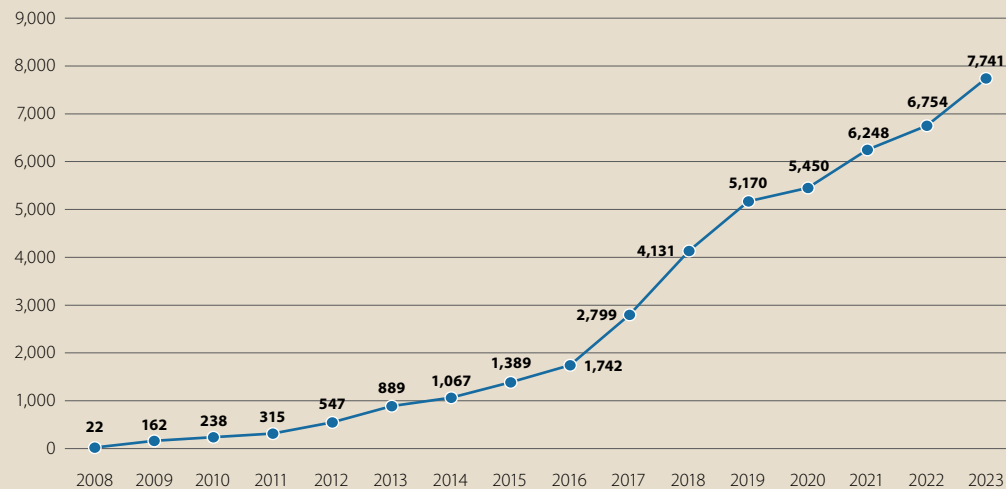
NUMBER OF E-GOVERNMENT PORTAL USERS.



Source: e-Government Statistics.

FIGURE 3

NUMBER OF SERVICES ON THE E-GOVERNMENT PORTAL.



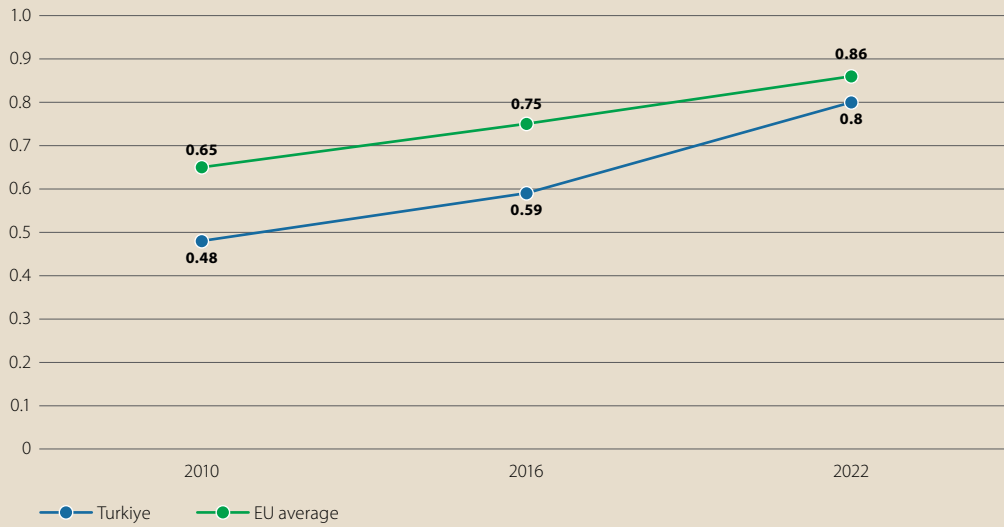
Source: e-Government Statistics.

United Nations e-Government Index

According to the United Nations e-Government Index, Türkiye's index score doubled during the 2010–22 period, approaching the European Union average (see Figure 4). The e-Government Portal, which was launched in 2008, has continually improved its range and quality of services. According to the United Nations e-Government Index, Türkiye's score increased from 0.48 to 0.80 between 2010 and 2022. The average score for European Union countries stands at 0.86. This index is determined based on three sub-indices: the Online Service Index, the Human Development Index, and the Telecommunications Infrastructure Index (PAL, 2023).

FIGURE 4

UNITED NATIONS E-GOVERNMENT INDEX, 2010–22.



Source: UN e-Government Index.

These statistics show that Türkiye has taken significant steps on the path to digitalization and that digital workplaces will become even more widespread in the future. The rapid adoption of digital workplaces will play a critical role in achieving Türkiye's digital transformation goals.

Future projections also indicate that Türkiye has great potential in digital workplaces. With the expansion of 5G infrastructure in Türkiye, it will be possible for digital workplaces to operate faster and more reliably. Furthermore, the increased use of advanced technologies such as artificial intelligence (AI) and the internet of things (IoT) will accelerate businesses' digital transformation processes, positioning Türkiye more competitively in the digital economy.

As the use of digital products and technologies becomes more widespread among companies, the volume of data produced and stored is increasing, strengthening the demand for data centers. With the growing adoption of cloud computing and the spread of big data, artificial intelligence, and IoT, it is expected that the data market in Türkiye will continue to grow, as it is globally.

R&D

Türkiye continues its strategy to enhance global competitiveness by increasing R&D expenditures. In 2023, the share of Türkiye's R&D expenditures in its GDP had reached 1.42%. The number of R&D and design centers established by the private sector in Türkiye has been increasing every year. As of 2024, the number of R&D centers in Türkiye had reached 1,326 while the number of design centers had grown to 332. These centers aim to contribute to Türkiye's industrial infrastructure through technology and innovation. They are particularly concentrated in sectors such as information technology, electronics, automotive, defense industry, biotechnology, and pharmaceuticals. Additionally, technology development zones (Techno parks) have become an important part of R&D and innovation activities in Türkiye. As of 2024, there are 104 technology development zones across the country. These zones serve as areas where high-tech firms collaborate with universities and research institutions to conduct R&D activities. Firms operating in these

zones have the opportunity to carry out their R&D projects more efficiently, benefiting from tax incentives and various government supports.

Current Policies Regarding Digital Transformation

There are various policies and initiatives prepared and implemented by the government in Türkiye aimed at digital transformation. These policies span several areas, such as supporting the digital transformation of businesses, enhancing the digital skills of the workforce and citizens, and strengthening digital infrastructure.

Development Plans

Development plans are high-level plans in Türkiye that aim at development and growth, outlining policies to be implemented in the public sector. These plans cover steps and policies in various areas such as industry, economy, education, health, transportation, tourism, and more, and are prepared for five-year periods. Digital transformation holds an important place in Türkiye's development plans, with digitalization considered one of the driving forces of economic development. The integration of digital technologies into the business sector, the public administration, and the society is seen as crucial in line with Türkiye's sustainable development goals. Digitalization and digital transformation play a prominent role in the most recent plan periods, namely, the 11th Development Plan and the 12th Development Plan.

The 11th Development Plan, covering the years 2019–23, addresses digital transformation from a broad perspective, emphasizing its impact on various sectors. The plan approaches digital transformation under several heads, including digitalization in industry and technology; the digital economy; digital public services and e-government; strengthening digital infrastructure; digital skills; and human resources.

