

Raising Productivity in Higher Education

Select papers on global best practices
from experts



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UNDERSTANDING AND IMPROVING HIGHER EDUCATION PRODUCTIVITY

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EXECUTIVE SUMMARY

Higher education has grown to play a major role in many countries. Surprisingly, little scholarly research has been conducted on measuring and improving higher education productivity. This paper discusses the generalization of a model validated by the United States National Research Council. It analyzes a cross-national data collection involving ten diverse Asian countries and dozens of institutions. Quantitative data was collected on inputs, and on education and research outputs. In each country, reviews were conducted of salient political and institutional contexts. The paper reviews technical and empirical contributions to research, and articulates contexts and strategies for improving national policy and institutional management. Most broadly, it highlights the value of progressing contextualized scientific studies of productivity in higher education.

INTRODUCTION

Higher education has grown to play a major role in many countries, thus spurring much greater interest in the costs and returns of education and research. This amplifies the interest in productivity, a matter that stimulates substantial attention and debate in many areas of higher education. Yet, surprisingly little scholarly research has been conducted to develop methods and insights for understanding and improving higher education productivity outputs in its various forms, including teaching and research [9–10]. Most existing work has been funded for political, advocacy or commercial purposes, and it is common for research to misapply general productivity models to higher education. This hinders effective analysis and development of methods relevant to the particular roles of universities. Building better scientific foundations for the study of higher education productivity carries the potential to improve policy and practice.

There are plethora of growing rationales to care about the productivity of higher education:

- The higher education sector is of growing scale and significance in many economies.
- Most traditional academic approaches do not scale well, escalating costs and spurring a need for new education and associated business models.
- The growth in scale is creating affordability constraints for governments, and in many countries more private forms of finance are being sought.
- Institutional leaders are examining pricing scenarios to maximize new revenues from tuition fees.
- Regulators are striving to understand the economics of higher education to prevent institutions from price gauging.
- Cross-subsidizations inherent in traditional university models are becoming harder to justify in more transparent contexts.

To tackle this matter head on, this paper distils insights from a broader research program, which has the aim of assisting the development of strategies for improving the productivity of higher education. Specific objectives of the broader work include:

- Developing and testing technical models of productivity for both education and research.
- Producing insights from diverse institutions and countries, and different types of higher education institutions (HEIs).
- Analyzing national and institutional correlates of productivity for both education and research.
- Distilling suggestions for improving policy and practice at both local and global levels.

This paper concentrates on the core quantitative facets of the broader agenda. It advances a model of productivity; presents insights from a series of countries; and seeds the articulation of contexts and strategies for improving national policy and institutional management. It first develops an analytical frame to model productivity and presents the relevant input and output measures. The paper then outlines the research approach, and surveys the emerging methodological and empirical results. Summary insights and suggested next steps are offered by way of conclusion.

The broader research program and this paper are shaped and positioned by decades of analyses and discussions regarding productivity contexts and drivers. They build upon an important prior study of general productivity [16]; studies of higher education funding and outcomes [8, 13, 15]; innovations regarding tertiary performance [18]; and analyses of institution costing and reforms [12]. The study makes contributions of a technical, empirical and practical nature, and seeks to improve future scholarship and work.

ANALYTICAL FRAMEWORK

Introduction to Productivity Models

It is important to place the investigation of higher education productivity in a broader technical frame. Theorists and practitioners have developed a suite of approaches for studying productivity. The overarching concept of indicating productivity rests on comparing a firm or an industry's relative output to its input. Different industries and different firms, however, often produce unique outputs; and require inputs that must be accounted for in any accurate assessment of overall productivity. Most frequently, inputs are represented by some measure of a firm's or industry's labor and capital. Outputs are often represented by measures of sales and units produced [2].

Although technical approaches may on initial inspection seem insufficient for accurately capturing the productivity in higher education, it is worth highlighting how different industries have deployed production function studies to capture very different types of activities, inputs and outputs. Bairam [1] describes numerous productivity studies from different economic sectors. Manufacturing industries often use total book value of capital stocks along with total number of full-time and part-time employees to represent inputs. Output may be represented by a measure of 'value added.' Alternatively, hospital efficiency

outputs have been indicated using total outpatient visits as compared to inputs of hospital size, total staff, and total assets [14]. The professional sports industry often examines individual team performances with points scored and match statistics to represent outputs and inputs, respectively [2, 5, 19].

Input-output studies allow for the estimation of production functions using statistical analysis. Production functions conventionally signify the maximum possible output that could be produced for a given, fixed amount of input [2]. Individual firms and industries may use production functions to specify optimal production frontiers, to compare an actual performance with a hypothetical optimal performance. Production frontiers, however, portray static conditions using sets of assumptions that hold numerous other variables constant. This limitation is partially solved by measuring year-on-year productivity change, or the rate of technical progress. Measuring productivity change is also referred to as 'growth accounting' [4]. This type of productivity measurement has proven highly useful and reliable for numerous industries, and is recommended by OECD [16].

The United States Bureau of Labor Statistics [3] also employs productivity change and growth accounting methodologies for industry productivity measurements. The specific calculation is called the 'Törnqvist chain index,' which measures multifactor productivity (MFP). Its widespread use in productivity measurement can be attributed to its accessibility, and more importantly, to its uniquely accurate and generalizable results, as shown by Caves et al. [6]. Törnqvist indices are calculated using weighted averages of the growth rates of the index components. The index itself represents a percentage change in a given input or output, or in a set of inputs and outputs. The following example shows the calculation of an input index, X_t from year $t-1$ to t , using capital (K) and labor (L) components:

$$\log(X_t) = \left(\frac{S_{K,t} + S_{K,t-1}}{2} \right) * \log \left(\frac{K_t}{K_{t-1}} \right) + \left(\frac{S_{L,t} + S_{L,t-1}}{2} \right) * \log \left(\frac{L_t}{L_{t-1}} \right) \quad [1]$$

$S_{K,t}$ represents the share of capital costs at time t , or capital costs divided by total costs at time t . $S_{L,t}$ represents the share of labor costs at time t , or labor costs divided by total costs at time t . The final MFP index, Q_t from time $t-1$ to t , takes an output index Y_t , calculated in the same fashion as X_t , and divides the output index by the input index, as shown in equation 2 below:

$$Q_t = \frac{Y_t}{X_t} \quad [2]$$

Some of the foremost productivity researches in the field of higher education, conducted by the United States National Research Council (NRC), recommend Törnqvist indexing as the standard methodological approach for analyzing higher education productivity [17]. The basic higher education MFP model developed by the NRC is further explained and summarized by Massy, et al. [13]. Under this model, higher education outputs are combined into a single measure that incorporates instructor delivery of courses and student degree completions. Inputs include labor, capital, and intermediate operational materials and activities. These are represented most commonly within the NRC model by the total expenditures on each input [13].

Extending the Prior Model

The NRC model was tailored for the USA higher education system. Both the model's input and output specifications reflect accounting and measurement techniques specific to the USA. This study generalizes the NRC model to align with diverse higher education systems worldwide. The new model differs from that of the NRC in three fundamental ways:

1. Education output is calculated based on the student load.
2. Research output indicators are added.
3. Financial inputs are not apportioned by the academic function.

First, this study internationalizes the base NRC education output indicator by designating the primary function output as the total number of full-time equivalent (FTE) students in a given year, instead of the USA's 'credit hours.' The USA universities associate each subject delivered with an assigned number of credit hours or 'points,' which are loosely determined by how much time students should spend attending lectures for that subject during a given week. The USA students' full- or part-time status is determined by the number of credit hours they take. Thus, an institution's total yearly student load, or total number of yearly FTE, directly indicates how many subjects an institution is currently delivering.

Internationally, although subject point calculation methodologies vary, most institutions track their yearly student FTEs, so this indicator allows enough consistency and accuracy across countries to represent total output of education delivery during a given year. The NRC model calculates a number of 'adjusted credit hours' for its final function output for education, which also accounts for the total number of graduate completions by coursework during the same year. The proposed extension also accounts for graduate completions by courseworks and calculates 'adjusted FTEs' in the exact same manner [13].

Second, this study expands the NRC model by incorporating outputs relating to the research function of higher education. Five potential research outputs seem feasible, based on the broader work [9–10] and the validation conducted in the current program of research. These are: publications, citations, patents, research completions, and research funds. The scientific field of research assessment and evaluation is large and growing, and in future research it is necessary to go into further details regarding the nature and specification of each of these potential indicators.

Third, the incorporation of research output affords further generalization of the input side of the NRC model. The financial inputs for the NRC model rely on a unique university accounting initiative in the USA, called the Delta Cost Project, in which institutional costs are tracked with respect to academic function such as education, research, or administration [17]. Thus, the financial inputs to the NRC model include only direct costs attributed to the education activity. Most countries' higher education systems or institutions, however, do not employ such methodologies for tracking or estimating costs by the academic function. By incorporating both education and research output indicators, the current study's model allows for inclusion of financial inputs that need not be separated by the academic function. The primary input categories for the current study's model are the same as the ones in the

NRC model, namely, labor, capital, and operations. However, the costs associated with these inputs are not divided by the academic function. The current model assumes that all costs, directly or indirectly, are reflected in the education and research outputs.

Table 1 describes input indicators and potential data elements. Input indicators include monetary values of labor, capital, and intermediaries. Labor is defined as all operational expenses tied directly to employees. Capital includes an institution’s non-current assets, or assets from which value is extracted for longer than a single fiscal year. Intermediaries include operational expenditures on various items used or consumed within a single fiscal year. The list in the table below includes a number of indicative data elements. These elements represent large, common budget categories but are not intended to be prescriptive. They are aggregated such as to account for the total sum of yearly operational expenses as well as all non-current assets used during operations. However, actual data elements will vary across countries and institutions, depending on the measurement and accounting practices.

Table 1: Input indicators and example data elements

Facet	Indicator	Variable	Data element
Inputs	Labour	L_1	Academic staff salary and benefits
		L_2	Non-academic staff salary and benefits
	Capital	K_1	Land capital services
		K_2	Buildings capital services
		K_3	Equipment and other capital services
		K_4	Repairs and maintenance
	Intermediaries	I_1	Grants and scholarships
		I_2	Administration and other expenses

Data elements grouped by indicator may be used to create Törnqvist chain indices. The chain indexing method in this study first requires calculating the three indicator component indices for labor, capital, and intermediaries. Then a single composite input index may be calculated from the component indices. The calculation for component indices is as follows. Let L_t represent the Törnqvist index for labor expenses from time $t-1$ to time t . Let $S_{L_1,t}$ be the share of academic staff expenses from total labor expenses at time t . Let $S_{L_2,t}$ be the share of non-academic staff expenses from total labor expenses at time t . These shares serve as weights for the data elements.

$$\log(L_t) = \left(\frac{S_{L_1,t} + S_{L_1,t-1}}{2}\right) * \log\left(\frac{L_{1,t}}{L_{1,t-1}}\right) + \left(\frac{S_{L_2,t} + S_{L_2,t-1}}{2}\right) * \log\left(\frac{L_{2,t}}{L_{2,t-1}}\right) \quad [3]$$

The indices for capital expenses, K_t , and intermediate expenses index, I_t , may be calculated in the same fashion. To find the composite input index, X_t from time $t-1$ to t , the model takes L_t , K_t , and I_t as arguments. Let $S_{L,t}$, $S_{K,t}$, and $S_{I,t}$ represent shares of labor, capital, and intermediate expenses, respectively, with regard to total operational expenses.

$$\log(X_t) = \left(\frac{S_{L,t} + S_{L,t-1}}{2}\right) * \log(L_t) + \left(\frac{S_{K,t} + S_{K,t-1}}{2}\right) * \log(K_t) + \left(\frac{S_{I,t} + S_{I,t-1}}{2}\right) * \log(I_t) \quad [4]$$

Calculation for the Törnqvist chain outputs follows a similar pattern but takes data elements measured in different units. First, consider the potential education output indicators, such as course work completions, graduate employment, and student load. As noted above, potential research outputs include publications, citations, patents, research completions, and research funds. As with inputs, actual data elements will vary across countries and institutions, depending on measurement, accounting considerations, and institutional priorities. Table 2 lists a number of indicative data elements for academic output.

Table 2: Output indicators and example data elements

Facet	Indicator	Variable	Data element
Education	Student load	E_1	Number of full-time coursework students
	Coursework completions	E_2	Number of coursework graduates
	Graduate employment	E_3	Percent of prior year graduates employed
Research	Publications	R_1	Number of publications
	Citations	R_2	Number of new citations
	Patents	R_3	Number of patents
	Research completions	R_4	Number of research graduates
	Research funds	R_5	Amount of research funding

Because output variables exhibit different units of measure, and because the importance and significance of any individual output could be debated, systematic arithmetic averages of value-added shares may not be used as index component weights. Instead, weights must be assigned according to strategic or ideological importance, such that the sum of the weights equals one. First, consider how a research component index could be calculated. The following example considers only the first three research variables, but the calculation can be made in the same fashion using all five. Let R_{1w} , R_{2w} , and R_{3w} represent the strategic weights of the research output components. Hence, the research index, R_t from time $t-1$ to t , is calculated as in equation 5.

$$\log(R_t) = R_{1w} * \log\left(\frac{R_{1,t}}{R_{1,t-1}}\right) + R_{2w} * \log\left(\frac{R_{2,t}}{R_{2,t-1}}\right) + R_{3w} * \log\left(\frac{R_{3,t}}{R_{3,t-1}}\right) \quad [5]$$

The education component is unique in a different way. As stated above, the NRC recommends a measurement of adjusted credit hours to indicate education output. This indicator incorporates a graduate completion ‘sheepskin effect,’ which represents “the additional value that credit hours have when accumulated and organized into a completed degree” [17]. One completion is set at approximately one year’s worth of credit hours. The current study calculates the sheepskin effect in the same way but uses student FTEs instead of credit hours for greater international compatibility. Let E_t represent the Törnqvist index for education outputs from time $t-1$ to time t . Let E_{1w} represent the strategic weight for adjusted student load and E_{3w} represent the weight for graduate employment. Note that the student load adjustment, or sheepskin effect, is accounted for by taking the sum of E_1 and E_2 .

$$\log(E_t) = E_{1w} * \log\left(\frac{E_{1,t} + E_{2,t}}{E_{1,t-1} + E_{2,t-1}}\right) + E_{3w} * \log\left(\frac{E_{3,t}}{E_{3,t-1}}\right) \quad [6]$$

The composite output index, Y_t from time $t-1$ to t , must also incorporate strategic weighting of education and research. Let R_w represent the strategic weight of research, and E_w represent the strategic weight of education. Equation 6 demonstrates the current study's calculation of Y_t .

$$\log(Y_t) = R_w * \log(R_t) + E_w * \log(E_t) \quad [7]$$

This modelling and the indicators rest upon a number of assumptions. First, there is an important assumption concerning the distribution of inputs across diverse academic functions. In the absence of accounting mechanisms that classify all university expenditures by academic function, and, without accurate, detailed records of faculty members' use of time, individual inputs cannot be linked directly to specific outputs. Hence, conclusions about efficiencies of individual output components, such as research publications, cannot be made directly under this model. The problem, though, is addressed through output component weighting.

Second, this model assumes equal weighting of research and instruction functions. Further, under the research category, each of the three indicators is also equally weighted. This weighting system implies that half of an institution's efforts and resources are allocated to education, and the other half goes to research. By the same token, education and research components are also weighted equally within their respective indicator categories. The topic of weightings is debated intensely in the assessment and evaluation literature [7, 11, 18], and for current purposes we adopt the most neutral, parsimonious, and transparent approach.

Insider knowledge about an individual institution's strategy and budgeting would likely reveal variable and unequal output prioritization. On one hand, even in the absence of more rigorous accounting, this could lead to more accurate productivity estimates. On the other hand, the nature of higher education outputs is such that their importance is debatable, depending on different stakeholders' interests in the results. Thus, the equal weighting system, while not exhaustive of the full range of university outputs, selects a few near-universal higher education priorities and subsequently attempts to eliminate biases concerning output significance.

Third, the current study makes further assumptions about capital inputs. Since the Törnqvist indexing method tracks productivity changes from year to year, the model does not include in calculation each year an institution's full book value of capital. Instead, capital services are estimated based on yearly flows from productive capital stocks. In the absence of directly observable flows, capital services are estimated as a proportion of capitals stocks [16]. With little available data on the dynamics of productive capital flows for the higher education industry, the current study estimates a yearly capital service proportion factor at one-twelfth the value of capital stocks. When left constant for each institution over the full period of study, the assumption has no bearing on final MFP indexes. Rather, it serves as a placeholder should accurate information on capital services emerge.

RESEARCH APPROACH

This paper presents emerging findings from research spanning diverse national and institutional contexts. A devolved and controlled methodology was used whereby international frames were specified for adaptation within countries. Given the innovative and formative nature of this research, such modifications in themselves furnished methodological insights into the nature and feasibility of studying productivity in higher education.

The study began by developing the supranational methods for managing the research and productivity investigations. Experts were drawn from ten Asia-Pacific countries: Australia, Cambodia, Fiji, India, Indonesia, Malaysia, Pakistan, the Philippines, Sri Lanka, and Thailand. A planning meeting was convened with the experts to develop a generic version of the productivity model and discuss pertinent assumptions and contexts. This generic model has been elaborated above. With ongoing international guidance, the experts then consulted nationally to further adapt the model to their own respective systems and institutions.

Quantitative data was collected on inputs, research, and education outputs. The experts sought data for the years 2010 through 2015 at a minimum. There was necessary variation in data collection methods and quality. With certain countries and elements, it was necessary to construct instruments to collect data directly from institutions, while in other cases data was available from ministries' archives or public sources. Missing data was a problem even with major institutions and core data elements. Nevertheless, sufficient data was collected to support target analyses and outputs. At the same time, data collection complexities exposed the immaturity of research and practice in this field.

A suite of quantitative and qualitative analyses was performed. Econometric analyses were performed on the quantitative data to validate the model and to produce empirical insights. In each country, critical reviews and consultations were conducted that isolated pertinent national and institutional contexts. The contextual information was used to build broader interpretations of factors that appeared to influence productivity and prospects for future improvement. Ongoing consultation played out during the study and a conference was convened after the fieldwork.

EMERGING RESULTS

This foundation research has sought to initiate ground and to give momentum to new perspectives on higher education. This paper presented interim findings based on consultations with a large number of experts and technical as well as empirical feedback from several countries. In what follows, results are presented with respect to:

1. Establishing the feasibility for analyzing productivity.
2. Garnering initial empirical insights from the field.

The Feasibility of Productivity Research

The feasibility of this kind of research must be considered from many perspectives. Only

initial and hopefully formative insights are offered in this paper, focusing on practical and technical dimensions. Broader forms of feasibility associated with consequential considerations require later and broader treatment.

First, given the extent of international engagement in the current study, signs of increasing feasibility for continued research on higher education productivity are encouraging. Researchers from ten countries have participated, and during the very first year, the work has gained sufficient momentum to convene a major international conference. Examining the discussion that flows from broader reporting of results will provide further important insights into the policy value of such work.

Second, technical feasibility can be affirmed via acceptance of the model and indicators among contributing experts, and via the capacity to collect and analyze the required data. All participating experts affirmed the parameterization of productivity used in this research, and the underpinning assumptions. The greatest barrier to feasibility remained the availability of data required to underpin the indicators. In summary, it appears that only in a few instances was sector-wide data available in existing databases. It was more common for a subset of data to be available for a part of the sector, typically the public institutions. However, many experts had to gather data from institutions or a variety of agencies. In a small number of cases, for practical or political reasons, it was not possible to collect any data at all. As part of the ongoing research program, a broader review of data is underway in terms of data coverage, availability, and veracity.

Emerging Insights from the Field

This research has furnished empirical insights from the field. A sample of findings presented here illustrate the kinds of results and interpretations that such analysis can yield. These presentations include:

1. In-depth results for a single institution.
2. Results for multiple institutions.
3. System-level results.
4. A range of combined reports.

First, the productivity model can help unpack insights from in-depth results for a single institution. For the sample institution in Figure 1, productivity is above a value of one for each of the five reported years, though the rate increases and decreases fluctuating between 1.68 and 2.20. Table 3 presents the underpinning figures, with estimated figures shown shaded. On the education side, credit hours and coursework completions have increased, though graduate employment has deteriorated. Research-wise, publications have increased, as have research funds, citations, and research completions, though the number of patents has declined in recent years. In terms of inputs, labor costs have almost doubled and there has been substantial capital investment, while the amount spent on intermediaries has more than doubled. Clearly, such analysis only touches the tip of a much larger story about the institution's past, present, and future.

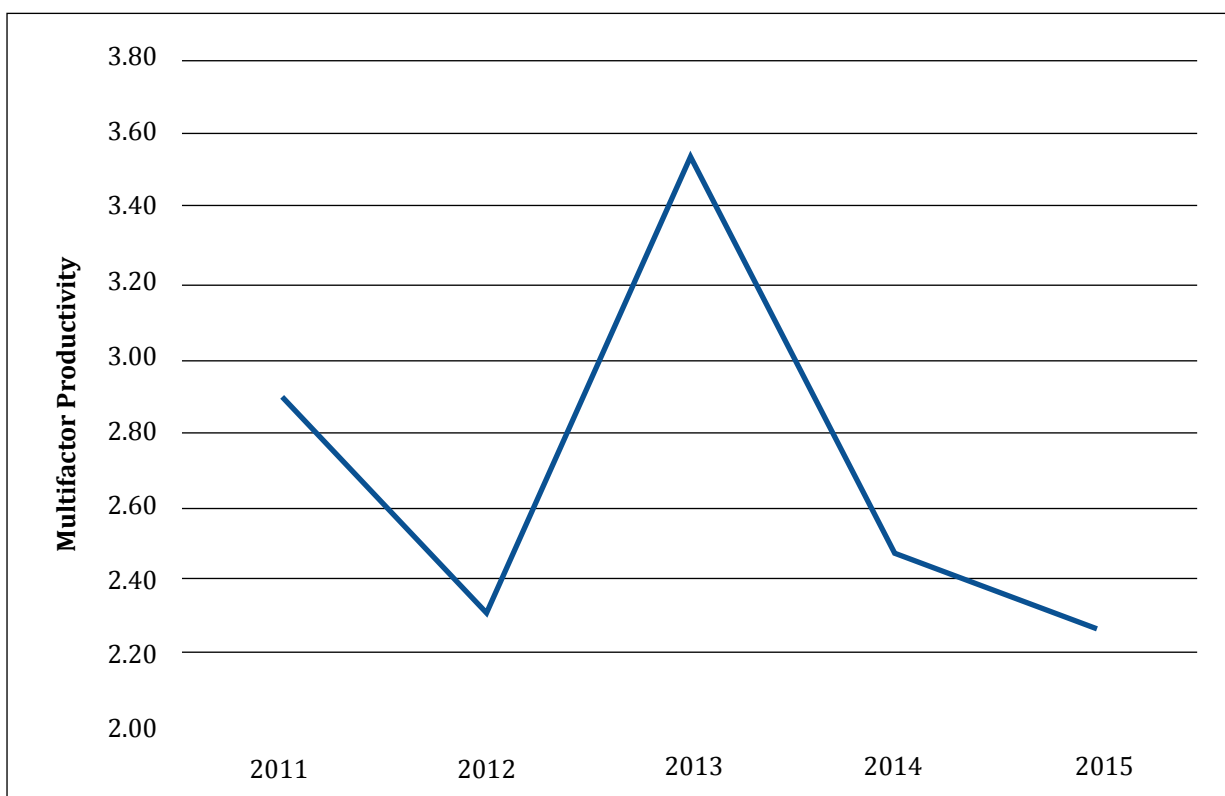


Figure 1: Results for a single institution

Table 3: Productivity indicator data for sampled institution from 2010 to 2015

Facet	Indicator	2010	2011	2012	2013	2014	2015
Education	Coursework completions (no.)	2,968	2,692	3,055	3,211	2,524	3,684
	Graduate employment (%)	64	64	66	64	55	58
	Credit hours (no.)	11,242	11,242	11,244	11,238	11,254	11,281
	Learning outcomes (%)	85	85	85	85	85	85
Research	Publications (no.)	80	80	80	80	86	90
	Citations (no.)	178	215	249	247	297	266
	Patents (no.)	20	25	25	25	20	15
	Research completions (no.)	80	80	80	80	86	90
	Research funds (\$)	84,203	144,705	150,309	219,026	786,011	1,001,238
Inputs	Labor (\$)	6,798,203	8,081,694	9,001,716	10,194,214	11,693,528	10,631,564
	Capital (\$)	2,105,077	3,617,618	2,849,599	4,637,658	4,726,894	5,607,007
	Intermediaries (\$)	2,665,799	3,169,098	2,808,370	3,453,001	6,273,966	5,704,187
	Total (\$)	11,569,078	14,868,409	14,659,685	18,284,874	22,694,387	21,942,758

Second, helpful comparisons can be made across HEIs. Table 4 presents results for MFP indices for eight institutions within a single system. These are mostly below a value of one. An index of one represents no change in productivity over the previous year.

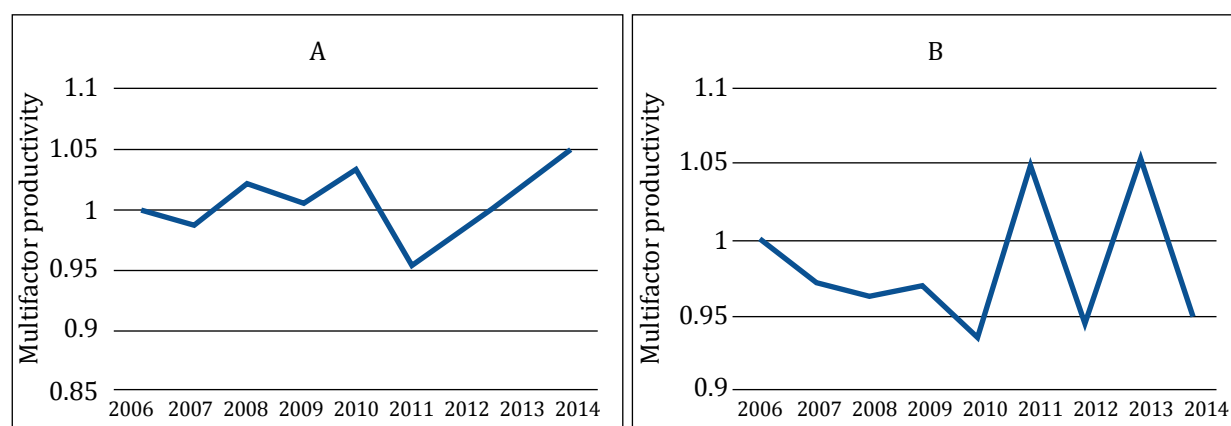
This analysis reveals that the rate of increase of inputs seems to be outpacing the rate of increase of outputs.

Table 4: Results for eight institutions in a single system

Year	A	B	C	D	E	F	G	H
2006	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2007	0.988	0.971	0.984	0.926	0.984	0.921	0.920	0.972
2008	1.023	0.962	0.960	0.973	0.955	0.916	0.950	0.991
2009	1.004	0.969	0.966	0.985	1.041	1.019	0.932	0.971
2010	1.033	0.934	0.939	0.952	1.009	0.928	1.018	1.026
2011	0.953	1.050	0.933	0.984	0.928	0.992	0.993	1.004
2012	0.981	0.944	1.011	0.958	0.976	1.008	0.970	0.981
2013	1.017	1.054	0.985	0.980	1.005	1.039	1.024	0.962
2014	1.050	0.948	1.012	0.960	0.937	0.969	0.952	0.985

Of the eight universities in this study, university A shows the greatest signs of consistent positive technical progress over the nine years, with five periods having an MFP index value of more than one (see Figure 2). All universities show decreasing indices from 2006 to 2007, but this decrease is longer for both B and C, lasting till 2010 and 2011, respectively. University D consistently shows decreasing returns over the period studied. The remaining four universities show highly variable results, with periods of growth and decline in productivity.

These outcomes are unadjusted for potentially key factors such as inflation and time lag between input and output. This indicates, however, that the universities in question seem to be doing consistently less with more. More detailed reviews of institutional financial reports show that inputs have risen annually, and even though outputs have also risen, these have not kept pace. In short, growth in spending seems to be outpacing any increase in education and research outputs.



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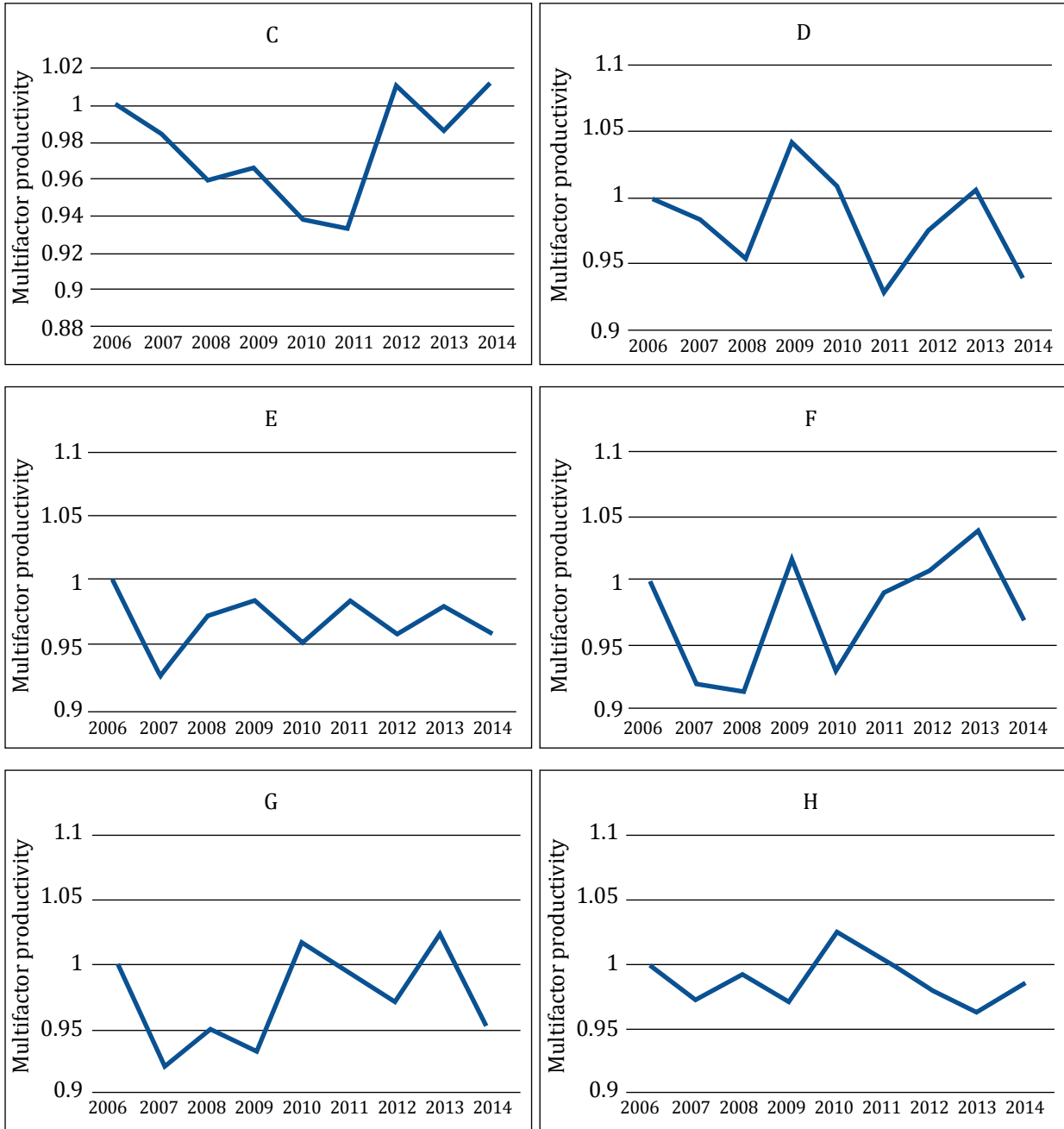


Figure 2: Results for multiple institutions in a single system

Third, there may be value in taking stock of system-level results. Figure 3 presents such findings, aggregating data from a large number of institutions. This presentation shows that in this system, productivity increased and decreased at varying rates between 2009 and 2015. Productivity increased, i.e., was above the value of one, for four of the seven years, and has been below a value of one since 2014. This kind of analysis provides a very high-level snapshot of whether the financial inputs being put into a system are returning commensurate education and research outputs or not.

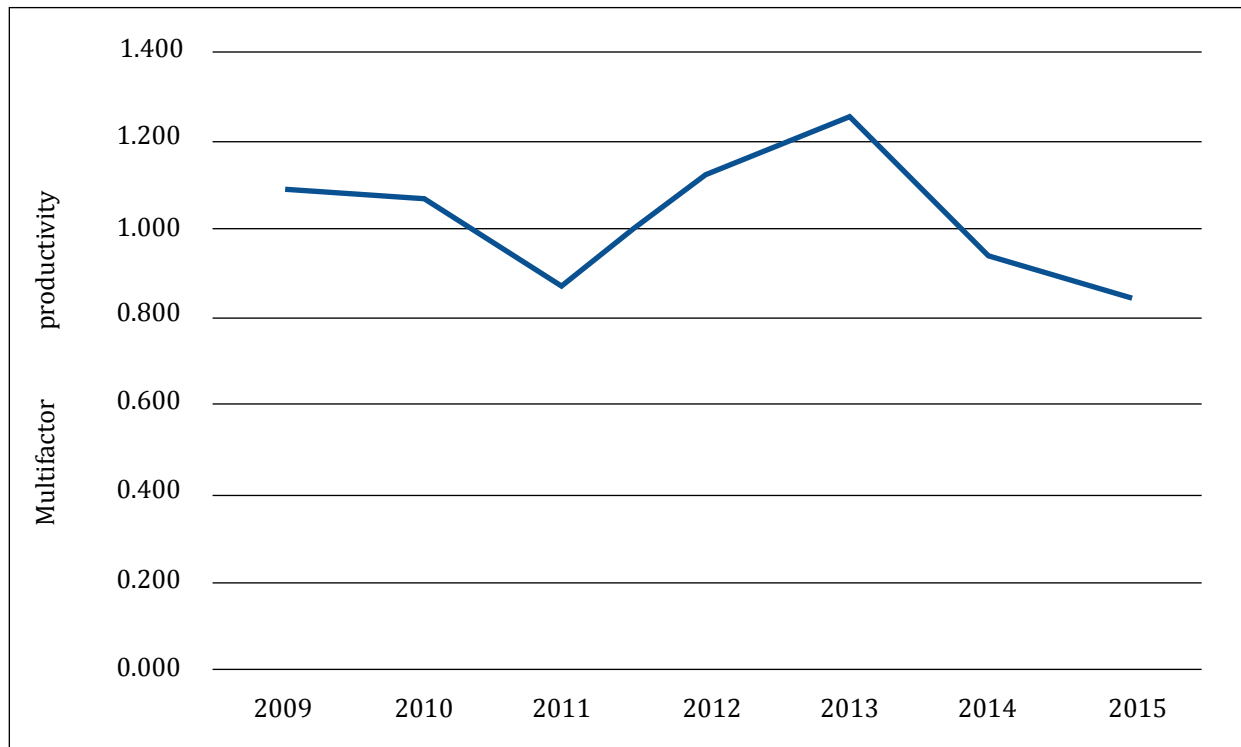


Figure 3: Results for aggregated institutions in a single system

Fourth, a plethora of further analyses are possible. A sample of results are presented here. These are provided without the contextualized explanation that would render them most meaningful. Nonetheless, they illustrate the kinds of analyses provoked by the productivity modelling reviewed in this paper. The presentations include productivity estimates for:

- Three systems (Figure 4).
- Three institutions with system benchmark (Figure 5).
- 14 institutions across five years (Figure 6).
- Three institutions across eight years (Figure 7).

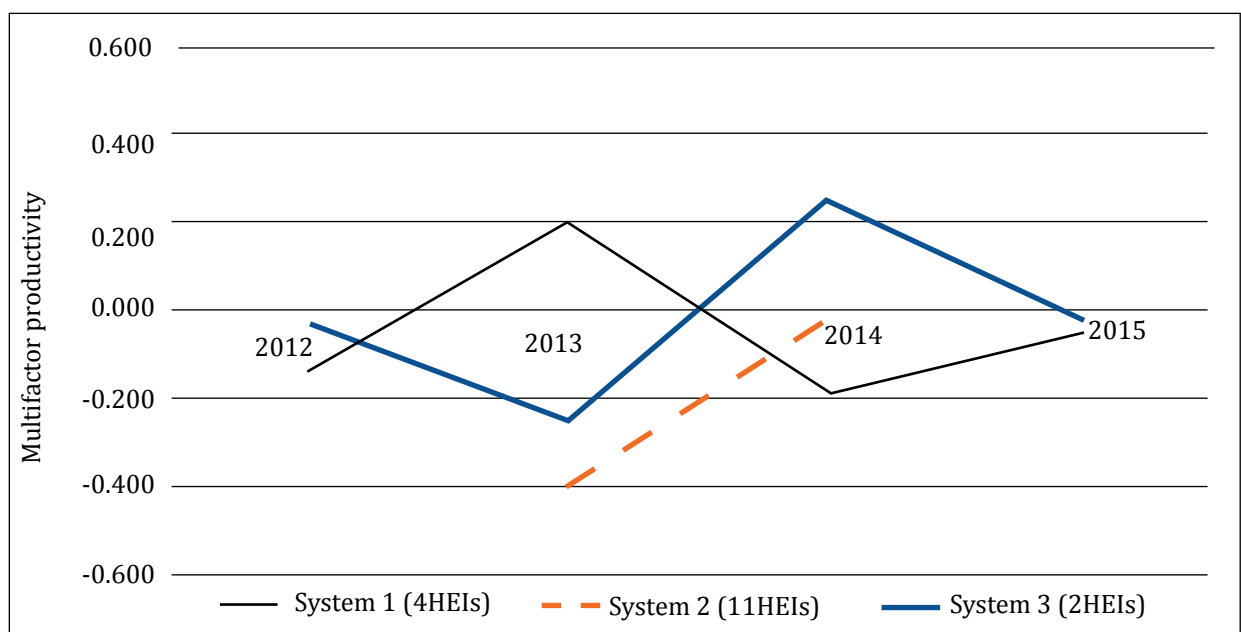


Figure 4: Results for three systems

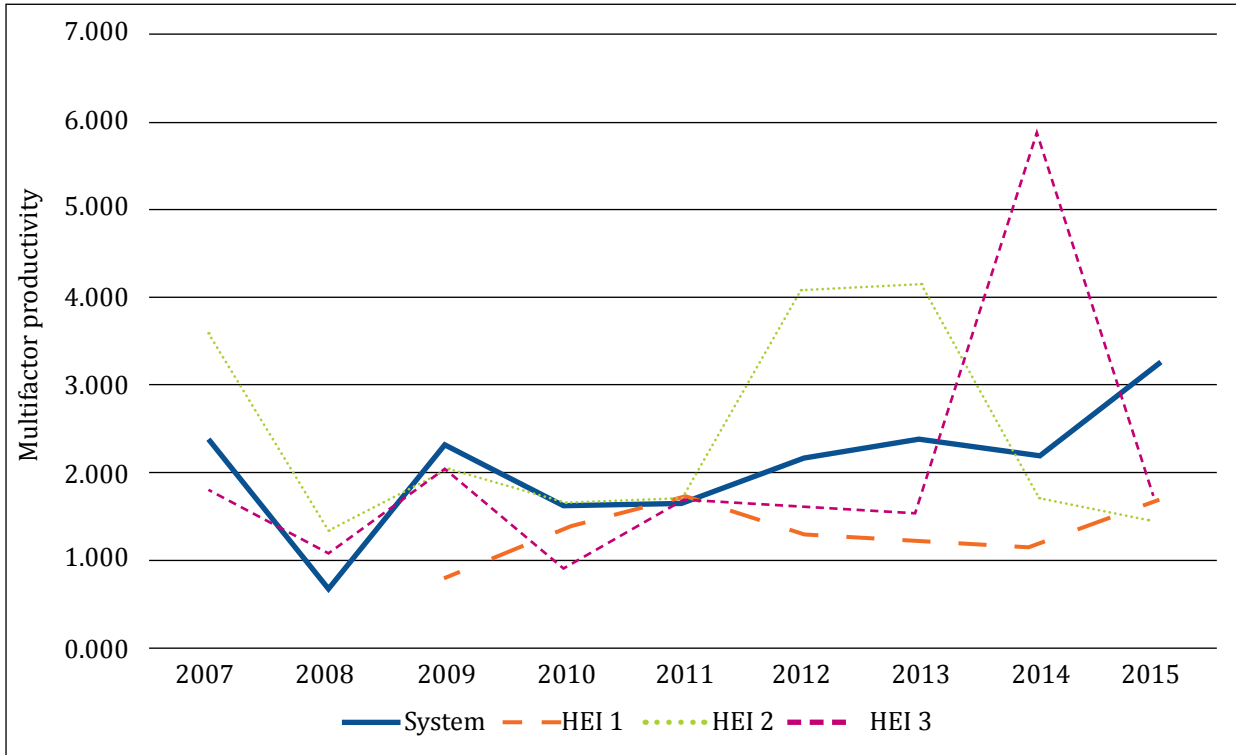


Figure 5: Results for three institutions with system benchmark

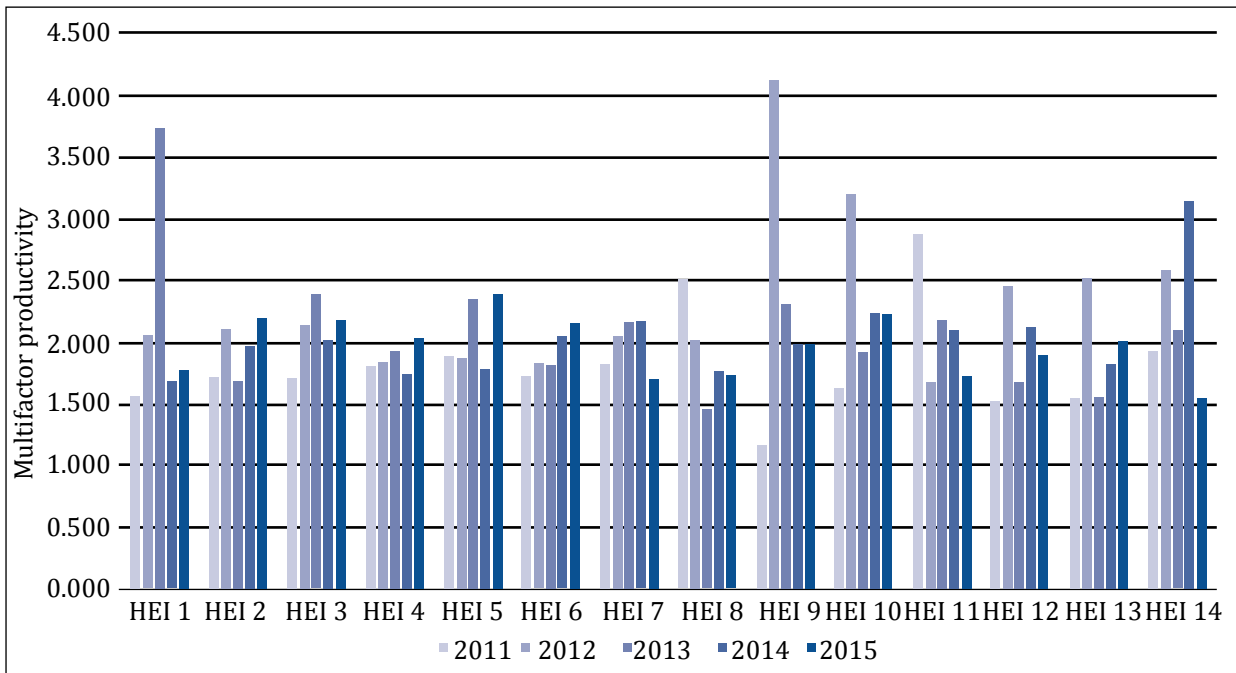


Figure 6: Results for 14 institutions across five years

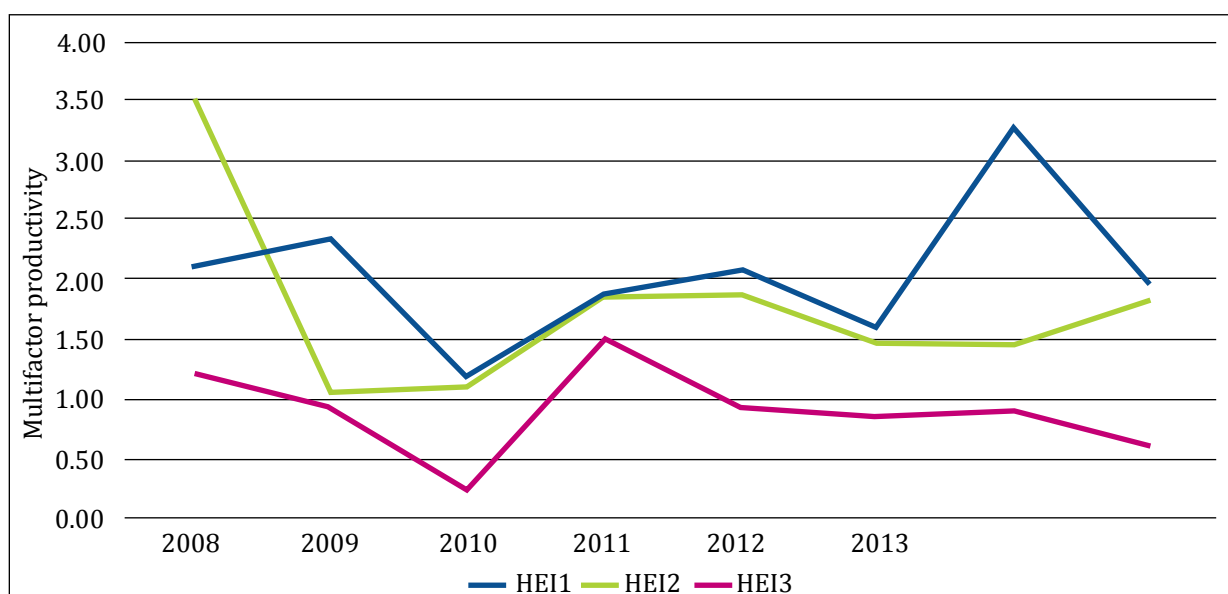


Figure 7: Results for three institutions across eight years

SUMMARY INSIGHTS AND NEXT STEPS

Interim Contributions

This research has made technical, empirical and practical contributions. These are summarized, before reviewing opportunities for future work. It is important to emphasize that while this paper contributes in terms of insights, all findings are of an intermediate nature and are gleaned from a larger piece of work that is still in progress.