The integration of digitalization and digital technologies in the industry has been identified as a strategic goal to enhance international competitiveness. In an era where digital transformation is changing business models and creating new economic opportunities, Türkiye prioritizes infrastructural investments needed for the growth of the digital economy and supports digital business models. Areas such as e-commerce, fintech, and the expansion of digital services are being promoted. The digitalization of public services is also a key focus of the 11th Development Plan, highlighting the importance of digital solutions to expand access to public services and reduce bureaucracy. Strengthening the infrastructure, which is a cornerstone of digital transformation, is one of the main elements of the plan. Goals include expanding broadband internet access across Türkiye, implementing the 5G technology, and strengthening digital infrastructures such as cloud technologies. The development of human resources is critical to the digital transformation process. The 11th Development Plan supports educational programs aimed at enhancing digital skills in Türkiye and encourages the integration of the young population into digitalization processes. Key topics in education include artificial intelligence, coding, and digital skills.

The 12th Development Plan, which will cover the years 2024–28, also places digitalization and digital transformation as one of its most important topics. Digital transformation, along with green transformation, is seen as a competitive production force in the industry. Under the axis of “competitive production with green and digital transformation,” policies are included that aim to increase competitiveness and productivity in the economy by realizing green and digital transformation in production, especially in priority sectors and development areas, thus contributing to the increase in prosperity.

Industry and Technology Strategy 2023

The Industry and Technology Strategy is a roadmap aimed at accelerating transformation in the fields of industry and technology to enhance Türkiye's global competitiveness. Digitalization is a key component of this strategy, focusing on the integration of technology into the industry and the use of digital technologies in production processes. The strategy aims to make the industry more efficient, flexible, and innovative by accelerating digital transformation.

In the strategy, the widespread adoption of digital technologies is recognized as one of the cornerstones of Türkiye's industrial policies, with a focus on the integration of digital technologies such as smart manufacturing systems, big data, AI, and IoT into industrial processes. The aim is to increase productivity, quality, and flexibility in the industry through the adoption of digital production technologies. The digitalization of the industry is supported through the use of AI-powered automation systems in production processes, applications such as data analytics, and predictive maintenance. Incentives have been provided for the digitalization of SMEs across Türkiye, and public policies are being implemented to increase access to digital infrastructure.

The digital transformation of the industry requires equipping the workforce with digital competencies. In this context, the strategy supports the enhancement of digital skills and the development of training programs to help employees adapt to digital technologies. The strategy emphasizes the implementation of training projects, particularly in areas such as digital leadership and AI education, through public-private sector collaborations.

National Artificial Intelligence Strategy of Türkiye

Prepared in collaboration between the Ministry of Industry and Technology and the Presidency's Digital Transformation Office, with the active participation of all relevant stakeholders, the National Artificial Intelligence Strategy of Türkiye came into effect in 2021.

The National Artificial Intelligence Strategy (2021–25) is a comprehensive roadmap aimed at enhancing Türkiye's global competitiveness in technology and the economy in the context of digitalization. This strategy emphasizes the importance of AI technologies in digital transformation processes and aims to advance Türkiye's digitalization vision.

The strategy seeks to strengthen the digital economy by increasing efficiency in business processes, public services, and industrial production through the use of AI. Additionally, one of the main objectives is to integrate AI into public services as part of Türkiye's digital transformation. From a human resource development perspective, the strategy focuses on training skilled individuals specialized in AI technologies.

The strategy also aims for Türkiye to collaborate internationally in AI and digitalization processes, fostering integration into the global digital ecosystem. Collaborations with the European Union and other global partners play an important role in accelerating digital transformation.

Türkiye's National Artificial Intelligence Strategy positions AI at the core of digital transformation processes by accelerating digitalization. Recognizing AI technologies as key to both economic and societal transformations, this strategy aims to enable Türkiye to take significant steps toward becoming a strong actor in the global digital economy.

Digital Transformation of Manufacturing Industry

Turkiye is very ambitious about digital transformation of its industry, with the 12th Development Plan's objective to boost productivity and competitiveness in priority sectors by accelerating digital transformation. Türkiye is looking to make its industry more innovative and advanced as part of the Industry and Technology Strategy for 2023. For an innovative and more advanced industry, Türkiye wants to increase the added value per worker in the industry to USD35,000 and manufacturing industry exports to USD210 billion, with 50% share of medium- and high-tech products in the manufacturing industry. Türkiye is expected to produce at least 23 smart products and be a world leader in terms of market share or brand value, in at least one of the disruptive technology areas of digital transformation.

On the other hand, the IMD World Digital Competitiveness Ranking, prepared by the IMD World Competitiveness Center, measures the capacity and readiness of 64 economies to adopt and explore digital technologies as a key driver of economic transformation across businesses, the government, and the society. Türkiye ranks 53rd out of 64 countries.

Some of digital transformation programs currently available in Türkiye are discussed below:

- The MoIT Digital Transformation Incentive Program is designed to support the digital transformation processes of businesses operating in the manufacturing industry through provision of incentive certificates and online trainings to increase digital transformation awareness, techniques and applications in this field. In this program, businesses looking to invest in digital technologies are not provided with direct cash support. Instead, during or upon the completion of the investment, the expenses related to the investment are indirectly incentivized, mainly through tax reductions, using tools such as corporate tax reductions, Social Security Institution (SGK) employer share premium support, VAT, and customs duty exemptions. Moreover, businesses supported under the program are certified as Digital Transformation Centers, and the personnel who will be part of the digital transformation team managing the digitalization process in these businesses will be included in digital transformation competency development programs. This ensures that businesses not only receive financial support but also acquire the necessary knowledge and skills to effectively manage their digital transformation processes.
- With the MoIT Technology Oriented Industry Move Program (Hamle), digital transformation calls call proposal have been released for innovative technologies and products in support of digital transformation investments.
- With the KOSGEB KOBİGEL SME Development Support Programme, calls for proposals on “Digitalisation of the Manufacturing Industry” have been released to support digital transformation of SMEs. Digital Transformation Consultancy is one of 16 different types of services provided under the Enterprise Development Programme.

Labor Force Statistics in Türkiye

When examining the figures related to the labor market in Türkiye, the labor force increased by 562,000 people in 2023 compared with the previous year, reaching a total of 34.896 million people (see Table 1). The labor force participation rate increased by 0.2 percentage points to 53.3%. The labor force participation rate was 71.2% for men and 35.8% for women (TURKSTAT, 2023).

TABLE 1

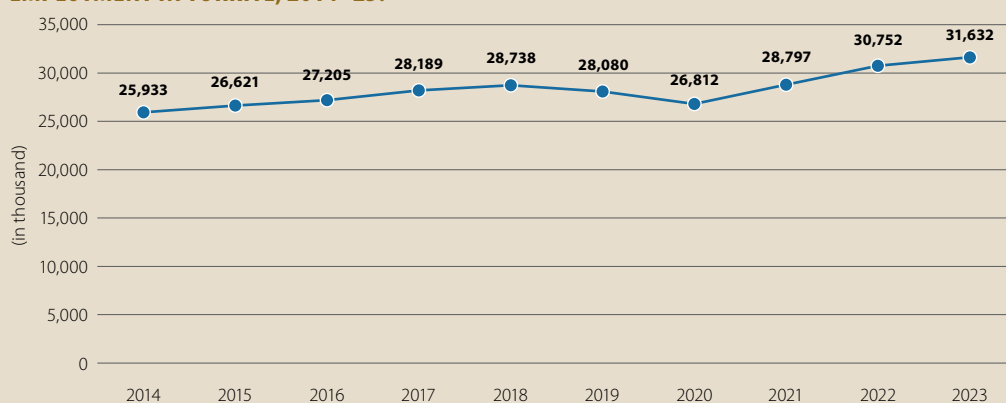
KEY LABOR FORCE INDICATORS, 2023 (THOUSANDS OF PEOPLE).

	Total	Men	Women
Population aged 15 and over	65,425	32,383	33,042
Labor force	34,896	23,052	11,844
Employment	31,632	21,286	10,346
Unemployed	3,264	1,766	1,498
Those not in the labor force	30,528	933	21,198

Source: TURKSTAT.

FIGURE 5

EMPLOYMENT IN TURKIYE, 2014–23.

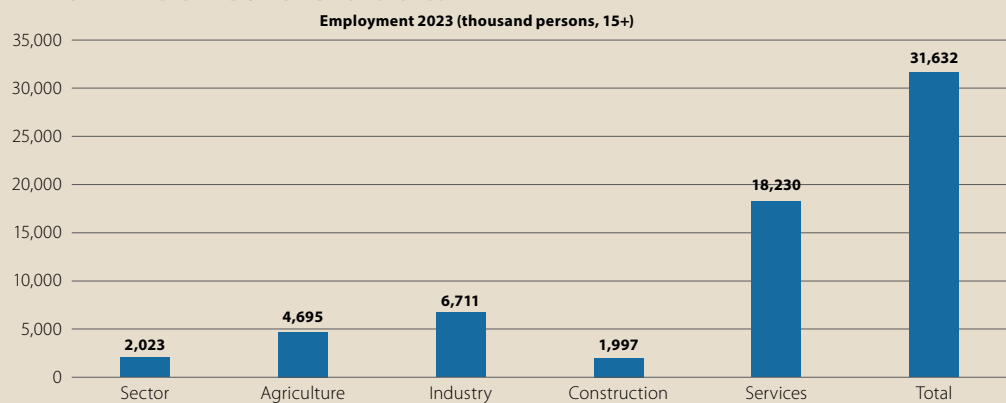


Source: TURKSTAT.

Of those employed (see Figure 5), 14.8% are in agriculture, 21.2% in industry, 6.3% in construction, and 57.6% in the services sector (TURKSTAT, 2023), as shown in Figure 6.

FIGURE 6

EMPLOYMENT DISTRIBUTION BY SECTORS.



Source: TURKSTAT.

Labor Productivity Statistics in Türkiye

Production per hour worked, which is used as a measure of labor productivity, also provides some insights into the relationship between labor efficiency and other production factors.

TABLE 2

LABOR PRODUCTIVITY ANNUAL GROWTH RATE, 2000–22.

Year	Labor productivity annual growth rate (%)
2000	8.5
2001	–6.0
2002	6.7
2003	6.6
2004	9.1
2005	6.3
2006	4.7
2007	5.3
2008	–0.3
2009	–4.1
2010	2.5
2011	5.5
2012	2.1
2013	6.8
2014	–0.1
2015	4.1
2016	2.3
2017	4.8
2018	2.5
2019	3.9
2020	17.8
2021	–6.1

Source: OECD.

Between 2000 and 2007, labor productivity showed consistent growth (see Table 2), reaching its highest growth rate in 2004 at 9.1%. During this period, economic recovery and reforms boosted labor productivity. In 2008 and 2009, there was a significant decline in labor productivity. In 2008, a sharp decrease of –0.3% occurred, followed by an even steeper decline of –4.1% in 2009. This drop reflects the global economic contraction and the negative impact of the 2008 financial crisis on labor productivity. After the crisis, labor productivity began to recover, and although growth rates fluctuated between 2010 and 2019, they remained generally positive. In 2020, labor

productivity growth surged dramatically to 17.8%. This increase can be explained by the effects of the COVID-19 pandemic on the labor market. Changes such as reduced labor force participation, the shift to remote work, and increased automation made the remaining workers more productive. However, in 2021, productivity sharply declined by –6.1%. This drop likely reflects the economic adjustments following the extraordinary productivity surge caused by the pandemic.

TABLE 3

GDP PER HOUR WORKED (TOTAL, 2015=100).

Year	GDP per hour worked
2000	62.35
2001	58.63
2002	62.57
2003	66.70
2004	72.80
2005	77.40
2006	81.04
2007	85.35
2008	85.06
2009	81.55
2010	83.61
2011	88.20
2012	90.05
2013	96.13
2014	96.08
2015	100
2016	102.26
2017	107.12
2018	109.82
2019	114.02
2020	134.42
2021	126.16
2022	124.77

Source: OECD.

During the 2000–07 period, GDP per hour worked showed a continuous increase, rising from its lowest value of 58.63 in 2001 to 85.35 in 2007, indicating a strong growth. This period was marked by stable economic growth and increased productivity. After 2008, GDP per hour worked declined, influenced by the global financial crisis. The crisis negatively impacted productivity and economic growth, causing a temporary decline in productivity. After the drop in 2009, the

value recovered, reaching 114.02 in 2019, showing a steady increase in productivity. In 2020, there was a notable spike, with GDP per hour worked reaching a record high of 134.42. This was due to changes in work arrangements resulting from the pandemic. The rise in productivity per hour worked during this period was driven by remote work, a reduced labor force, and increased productivity related to digitalization.

TABLE 4

GDP PER PERSON EMPLOYED (CONSTANT 2021 PPP USD).

Year	GDP per person employed (constant 2021 PPP USD)
2002	47,741.10
2003	50,864.60
2004	57,253.40
2005	60,867.10
2006	63,792.10
2007	66,196.70
2008	65,226.80
2009	61,699.10
2010	62,689.30
2011	65,286
2012	66,560.40
2013	70,019.10
2014	72,713.50
2015	74,960.60
2016	75,575.40
2017	78,720.30
2018	79,410.70
2019	81,707.10
2020	87,667.20
2021	91,458.70
2022	90,576.80
2023	92,658.40

Source: The World Bank.

GDP per person employed decreased from USD66,196.70 in 2007 to USD61,699.10 in 2009 (see Table 3). This drop reflects the slowdown in economic activity during the recession years. In 2020, there is a noticeable spike to USD87,667.20, which is likely a result of economic adjustments during the COVID-19 pandemic. Productivity per employed individual may have increased due to changes in the workforce, such as remote work or shifts in certain sectors.

The productivity increase during the pandemic was fueled by the digitalization of economies and changes in working conditions, but this growth momentum slowed in the post-pandemic period.

TABLE 5

PRODUCTIVITY BY ACTIVITY (BASED ON 2009 REAL PRICES).