The research has made several technical contributions. First, through a review of prior work and consultation with experts, it has replicated, extended, and validated the econometric models for measuring productivity in higher education. Second, it has considered fundamental architectures and assumptions of higher education systems and institutions. Third, the research has shown the feasibility of collecting required data, and the kinds of analyses useful to advance scientific study of this phenomenon.

Empirically, the research has generated novel insights into productivity levels and trends across a diverse suite of tertiary institutions and systems. While no attempt was made to collect baseline data, the results do provide broad reference points for subsequent analyses. Such a study highlights the value of progressing contextualized quantitative studies of productivity in higher education. Understanding productivity in higher education is core to better managing institutions and designing policy frameworks and interventions. The research exposes the value in progressing scientific study of the phenomenon that puts more robust foundations in place. The evidence-based conversations initiated by this project were new in many of the countries involved, and were enriched by the cross-national perspectives.

Practically, through results from the modelling, the expert insights, and the broader consultations, the research has spotlighted factors associated with improving productivity. The paper has explored initial system-level, multi-institution and within-institution insights.

Through such quantitative analyses, and expert consultations and context reviews, such results carry the potential to highlight levers for improving productivity. While these, such as governance reforms, increased use of technology, workforce reforms, new institutional types, and new education models, may not be surprising, it is likely that the study will furnish the evidence and frameworks for ongoing systematic investigation.

Future Directions

A formative research such as this contributes in terms of insights, and also signals areas for future investigation. A further model development would be helpful. For instance, HEIs produce a range of outputs and require numerous inputs. No single model could represent the full picture of higher education productivity. Studies must further examine different types of productivity models and additional model parameterizations, noting the utility as well as the strengths and weaknesses of various functions. For example, the modelling presented here could be modified to better account for time lags between inputs and outputs, as well as for adjusting the financial data for inflation over the time series studied. Such modifications would provide additional insights into productivity changes.

Working to enhance data availability would be an important future development. As touched upon in the discussion of results, data availability creates barriers for higher education productivity research. Publication and appropriate disaggregation of financial data is crucial for determining efficiency in higher education. Organized, accessible databases that link information from multiple public sources, are needed to facilitate appropriate comparison of ranges of inputs to numerous outcome indicators. The absence of data also poses problems for directly linking higher education inputs to outputs. Accounting mechanisms that track expenditures based on academic functions would allow for a more specific and isolated study of productivity. Accurate and precise data on academic and non-academic staffs' time usage would also greatly inform productivity studies in higher education. More accurate estimates of capital services for educational functions would also improve research in this field.

Great potential lies in productivity studies to inform national and system-wide policy makers. Feedback between policy and productivity holds the promise for continued development. New regulations and emerging educational models for staffing, technology, and services provide considerable opportunities for the study of higher education productivity. Productivity measurement has become integral to both micro- and macro-economic analyses across multiple sectors. Testing various productivity models for higher education and integrating productivity measurement into regular monitoring and decision-making processes may prove useful for governments and institutions aiming to optimize quality and improve efficiency.

Higher education is assuming a much greater role in contemporary societies, with increasing expectations from industry and public. The convergence of financial, political, and competitive pressures means that productivity reforms are becoming non-ignorable. Understanding and improving productivity is increasingly seen by the government and institution leaders alike as critical to a sustainable future for many higher education

systems, both to make the best use of limited resources and to reassure that public money is being spent efficiently. Combined, this research, and its findings and contributions, speak to heightened calls for greater transparency around the distribution and allocation of both costs and returns, not just for education but also for research and a broader engagement.

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TRANSNATIONAL EDUCATION AND HIGHER EDUCATION PRODUCTIVITY

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INTRODUCTION

The productivity challenge facing the Asia-Pacific region is considerable. The demand for higher education will grow strongly over the next decade, with enrollments projected to rise by 50 million in the region by 2025 [3]. Unlike manufacturing, higher education has been plagued by stagnant productivity growth, with tuition costs spiraling as a result. For the average university ranked in the world's 'Top 200' by the Times Higher Education, revenue per student is now approximately US\$70,000 (see Figure 1). Unless universities in the Asia-Pacific can significantly increase their productivities, a high-quality education would be beyond the reach of most citizens.

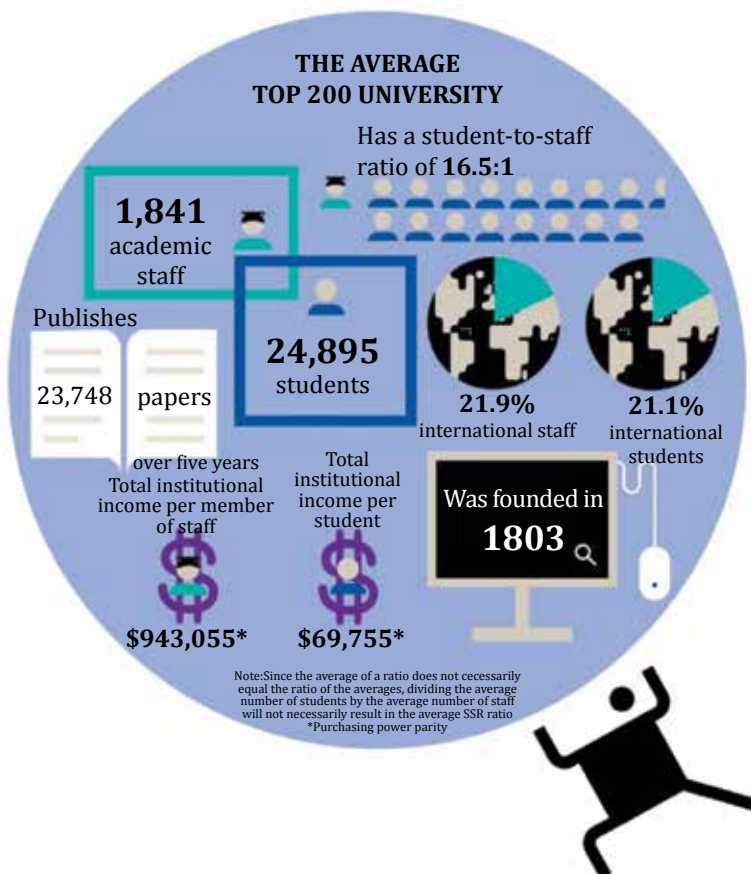


Figure 1: The Top 200 university average

Source: Times Higher Education

Productivity is closely associated with, but different from, quality. Productivity measures the efficiency with which universities transform inputs (labor, capital, and consumables) into outputs (trained graduates and research) and is properly a major concern for governments that seek the best returns on their investments in higher education.

The overlap with quality is that measuring productivity makes it necessary to define the output in terms of the minimum quality acceptable, as otherwise universities could increase the output by simply reducing the quality [35]. For example, if output was simply defined as the number of students graduating, universities could increase output by reducing the passing grade. However, if output is defined as the number of graduates who get a well-paid job within six months, the distorting incentive is removed.

Another feature of contemporary higher education has been the globalization of universities, with institutions reaching out to new student markets in foreign countries by setting up local provisions, either directly in the form of an international branch campus (IBC) or by working in partnership with a local organization to franchise their degrees [1, 14, 18]. This paper explores the scope for host countries to use the so-called ‘transnational education’ to accelerate development of their domestic higher education sectors and thus drive productivity growth.

The structure of the paper is as follows: Having established the productivity challenge facing the Asia-Pacific region, it first outlines the meaning and forms of translational education. It then considers the potential scope for transnational education to meet demand in the region and the benefits for the host countries. These depend on the policy motives of the host governments for allowing or encouraging foreign universities to set up local provisions on their soils and the forms that the transnational education takes.

UNDERSTANDING TRANSNATIONAL EDUCATION

Transnational education is defined as any teaching or learning activity in which ‘the students are in a different country to that in which the institution providing the education is based’ [8]. Put another way, transnational education includes all types of higher education study programs, sets of study courses, or educational services (including those of distance education) in which the ‘learners are located in a country different from the one where the awarding institution is based’ [5].

At the heart of both these definitions is the fundamental principle of transnationality, which means that the student is in a different country from the university awarding the qualification. Transnational education is thus essentially about the means by which the educational service is provided by the university in country A to students in country B (see Figure 2).

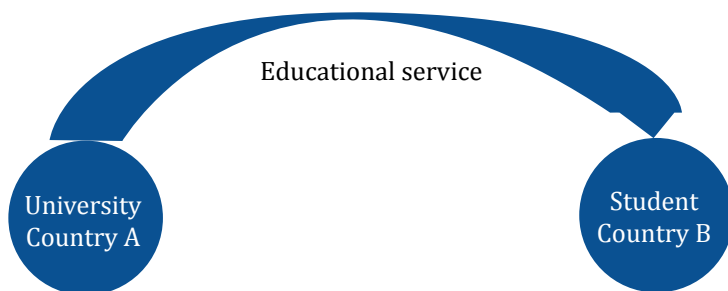


Figure 2: The principle of transnationality

Scope for Transnational Education

The phenomenon of transnational education is generally seen as the most advanced stage in the internationalization of universities. Universities start to internationalize their teaching activities by recruiting foreign students to their home campuses. This is sometimes termed as ‘export education,’ as it is the educational equivalent of exporting services like tourism (where the foreign tourist has to visit the exporting country to consume the service). For universities in the most advanced export-education countries like the UK and Australia, roughly one in five university students are foreign [25].

There are, however, limits to the growth of traditional export education. Universities face capacity constraints. International students tend to be concentrated in subjects like business and engineering that offer graduates the best prospects of a successful career. International student numbers cannot be expanded beyond a certain point without distorting the shape and academic character of a university.

Perhaps more fundamentally, there is a limit to the number of students who are willing and able (financially and culturally) to study in a foreign country. Tellingly, while the total number of students in tertiary education has grown rapidly over the last 35 years, the percentage that study outside their own countries, i.e., those who are internationally-mobile, has remained fairly constant at around 2% (see Table 1).

Table 1: Global and internationally-mobile tertiary enrollments

	1980	1985	1990	1995	2000	2005	2010	2013
Internationally-mobile students (in million)	1.1	1.1	1.3	1.7	2.1	3.0	4.1	4.5
Global tertiary enrollments (in million)	51.2	60.3	68.7	81.7	99.9	139.0	181.7	198.6
Internationally mobile as % of total	2.1%	1.8%	1.9%	2.1%	2.1%	2.2%	2.3%	2.3%

Source: UNESCO, OECD

Transnational education allows universities to increase their international enrollments by offering their qualifications in third countries, competing for 98% of the market for higher education that is not internationally mobile. Moreover, by establishing themselves in markets where the local higher education sector is too underdeveloped to satisfy demand, universities may actually increase global participation in higher education [39].

Types of Transnational Education

The principle of transnationality begs the question of how the university in country A can provide an educational service to students in country B. The simplest way is to classify transnational education in terms of the institutional and contractual infrastructure that the university uses to deliver education.

This approach is derived from international business theory. The Uppsala ‘stages approach’ to internationalization argues that companies internationalize incrementally, by first exporting their goods, then moving to licensing production to a partner in a third country (where the financial risk is primarily borne by the partner), and finally investing directly in their own production and distribution facilities [15]. The underlying principle is that each stage is riskier than the one before, so the companies only move from exporting to licensing, and from licensing to foreign direct investment, as they acquire more knowledge about the third market and gain greater confidence.

There are countless examples from the corporate world of companies penetrating new markets in a staged way. Coca Cola, for example, is sold in every country except Cuba and North Korea, but has never moved beyond licensing. It manufactures syrup in the USA which is shipped to franchisees who make and bottle (or can) the final product for distribution in their respective countries. Honda, on the other hand, has production facilities in a wide range of countries, including the UK and the USA, but also licenses the production of outdated models to foreign manufacturers in developing countries.

The main forms of transnational education represent each of following stages of internationalization according to the stages approach: distance learning (exporting); franchising and validation (licensing); and IBCs (foreign direct investment). See Healey [11] for more details. Consider each form in turn.

Distance Learning

In higher education, the traditional equivalent of exporting has been for students to travel to the home campus to study. However, distance learning provides an alternative way of exporting education directly to students in their own countries. Students located in another country can access online program materials, either independently or as part of an online, tutor-supported program [26].

Universities have engaged in distance learning education for many years. The University of London pioneered correspondence courses in the 19th century [10]. The UK’s Open University used the medium of national television to broaden the reach of distance learning in the 1960s. The internet and the spread of smart phones have dramatically reduced the costs of providing distance learning, thus allowing universities to reach increasing numbers of students around the world without leaving their home campuses. The recent emergence of massive open online courses (MOOCs) and the huge global enrollments in popular courses have illustrated the enormous potential market for distance learning [13].

Franchising

The higher education equivalent of licensing production to a foreign partner is franchising. It involves entering a partnership with a foreign provider, under which the partner is licensed to promote and teach the university’s degree in its own country, with no curricular input from the host institution [4]. The precise terms of franchise agreements vary widely, but generally the partner is responsible for providing the physical infrastructure (the teaching

buildings, library, and computing facilities) and employing the administrative and academic staff who recruit, support, teach, and assess the local students. Importantly, students enroll with the local delivery partners [6]. The university provides the intellectual property, i.e., the curricular content, and learning outcomes, and oversees the quality of the teaching and assessment [4]. The partner bears most of the financial risk and normally pays the university a royalty fee per student, although financial arrangements vary widely.

Validation

Validation is a closely related form of licensing. In most respects, the relationship between the university and the foreign provider is the same as in a franchise. The main difference is that the curriculum, including the degree title, is developed by the partner and validated by the university [4]. If the proposed curriculum is deemed appropriate in terms of quality and meets the awarding university's degree standards, the university licenses the partner to market its own qualification as an award of the university. Validation allows the curriculum to be more closely attuned to the context of the market in which it is being delivered. In some cases, the curriculum may be delivered in the local language, which makes the qualifications accessible to a much wider pool of students.

While the USA and Australian universities engage in franchising, validation appears to be a uniquely UK practice. In the USA, for example, regional accrediting bodies require franchised degrees to be identical to those taught on the home campus. One possible explanation for the difference may be that, until relatively recently, the degree-awarding powers in the UK were restricted to a relatively small number of institutions. Before 1992, only universities established by Royal Charter could award degrees. Many small colleges relied on local universities to validate their degrees. The polytechnics had their degrees validated by the Council for National Academic Awards (CNAA). The use of validation within the UK borders was thus widespread [33]. When the polytechnics gained university status and degree-awarding powers in 1992, they already had the organizational infrastructure and experience to begin validating degrees themselves, both in local colleges, and, increasingly over time, offshore.

Joint Programs

Joint programs are not a separate stage of internationalization, but a variant of franchising and validation. Although multiple definitions of the 'joint program' exist, the QAA [26] defines it as a program that allows offshore students to complete the university's entire degree at a partner institution or to begin the program in the partner institution and transfer to complete the degree at the awarding university.

The program being delivered at the partner institution could, in principle, be either a franchise or a validation. For example, in the 1990s many UK universities offered their degrees through private Malaysian colleges on a '2+1' basis, where the first two years were studied in Malaysia and the final year was completed by students coming to the UK. The Malaysia-based part of the program was typically a franchise, to ensure a seamless transition to the UK for students as they moved into the final year of the same degree.

As these colleges developed, they gained local degree-awarding powers, but some continued to want the academic credibility they had enjoyed by granting the degrees of UK universities. One solution was to design and award their own degrees, which were validated by the UK university, so that the students could graduate with two awards. This form of joint program is becoming increasingly popular in Malaysia as many private colleges are being upgraded to university colleges.

In other countries, the early years of the degree may be franchised to the foreign partner, while the final year of the degree is taught at the foreign partner's campus by faculty from the awarding university on a 'fly-in, fly-out' mode of delivery, which usually involves intensive block teaching [34]. This variant combines franchising and distance-learning. As with other forms, joint programs are not a separate stage of internationalization, but rather a mix of the more distinct stages like franchising and validation.

International Branch Campuses

International branch campuses (IBCs) represent the final stage of internationalization, with the university establishing a satellite campus in a third country [4]. Currently the USA has the most IBCs, followed by the UK and Australia [27]. Financially, an IBC is much riskier than franchising or validation. There are a number of examples of IBCs that failed to break even and were closed at a financial loss to the university. These examples include UNSW Asia in Singapore (closed in 2007); George Mason University in the United Arab Emirates (closed in 2009); and the University of East London in Cyprus (closed in 2013). In an earlier era, several USA universities opened IBCs in Japan in the 1980s, which subsequently floundered in the protracted recession of the 1990s [37].

However, when they are successful, IBCs enable universities to project themselves as 'global universities.' The University of Nottingham and Monash University have both used their IBCs around the world to position themselves as global brands [31]. These universities present themselves as global universities, with campuses in multiple countries, rather than as a university with its headquarters in, say, Nottingham, and small, dependent IBCs in developing countries. Systems and academic procedures are operated on a pan-university basis, to reinforce the model of a single university, with globally distributed campuses.

BENEFITS FOR THE HOST COUNTRY

Table 2 illustrates the differences between the different types of transnational education, expressed in terms of the 'elements' of the higher education service that are being transferred to the host country. In distance-learning, the students study for the qualification in their own country, but the university retains complete control over the curriculum, teaching, assessment, and certification, i.e., the issuing of the testamur or the certificate. For all intents and purposes, the student could be in any country, and apart from the upskilling of students completing the distance-learning degree, there is no wider benefit for the host country.

Table 2: The transfer of higher education to the host country by type

	Distance learning	International branch campus	Franchise	Validation
Curriculum	X	X	X	✓
Teaching	X	✓	✓	✓
Assessment	X	X	✓	✓
Certification	X	X	X	X

In case of a branch campus, the home university retains control of the curriculum, assessment and certification, but typically employs local academic and administrative staff to teach the students, even though it may second a small number of its permanent staff to provide leadership and mentorship. In this case, the IBC is making a contribution to the host country over and above the students it graduates, by providing valuable professional development of the local staff and training them in new methods of pedagogy and use of educational technology.

In a franchise, the home university normally retains control of the curriculum and certification, but allows the franchise partner to teach and assess the degrees using local staff, providing only a moderating role to ensure academic quality. This further enhances the capacity and capability of local academic and administrative staff, who have the autonomy to deliver and assess the curriculum, but with the support and oversight of the home university.

Finally, validation allows a local partner to develop the curriculum, and teach and assess the degree, with the home university using its quality assurance procedures to control the quality of the degree offered and certify it as its own. Although validation is often regarded as the riskiest form of transnational education for the home university, it arguably provides the greatest potential benefit to the host country in terms of building local capacity.

Productivity Growth in Host Countries

The globalization of business, which has broadly followed the stages of exporting, franchising, and direct foreign investment, has played a dominant role in accelerating the economic development of host countries. Although the extent to which the benefits of economic growth have ‘trickled down’ to the poorest sections of society are strongly contested by the anti-globalization movement, there is no question that the rapid productivity growth experienced in countries like PR China over the last 25 years has been driven by the transfer of capital, management, and technology from the West to the host countries. With higher education globalizing along a similar path, will transnational education provide the same boost to productivity growth in the higher education systems of the host countries?

It turns out that the answer to this question depends significantly on the policy motives of the host governments in allowing or inviting foreign universities to establish a presence in

their countries. There are essentially three broad motivations:

- Demand absorbing.
- Export-oriented.
- Demonstration effect.

Demand Absorbing

Higher education is a superior good, in the sense that the demand for higher education grows faster than gross domestic product (GDP). For example, a 1% increase in GDP may raise the demand for higher education by 1.5%. On the other hand, it takes time to increase the supply of university places if quality is to be maintained. Campuses need to be built, academic and administrative staff are to be trained, policies and procedures must be developed, and management systems need to be installed. In countries enjoying rapid economic growth, the demand for higher education tends to outstrip the growth in the supply of places, either forcing the unplaced students to look abroad for opportunities or creating a vacuum that could be filled by transnational education.

Countries like Hong Kong, Greece, Uzbekistan, and, until recently Malaysia, have used transnational education as a way of supplementing domestic higher education and increasing the supply of places to local students, sometimes in a deliberate effort to reduce the foreign-exchange drain of students going abroad to study. In the case of the United Arab Emirates, there is a large expatriate population that cannot access the free domestic higher education system. That is reserved for Emirati nationals, forcing the children of expatriate workers to either go abroad to study or join one of the many transnational education ventures in the country [41].