Activity	2005	2022
(C) Manufacturing industry	12.9	25.6
(F) Construction	16.6	24.2
(G) Wholesale and retail trade	10.5	28.3
(H) Transportation and storage	32.6	51.9
(I) Accommodation and food services	7.5	14.5
(J) Information and communication	59.6	129.2
(K) Financial and insurance activities	39.9	162.4
Total	15.7	28.2

Source: Presidency of Strategy and Budget.

When examining the long-term changes in labor productivity in Türkiye by sector (subsector), it is observed that productivity in the manufacturing sector rose from 12.9 in 2005 to 25.6 in 2022 (see Table 5). Technological innovations, increased automation, and digitalization in the manufacturing sector have triggered improvements in production processes and productivity growth.

In the information and communication sector, productivity rose from 59.6 to 129.2, one of the largest increases. Digitalization, widespread use of information technologies, the development of internet infrastructure, and big data management have significantly contributed to productivity growth in this sector. Overall, productivity across all sectors increased from 15.7 to 28.2. This reflects a positive development, highlighting the effects of general economic growth, digitalization, and technology on various sectors (SBB, 2023).

Surveys and Reports Regarding Digitalization

The Digitalization Index report of Türkiye, first published in 2020 by the Turkish Informatics Industry Association (TÜBİSAD), demonstrates the performance of the Turkish economy and society in terms of digitalization. As part of the TÜBİSAD Digitalization Index report, a survey was conducted with the top executives of leading companies in the ICT sector. The study was carried out to assess the impact of the COVID-19 pandemic on the ICT sector. Digital technologies have played a critical role in enabling economic and social life to continue with minimal damage. The survey included a series of questions to evaluate the impact of the coronavirus pandemic on the ICT sector and its lasting effects post-pandemic (see Table 6 for the survey results).

TABLE 6

LONG-TERM EFFECTS OF THE COVID-19 PANDEMIC (%).

Percentage of total respondents	Percentage (%)
Increase in the duration of employees working from home	68
Increased use of online platforms	66
Decrease in the number of full-time employees	18

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Percentage of total respondents	Percentage (%)
Increase in the number of flexible-time employees	62
Reduction in office space	42
Price discounts and installment plans to attract new customers	10
Customer and market diversification	58
Diversification of supply channels	28
No opinion/not applicable for the company	2
Other	4

Source: TÜBİSAD.

Respondents to the survey said (see Table 7) they planned to increase the time for which employees work from home (68%), make greater use of online platforms (66%), increase the number of flexible-time employees (62%), and diversify customers and markets (58%). It was observed that 42% of the sector is considering reducing office spaces, a topic that has been discussed since the onset of the pandemic. Diversifying supply channels, a topic widely debated globally due to the pandemic, is also on the agenda of Türkiye's ICT sector (28%). The sector is not heavily considering price reductions or installment options to attract new customers. Additionally, the proportion of those planning to reduce the number of full-time employees is also low (TÜBİSAD, 2021).

TABLE 7

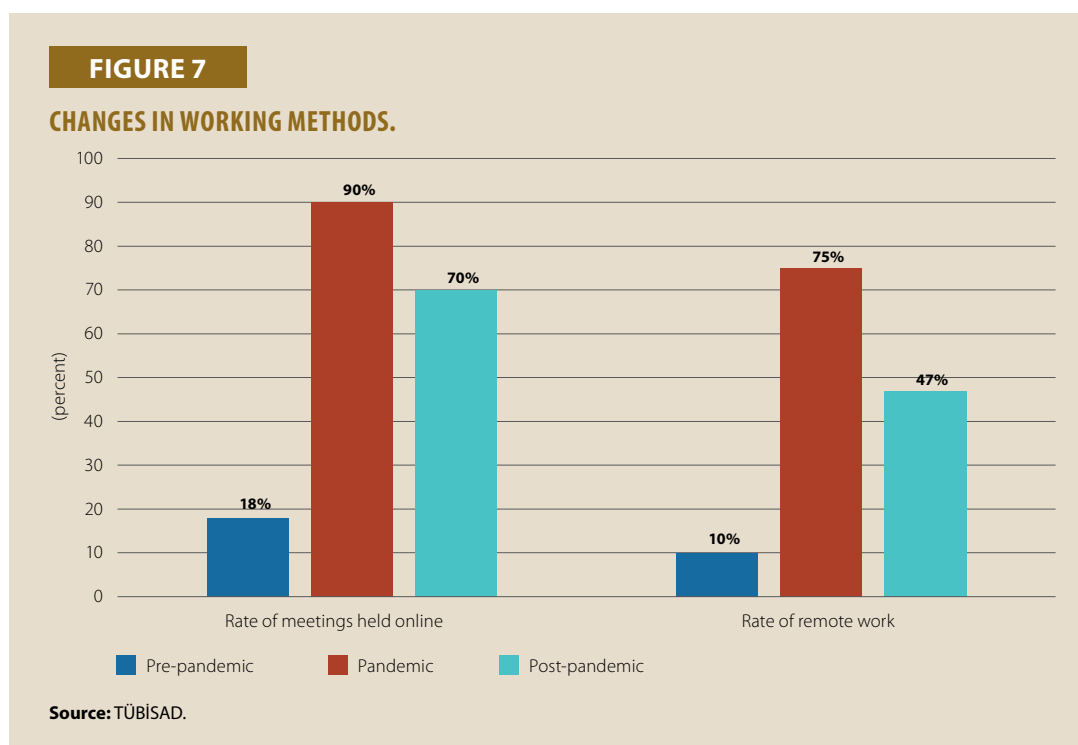
EXPECTED CHANGES IN BUSINESS PRACTICES AFTER THE PANDEMIC (%).

Percentage of total respondents	Percentage (%)
Improving working conditions for employees working from home	60
Strengthening technological infrastructure for preparedness in case of a similar pandemic	30
Developing new digital business models	70
Increased use of ICT to improve employee productivity	72
No opinion/Not applicable for our company	4
Other	0

Source: TÜBİSAD.

After the coronavirus pandemic, the majority of companies said they would be making new moves in the ICT sector. Plans had begun for improving the working conditions of employees working from home (60%), developing new digital business models (70%), and making greater use of ICT to increase employee productivity (72%). Additionally, 30% of the companies had placed strengthening technological infrastructure in preparation for a similar pandemic on their agenda (TÜBİSAD, 2021).

In the 2022 report, with the addition of survey questions, the impact of digitalization on companies' working methods due to the coronavirus pandemic was evaluated. According to the findings, the coronavirus pandemic had a very clear accelerating effect on digitalization trends, and this effect has proven to be lasting. Before the pandemic, the percentage of company meetings held in digital



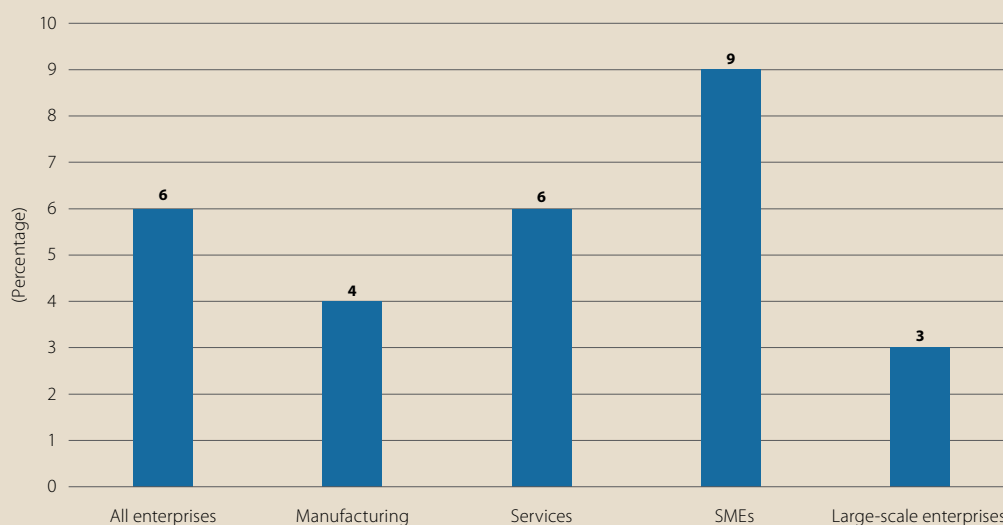
environments was 18%, which rose to 90% during the pandemic (see Figure 7). Although this rate dropped slightly after the pandemic, it was observed that almost 70% of companies continued to hold meetings digitally. The rate of remote working, which was below 10% before the pandemic, reached 75% during the pandemic. Remote working has continued even after the pandemic, with 47% of the total employees in companies working remotely.

According to the report “Digital Türkiye 2030: Economic Impacts and Policy Framework 2023,” prepared by the Policy Analysis Laboratory (PAL) with the support of Vodafone Türkiye, the full access to high-speed internet for all internet-using companies in Türkiye could result in a 0.5% increase in GDP. The econometric analyses conducted as part of the study showed that companies with access to high-speed internet (over 30 Mbps) had a productivity advantage of 2.6%. If companies currently using the internet with speeds below 30 Mbps switched to high-speed internet, the productivity increase would correspond to a 0.5% GDP growth for Türkiye’s economy, equivalent to approximately 4.2 billion dollars in value.

As part of the report, a digitalization index was created based on six variables: high-speed internet usage; the use of enterprise resource planning (ERP) and customer relationship management (CRM) software; cloud computing usage; internet access for more than half of the employees; and the employment of IT specialists.

A one-point improvement in the digitalization index (see Figure 8) for companies in Türkiye could trigger a 3% increase in Türkiye’s GDP due to the associated productivity gains. Although companies are at different levels of digitalization, it can be said that each one has room for development in adopting new tools. If all companies in Türkiye achieve an average one-point improvement in their digitalization index by 2030, their productivity could increase by an average of 6%. This productivity increase could result in a 3% rise in GDP across Türkiye, which, according to 2023 GDP forecasts, would amount to USD26 billion (PAL, 2023).

FIGURE 8

IMPROVEMENT IN SECTORS' PRODUCTIVITY WITH ONE-POINT INCREASE IN THE DIGITALIZATION INDEX.

Source: TURKSATAT, PAL.

In the “Turkiye’s Digital Transformation Index 2022” report, the responses to questions regarding “the impacts of ICT on Turkiye over the next 5 years and the factors limiting the development of ICTS in Turkiye” provide insights into the barriers to digital transformation and, consequently, the spread of digital work environments in Turkiye. According to the responses, the most significant factor limiting the development of ICT in Turkiye is the difficulty in securing a qualified workforce. Access to financing, within the framework of macroeconomic developments, also emerges as another factor restricting the development of ICT. A lack of vision regarding ICT also holds a significant place among the factors limiting its development.

Moreover, closely related to the subject of this study, the lack of sufficient encouragement for flexible employment by labor regulations is highlighted as one of the most important factors limiting the sector’s growth. The aforementioned key factors can be considered as the primary barriers to the spread of digitalization and digital work environments.

Digital Workplaces and Remote Work in Policy Documents

Remote work and flexible working arrangements are also addressed in the 12th Development Plan, which will cover the years 2024–28 and includes Turkiye’s highest-level policies as part of the first development plan of the second century for Turkiye. In the “Employment and Working Life” section of the plan, measure number 697.6 states: “Flexible working models, such as remote work, will be implemented and expanded in a registered and secure manner.” This measure will be instrumental in guiding the steps to be taken regarding remote work and working in digital environments in the coming period.

Similarly, the action plan of the Coordination Council for the Improvement of the Investment Environment (YOİKK), a body created to improve the investment climate in Turkiye, resolve the

issues faced by investors, and simplify investment processes, also includes actions related to remote and digital work environments. YOİKK brings together various ministries, public institutions, and private sector representatives to work in coordination on improving legal regulations for investors, reducing bureaucratic barriers, and resolving issues in various sectors.

In this context, the actions “Determining the legislative changes required for new-generation flexible working models, such as remote, part-time, and temporary work and platform work, by taking into account the needs of the business world and the balance between work and private life” and “Ensuring the continuity of the remote work rights provided to employees in R&D and Design Centers and Technology Development Zones, especially for those working in digital technologies, to allow 100% remote work on a continuous basis” aim to make the working environment in Türkiye more conducive to flexible working arrangements, including remote and digital work.

Industry and Technology Strategy 2023

Türkiye’s Industry and Technology Strategy 2023 is a crucial strategic document aimed at adapting to the rapidly changing world of digitalization and technology. This strategy indirectly addresses new work models, such as remote working.

In the Industry and Technology Strategy 2023, remote working is addressed within the scope of digitalization and technological transformation goals. The strategy adopts an approach that encourages remote working by focusing on elements such as the creation of digital work environments, the enhancement of digital skills, and the support of flexible work models. Additionally, the strategy includes goals for the development and widespread adoption of technologies that will support remote work.

The Industry and Technology Strategy 2023 highlights the importance of flexible and new work models life, predicting that remote working will play an increasingly significant role in the labor market. The widespread adoption of digital platforms and technology-based work methods is considered a key driving force in this process.

Work is ongoing to develop a new Industry and Technology Strategy. It is expected that the new document will include more actions and initiatives related to remote working and digital work environments.

National Artificial Intelligence Strategy

With the National Artificial Intelligence Strategy, which is Türkiye’s first national strategy document in the field of artificial intelligence, Türkiye has positioned itself among the countries that have published an AI strategy.

Türkiye’s National Artificial Intelligence Strategy adopts an approach aimed at making remote and flexible working more effective and efficient by leveraging the advantages offered by AI. The strategy supports the transformation of labor markets into more flexible and productive structures with AI-powered digital tools. The strategy document emphasizes that AI technologies significantly change labor markets and working methods, acknowledging that remote and flexible working models are part of the digital transformation.

National Youth Employment Strategy 2021–23

Türkiye’s National Youth Employment Strategy addresses topics such as digitalization and remote working with the aim of increasing youth participation in the labor force and solving problems

encountered in youth employment. The strategy considers the opportunities offered to young people by flexible work models such as the spread of digital work environments and remote working.