Export-oriented

Higher education is a major export sector, with countries like Australia and the UK heavily dependent on export education. Some governments have used transnational education to create education hubs that are intended to attract foreign students from across the surrounding geographic regions [17, 38]. The benefits of an export-oriented approach to transnational education go beyond earning foreign exchange. Transnational education projects soft power, with students returning to their home countries as advocates of the country that provided their education. In a world where many countries have ageing populations, attracting students to study in an export hub is also an important way of wooing skilled migrants to counter the 'demographic time bomb' [20].

Singapore's Global Schoolhouse is one of the best-known education hub projects, although, as argued in the case study below, Singapore has actually combined a small export-oriented project with elite foreign providers like Yale with a much larger demand-absorbing strategy by allowing private colleges to franchise foreign degrees aimed at local students. Countries like Botswana and Mauritius, with underdeveloped domestic higher education systems and low populations, have used transnational education to build up their positions as educational destinations for the surrounding regions.

Demonstration Effect

A third policy motive is to use transnational education to provide a demonstration effect for the domestic higher education. In other words, it is to use high-quality foreign universities to provide an example of the best practice to local institutions and to encourage the transfer of forms of education technology. These include curriculum design, pedagogy, quality assurance, use of English as a medium of instruction, and systems of academic governance. There is some evidence that the Chinese government is using transnational education to strengthen its domestic higher education system, by requiring foreign universities to work in close partnership with Chinese universities and cosharing the design and teaching of the curriculum.

BENEFITS FOR THE HOST HIGHER EDUCATION SECTOR

As discussed above, transnational education could potentially accelerate productivity growth in the domestic higher education sector through a variety of channels. For example, it helps by expanding the pool of qualified and experienced faculty and administrators; transferring education technology in the form of academic quality processes and regulations; strengthening the local higher education institutions that work with foreign universities; and connecting the local higher education sector to the wider global higher education market [17, 23–24].

As the sections above have outlined, the potential benefits of transnational education for domestic productivity growth depend on the type of transnational provision (e.g., IBC versus validation) and the motivation of the host government. To illustrate these differences, consider the following three country case studies:

Case Study 1: Malaysia

Until the 1990s, large numbers of Malaysian students went abroad for higher education. This was mainly because the domestic higher education system was underdeveloped, but the outflow was further fueled by a racial quota system (in place until 2002) that restricted the availability of domestic places to Malaysians of Chinese descent, and by the generous Majlis Amanah Rakyat (MARA) Overseas Scholarships for Bumiputera students [9].

Many local entrepreneurs saw the commercial opportunities in filling the gap between the domestic demand and supply, and in partnership with mainly the UK and Australian universities, set up franchised and validated operations, often on a so-called '1+2' or '2+1' basis. The Malaysian students studied the first one or two years of the degree in-country and then transferred to the overseas universities to complete their studies. After the 1997 Asian financial crisis, when the value of the Malaysian currency collapsed, many of these partnerships were transformed into '3+0' partnerships, with the entire program completed in Malaysia, in order to prevent this lucrative market from collapsing [12].

The Malaysian government recognized both the opportunity (if properly regulated) and risk (if uncontrolled) of this rapid growth of transnational education [36]. In 2007, the new Malaysian Qualifications Agency (MQA) established the Malaysian Qualifications Framework (MQF) and began to closely regulate transnational operations to ensure that

they evolved within a strict quality framework. This framework has allowed many private colleges offering franchised and validated foreign degrees to be upgraded to private university colleges with degree-awarding powers, and ultimately to full university status. Sunway University and Taylors University are two of the best known of these success stories. In recent years, the Malaysian government has set out its ambition to establish the country as an education hub, completing a remarkable transformation for its transnational providers from demand absorption to export-orientation [28, 30].

Case Study: Singapore

Despite the Global Schoolhouse project targeting elite universities to set up export-oriented operations in Singapore, the country has for at least two decades allowed a large numbers of private colleges to offer a franchised or validated degree from the Australian and UK universities [31–32]. As investment in public universities, including the launch of new universities like Singapore Management University, and polytechnics, drove up the quality of the domestic higher education system, the government became concerned that many of the transnational programs being offered by the private sector were of low quality [21].

In 2009, the Singapore government launched the Council of Private Education, which was charged with evaluating and regulating the quality of private transnational operations. In the last seven years, approximately two-thirds of the 2,000 or so transnational programs that existed in 2009 have now closed [22]. In contrast with Malaysia, where transnational education set the country on a path to a much stronger higher education system, it is arguable that in Singapore, quality improvements have been driven by the domestic institutions and the private transnational education has been of lower quality, with relatively few wider benefits for the country.

Case Study: People's Republic of China

People's Republic of China (PR China) has witnessed an extraordinary expansion in its public tertiary sector since 2000, with a three-fold increase in total enrollments [2]. This dramatic expansion in the number of domestic places has been coupled with a decline in the 18–22 year-old population, which began falling in 2011 as a result of the 'one child' policy [40]. Tertiary participation rates have risen rapidly to reach 30%, but there has been considerable policy concern about the quality of much of the new provision, with graduate employment rates emerging as a key policy issue [19]. At one point, the Chinese government made postgraduate study in public universities tuition-free to mop up the growing pool of unemployed graduates.

Given the scale of PR China's domestic higher education system, transnational education is so small that it has no appreciable impact on either absorbing demand or generating export revenue. However, the Chinese government is using Sino-foreign transnational joint ventures, which require local education partners, as a means of transferring technology from foreign providers to their local counterparts [7]. This is a new, but interesting development in the way that transnational education can influence productivity growth in the domestic higher education sector through a demonstration effect [29].

The Value to the Host Country

Table 3 summarizes the value of the transnational education, in terms of enhancing the productivity of the domestic higher education, by type and by role. The case studies suggest that when the transnational education provides a demand-absorbing role, i.e., targeted at local students, it can have a positive impact on the domestic sector. However, gaining these benefits requires that the host country has a strong quality assurance framework in place (as in Malaysia) to avoid the risk that profit-seeking private entrepreneurs with short-time horizons dominate the market (as in Singapore pre-2009). These benefits are likely to be systematically lower if the transnational education has an export-orientation, because the host government has a less direct interest in ensuring the quality of the transnational provision and so in integrating the transnational education providers into its domestic sector. Finally, IBCs can have a powerful demonstration effect if they are used systematically by higher education policymakers, but this effect is likely to be dissipated if the transnational education has a strong local component, as with a franchise or validation.

Table 3: The value of transnational education by type or role

	Distance learning	International branch campus	Franchise	Validation
Demand absorbing	Low	Medium	High	High
Export-oriented	Low	Low	Medium	Medium
Demonstration effect	Low	High	Medium	Medium

CONCLUSION

Higher education globally faces a serious productivity challenge, with universities tending to pass on higher costs to students and governments through higher fees, rather than systematically reengineering the way they educate to drive efficiency gains. This is particularly true in the world's leading universities, where despite the enormous advances in digital technology, universities still teach in the same lecture-tutorial and face-to-face formats they have used for decades.

The productivity challenge is particularly acute for Asia-Pacific, where economic growth and traditional 'demographic pyramids' in countries like Indonesia and Vietnam, due to the rising numbers of young people reaching university age each year, are increasing the demand for higher education. Unless the productivity challenge can be overcome, the region faces a stark choice between higher tertiary participation rates and lower academic quality.

This article has reviewed the phenomenon of transnational education, the educational equivalent of the globalization of business, and asked whether allowing foreign universities to set up some form of local presence provides a way of accelerating productivity growth in host countries. The answer appears to be that, under the right circumstances, transnational

education can play a positive role, but it requires that the host government has a clear objective for transnational education and that it can control not just the quality but also its integration into the wider domestic higher education landscape.

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PRODUCTIVITY, QUALITY AND PERFORMANCE EXCELLENCE

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INTRODUCTION

Recently, globalization has increasingly brought countries closer together, and it has become quite common to hear about the influence of globalization on numerous aspects of our lives, such as economics, politics, business, and education. Globalization now impacts higher education throughout the world, with the resultant competition forcing universities everywhere to adapt to the present-day knowledge-based societies. The transfer of knowledge and human resources within such societies is synonymous with internationalization, and universities worldwide now need to upgrade their excellence in both research and teaching within a global context.

In order to be acknowledged as world-class institutions, it is important that individual universities undertake innovations, and endeavor to raise productivity. In such an environment, competition has become a central concern in so far it is closely associated with the economy and productivity. Such competitive forces have resulted in a globalized competition that is currently reshaping higher education, framed in many respects by international 'ranking' regimes.

In this sense, the globalization movement in recent years has greatly affected higher education policies worldwide and the higher education institutions (HEIs) in particular. To be a world-class university in research, investment in science, technology, engineering, and maths (STEM) fields is observed worldwide. Quality assurance is essential for HEIs, and student learning outcomes become one of the key conceptual policies for universities across the world. Thus, demonstration of learning outcomes as an end goal of university education has been strongly emphasized in higher education policies as well as demanded by the society in general worldwide.

HEIs have held countless discussions on the measures that should be taken to help students to achieve the necessary learning outcomes and what needs to be done to realize quality assurance. There is increasing understanding that, in order to advance educational improvement, it would be highly useful to conduct better assessments of the current state of students. These assessments could be based on objective data pertaining to the students' learning behaviors and daily behaviors during the high school as well as their academic progress and personal growth in the context of the university life. Simultaneously, as the Assessment of Higher Education Learning Outcomes (AHELO) project has shown, the study of learning outcomes in comparative perspective is recognized as an important challenge.

Recent trends in Japan are that all HEIs are concerned with the outcome of undergraduate education and quality. They regard the quality of undergraduate education to be associated with outcomes and increasing labor productivity; and while research output and productivity

are limited to certain HEIs, the quality and outcome of undergraduate education are expected of all HEIs.

The challenges of research and practices on university education include diversified issues, such as the ones represented by faculty development, assessment, curriculum, and effective pedagogies. All of these are expected to improve the Japanese university education.

The purpose of this research is to integrate or link direct and indirect assessments for core subjects, taking into consideration the results of previous studies; and to show the benchmarking results of self-reported student surveys conducted in Japan, Republic of Korea (ROK) and the USA as examples of measuring the quality of undergraduate education. In this paper, the process of integration of two types of assessments and the benchmarking results of self-reported student surveys in three countries will be shown.

Direct versus Indirect Assessments

Banta [2] proposes that methods for assessing learning outcomes can be divided into direct assessment methods such as subject tests, reports, projects, graduation exams, graduation research, graduation theses, or standardized tests; and indirect assessment methods such as surveys to evaluate students' learning behaviors and daily behaviors, perceptions, and satisfactions with their universities' academic programs. The various assessment methods used by instructors to certify credits, including end-of-term exams, evaluations of reports, projects, portfolios, graduation research, and graduation theses, along with graduation exams conducted by the universities, also fall under these categories.

The question of whether or not direct measures of students' learning outcomes are correlated with indirect measures, i.e., whether or not students showing high learning outcomes based on direct measures also have higher assessments based on indirect measures, is one of the main points of discussion of this paper. Earlier, this question has been addressed not only in terms of 'direct measures versus indirect measures' but also in terms of 'tests versus surveys,' 'objective measures versus subjective measures,' and 'tested knowledge versus self-reported knowledge.'

Direct assessments directly measure students' learning outcomes and are thus well-suited as assessment methods. However, direct assessments are limited in terms of understanding students' learning processes and behaviors. This is because these assessments are based on test results, which may reflect the students' learning outcomes to a certain degree if we assume that the students spend sufficient time studying, preparing, and reviewing the material. However, these results, especially in the case of standardized tests, may be inflated by students' use of exam-prep materials, which is quite common. In the latter case, there is only a weak relation between students' learning outcomes in terms of test results and the learning process.

This is where indirect assessments can be used to measure other aspects of the learning process, including students' learning behaviors, daily behaviors, self-perception, and satisfaction with their university's academic programs, that cannot be assessed using direct

measures. One of the most common forms of indirect assessment is the self-reported student survey. Pascarella & Terenzini [4] argue that the results of direct assessments and those of students' self-evaluations or indirect assessments are consistent. There is a growing number of studies demonstrating the effectiveness of indirect assessments. Anaya [1] showed that students' self-evaluations of their own developments are consistent with direct assessments in the forms of grade point average (GPA) and Graduate Record Examination (GRE) scores.

In the USA, for example, as a matter of fact, the majority of universities that have introduced standardized tests such as the newly-developed Collegiate Learning Assessment (CLA) for evaluating outcomes of undergraduate education, also use student surveys such as the National Scholar Search Examination (NSSE) and Cooperative Institutional Research Program (CIRP) while positioning these as ways to assess the educational process. In other words, presently in the USA, there is a consensus that student surveys should be used in combination with direct assessments rather than as standalone measures [3].

Integrating Direct and Indirect Assessments

The goal of this research is to integrate or link direct and indirect assessments for core subjects, taking into consideration the results of previous studies (Figure 1).

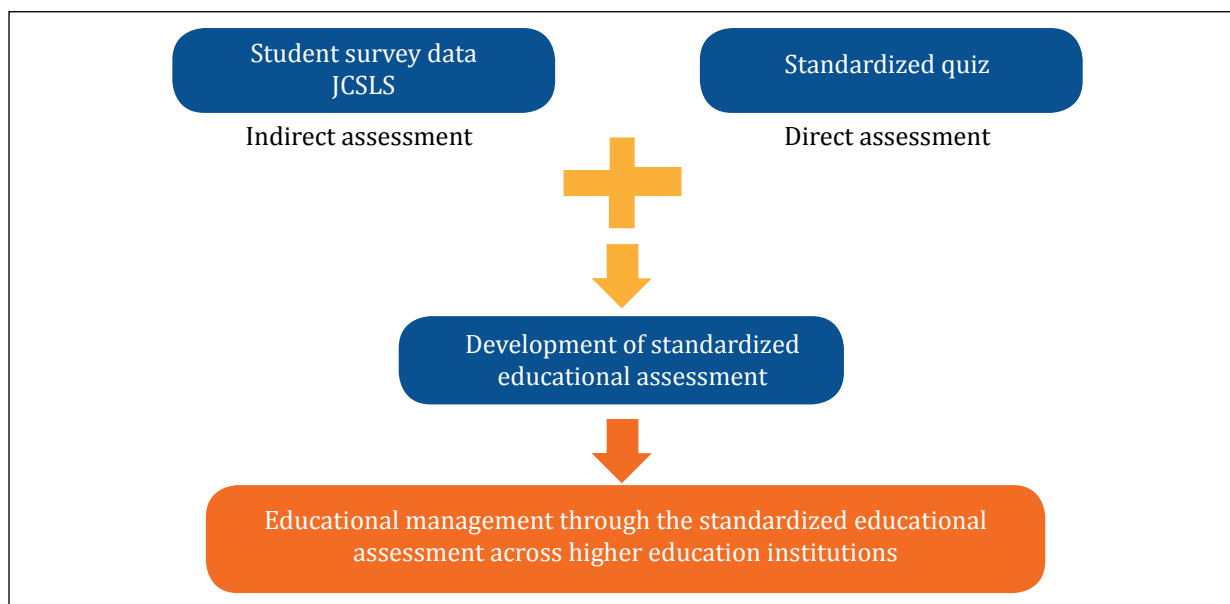


Figure 1. Integration model of direct and indirect assessments

According to a previous research in the USA, we found that while numerous standardized tests to measure the learning outcomes of general education (core subjects) were conducted as direct assessments, standardized student self-evaluations such as the NSSE and the CIRP were being used as indirect assessments. In recent years, a growing number of HEIs have introduced the Valid Assessment of Learning in Undergraduate Education (VALUE) rubric developed by the Association of American Colleges & Universities (AAC&U). That said, even in the USA, few studies have attempted to measure learning outcomes using the NSSE or CIRP in conjunction with the VALUE rubric¹.

¹ It refers to the keynote speech of Dr. Caryn Musil of AAC&U at the 2013 Research Project Conference of Japan Association of College and University Education.

In Japan too, there has been little research related to the development of standardized tests to assess the learning outcomes of general education, and little progress has been made in the development of such tests. It is in this context that we have endeavored to develop an objective test combined with student self-evaluations to assess learning outcomes for the Japanese general education. The first step entailed identifying the nature of learning outcomes for general education. Toward this end, we collected paper-based questionnaires focused on learning outcomes used in Japan and abroad, and formulated our own questionnaire with question items related to relevant outcomes, which we tested in a pilot study at one university. The second step involved the development of a short objective test with the goal of combining the test with the above-mentioned questionnaire to develop a method for assessing learning outcomes that integrated both direct and indirect assessments.

We endeavored to develop rubric-type questions, to refine the ability of the questionnaire to measure students' levels of skills acquisitions, and quiz-type questions, to directly test their skills. Specifically, we used concrete numbers and terminologies in questions for indirect assessment; and developed a measure for making explicit the relationship between the data from the short, objective quiz-type questions for direct assessment and indicators from the questions for indirect assessment contained in the same questionnaire. The result of these efforts was the Japanese College Student Learning Survey (JCSLS) 2015. The questionnaire for indirect assessment comprised 101 questions across 14 categories, along with five questions regarding the respondents' attributes. Examples of the categories included students' self-evaluations regarding learning outcomes, learning behaviors including the time spent studying, and rubric-type questions to be linked with the results of the quiz-type questions.

The short objective test for direct measures comprised 12 questions, consisting of six questions in English, of which five questions were to assess reading comprehension while one question was to assess the knowledge of current affairs. Three questions in Japanese were to assess the students' ability of logical thinking and reading comprehension; and three math and science questions, also to assess the students' ability to think logically.

The indirect measures included in the student survey consisted of questions regarding the students' self-evaluations; for example, of their writing ability, the ability to speak persuasively, analytical thinking skills, mathematical reasoning skills, and cooperativeness; using four response options, namely 'extremely confident,' 'very confident,' 'not very confident,' and 'not at all confident.'

OVERVIEW OF SURVEY RESULTS

The JCSLS 2015 was handed out and filled in by students in university classes at five universities between April and July of 2015. There was a total of 533 respondents from the five universities. Of the respondents, 320 (60%) were male, 197 (37%) were female, and 16 (3%) did not provide a gender; 203 (38.1%) were first-year students, 208 (39.0%) were second-year students, 68 (12.8%) were third-year students, 42 (7.9%) were fourth-year students, seven (1.3%) were fifth- or higher-year students, five (1%) did not provide their years; and 7 (1.3%) were international students.

The percentages of correct responses, to the five quiz-type questions in English to assess reading comprehension and the one question to assess knowledge of current affairs, were as follows: 41.5%, 21.6%, 44.1%, 52.5%, and 49.2%, for the reading comprehension questions, q20-1-1, q20-1-2, q20-1-3, q20-1-4, and q20-1-5, respectively; and 36.0% for the current affairs question q20-2.

The percentages of correct responses, to math and science questions designed to assess logical thinking (q21-1, q21-2, and q21-3; and q21-4 and q21-5) and the ones to assess the math and science ability that was assumed to have been acquired in high school (q21-6), were as follows: 55%, 57.8%, and 48.6%, for q21-1, q21-2, and q21-6, respectively. For the questions designed to assess logical thinking and reading comprehension in Japanese, the percentages of correct responses were: 81.2%, 74.3%, and 76.7%, for questions q21-3, q21-4, and q21-5, respectively. Overall, the percentages of correct responses were found to be higher for questions designed to assess logical thinking and reading comprehension in Japanese than questions used to assess reading comprehension and knowledge of current affairs in English or the ones used to assess the math and science ability.

ANALYSIS OF SURVEY RESULTS

The questionnaire included rubric-type questions modeled after the Common European Framework of Reference Languages to measure the students' self-evaluations of their English language ability and skills at the time of the survey. The students' self-evaluations regarding English are shown in Figure 3. The questions represent sequentially higher levels of English competence, with q13-1 representing the lowest level (level 1) of competence and q13-6 representing the highest (level 6). The results indicated that the lower the competence level, the higher was the percentage of students responding with 'extremely confident' and the higher the competence level, the higher was the percentages of students responding with 'not at all confident.'

A concrete example of the relationship, between students' self-evaluations of confidence with respect to different levels of English competence and the number of correct responses on the English quiz-type questions, is shown for level 2 English competence (Figure 3). A general trend can be seen whereby students who responded with 'not at all confident' had fewer correct responses and those who responded with 'extremely confident' had greater number of correct response. Similar trends were observed for different levels of English competence, which suggested that there existed a broad trend in which the higher a student's confidence in his or her English ability, the higher the number of correct responses would be to the quiz.

Looking at the cross-correlation of students' self-evaluations for level 4 English competence regarding the 'ability to read articles and reports on current affairs in the news and other media' and the results of the q20-2 on the quiz regarding current affairs, the percentages of correct responses for students who answered that they were 'not at all confident,' 'not confident,' 'confident,' and 'extremely confident; were 27.8%, 36.6%, 42%, and 38.1%, respectively, with a correlation coefficient of 0.164 ($P < 0.01$ level). We can thus conclude that students' confidence in English ability was correlated to a certain degree with the number of their correct answers to questions in English.