The strategy document emphasizes the need to enhance the capabilities of young people for digital work environments as digital transformation accelerates. Furthermore, the strategy highlights the flexible working opportunities offered to young people by remote working and digital work environments. It encourages young people to engage in entrepreneurship through digital platforms and to develop online business models. Supporting youth entrepreneurship in areas such as e-commerce and freelancing in the digital economy is a key focus of the strategy.

The strategy also references the necessary legal regulations to ensure that, as remote work becomes more widespread, young people can have secure and fair working conditions in this model. In summary, the National Youth Employment Strategy aims to use the opportunities presented by digitalization to increase youth participation in the workforce. Remote working and working in digital environments enable young people to access a wider range of job opportunities, while developing their digital skills and establishing fair working conditions are among the strategy's primary goals. Future strategies will place more emphasis on working remotely and in digital environments.

Governance Structure Regarding Digital Transformation

The governance structure regarding digital transformation in Türkiye is multi-layered and is shaped by various public institutions, private-sector actors, academic organizations, and civil society organizations operating in different fields. The roles and responsibilities of the institutions responsible for and involved in digital transformation are summarized as follows:

Presidency's Office of Digital Transformation

It is responsible for the creation, implementation, and monitoring of digital transformation policies of public sector. It coordinates Türkiye's digitalization processes, promotes digital government applications, and supports national technology policies.

Ministry of Industry and Technology

It supports Türkiye's digital and industrial transformation processes, with a particular focus on the integration of advanced technologies such as AI and automation into the industry. It is responsible for developing digital industry policies, supporting digital transformation of manufacturing industry, and creating policies to enhance technology and R&D infrastructure.

Ministry of Transport and Infrastructure

It ensures the development of Türkiye's digital infrastructure, widespread access to broadband internet, and the advancement of digital connectivity technologies. It is responsible for promoting investments in 5G and fiber infrastructure, developing communication infrastructure strategies, and strengthening the digital economy and communication infrastructure.

The Scientific and Technological Research Council of Türkiye (TÜBİTAK)

It encourages R&D activities in digital transformation, supports technology-focused projects, and contributes to the development of the innovation ecosystem. It is responsible for supporting research projects in digital transformation areas such as AI, big data, and IoT, managing national and international R&D programs, and providing funds to technology-based companies to foster innovation.

Ministry of Trade

It promotes the development of e-commerce and digital trade, and formulates policies for the digital economy. It is responsible for enhancing the infrastructure for digital trade and strengthening the e-commerce ecosystem.

Information and Communication Technologies Authority (BTK)

It regulates Türkiye's communication infrastructure, supervises internet and telecommunication services, and develops cybersecurity policies. It is responsible for regulating telecommunications and broadband services, developing policies for digital security and data protection, and acting as a regulatory body in cybersecurity matters.

Small and Medium Enterprises Development Organization (KOSGEB)

It provides various incentives and support programs to enhance the digitalization and competitiveness of SMEs, thus encouraging their participation in digital transformation processes. It is responsible for offering grants and support for SME digitalization, supporting technology and innovation-based entrepreneurship projects, and facilitating the integration of SMEs into national and international digital markets.

Legislation Regarding Digital Workplaces and Remote Working

In Türkiye, digital work environments and remote working has been regulated, particularly in recent years, as digital transformation and remote working models have become more widespread. Below are the main legal regulations related to digital work environments and remote working:

Labor Law (Law No. 4857)

With an amendment in 2016, remote working was given a legal framework in Türkiye. According to it, remote working is a type of work where the employee performs their duties away from the workplace, using technological communication tools. The employer has responsibilities in terms of informing the employee and ensuring occupational health and safety. Under the law, a work contract for remote working is mandatory. This contract must include details such as working conditions, job description, salary, method and duration of payment, etc.

Occupational Health and Safety Law (Law No. 6331)

Remote workers are subject to the same occupational health and safety conditions as those working on-site. The employer is required to provide necessary training on occupational health and safety during remote work and ensure that employees work in a safe environment.

Regulation on Home-based and Flexible Working Models

The Regulation on Remote Working, which came into effect after being published in the Official Gazette on 10 March 2021, details the principles of digital and remote working. The regulation outlines the rights and responsibilities of both the employer and the employee in remote working, including provisions on who will provide the necessary tools and equipment for the job. Additionally, the regulation specifies rules on working hours, confidentiality, and data security. Within the regulation:

- A written employment contract will be established for remote work. The employment relationship can either be initiated with a remote work contract from the very beginning, or an existing employee's contract can be mutually agreed upon and transformed into a remote work agreement.

- The timeframe and duration of remote work will also be included in the employment contract. Overtime work will be carried out upon the written request of the employer and with the consent of the employee.
- All employees covered under the Labor Law can request for remote work. The employer will respond to the employee's request within 30 days.
- An employee who transitions to remote work can also request to return to regular work. The decision to implement remote work for the entire workplace or part of it due to compelling reasons will be made by the employer.
- The employer will be responsible for informing the employee about occupational health and safety measures during remote work, providing the necessary training, ensuring health surveillance, and taking the necessary safety measures regarding the equipment provided.
- Remote work will not be permitted for jobs involving the handling of dangerous chemical substances, radioactive materials, or tasks involving the processing or disposal of such materials, nor for work where there is a risk of exposure to biological agents.
- Additionally, in jobs of strategic importance for national security, whether remote work can be performed will be determined by the relevant public institutions and organizations.

The regulations mentioned above form the core legal framework for digital work environments and remote working in Türkiye.

Best Practices and Use Cases

Best practices that accelerate digitalization processes and transform business models in both the public and private sectors contribute to the development of the digital economy and extension of digital workplaces. Digital transformation is not limited to improving technological infrastructure alone; it also requires some practices in order to encourage the businesses and individuals.

In this section, successful digital transformation practices from different sectors will be examined, showcasing best practices that contribute to the development of digital workplaces in Türkiye and globally.

Digital Transformation Support Program by MoIT

Digital Transformation Support Program that can be utilized by SMEs has been initiated by the Ministry of Industry and Technology. The support program aims to assist investments that integrate digital products and solutions into business processes, leading to outcomes such as cost reduction, increased efficiency and quality, and enhanced employee and customer satisfaction, thereby helping businesses maintain their competitive edge in the global market.

SMEs and large enterprises that have been operating in the manufacturing industry for at least five years can benefit from the program. The program will later be expanded to include all sectors. Businesses wishing to benefit from the program apply to the Ministry through an online portal. The Ministry requires businesses to have their digital maturity assessed and prepare a corresponding digital transformation roadmap. Additionally, the ministry asks businesses to prepare a digital

transformation investment plan in line with the “Digital Product List.” These applications are then evaluated, and eligible digital transformation investments are supported.

Businesses receiving digital transformation support earn the title of Digital Transformation Center during the support period. Those entitled to digital transformation support and receiving the Digital Transformation Center status benefit from various tax reductions and interest support throughout the investment process.

SME Digital Transformation Support Program by KOSGEB

KOSGEB is a key government institution established to support the growth and digital transformation of SMEs in Türkiye. Since its founding in 1990, KOSGEB has played a vital role in promoting SME competitiveness and innovation, particularly through digitalization.