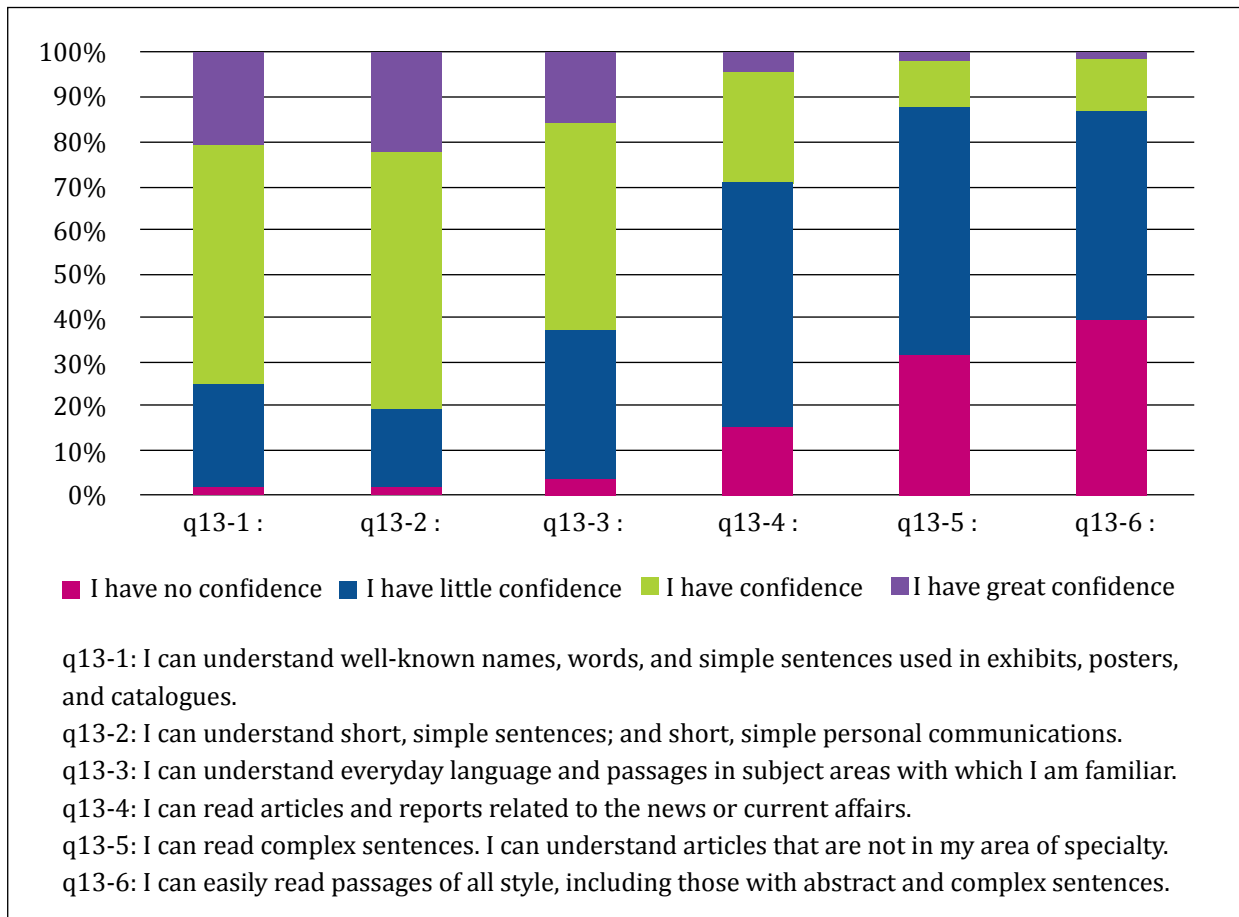


Figure 2. Students' confidence levels in English ability

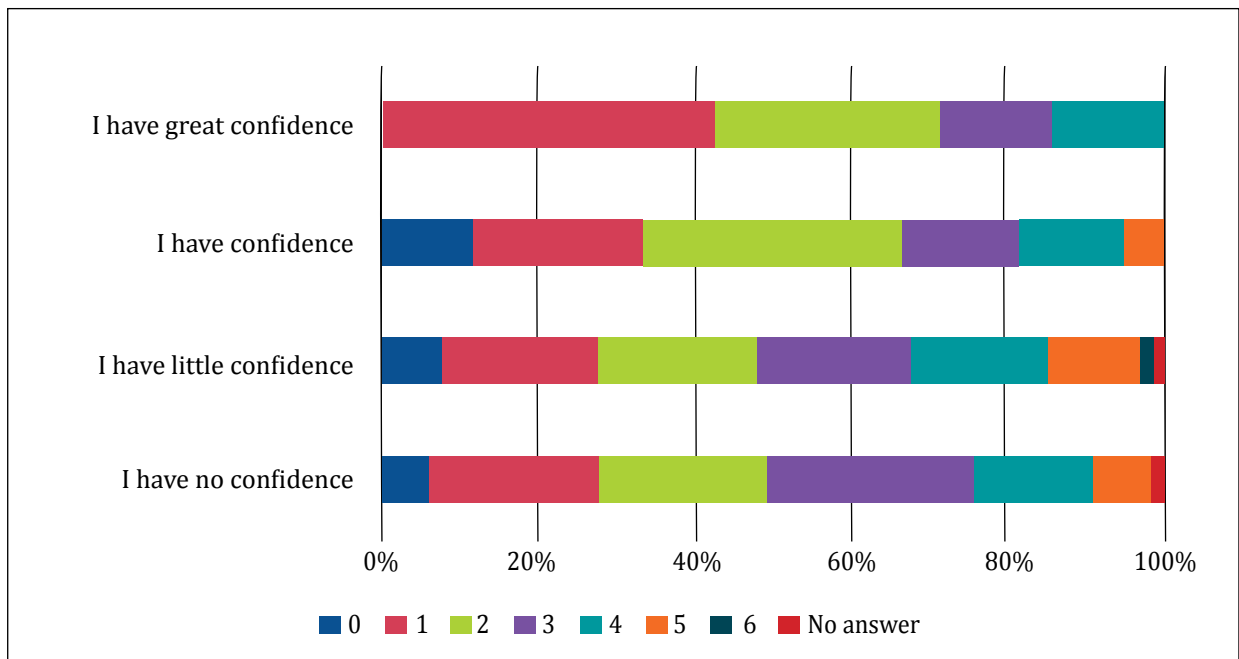


Figure 3. Students' confidence levels in English ability and percentages of correct responses

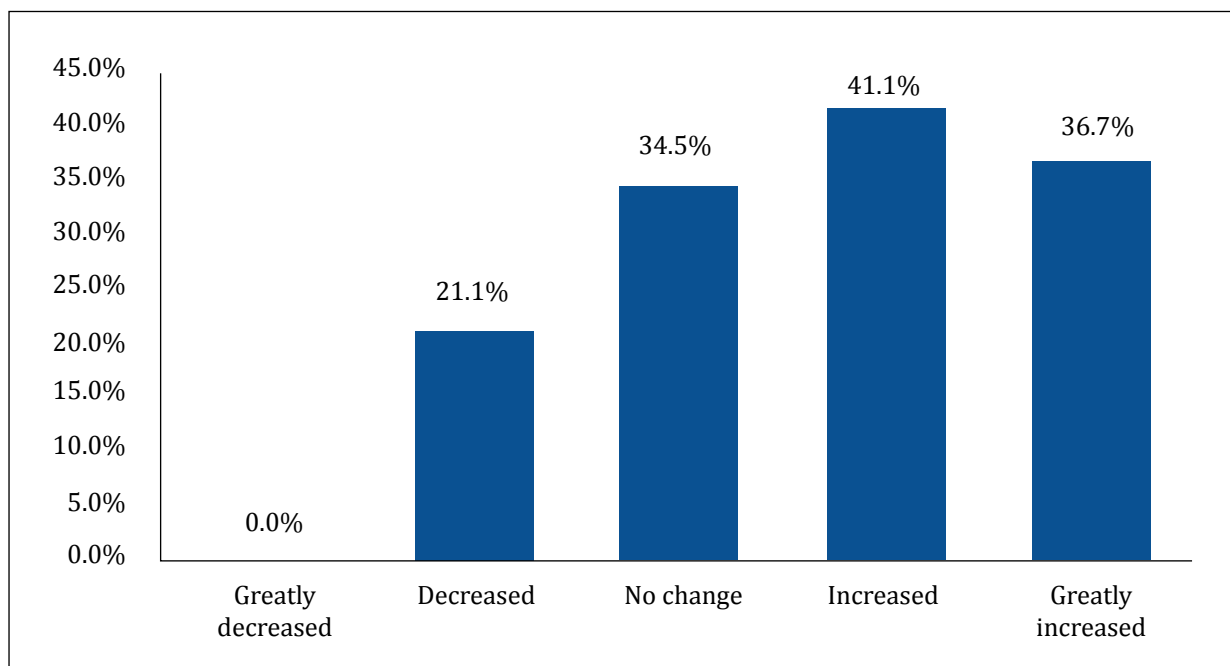


Figure 4. Relationship between students' self-evaluation and percentage of correct answers on the current affairs question in English

Further, as can be seen in Figure 4, the higher the students' self-evaluation regarding improved understanding of global issues after entering university, the greater the number of correct answers given on the current affairs question.

It should be noted that the percentage of correct answers declined slightly for students who responded that their understanding of global issues 'improved substantially.' That said, the results of this analysis demonstrate that subjective evaluations offer a certain degree of reliability and can be used as assessment measures of learning outcomes.

Our analysis of the results of the questionnaire survey, combining the direct and indirect assessments, developed by our team yielded the following three insights:

1. Students' confidence level in their English ability was correlated to a certain degree with the number of correct answers to the English questions in the objective test.
2. Students' perceptions of their ability or inability were largely accurate.
3. The students' number of hours spent studying either inside the class or outside was not correlated with the results of the general-content short objective test.

The results of the survey are meaningful in that they provide evidence to counter criticisms regarding the significance of indirect assessments.

Benchmarking Research between Japan, ROK and USA

It is also important to do the comparative international study to understand the strengths and weaknesses of each country in order to improve the quality assurance and raise the productivity of higher education. Thus, in this section, the results of benchmarking of self-reported student surveys conducted in three countries (Figure 5) will be shown.

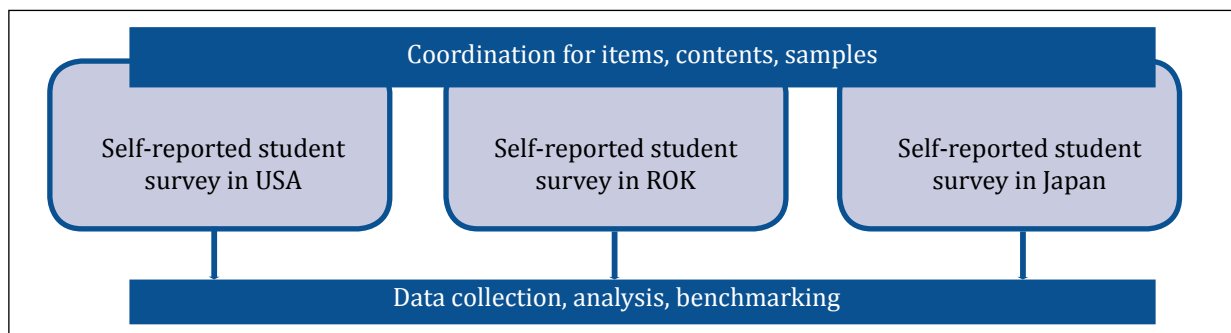


Figure 5. Model of benchmarking in three countries

This study uses a quantitative research design using data obtained from JCSS 2012, KCSS 2012, and CSS 2012, which were all designed for both upper-division and lower-division students. The research framework, based on five research questions, is designed to examine the relationship between the learning environments and the learning outcomes among academic majors.

KCSS 2012 consists of a stratified random sample of junior and senior students attending four-year university degrees in the ROK. The final sample included 6,666 students at 51 institutions (3,036 male students and 3,630 female students), but we are using the 4,902 samples at the private four-year colleges and universities.

JCSS 2012 consists of a sample of junior and senior students attending four-year university degrees in Japan. The total number of respondents is 8,300 from 81 institutions and here we use 2,921 samples from 17 private universities.

The USA sample consists of 9,135 senior students at 86 private four-year universities. There are limitations in the data. Since the survey is conducted using self-reporting, the USA samples account for a large portion of the data. While the USA private institutions are not representative of massification, as is shown in the proportion of private institutions in the overall number of HEIs, private institutions in both Japan and the ROK do represent massification.

The items of the questionnaire used for this study consisted of self-reported answers on hours spent on activities, students' engagement in classes, their experiences, their engagement with faculty, self-reported learning outcomes, self-reported overall satisfaction, college GPA, and undergraduate major.

FINDINGS OF THE STUDY

In order to determine the dependent variable for learning outcomes, we conducted a factor analysis. Factor 1 was termed as the 'basic qualities required for the 21st century' and factor 2 was termed as the 'basic knowledge required for the 21st century.' The reliability of the alpha scale is 0.78 for factor 1 and 0.82 for factor 2.

In order to obtain an idea of the prevalent student types across the three countries, and to get a pattern of activities and self-reported learning outcomes by student types, we compared

different patterns of activities by student types across the three countries. Concretely, after integrating the data for the three countries, we conducted a cluster analysis based on the number of hours that students spent on activities in a week.

We obtained five types of students through the cluster analysis based on the hours students spent on socialization; the hours they spent on learning in and out of the class; and the hours they spent working on and off the campus. The results are shown in Figure 6.

These types show the following characteristics.

- **Type 1:** Active in socialization, and relatively less active in learning in and out of the class and in working on and off the campus.
- **Type 2:** Less active in working on and off the campus.
- **Type 3:** Busy with working on and off the campus, and less active socializing and learning.
- **Type 4:** Spends a well-balanced amount of time in studying, socializing, and working.
- **Type 5:** Very active in learning, but less active in socializing.

As a result of the analysis, 1,999 students belonged to type 1; 3,047 belonged to type 2; 3,367 belonged to type 3; 4,424 belonged to type 4; and 3,899 belonged to type 5.

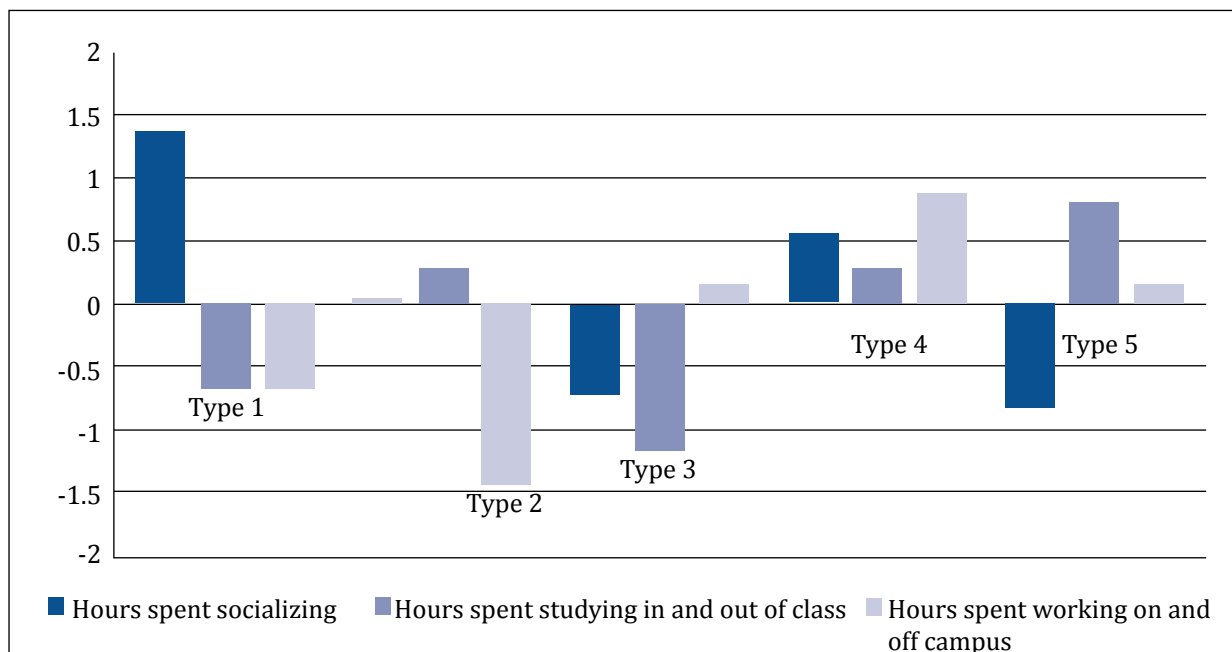


Figure 6. Cluster analysis by types of students

Figure 7 shows the proportion for each student type across the three countries. When we focus on the type 4 students, who spend a well-balanced amount of time on study, socialization, and work, the results show that while 44.5% of the USA students belong to type 4, only 10.4% of the ROK students and 2.1% of the Japanese students belong to type 4. However, there is not so much difference in the percentages of type 1 students across the three countries. Also, compared to the USA and ROK students, there are more type 2 students in Japan.

Compared to the USA students, the ROK and Japanese students are relatively busy with work on and off the campus. Also, compared to the USA and Japanese students, the ROK students are relatively busy with their studies and are less active when it comes to socializing.

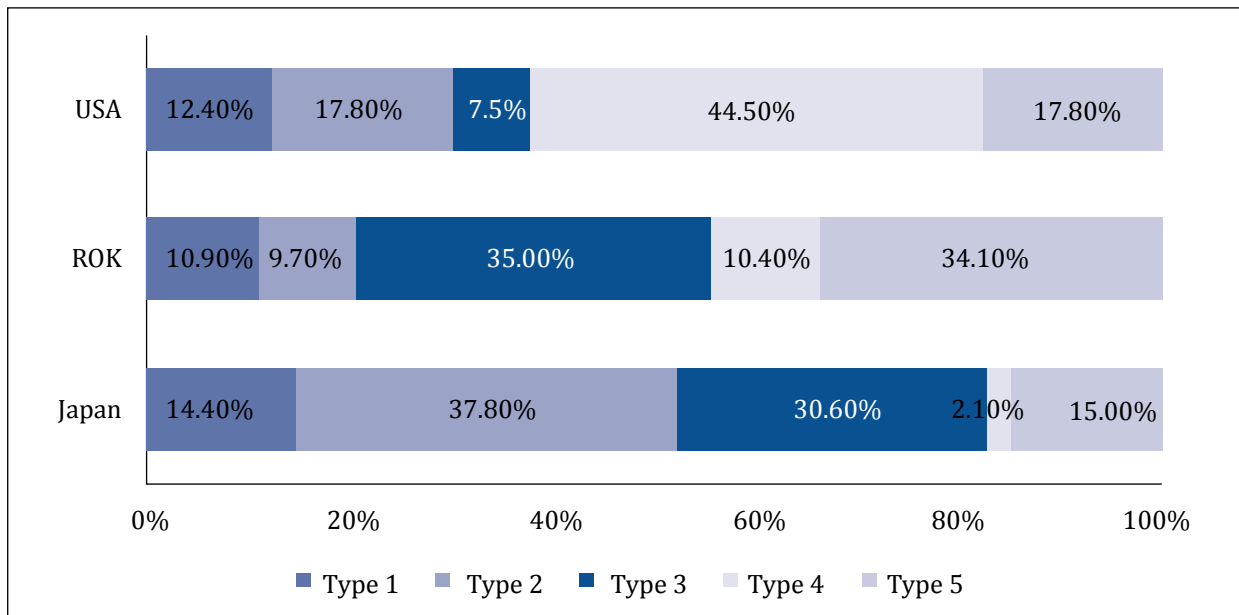


Figure 7. Proportion of student types for USA, ROK and Japan

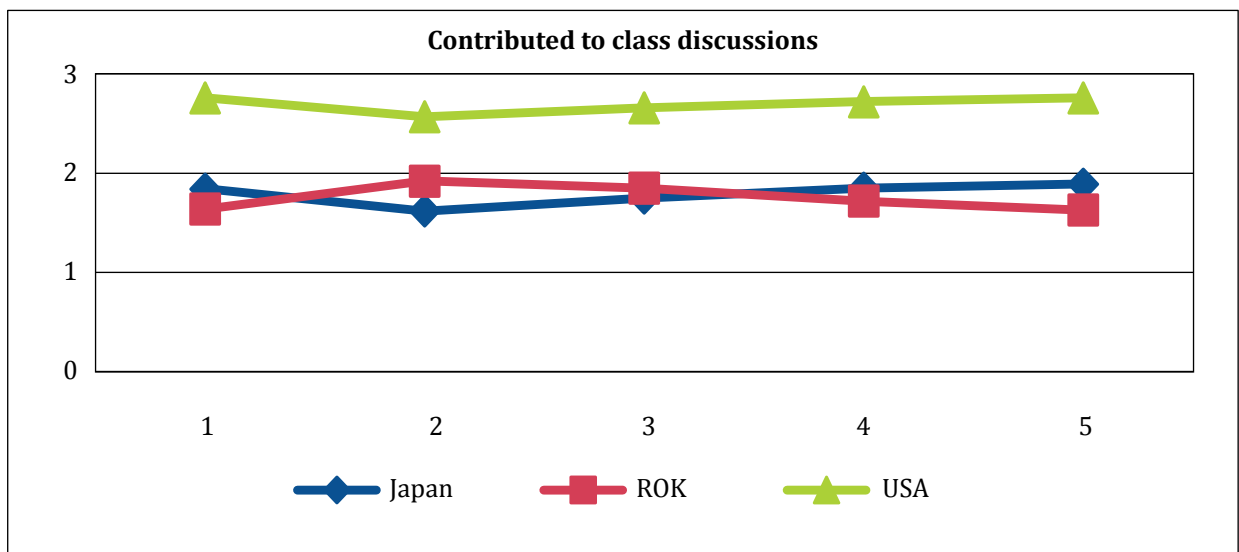


Figure 8. Comparison of class experience for the three countries

Regarding the experience of contributions to class discussions, the self-evaluations of all types of the USA students are the highest. Japanese and ROK students have relatively fewer experiences compared to the USA students. Japanese students' self-evaluations for this experience are higher than those of the ROK students, except when it comes to type 2 ROK students.

The findings suggest that type 4 students achieve more learning outcomes in all the countries. An institutional climate such as a faculty's emotional and academic support moderates the relationship between student engagement and learning outcomes in each

country. While there are more well-balanced students in the USA from the perspective of spending time on activities, Japanese students are less active in work on and off the campus and the ROK students are very active in learning and less active in socializing.

The pattern of some student experiences by student types is similar for the USA and Japan, but the ROK is different. Concretely, both type 2 students in the USA and Japan are less active in collaborative work in the class and in a discussion, but type 2 ROK students are more active in these areas. Although private universities play different roles in the three countries, we find that HEIs share the common goal of creating an environment that leads to student development through well-balanced activities. To do so, faculty and student interaction is supposed to be active and meaningful.

CONCLUSION

As evidenced by Porter's skepticism regarding the efficacy of indirect assessments [5], there is substantial debate regarding the reliability and validity of indirect assessments. Similarly, in Japan, skepticism is frequently expressed regarding the validity of students' subjective self-evaluations. That said, in this research, we observed a certain degree of correlation between indirect and direct assessments, i.e., between students' self-evaluations regarding their acquisition of knowledge and skills and the objective measures of learning outcomes. In this sense, our results are in line with those of Pascarella & Terenzini [4], who argue that the results of students' self-evaluations regarding their own learning outcomes, which constitute indirect assessments, are consistent with the results of direct assessments. Student perspective is important to assess the quality of undergraduate teaching and learning.

Simultaneously, cross-national benchmarking is also important for conducting a SWOT analysis of the quality of the home country and for improving the quality assurance and raising the productivity of HEIs of the home country.