SMEs constitute over 99% of Turkish businesses, making them central to the economy. KOSGEB’s programs, especially in recent years, have focused on enabling these businesses to adopt advanced digital tools, ensuring they remain competitive in the global market. The organization offers financial, technical, and advisory support, helping SMEs integrate technologies such as AI and cloud computing into their operations.

The SME Digital Transformation Support Program is a KOSGEB initiative designed to support the digital transformation processes of SMEs in Türkiye. The program provides financial assistance for SMEs’ digital transformation needs, covering expenses for machinery, equipment, software, and hardware. Support limits range from TRY1 million to TRY20 million per business, with repayment terms up to 36 months and an option for a six-month grace period.

To apply, SMEs must obtain a digital transformation assessment report through consultancy and meet specific financial eligibility criteria. The program aims to enhance the productivity and competitiveness of businesses through digital transformation.

e-Government Portal

With the development and widespread use of information and communication technologies, public services have been transferred from physical environments to electronic platforms, and these services have begun to be provided electronically. In this context, one of the most successful initiatives implemented by the public sector in Türkiye is the e-Government Gateway, which facilitates the provision of public services through digital platforms.

e-Government is a central platform that enables citizens of the Republic of Türkiye to access public services digitally. Launched in 2008, e-Government allows individuals and institutions to access a wide range of government services over the internet. This application enables citizens to perform many tasks quickly and easily in the digital environment without having to visit public institutions in person.

Through the e-Government portal, a broad range of services ranging from justice, social security, and insurance to healthcare, transportation, education, and urban planning, are provided in a digital environment. As of September 2024, the total number of e-Government users exceeded 66 million. The total number of logins to the e-Government portal, including both web and mobile access, surpassed 20 billion. Currently, 8,350 services are offered through the e-Government portal, with 6,663 of these available via the web and 5,103 via mobile platforms.

According to the results of the “e-Government Gateway Satisfaction Survey,” which gathered feedback and suggestions from 1 million users through the e-Government website and mobile app, the e-Government satisfaction rate as of 2023 was 94.8%.

The digital provisioning of public services through the e-Government portal has allowed citizens to complete their transactions digitally without needing to physically visit public institutions, resulting in significant time and cost savings. Moreover, the digitalization of public institutions has accelerated business processes and increased the efficiency of public personnel. The reduction in physical document traffic has significantly decreased paper consumption, contributing to an environmentally friendly public administration approach. Citizens across Türkiye can access government services equally, regardless of geographical limitations (e-Government Statistics, 2022).

e-Nabız Portal

e-Nabız is a digital health platform launched in 2015 by the Ministry of Health of the Republic of Türkiye. It enables citizens to access all of their health information online, allowing for the digital storage and sharing of a wide range of data, including medical history, prescriptions, test results, and appointments. It also facilitates the analysis and monitoring of health data.

Launched in 2015, e-Nabız allows citizens to access their health records 24/7, including details of their medical examinations, such as lab tests, radiology images, prescribed medications, diagnoses, and reports. This platform has played a key role in the digital management of the pandemic. The system integrates with the information systems of all healthcare institutions, whether public, private, or university hospitals, enabling real-time data sharing. It serves as a platform where citizens, their doctors (with permission), or their relatives can access personal health records.

The e-Nabız infrastructure, which encompasses all healthcare institutions and every type of health data, had played an active role in the fight against the coronavirus pandemic. Systems like the Public Health Management System (HSYS) and the Filtration and Isolation Tracking System (FİTAS) were developed using the e-Nabız infrastructure to monitor case samples, tracking data, and contact tracing. These interconnected systems allowed the tracking of patients’ radiological tests, test results, past health records, monitoring reports, medication tracking, and contact tracing, all on a single platform.

Doctors could monitor the entire process for their patients through the Public Health Management System and accessed the medical histories, medications, surgeries, and tests of COVID-19 positive cases via e-Nabız.

Citizens, on the other hand, were able to access their results and chronic disease reports through e-Nabız without having to visit hospitals during this critical period. COVID-19 test results could be viewed either through the “my tests” screen in their e-Nabız account or through a module on the site where they could enter their Turkish ID, passport number, or barcode number to check their results. Citizens traveling abroad could also download their test results in Turkish, English, and German.

Additionally, to ensure data integrity regarding medications used in the treatment of COVID-19 in hospitals and to create a data pool that could guide treatment protocols, the e-Nabız Prescription System was implemented. This system, integrated with the Public Health Management System, was established for issuing outpatient prescriptions for COVID-19 medications to be dispensed at hospital pharmacies (or in a special section within the hospital with necessary precautions). The

e-Nabız Prescription System ensured that information about the use of COVID-19 medications in all healthcare facilities was entered into a single system, minimizing public contact by ensuring that patients requiring outpatient treatment were monitored under isolation conditions.

During the pandemic, citizens did not forget about organ donation through e-Nabız, with 362,500 people making 5,580,000 organ donation notifications.

With e-Nabız, citizens can track their health status and instantly access all past test, examination, and treatment information online. The digital sharing of patient data between healthcare institutions speeds up treatment processes and enables more accurate diagnoses. In emergency situations, rapid access to a patient's health history facilitates better treatment decisions. The prevention of repeated tests reduces the financial burden on the healthcare system. By collecting statistics on citizens' health, nationwide health data can be analyzed, thus contributing to the shaping of health policies.

Koç Holding

Koç Holding, one of Türkiye's largest private sector corporations, has launched the Office Free project, which offers a personalized hybrid working experience and the ability to work from various offices. With Office Free, which allows Koç Group employees to work from any place they want on any day they choose, a reservation platform accessible via both computer and mobile applications was also introduced. This platform allows employees to create daily, weekly, or monthly work schedules.

The Office Free application, which offers a personalized hybrid working experience, enables Koç Group employees to select and personalize their work environment. Depending on their job requirements, employees can work from home, a café, their own office, or even from the office of a different Koç company. They can organize these preferences easily through the Office Free reservation platform on a daily, weekly, or monthly basis without needing any approval from a manager.

With the Office Free application, employees can choose the days they will work remotely based on the requirements of their job, with eligible roles allowed to work remotely for up to five days. When they want to work from an office, they can select offices near public transport or with parking facilities, choose from offices with gyms, or even decide on specific details like a desk with a view, a desk by the window, or one with dual monitors. There are currently 45 Office Free working spaces at different locations across more than 25 companies, and this number is expected to exceed 100, including offices abroad (Koç Holding, 2022).

Sabancı Holding

Sabancı Holding, one of Türkiye's largest private sector corporations, launched the Flexible Management of Digital Roles initiative in 2022 to achieve its growth targets in the digital sector, where talent competition is intense. With this initiative, the aim is to implement a flexible working model for digital roles, not only to attract and retain top talent but also to enrich the employee experience journey.

A significant portion of the group's companies has renovated their office spaces to further enhance agile working, innovation, and collaboration. The frequency of using online tools such as Teams, Zoom, and Sabancı Social has increased to improve collaboration between remote and on-site employees, as well as to boost employee motivation and productivity.