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CONCEPTS AND APPROACHES TO MEASURING PRODUCTIVITY IN HIGHER EDUCATION

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INTRODUCTION

“In higher education, productivity improvement is seen as the most promising strategy for containing costs and the continuing effort to expand access and affordability while keeping the quality of higher education... at world-class levels.” [4]

Productivity has many faces. For example, professors have told me, “I’ve been very productive when I’ve changed the life of a single student; that’s what counts for me.” Popular measures include: degrees and graduation rates, time to degree, cost per creditor degree, and student faculty ratios [4]. However, none of these truly captures what economists view as ‘productivity,’ which is the topic of this chapter. This is based on my presentation at the conference on Raising Productivity in Higher Education, organized by the Asian Productivity Organization (APO) and the Ministry of Manpower and Transmigration, Government of Indonesia. The conference was held in Jakarta, Indonesia on 29 August 2016.

Productivity is an engineering concept, not a financial one: it is the ratio of outputs to inputs, measured as physical quantities or surrogates for physical quantities. This definition applies to services like higher education as well as to products. Productivity measurement is straightforward when quality is constant and only one output and one input are being considered. One simply divides the output quantity by input quantity to get, for example, output per man-hour, or, in higher education, student credit hours (SCH) per faculty full-time equivalent (FFTE).

Things get more complicated when multiple outputs are considered. What is necessary is to combine the outputs into a single variable using some sort of weighting procedure. The same is true for multiple inputs. The challenge is to choose the right procedure (usually a weighted arithmetic or geometric average) and weighting variables (usually market prices). Adjustment for quality also poses a significant challenge. Much work goes into finding adjustments that are appropriate for the particular product or service being considered.

Universities produce multiple outputs and use multiple factors of production. Thus, one should lean toward a multifactor productivity measure. The problems of developing such a measure in the higher education space include:

- The choice of appropriate output variables for teaching, research, and public service is not necessarily clear. Many of the outputs are either heavily subsidized, not costed separately, or not priced in competitive markets, which makes it hard to find appropriate weights.
- Detailed measures of inputs are hard to find because university accounting systems don’t track how faculty time and other resources are used, which makes it hard to relate outputs to the inputs used to produce them.

- The quality of inputs and outputs varies enormously over time, across institutions, and among fields. Adjustment for these variations is not possible, which makes the interpretation of productivity metrics exceedingly difficult.

Yet, the difficulties should not deter us from doing the best we can to measure multifactor productivity in universities, provided we are appropriately cautious. “You can’t improve something if you can’t measure it.” Without measurement, the effects of process changes cannot be evaluated. It turns out that progress on measurement is being made, and that efforts to improve processes are helping to improve the measurements themselves and vice versa. I will focus on the measurement of teaching productivity. Research and public service productivity are very important, but they remain topics for future research.

Most of the so-called productivity measures in current use are highly ambiguous. For example, the aforementioned student credit hours per faculty FTE ratio can easily be misinterpreted. Figure 1 shows how deviations of this ratio from its benchmark or past levels are likely to send misleading signals to decision-makers and drive changes in the wrong directions. For example, I once visited an English department where the ratio had been climbing steadily, to the delight of the central administration. What I found was that a series of budget cuts had forced the department to boost class sizes, increase the use of part-time sessional staff, and simplify the curriculum (e.g., by eliminating most of the writing assignments) to reduce the cost of grading. This represented quality diminution rather than productivity improvement, but one would never know that from the SCH/FFTE statistic.

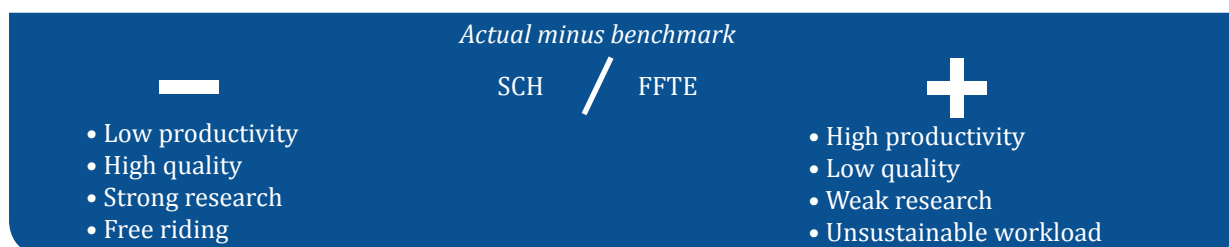


Figure 1: Student credit courses per faculty FTE

Use of such measures alienates professors, who are right to mistrust the oversimplified and dangerous premises on which such measures are based. Yet, professors, with their deep disciplinary knowledge and hands-on experience in teaching, are in the best position to effect change. Introducing the productivity idea in such a simplistic way virtually guarantees that academics will resist productivity improvement efforts. The integrity of the productivity concept within universities depends on the use of realistic concepts that professors can relate to in a meaningful way. Fortunately, the needed concepts, and metrics related to them, can now be made available within universities.

Two lines of research are producing useful results. A good ‘macro’ metric, based on aggregate data, is now available for higher education researchers to track the quantitative relation between teaching inputs and outputs for the sector and the major segments within it. At the other end of the spectrum, a ‘micro’ metric, based on course-and field-level data, has recently become available. It allows individual schools to analyze, and improve, their teaching productivity, while at the same time gaining insight about quality changes. I will first describe recent progress in the macro domain and then move on to the micro domain.

MEASUREMENT USING AGGREGATE DATA

Recognizing the implications of higher education productivity for public policy, the USA National Academy of Science's National Research Council (NRC) convened an expert panel on the subject. Its report, published in 2013, contains an extensive discussion of productivity measurement in colleges and universities [8]. The panel focused on teaching productivity, i.e., the 'business of the business' for most schools. Work on research productivity was deemed to be of lower priority because, despite its importance, most schools spend less on research than on teaching, and also because principal investigators are driven by competition for grants and publications to be as efficient as possible in their use of funds. However, building a research productivity component into the NRC productivity index should be a high priority for the future.

The panel's recommended macro teaching productivity index is:

- Calculable from the USA Integrated Postsecondary Education Data System (IPEDS) or a similar publicly available database.
- Intended for use in the higher education sector as a whole or for large groupings of institutions within it. (The index can be calculated for individual schools but the panel strongly recommended against such usage.)

The NRC Productivity Index makes optimal use of the available data but does not offer a control for quality. While by no means perfect, the index mitigates several difficulties associated with previous measurement tools. It has been applied to all colleges and universities in the USA, as will be described below.

The input data for the NRC Productivity Index is as follows [7–8]:

- **Labor:** FTE employees, both academic and nonacademic.
- **Intermediate inputs:** Inflation-adjusted expenditures on purchased items, which is the best surrogate available for the physical quantities.
- **Capital:** Opportunity cost (rental value of capital), approximated by inflation-adjusted book value times the estimated national rate of return on capital.
- **Nominal expenditures:** Uninflated dollar figures for the three variables are used as weights in the calculations.

IPEDS reports these variables on a university-wide basis, but only the portions related to teaching are relevant to the productivity index. Hence the raw data is allocated among teaching, research, and service, according to the widely-used methodology of the American Institute of Research's Delta Cost Project [2].

The index uses two outputs, which are connected by a structurally defined weight:

- **Credit hours:** Number of student enrollments and courses, weighted by the number of hours the course meets each week.
- **Completions:** Number of degrees, certificates, etc. that are awarded.
- **Sheepskin effect:** The 'market value added' by the academic award as opposed to the credits alone is the weight used for combining credit hours and completions into a single output variable. For undergraduate degrees, it is approximated by the credit hours obtained by one year of study.

It is worth noting that the sheepskin effect is informed by empirical studies of labor markets. In the USA, it is possible to compare the starting salaries of graduates with those who have earned almost enough credits for the degree but in the end did not complete it. That difference approximately equals the salary increment associated with one year worth of college achievement. The panel judged that using the labor market data in this way would produce a better output measure than either credit hours or degrees alone, or an average of the two based on an ad hoc weighting.

The NRC Multifactor Productivity Index measures the change in productivity between time periods (which need not be consecutive), as defined in the text box. In this instance,

Y equals adjusted credit hours (ACH), and X equals a combination of labor, intermediates, and capital, all of which were defined

$\text{Productivity} = \frac{Y}{X}, \text{ where } Y \text{ is output and } X \text{ is input}$ $\text{Productivity Change (periods } s \text{ to } t) = \frac{Y_t/X_t}{Y_s/X_s} = \frac{Y_t/Y_s}{X_t/X_s}$

above. The panel recommended using Törnqvist Aggregation to combine the three inputs into a single index, i.e., by calculating the weighted geometric average of the input growth ratios, with averages of their respective nominal expenditures for periods ‘s’ and ‘t’ serving as weights. This method is the one used by the U.S. Bureau of Labor Statistics (BLS) and the OECD.

Table 1 presents a sample calculation. The first row for output variable, shows the Adjusted Credit Hours for the years s and t, together with the ratio of the two (1.044). There is only one (composite) output variable, so the output index simply equals the year-to-year ratio. The next three rows for input variables show the labor FTEs, deflated dollars spent on intermediate inputs, and the rental value of capital for the two years, plus their respective ratios. This is followed by the input weights (constant-dollar expenditures) for the two years plus columns for the averages for the two years, and the percentage distribution of the averages. The input index, in the last column of the last sub-table, equals the geometric average of the quantity ratios using the percentage distribution of the average expenditures as weights. Finally, the index of productivity change equals the ratio of the output and input indices, as shown at the bottom of the table.

The panel lacked the resources to calculate the index for more than a few test cases, but consultant Sandra Archer did that later with support from the Lumina Foundation. Table 2 shows newly obtained results for the 2,175 two- and four-year USA colleges and universities applying that reported usable data for 2006, 2008, 2010, and 2012 [3]. Each year’s productivity calculation is based on data for two calendar years, which need not be consecutive. Values less than one indicate that the percentage change in outputs is less than the weighted average percentage change in inputs. By this measure, it appears that productivity may have declined in all but one of the USA higher education sectors between 2006 and 2008, and again between 2010 and 2012; and for half of the sectors between 2008 and 2010. (The sectors are based on the U.S. Carnegie classification system.) One must be cautious in stating this conclusion, however, as factors other than a change in productivity as herein defined may be responsible for the results. I will unpack this question later, after proper groundwork has been laid in the next section.

Table 1: Sample calculation for the NRC Productivity Index

Output variable	Year <i>s</i>	Year <i>t</i>	Ratio (Y_t/Y_s)	Output Index	
Adjusted credit hours (000)	427.2	446.1	1.044	1.044	
Input variable (quantities)	Year <i>s</i>	Year <i>t</i>	Ratio (X_t/X_s)		
Labor FTEs	1,736	1,821	1.049		
Intermediates (\$000)	37,041	40,178	1.085		
Capital (\$000)	41,912	48,201	1.150		
Input weight (expense)	Year <i>s</i>	Year <i>t</i>	Avg. (X_t, X_s)	Relative weight	Input index
Labor (\$000)	116,122	134,122	125,122	55.7%	1.079
Intermediates (\$000)	43,053	51,560	47,306	21.0%	
Capital (\$000)	48,040	56,694	52,367	22.2%	
Productivity Index = 1.044/1.079= 0.968					

Table 2: NRC Index results for USA, by institutional sector

Sector*	Number of institutions	Productivity Change Index			Change in the Index	
		2006-08	2008- 10	2010-12	2006-08 to 2008-10	2008-10 to 2010-12
Public Research	158	0.967	0.987	0.975	2.1%	-1.3%
Public Masters	232	0.962	0.963	0.976	0.1%	1.4%
Public Bachelors	76	0.959	1.007	0.977	5.1%	-3.0%
Public Associates	788	0.989	1.016	0.956	2.7%	-5.9%
Private Nonprofit Research	100	0.935	1.034	0.937	10.6%	-9.4%
Private Nonprofit Masters	326	0.982	0.987	0.956	0.4%	-3.1%
Private Nonprofit Bachelors	450	0.984	0.997	0.979	1.3%	-1.8%
Private Nonprofit Associates	45	1.052	1.003	1.100	-4.7%	9.7%
All Sectors	2,175	0.968	1.016	0.966	5.0%	-4.9%

* 2010 Carnegie Class

< 1

> 1

Increase

Decrease

The advantages of the NRC Productivity Index can be summed up as follows:

1. It is a multifactor productivity index that takes account of all the important outputs and inputs for teaching.
2. It does not depend on output prices. The two output variables are combined using a theoretically justified and empirically estimated weight.
3. It takes account of part-time students, entered appropriately into the credit hour calculations.

4. It takes account of non-completions, which enter appropriately into the completions (degrees awarded) calculations.
5. It allows differentiation of labor categories. While not shown in the example, it is possible to separate the FTEs for, say, academic, other teaching, and other staff.
6. It dampens the effect of changes in field mix (important because some fields are inherently more expensive than others). Use of percentage changes rather than the variables themselves somewhat reduces the sensitivity to such changes.
7. It is firmly rooted in economic theory. The basic structure of the index and the Törnqvist aggregation technique have been shown to exploit the information contained in the dataset to the greatest extent possible.

Like all possible indices that can be calculated from today's publicly available datasets, however, the NRC Index does not offer control for quality. The panel considered this problem carefully, based on a review of the literature and testimony by researchers in the field. It reached two conclusions. First, there is at present no way to adjust the output variables for quality and none is likely to emerge in the foreseeable future. Second, it would be a mistake to ignore the information contained in the available quantity data, even though it cannot be adjusted for quality variation.

The panel offered the following two pieces of advice on how to mitigate the effects of not adjusting for quality:

- The productivity index should be used only at the macro, segment, and similar aggregate levels. It should not be used to hold individual institutions or small groups of institutions accountable for productivity improvement because, doing so would invite a 'race to the bottom' in terms of quality.
- Higher education systems should maintain robust quality assurance regimens to detect significant changes in quality that might result from efforts to improve productivity as measured by the index. Among other things, this puts institutions on notice that, despite the need to control the resources used to produce credit hours and degrees, this should not be done at the expense of educational quality.

The panel hoped that its proposed index, or something similar, would be used on a sufficiently large scale to allow governments, higher education systems, and institutions to understand trends in resource utilization to a much greater extent than is possible today. The work leading up to Table 2 was the first step in this direction. The next step should be to institutionalize preparation of the index on a regular basis, so that time trends can be discerned and benchmarks created. This would become increasingly important as methods of teaching and learning are changed in response to developments in learning science and technology.

THE REENGINEERING CHALLENGE: PROMOTING INNOVATION

This section discusses the microanalysis of teaching productivity and how it can be used to improve the cost-effectiveness of teaching. Microanalysis examines the teaching production function (TPF) bottom-up, which is essential for systematic and continuous improvement of teaching activities and resource utilization; that is, of the cost-effectiveness of teaching.

It involves construction of detailed structural models of the teaching process, which contrast sharply with the macro models that allow only for high-level summary interpretations. As elsewhere in economics, structural models of teaching can be used for both measurement and improvement.

Improvements in cost-effectiveness can take either of two forms. One can:

- Optimize resource utilization for the current TPF, which I shall refer to as 'efficiency improvement.'
- Change the TPF by creating more effective or more efficient processes, which I shall refer to as 'productivity improvement.'

Both are very important. Unfortunately, though, there is a great deal of confusion between the two. Still more confusion is associated with the erroneous idea that better cost-effectiveness means slashing costs without regard to consequences. As noted in the previous section, any kind of cost adjustment should include consideration of educational quality.

Higher education's track record in improving the cost-effectiveness of teaching leaves much to be desired. I believe this is not due to a lack of caring, but instead stems from deep-seated flaws in the academic business model, i.e., the ways in which universities and their faculties go about the business of teaching. My recent book, *Reengineering the University: How to Be Mission Centered, Market Smart, and Margin Conscious*, argues that the following problems inhibit the improvement of cost-effectiveness in teaching:

- Limited understanding of the production function. The lack of comprehensive data about teaching prevents decision-makers from understanding how their decisions will affect quality and resource consumption.
- A lack of good learning metrics exacerbates the above, by preventing evidence about educational quality from being obtained even on an anecdotal basis.
- The decentralization of teaching activity to individuals or small groups of faculties, who rotate in and out of particular assignments, further reduces the incentives and ability for improving cost-effectiveness.
- The tendency for institutions to view educational quality as the domain of faculty, and cost as the domain of the central administration and cost accountants, further inhibits improvement of cost-effectiveness.

The cumulative effect of these flaws is to limit the incentives and capacities of academic departments in optimizing resource utilization and improving the teaching production function. This leaves administrators with few options except to cut a department's overall budget, a blunt instrument that is likely to breed resentment and hurt quality rather than stimulate efficiency or productivity improvement. The flaws stand in the way of delivering better learning, consistently, at scale, and at affordable costs, which is the challenge that is faced by most higher education institutions today.

What is needed is seriously transformative innovations at the grass-roots or at the micro level. These can only be made by faculties, albeit with the help of IT, cost analysts, and other professionals. My book describes innovations in the areas of technology-assisted on-campus learning, better learning assessment metrics, application of learning and service sciences, end-

to-end systems approaches to educational process design, structural models for analyzing the cost of teaching, development of cultures of process improvement, and use of evidence.

The idea of redesigning courses, from the standpoint of teaching methods as well as content selection, is slowly catching on in the USA. Course redesign involves small groups of interested professors reengineering their teaching processes, one course at a time, using the kinds of innovation listed above. The faculty teams, with the assistance of outside experts as necessary, address all the important elements of teaching productivity, i.e., content, process, resource allocation, and cost. The main elements include:

- Learning objectives and metrics
- Use of technology and/or learning science
- Resource utilization and cost analysis spreadsheets

When well done, the result almost always is improved learning at lower cost. These successes show that a faculty can improve the traditional education production function. So far, however, course redesign is practiced only on a small scale.

The key to improving educational productivity is to spread the impetus for course redesign across all elements of the curriculum, persistently over time. This will focus the attention of the university's most valuable resource, the faculty, on the cost-effectiveness of teaching as well as the content being taught. It will take time to move the needle on cost, but eventually the result will be better efficiency using existing methods and, even more importantly, innovations that change the teaching production function in desirable ways.

So how can one get the faculty involved? My research showed that the needed teaching production function model can be imbedded in a campuswide activity-based costing (ABC). This has in fact been done by the Pilbara Group (Australia), a company with which I have been working for several years. Their 'Enhanced ABC' model has been implemented multiple times in Australia and the USA, but its potential as a decision support model for faculty is only now being exploited. Figure 2 shows how the model can affect faculty behavior by providing interlocking information about the activities, costs, and enrollments associated with individual courses, and the effects of changing those on the degree programs, budgets, and student outcomes. The ready availability of such data, for every course in every semester, can provide a 'dislodging stimulus' for the faculty to consider productivity improvement.

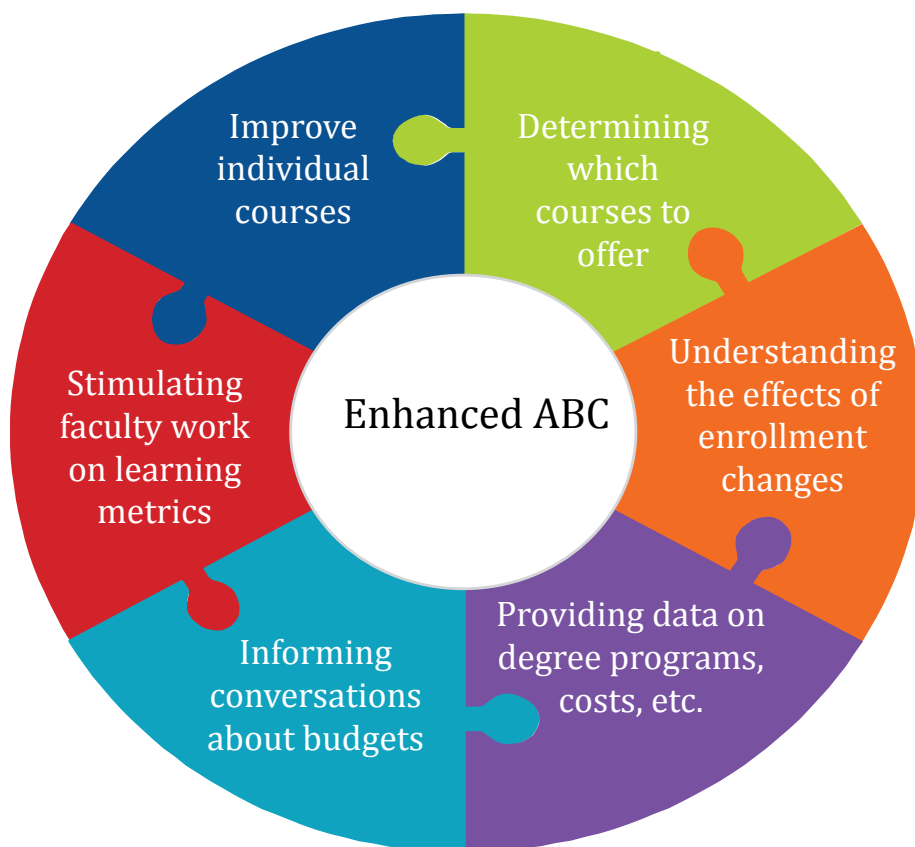


Figure 2: Some benefits of Enhanced ABC

Table 3 illustrates the kinds of results obtainable from the Enhanced ABC model. The results fall into three broad categories:

1. Activity variables quantify what is happening in the course, so far as can be determined by timetabling, student registration, and other available data sets. Without the model, few universities or academic departments can track such information on a regular basis.
2. Cost, revenue, and margin variables show the expenditures associated with the activities; the revenues obtained from the students served; and the resulting financial gain or loss. Importantly, the model links the costs and revenues directly to the activities associated with specific courses, so decisions about activities are reflected directly in the financial variables.
3. Quality-related variables report any available information about student learning. This information is often rather sparse, but is likely to improve over time as faculties seek to relate student outcomes to their decisions about teaching activities.

As noted, these variables pertain to individual courses, and where applicable, to different kinds of sections (e.g., lectures and laboratories) within courses. They can be rolled up to the levels of departments, degrees, schools or faculties, and to the university as a whole. The ability to produce both micro- and rolled-up reports from the same model is a defining feature of Enhanced ABC.