The continuous performance system, which has been adopted by Sabancı Group companies, incorporating objectives and key results (OKRs) and key performance indicators (KPIs), focuses on transparency, agility, flexibility, and supports collaboration, fueled by open and continuous feedback dialogues. In 2022, all employees within the group underwent a regular performance evaluation process (Sabancı Holding, 2022).

Yıldız Holding

Yıldız Holding, one of Türkiye's major enterprises, has implemented four new working models under the UYDU-New Generation Working Models framework across its companies. The UYDU model consists of four categories based on duties and responsibilities: remote, hybrid, office, and sales-field work.

This working model was created based on employee feedback and a study of global trends and practices. The motivation behind its implementation stemmed from the need to improve the work–life balance, especially for women with child and elderly care responsibilities, as emphasized by the International Labour Organization (ILO).

In 2021, pladis (a company within Yıldız Holding) established Hybrid Working in the UK, Ireland, Europe, Türkiye, the USA, and emerging markets, facilitating agile work for those who could perform some tasks remotely from the office. This particularly helped employees with caregiving responsibilities and family obligations, thereby providing a better balance, especially for women.

With the UYDU working model, the holding's buildings and offices were also redesigned to create spaces where the physical and virtual environments blend together. Shared workspaces have been increased, digital meeting rooms have been provided, and areas designed to foster social interaction have been established (Yıldız Holding, 2024).

TÜSİAD SD²

The Turkish Industry and Business Association (TÜSİAD) Digital Transformation in Industry Program (TÜSİAD SD²) is a comprehensive initiative aimed at accelerating the digital transformation of the industrial sector in Türkiye. This program brings together technology users and suppliers to foster high-value production and increase global competitiveness in industry.

The main objectives of TÜSİAD SD² are to:

- Connect technology users and suppliers: This involves creating collaboration opportunities by bringing together companies that use technology in production processes with SMEs that provide technological solutions.
- Support the technology supplier ecosystem: This is to promote the competencies of technology suppliers in Türkiye and encouraging technology production.
- Provide best practice examples: This is about showcasing successful implementations as a source of inspiration for digital transformation planning.

In the program, technology users announce their digital transformation needs, and technology suppliers that can provide suitable solutions apply. After a preliminary evaluation, selected

suppliers meet with users at the Industry–Technology Integration Program (STEP) event to work on joint solution files. Success stories from this process are then shared with the public.

Conclusion and Recommendations

Digital transformation and digital work environments will play an increasingly significant role in the agendas of countries and companies moving forward. In its Future of Jobs report published in 2023, the World Economic Forum asked companies which technologies they expected to adopt the most in this evolving world order. The top response, given by 86.4% of participants, was digital platforms and applications, followed by education and workforce development technologies at 80.9%. Businesses needed to develop certain practices to retain qualified employees and prevent skills gaps. It was noted that, from the perspective of companies, it was essential to enhance talent progression and promotion processes to avoid losing talented individuals. Additionally, feedback from businesses indicates that 20% of them have highlighted the importance of offering more remote and hybrid work options according to the report.

The impact of the technologies that companies will adopt and integrate into their processes is significant in terms of creating new jobs. The influence of these technologies on job creation will lead to substantial changes and innovations across many sectors (Yeşilova, K. Y., 2023).

In recent years, Türkiye has taken significant steps toward digitalization, thanks to advancements in internet infrastructure, government initiatives, and the increasing use of digital technologies across various sectors. The COVID-19 pandemic acted as a catalyst for the acceleration of digital workplaces, making remote work a permanent feature in many industries. The country's young and dynamic population, combined with high internet access and e-government initiatives, has positioned Türkiye well on its path toward digital transformation. Labor productivity in Türkiye has seen positive developments, particularly in sectors like information and communication, financial services, and manufacturing, thanks to the integration of digital technologies. However, despite these gains, there are still steps to be taken and challenges to overcome in order to further accelerate digitalization and expand the use of digital workplaces.

It is possible to summarize the challenges to digitalization, as well as the necessary steps to be taken, in the following key areas: strengthening infrastructure, improving workforce competencies, making legal regulations, taking measures against cybersecurity threats, managing the culture of doing business and incentives and public policies.

Although Türkiye's internet infrastructure is relatively good, OECD broadband statistics indicate that Türkiye's fiber internet penetration is below the OECD average (OECD, 2023). Particularly in areas where broadband internet infrastructure is still lacking, taking swift action toward building fiber and internet infrastructure will contribute to digitalization in general and, more specifically, to conducting business remotely and in digital environments. On the other hand, Türkiye is experiencing infrastructural deficiencies and delays in its transition to 5G technology. This situation makes it difficult to fully utilize next-generation technologies in the process of digital transformation.

The spread of digitalization and digital work environments is directly related to workforce competencies. The lack of a workforce with digital skills negatively affects digital transformation. The digital skill level of Türkiye's workforce remains below the OECD average according to the WEF's The Future of Jobs Report 2023. Although many steps are currently being taken and policies

developed to improve workforce competencies, the workforce's skills need to be further enhanced to meet the requirements of digitalization, to accelerate digitalization, and to expand the use of digital work environments.

In our time, digital work environments have become a part of daily life, and the culture of working in digital environments is expected to increase further in the coming years. In this context, it is necessary to update regulations and legal frameworks to meet the needs of the modern era. In particular, regulations related to data security and privacy, digital rights, occupational safety, and union rights must be aligned with new work models.

Cybersecurity must be ensured in digital work environments, as in all processes related to digitalization. To ensure the healthy progression of the digitalization process, it is crucial to enhance cybersecurity infrastructure, expand policies and practices related to cybersecurity, and raise awareness of this issue in response to the increasing number of cyberattacks every day.

On the other hand, cultural factors and business habits are also barriers to the spread of digital workplaces. Some sectors and businesses may resist the digital transformation process. Therefore, both businesses and the public sector need to manage this cultural transformation effectively and develop policies to reduce resistance.

Small and medium-sized enterprises (SMEs) play a vital role in Türkiye's economy but often face challenges in adopting digital technologies. Government support programs, such as those offering incentives, training, and consultancy services, should be expanded to accelerate digital transformation in SMEs.

While remote work has been widely adopted, there is a need for more comprehensive policies to ensure that both employers and employees benefit from flexible work arrangements. This includes promoting hybrid work models, improving occupational safety standards for remote workers, and fostering work-life balance.

The transition to remote work through digital work environments has significantly transformed the traditional workplace, providing advantages such as speed and efficiency while also impacting employees psychologically, sociologically, and economically. Many academic studies examine the psychological and sociological effects of remote work on employees. While the flexible working methods, which have increased with digital work environments, improve employees' work-life balance, they can also blur the boundaries between work and personal life, making it harder for employees to disconnect from work (Artar, M., 2004). The reduction in face-to-face interactions may lead to isolation, negatively affecting mental health and job satisfaction. Social support and organizational commitment may decrease, leading to feelings of loneliness.

Therefore, in addition to addressing technical challenges, managers should also develop strategies to overcome these psychological and social difficulties.

Steps taken in the areas mentioned above will specifically contribute to the spread of digitalization, particularly the proliferation of digital work environments, and will support the faster and more efficient progress of this transformation.

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