Table 3: Results obtainable from the Enhanced ABC model

Activity variables	Cost and revenue variables
Delivery mode (e.g., F2F, on-line, hybrid) and types of sections Student headcount: in-state/out-of-state; student level (LD, UD, GR) Numbers of primary and secondary sections by type (e.g., lectures, labs) Average class size by section type, and groupings of sections by size categories Personnel hours used, by kind of activity and teacher type Percent of room capacity utilized	Direct costs of teaching: total, per section, per student, per credit hour Direct revenue (e.g., tuition and fees): total, per section, per student, per credit hour Gross margin generated: total, per section, per student, per credit hour Full costs (i.e., including allocated overhead) and net margins Costs, revenues, and gross margins for degree and certificate programs Incremental direct costs for adding a certain number of students
Quality-related variables	
Student attrition, grades and/or pass rates in this course and downstream	Faculty-generated learning measures as they become available

Figure 3 provides a shorthand description of how these results are obtained. The first box brings together the data from the university’s timetabling, student registration, general ledger, and other systems. The timetabling system is boldfaced because, as noted below, it provides key information about the course activities. The timetabling data is supplemented in the second box by surveys of faculty as well as department chairs on the amount of out-of-class activity in relation to the timetabled activities. However, one of the benefits of having multiple university models previously developed is that there is no need to survey the faculty up front. The model can be built using standard profiles and then the faculty members can be surveyed after they become familiar with the profiles and can gauge their impacts. The third box notes that Enhanced ABC provides much more explicit models of teaching activity than a standard ABC, and that the difference is critical for faculty decision-making. The fourth box reminds us that the benefits of Enhanced ABC were not available until university data systems had reached their current state of development, which, generally speaking, has only been in the last decade.

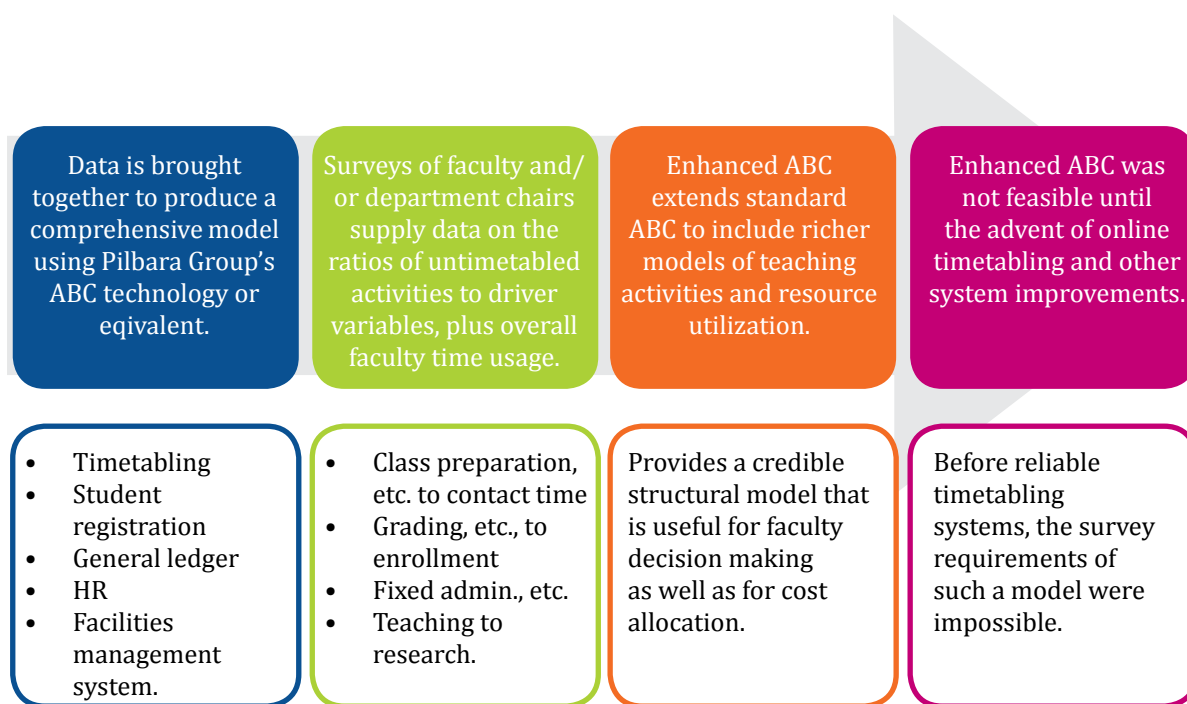


Figure 3: How the Enhanced ABC results are produced

The key role of timetabling data is illustrated in Table 4, for a hypothetical course labeled Biology 001. The course enrolls 440 students and is taught with one large primary (lecture) section that meets twice a week, and 15 smaller secondary (discussion) sections that meet once a week. Eight of the secondary sections are taught by instructors who meet two such classes every week, which saves them preparation time (preparation time is used in the costing procedure). These data sets, all obtainable from the timetabling system, can be used to calculate total class hours for the semester by teacher type. The lecture, which is assumed to be taught by a professor, requires two in-class hours per week or 30 hours for a 15-week semester. The 15 discussion sessions, all taught by teaching assistants, require a total of 225 in-class hours. The model allows for lecturers and adjunct professors, but none are assumed to be active in this example. Finally, the room identification can be looked up in the university’s facilities database and used to calculate the percent of the applicable seating capacity being utilized by the course.

Table 4: Uses of timetabling data in Enhanced ABC

Course	Head count	Class type	Section count		Meetings per week
			Total	Repeat	
Biology 001	440	Primary	1	0	2
		Secondary	15	8	1

Semester class hours by teacher type					Room ID
Total	Prof.	Lect.	Adj.	TA	
30	30	0	0	0	xxx
225	0	0	0	225	yyy

Table 5 illustrates the costs, revenues, and margins that can be obtained from the model, for one department in the School of Engineering and one in the School of Humanities, Arts

and Social Sciences at the University of California, Riverside. (The data has been adjusted slightly to avoid inappropriate disclosures.) For example, the top line of the Table shows that Engineering Department A had 208 enrollments in its upper division (advanced) courses and that each enrollment cost about \$17,000. The direct revenues associated with these enrollments averaged \$14,000, which produced a negative margin of \$3,000. The Enhanced ABC model provides such data for every department and degree program in the university, for every semester.

Table 5. Costs, revenues, and margins per enrollment

College, dept., course level	Enrollments ENR	Cost/ ENR	Revenue/ ENR	Margin/ ENR
Engineering: Department A				
Upper division	208	\$17,000	\$14,000	(\$3,000)
Lower division	464	\$12,000	\$14,000	\$2,000
Humanities, arts and social sciences: Department A				
Upper division	529	\$15,000	\$12,000	(\$3,000)
Lower division	525	\$11,000	\$12,000	\$1,000

Tables 6–9 detail the activities that generated the costs and revenues. Table 6 shows the number of primary sections offered by the aforementioned departments during the 2014–15 academic year, arrayed by the class-size category. Table 7 adds information on the average class size for each student level and course type. For example, the three small upper-division (advanced) engineering courses average only 1.4 students each, which suggests one-on-one research tutorials. The nine very large classes, on the other hand, average more than 330 students. Table 8 extends these results to show the percentage of primary sections in each class-size category taught by non-regular faculty. These sessional or adjunct staff are less expensive but may not be as effective as regular faculty.

Figures like these are important for understanding the departmental activity profiles, and once a track record has been compiled, for understanding how they are changing over time. Such data points are important for making decisions about resource allocation and, hopefully, stimulating course redesign.

Table 9 shows the cost of teaching activities, rather than the activities themselves, for two particular courses (such data is available for every course). The model allocated about \$11,800 of professorial salary for teaching ‘Computer Science 141’ (Intermediate Data Structures and Algorithms) during the fall semester, for example; and \$5,700 of lecturer salaries during the spring semester, when the course was taught by a lecturer rather than a professor. Smaller amounts were allocated for tutors, teaching assistants, and other staff. The course also incurred costs for facilities usage, as determined by the particular rooms that were utilized. The bottom line was that CS 141 cost \$14,400 to teach during the fall semester and \$11,000 during the spring semester. These figures can be compared with direct tuition revenue to obtain the course’s contribution margin. All the numbers can be converted to a per-student basis if desired.

As noted, each semester's results can be rolled up to departments, degree programs, faculties, and the university as a whole, thus providing transparent data for tracking, benchmarking, financial planning, and budget setting. These data sets will be hard to ignore when they are available to responsible parties at all levels in the university and are used regularly in resource allocation. Professors, department chairs, deans, and other academic officers will have to think regularly about their teaching processes, costs, and margins. That's why I consider Enhanced ABC to be the 'dislodging stimulus' needed to focus academic attention on costs and margins as well as on educational content. Hopefully, over time, universities will develop better understanding of the relation between resource usage and the quality of provision, which is essential in an era of constrained public and private resources.

Table 6. Number of class sections

College, dept., course level	Small	Medium	Large	Very large
Engineering: Department A				
Upper division	3	6	18	9
Lower division	1	6	13	23
Humanities, arts and social sciences: Department A				
Upper division	4	14	7	23
Lower division			8	16

Table 7. Average class sizes

College, dept., course level	Small	Medium	Large	Very large
Engineering: Department A				
Upper division	1.4	14.3	72.5	336.4
Lower division	4.4	12.3	97.8	79.9
Humanities, arts and social sciences: Department A				
Upper division	17.0	27.4	46.4	200.7
Lower division			51.0	321.0

Table 8. Percent use of non-regular faculty

College, dept., course level	Small	Medium	Large	Very large
Engineering: Department A				
Upper division	33.3%	16.7%	5.6%	11.1%
Lower division	0.0%	83.3%	92.3%	95.7%
Humanities, arts and social sciences: Department A				
Upper division	0.0%	0.0%	0.0%	8.7%
Lower division			12.5%	12.5%

Table 9. Detailed cost allocations for specific courses

College, department, course level							
	Teachers of record				Teaching assistant	Direct facilities	Grand total
	Prof.	Lect'r	Tutor	Other			
Engineering: Department A							
141: Intermediate Data Structures and Algorithms							
Fall	11,800	0	200	200	1,300	900	14,400
Spring	0	5,700	200	200	3,900	900	11,000
Humanities, arts and social sciences: Department A							
001: Introductory Psychology							
Fall	11,000	0	300	300	17,900	3,200	48,000
Spring	0	2,700	300	300	22,600	3,300	45,200

The Enhanced ABC model can produce nearly all the efficiency and productivity metrics currently used by universities and higher education systems. For example, student credit hours per faculty FTE (discussed in connection with Figure 1), cost per credit hour, cost per degree, and similar metrics are easily calculated. But that’s not all. The model also produces the data needed for applying the NRC Productivity Index to individual universities, schools, and even degree programs. Applying the NRC Index would provide better summaries of the changing relationship between inputs and outputs than are available currently, while allowing users to drill down into data to check on potential quality changes.

Basing such efficiency and productivity measures on Enhanced ABC allows decision makers to drill down and identify the causes of observed changes. For example, misunderstandings of the kind depicted in the English Department example discussed earlier would not be allowed to persist and fester. This will go a long way toward addressing the NRC’s concerns about quality. Any race to the bottom, triggered by increased attention to productivity, would be detectable from the data on class size, use of non-regular faculty, and eventually, other quality-related variables. For the first time, it would be possible to connect the dots between the macro and micro productivities in teaching and at the same time take quality into account.

PRODUCTIVITY PERFORMANCE IN USA

The fact that the USA spends more on higher education per student than most other countries is well known, but the size of the difference is still worth noting. The OECD data in Figure 4 shows that the USA spends about 85% more than the OECD average and considerably more than the average of the APO countries. What the data doesn’t show is what these expenditures would be if the USA system was operating at optimal efficiency and if large-scale efforts were being undertaken to improve the teaching production function.

It is impossible to give a definitive answer to the above question, but the available data suggests that the story in the USA is at best mixed. Figure 5 shows the changes in expenditure

per student between 2001 and 2011. Breakdowns by types of expenses show that spending on non-instructional student services is up; administrative and support spending is down; and the trend of direct instructional spending seems to reflect resource availability. Along with many other higher education researchers, I believe that, barring efficiency or productivity gains or quality changes, per-student cost will grow in the neighborhood of a point or two over inflation. I'll examine what happened as a result of the 2008 recession later, based on data from the NRC Productivity Index.

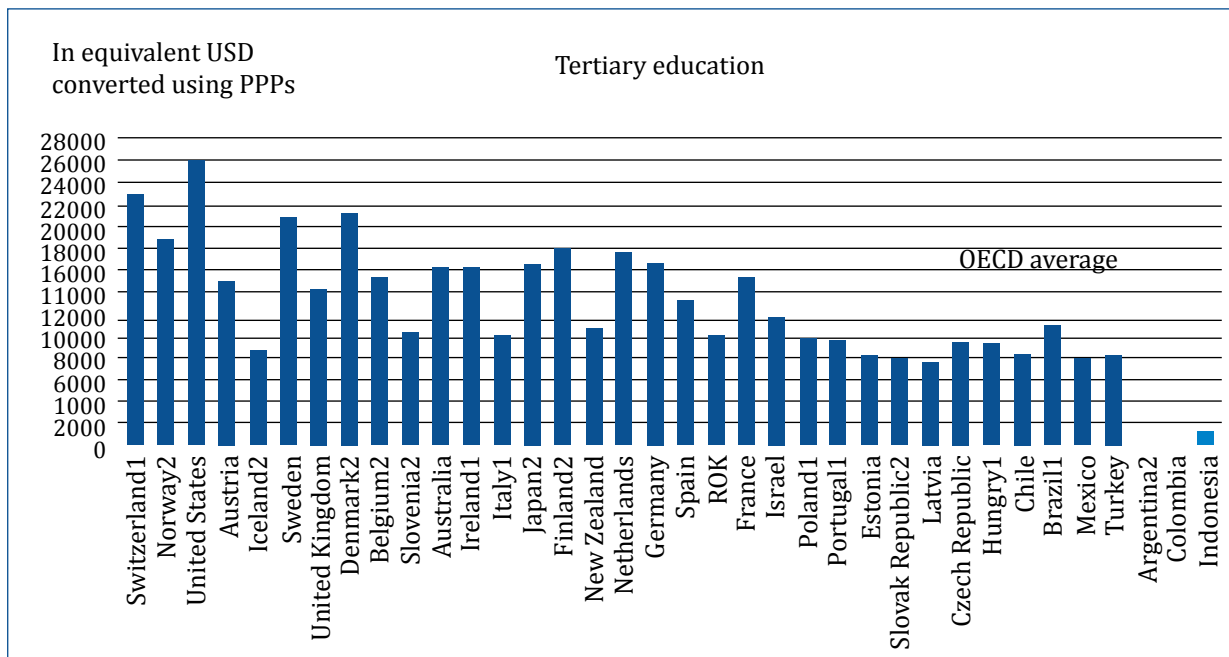


Figure 4: Higher education expenditures per student, by country

Source: OECD, [4]

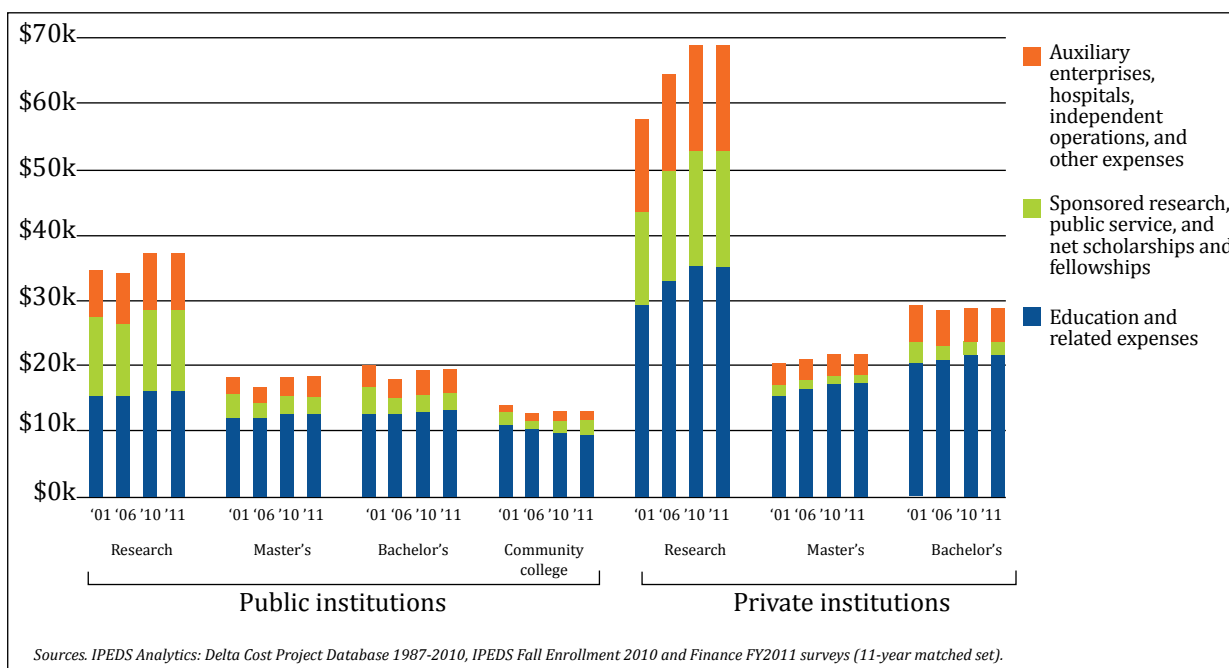


Figure 5: USA expenditures per student, by grouped expense categories

Source: Delta Cost Project [2]

Figure 6 shows that tuition has grown much more sharply than per-student cost in most of the USA institutional segments. This is due to marked declines in public subsidies. It is apparent that education costs have been shifted from governments to students so that for the first time, in 2011, tuition covered more than half of the total instructional cost in the public sector. Figure 7 illustrates dramatically how the public-funds squeeze has impacted affordability, and possibly educational quality, at the University of California, Riverside. Student costs are up at the same time that total expenditures per student are down. It is likely that the decrease in total expenditures is at least partly due to efficiency improvements, as the university has been working hard to stretch its dollars. On the other hand, many on the campus question whether quality may be threatened. Riverside has just installed the Enhanced ABC model described earlier, which would make answering this question vastly easier.

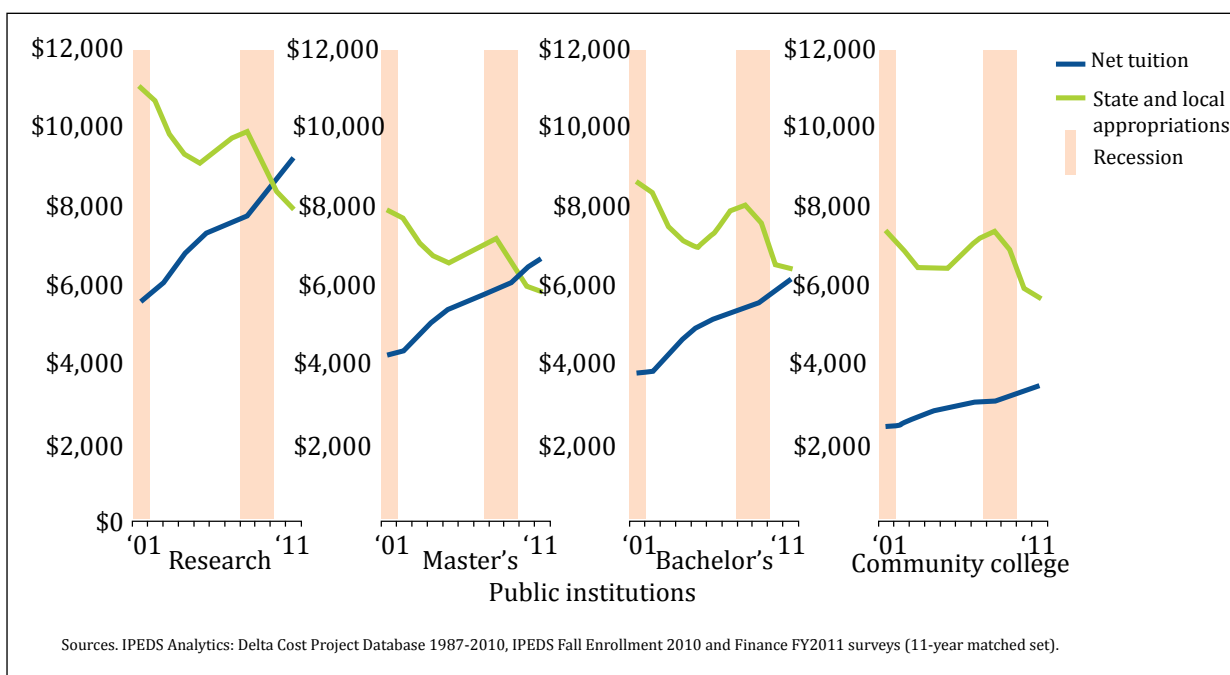


Figure 6: USA net tuition revenue and local appropriations per FTE student: FY 2001–11, in 2011 dollars

Source: Delta Cost Project [2]

Finally, Figure 6 shows that total degrees and other completions per 100 FTE students have risen in most sectors during the ten years ended 2011. The degree completion rate is another area that has received great attention in recent years, and progress does appear to have been made. To sum up, the aggregate data suggest that the USA costs per student tend to rise unless fund shortages prevent that from happening, and that degree completions per 100 FTE students are also rising.

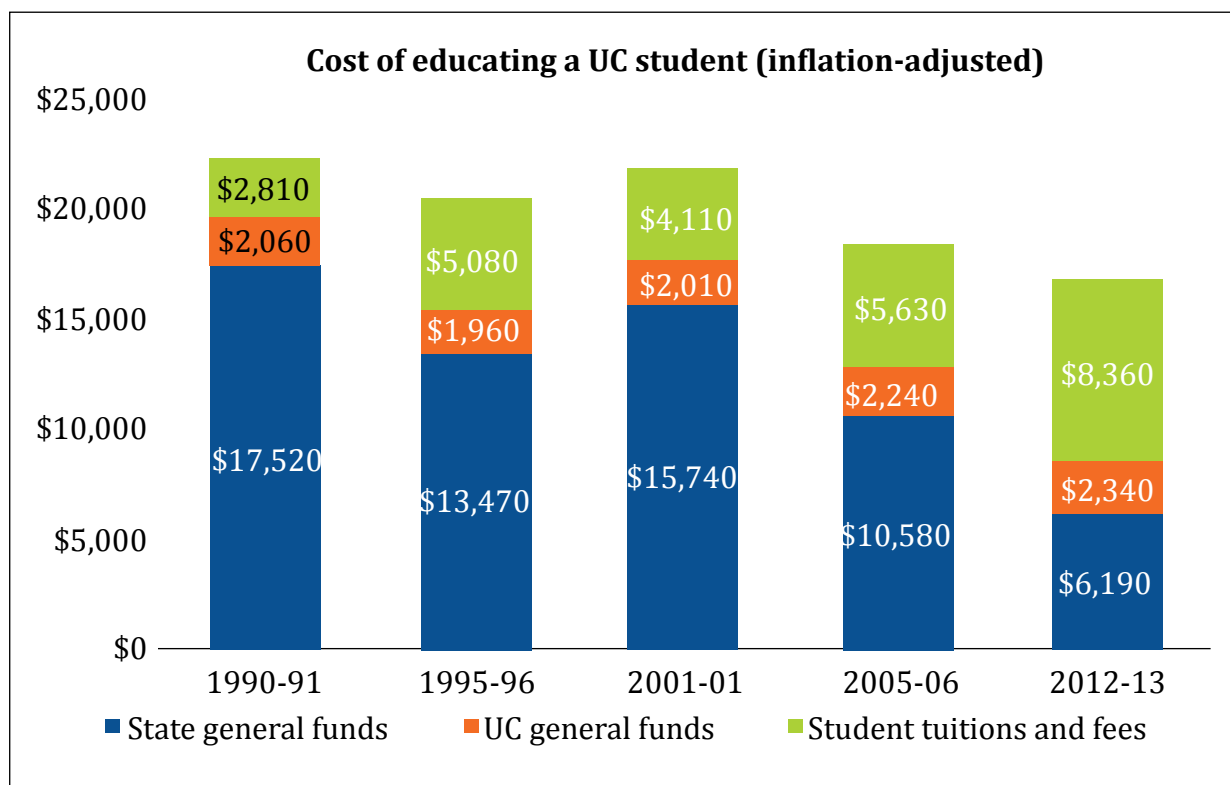


Figure 7: The public-funds squeeze at the University of California, Riverside

Results from applying the NRC Productivity Index to the USA colleges and universities, presented earlier in Table 2, generally support these findings. These show that, in the absence of acute budget stringency, the quantity of teaching inputs tends to grow faster than the quantity of outputs. The Great Recession of 2008 provided a natural experiment that seems to corroborate this conclusion.

Table 2 shows that the NRC index for 2006–08 declined for most sectors, then increased for half of those in the 2008–10 timeframe before declining during 2010–12. This result is highlighted in the last two columns of the table, which represents the change in the NRC Index of productivity change. It is apparent that, with only minor exceptions, the recession caused increases in the percentage change of outputs divided by the percentage change of inputs, which were then followed by decreases of roughly similar magnitudes. The question is whether the increases during the recession years actually represent a change in productivity.

I believe it is doubtful that the uptick in 2010 was due to better productivity or even short-term efficiency improvements. Any such improvements would have required major efforts, so one would expect these to persist for more than just two years. It is more likely that the temporary improvement represented a coping strategy that involves unsustainable workloads, diminution of research efforts, or unplanned decreases in quality, the results that universities would want to reverse as soon as possible. Improvements that were sustained over time would present a better case for productivity improvement, though even then quality assurance studies or Enhanced ABC results would be needed in order to verify those outcomes. Longer time series of NRC Index results could generate a national conversation about these questions, which would be a big step forward.

The 2008 experiment suggests, once again, that university costs are driven by the amount of money available rather than evidence-based notions about the ‘proper’ amount to spend. This is consistent with the so-called Revenue Theory of Budgeting (Bowen’s Law), which predicts, “Universities will raise all the money they can and spend all the money they raise.” The good news in the data presented above is that improvements in degree completions may signal better quality, e.g., through course redesign, better student tracking or other analytics methods, and streamlined administrative processes. Once again, data about what is really happening inside institutions will be required before we can reliably connect the cause and the probable effect.

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DIGITAL AND DISTANCE-LEARNING TRENDS IN INDONESIA

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INTRODUCTION

Higher education has been recognized to play a significant role in the development of political security, sociocultural, and economic pillars of Indonesia. In about two decades, Indonesia would expectedly hit the demographic bonus, i.e., the 90 million Indonesians who were aged 19 years or below in 2010 would be running the country in 2045. This bonus can be beneficial if only Indonesia can affirm its human development through provision of quality education and healthcare. As such, increasing participation of Indonesians in quality higher education institutions (HEIs) through various means and expanding educational services to meet the demand have been highly crucial for Indonesia.

Various efforts have been made both by the government and the private sector to expand the higher education services to reach Indonesian people. Opening access to quality and affordable higher education, providing equal opportunities for Indonesians to access higher education, and developing quality higher education across the country have been the main reasons for Indonesia to engage in distance education since the early 1950s. Supported by the advancement of information and communication technology (ICT), distance education in Indonesia has evolved into ICT-based distance education five decades later. Further advancement of ICT has enabled various HEIs to engage in digital learning through online education, e-learning, and the most recent development of massive open and online courses (MOOCs).

This paper will highlight the evolution of distance education and digital learning in Indonesia, and its recent trends and developments.

POLICY AND REGULATION

The first policy on distance education in Indonesia dates back to the government's policy on offering correspondence courses for teachers' education in the late 1950s, followed by correspondence-based teachers qualification upgrading program to Diploma II (two years after high school) in early 1980s, and also the lecturers' professional development programs for teaching skills (Akta Mengajar V) in the late 1980s. However, the Presidential Decree of establishment of Universitas Terbuka in 1984 (Kepres No. 41/1984) truly marked the beginning of a distance education era in Indonesia.

In 2001, the government issued a ministerial decree on implementation of distance education program in higher education (Permendikn as 107/2001). Then distance education was included in the National Education Law (UU Sisdikn as 20/2003) as an alternative education system in Indonesia. The interest in distance education has been growing ever since. In

2007, ministerial decrees were issued to 23 teacher colleges to offer ICT-based distance education program for elementary teachers' qualification upgrading in a consortium mode (HYLITE Program). The 23 teacher colleges offered three-year programs in bachelor's degree for elementary teachers with Diploma II qualification. As many as 7,000 elementary school teachers graduated through the program, with enhanced ICT skills.

In 2012, a ministerial decree (Permendik bud 24/2012) was issued on the implementation of distance education in higher education as a revised version of the 2001 regulation. The new regulation allowed conventional universities to offer some of their programs or courses utilizing the distance learning mode. Subject to certain prerequisites, such as a national accreditation of B, the decree facilitates HEIs who have interest in implementing distance education in addition to the face-to-face conventional education, to operate in at least three of Indonesia's 35 provinces. Another alternative is that HEIs are also able to deliver 50% of the course in distance mode in learning centers, while the other 50% is expected to be delivered in face-to-face mode in a campus. The 50% courses delivered in distance mode can be sourced from other providers endorsed by the ministry. In 2013, the decree was revised to accommodate a wider interest in implementing distance education in higher education, and to add an important point of quality assurance in distance education.

Since then, permission to implement distance education in certain study programs has been granted to Universitas Bina Nusantara, Politeknik Elektronika Negeri Surabaya, London School of Public Relations, and Universitas Pelita Harapan, in addition to the single-mode distance education university, Universitas Terbuka.

In parallel, the policy on ICT in Education was part of the 2001 Presidential Decree on Telematics. Later, the National Education Law (UU Sisdikn as 20/2003) also stated ICT as one modality to deliver education both in face-to-face as well as distance-education modes.

The use of ICT in education has been promoted through various policies. In 2005, the Law on Teachers and Lecturers promoted ICT competency for teachers and lecturers as part of professionalism. The Indonesia Goes Open Source (IGOS) program was launched in 2004 to promote the development and use of open-source software in the country. In 2006, National ICT Board prioritized e-education as one of its flagship programs (Nandika, 2007). Further, the national education network (National ICT Backbone) and information system (Jardiknas & Inherent) were also established to serve integrated educational services in provinces, cities, universities, and schools.

In March 2008, Indonesia's House of Representatives passed the Electronic Information and Transaction Act (UU 11/2008), which covers information protection, certificates of authority, domain names, dispute resolution, and intellectual property rights. It has provisions against misuse, hacking, and unauthorized system interception. In 2012, the law was materialized into the government regulation on Implementation of Electronic System and Transaction (PP 82/2012). Nevertheless, specific policy on e-education has not been devised since the issuance of Presidential Decree on Telematics in 2001, while the use of ICT in education has been growing into web-based learning, e-learning, online learning, and blended learning.

DISTANCE EDUCATION

Distance education is the most well-known term to describe provision of education across time and space, such as it is accessible to learners anytime and anyplace, irrespective of geographical distances. Typically, students and teachers reside in different locations, so a physical classroom is not necessary. In this case, the teaching and learning process relies heavily on the use of media and technology. As such, traditionally, distance education serves the purpose to overcome barriers and difficulties of students that were unable to attend a conventional campus. The obstacles that distance education has been able to overcome include lack of formal entry qualifications; physical or health constraints; geographical barriers; working; family obligations; and being held in closed institutions, such as prisons and hospitals.

In many cases, the term distance education has been used interchangeably with distance learning. Distance learning is referenced more as a process of learning at a distance across time and space [10]. Distance education is not a mere delivery mode, but an educational system by itself. Dhanarajan [6], mentioned that adding a 'distance education' to an education system is not a mere add-on component of the system, but actually offers a new education system to be managed side by side to the existing system. Recently, the term distance education has been established to be an umbrella term covering correspondence education or correspondence study, independent study, multimedia education, and open learning. It also includes the latest technology-based educational forms such as online learning, e-learning, mediated learning, online collaborative learning, virtual learning, and web-based learning.

In Indonesia, the introduction of distance education as the non-conventional model of education was started in the late 1950s when the government initiated the correspondence model of distance education for teachers training. Distance education was first seen as an alternative mode of education to prepare the massive number of teachers the country needed, via correspondence courses.

The development of distance education in Indonesia gained its biggest milestone in the 1980s when Universitas Terbuka (Open University of Indonesia) was established in 1984 [11]. Universitas Terbuka (UT) is the only single-mode distance higher education institution in Indonesia, with 30 study programs at the bachelor's and diploma levels and six study programs at the master's level. It currently has 1.2 million enrolled students and more than 300,000 active students, of which 95% are working adults. Started as a correspondence-based distance education university, UT employs the principles of open learning to provide learning flexibility to minimize hindrances of access due to aspects related to place, time, economy, geography, and age [3]. The main goal for the establishment of UT is provision of equity and access to quality higher education for Indonesians across time and place. In addition, UT also serves as a second chance to many of its students.

Since then, the massive nature and application of economy of scale in distance education have appealed to many HEIs to go into the distance education business. Within about three decades, various experiments to advance distance education have been undertaken by the

government, donor agencies, as well as private parties. The results of these experiments have been the emergence of a number of models of online learning at the tertiary level. These include UT, Hybrid Learning for Indonesian Teachers (HYLITE), Global Development Learning Network (GDLN), Distance Education for Polytechnics, and Distance Education for Continuing Vocational Education [14].

Nevertheless, just like many other innovations in education, sometimes replications are made based on tangible aspects, without enough understanding of the underlying intangible assumptions and philosophy. This applies in the case of distance education. Some of the HEIs translate the distance education as a remote classroom, while some others see it as offering a stack of lecture notes and textbooks for students to read on their own, until the exam time comes. Still other HEIs translate distance education as a mere delivery mode for open learning which may be conducted in the campus as well as off-campus across space, but emphasize in a degree of openness as to how, when, where, and what a learner will study. As such, HEIs have to be ready with provisioning of various learning flexibilities to minimize constraints of access due to aspects related to time and space.

At this moment, in addition to the single-mode open and distance learning of UT, distance education has also been implemented by Universitas Bina Nusantara for study programs in accounting and informatics; Politeknik Elektronika Negeri Surabaya for study programs in telecommunication engineering and informatics; London School of Public Relations for study program in communication; and Universitas Pelita Harapan for study program in communication.

Distance education in Indonesia has been growing intensively, and has become a national strategy to provide increased access to quality and equity of higher education across time and space in the archipelago. To many, distance education has meant to be a provision of second chance to go for higher education, and as an opportunity to engage in higher education flexibly and affordably without having to leave work. As such, many of distance education students are employees seeking their first degrees in higher education, or seeking upskilling or reskilling opportunities. The tangible results of distance education are the increased enrollment rates in higher education and provisioning of an efficient education model, since distance education can facilitate massive enrollments without addition of physical infrastructure for HEIs and be affordable to many across time and space.

DIGITAL LEARNING

Digital learning is a common term encompassing various terms to denote access to learning experiences via the use of some technology, including the connectivity, flexibility, and ability to promote varied interactions. It is usually called online learning, and commonly includes e-learning, internet learning, distributed learning, networked learning, tele-learning, virtual learning, computer-assisted learning, web-based learning, distance learning, technology-based learning, and podcast or webcast learning. Many experts also view that digital learning falls under the broader category of distance education, and that distance education can employ digital learning as one of its delivery methods for education across time and space. Digital learning has enhanced and enabled the growing practices of distance education by various institutions

and has empowered distance education to offer massive education across time and space. Some others argue that 'distance' is not a defining characteristic of digital learning as it is also relates to ICT-based learning in a conventional or face-to-face campus system.

Digital learning emerges as a manifestation of the advancement of ICT, which offers effective and efficient learning supports at all levels of education and in all fields of knowledge [9]. With increasingly widespread access to computers and internet, digital learning has become a consistent presence at all levels of education. Through its use of technology, digital learning provides accessibility of learning to anyone, anytime from anywhere. As such, digital learning has been identified as a more recent version of distance learning that improves access to educational opportunities for learners described as both nontraditional and disenfranchised. Digital learning in the form of online learning offers learning without the learners attending a brick-and-mortar education institution. Instead, online students and teachers interact over the internet. The ability for learners to extend communication and access resources outside of their schools or work environments via the use of various gadgets, allows them to supplement, and sometimes fully replace, activities once reserved for the traditional classroom.

The advancement of ICT and its penetration in Indonesia have been spectacular in recent years and particularly beneficial to higher education. We Are Social's compendium of world digital stats notes that in 2015, Indonesia had 88.1 million active internet users, an increase of 15% over the past 12 months. Also, 85% of the population own mobile phones, while 43% of them carry smart phones. Most of the Indonesians now access the internet using their mobile devices, with mobile accounting for 70% of web page views versus 28% for laptops and desktops. The share of mobile devices went up by 41%, which was also the amount of decline for laptops and desktops. "Indonesia is truly a mobile-first country, with a lot of people there getting their first taste of the internet via mobile devices" [17]. Indonesian e-commerce is one of the most talked about in southeast Asia's startup world. While advancement of ICT in various sectors is being highlighted, advancement of digital learning, especially in higher education in Indonesia, has not been in the spotlight yet.

In its early establishment, distance education in Indonesia has primarily been correspondence-based. Nevertheless, the landscape has become quite different recently, due to the technological development that has created new possibilities for ICT-based distance education. ICT can make it possible to connect people with each other and create interplay between people regardless of time, place, regions, and countries.

The first official ICT-based distance education initiated in 2007 by the government has been the HYLITE Program [13]. It is an in-service teachers-training program, especially designed for primary school teachers in Indonesia to improve their qualification from Diploma II to Sarjana (S1) level. It is one of the strategies taken by the Government of Indonesia (GOI), in particular the Ministry of National Education, for providing access to quality education to all, especially to primary school teachers in all areas of Indonesia. It is designed for primary school teachers aiming to especially upgrade their competencies and qualifications through a continued process of education with a lifelong learning spirit. Involving 23 teacher colleges in a consortium, the HYLITE program is an innovation of the GOI to overcome the issue

of scarcity of quality primary school teachers through extensive use of ICT. The HYLITE program was conducted based on web 1.0 technology in a blended mode, including web repository for study materials, videos, and test banks; email for learning interactions; and residential time in campuses for face-to-face tutorials.

In 2014, the Indonesian MOOCS was launched by the Vice President of Indonesia under the name of Pembelajaran Daring Indonesia Terbuka dan Terpadu (PDITT, or Open, Integrated and Online Learning of Indonesia). Being developed since 2013, it is expected to be a hub for e-course offerings from various parties (individuals as well as institutions) in the form of open content, open courses, as well as online courses. The online courses offer credit-earning certified courses for students and general public, and can be transferred to any relevant study program later in any HEI. These offers, i.e., the open content, open courses, and the online courses, are expected to answer the demand for anyone in Indonesia to study anytime and anywhere, based on the lifelong learning principles.

The other goal of the establishment of Indonesian MOOCs has been to provision a means for foreign universities to participate in the offering of MOOCs as well as for foreign students to participate in learning through the Indonesian MOOCs. This first edition of Indonesian MOOCs has been following the xMOOCs principles of highly structured, content-driven courses designed for large number of individuals working mostly alone, guided by (pre-recorded/virtual) lecturers or tutors, assessed by automated or peer-marked assignments, and aimed at providing access at scale and at establishing higher education subjects as presented by authorities in various fields. Meanwhile, cMOOCs principles are applied to the open courses and open content provided as additional services by the Indonesian MOOCs.

The providers of Indonesian MOOCs are accredited HEIs with at least B accreditation for the study program offering online courses in Indonesian MOOCs. The initial providers of 30 online courses were Universitas Indonesia, Institut Teknologi Bandung, Universitas Gajah Mada, Institut Teknologi Sepuluh November Surabaya, Universitas Bina Nusantara, and Sekolah Tinggi Manajemen dan Ilmu Komputer AMIKOM Yogyakarta [15]. Currently, the Indonesian MOOCs is named Sistem Pembelajaran Daring Indonesia (SPADA Indonesia), or the Indonesian Online Learning System, involving 11 HEIs as providers, and 5,946 students coming from 51 partner HEIs as users; offering 137 online courses, 51 open courses, and 94 open content.

Along with the establishment of SPADA Indonesia comes the Indonesia X (Id-X) (<https://www.indonesiavax.co.id/>), an Indonesian version of Ed-X di USA. It was initiated by a private university, and focuses on offering open courses via the intensive use of videos coming from various experts in the country. To obtain the learning objects, Id-X has collaborated with various HEIs in Indonesia who are willing to contribute their open content or open courses to ID-X. The Id-X is following the cMOOCs principles which involve a networked and collaborative approach to learning that is not primarily curriculum-driven, distributed, self-led exploration of topics, and does not necessarily involve formal assessment. However, students may apply for assessment and certification for a certain fee at the end of the course, and the certificate may be credited or transferred to a study program in any HEI.

Within the last decade, UT too has evolved into employing a supermarket model of learning,

where a customer can buy anything available in the supermarket, anytime, through various channels of delivery anywhere in the world. As such, UT has widened its access to students anywhere, including in foreign countries. For that purpose, UT has used ICT extensively, yet cautiously, in providing its services. Hence, the utilization of ICT does not transform UT into an 'online education provider,' but an enhanced ICT-based distance education provider. Provision of support for learning at UT takes a number of forms to suit infrastructure throughout the archipelago. This includes an extensive digital library and more than 4,000 online classes as well as face-to-face tutorials in 446 locations and more than 1,000 learning packages. UT began creating digital content since 1995 using an open-license software. Since 2012, a creative commons license for all resources was adopted. UT has more than 200 courses available as OER that have been used by 1.5 million users. In 2014, UT also launched 18 MOOCs.

There is also the 7in1 Project of Islamic Development Bank involving seven HEIs in Indonesia namely, Universitas Negeri Surabaya, Universitas Syahkuala, Universitas Negeri Yogyakarta, Universitas Tanjung Pura, Universitas Lambung Mangkurat, Universitas Sam Ratulangi, and Universitas Negeri Gorontalo, which in addition to developing their infrastructures, also developed online courses for credit transfer purposes among the members as well as other HEIs. So far, 14 open courses have been contributed to SPADA Indonesia by the seven HEIs, and each member has developed more than 20 online courses for internal use. Previously, there was also the IMHERE project (a World Bank Project), which offered initial grants for online course development by HEIs to be implemented collaboratively with partner HEIs.

Other initiatives have also been emerging. All are trying their best to incorporate ICT into their educational practices to be able to offer quality education across time and space, thus serving the needy students in remote urban areas. They are offering education at affordable prices, as well as applying ICT in appropriate combination with traditional face-to-face classroom-based teaching and learning [12].

Universitas Indonesia has been hosting Global Development and Learning Network (GDLN) programs through intensive use of teleconferencing to broadcast worldwide emerging issues to higher education community. It has more than 400 online video streaming collections of various public lectures that are freely accessible; more than 15 courses available through Open Courseware Consortium (OCWC), and more than 600 online courses under Student Centered E-Learning (SCELE). SEAMOLEC in collaboration with Institut Teknologi Bandung has been experimenting the use of podcasting for learning at diploma as well as graduate levels of study. ITB itself was famous for School on Internet Asia (SOI-Asia). Universitas Gajah Mada initiated Elisa, e-learning for Gajah Mada Students. Universitas Islam Sultan Agung has come up with Sinau Online, while Universitas Padjadjaran has 207 lecturers producing 75 graduate level courses in e-learning format.

Some other teacher colleges have been replicating HYLITE programs with slight modifications. Universitas Bina Nusantara has Binus Online, while the APTIKOM group of school of informatics has more than 500 online courses for exchanges among its members and other HEIs. Ministry of Health has employed ICT-based distance education in two polytechnics to offer qualification upgrading program for its health officers in various

areas of Indonesia. Other ministries are also establishing their online training centers. The Erasmus Mundus Project in Asia-Europe has been able to produce a MOOC initiatives atlas of the world (E-Mundus Atlas) [8] in which Indonesia is listed as a country actively initiating MOOCs.

PRODUCTIVITY IN DIGITAL AND DISTANCE LEARNING

Assessing the productivity of digital and distance learning has long been a challenge for many distance-education and online-learning scholars and practitioners. Although digital and distance learning in higher education have been growing rapidly, it is not clear whether digital and distance learning contribute to productivity of higher education in general, or whether digital or distance learning can itself be a productive education system. Will the increased capital investment in digital- and distance-learning technologies result in the increase of skillful graduates and innovation from HEIs?

Tony Bates [1] through his blog has been intensively discussing the productivity of distance education and online learning. Hamish Coates [5] has also discussed productivity of online learning in campus-based education in his book *Student Engagement in Campus-Based and Online Education: University Connections*. Carey T. and Trick D. [4] have discussed how online learning affects productivity, cost, and quality in higher education. Siemens [16] and Downes [5] have argued that digital and distance learning have the potential for reducing the costs of education by content being increasingly freely accessible on the internet and dramatically reducing the need for professional lecturers. The discussion concludes that online learning does contribute to the productivity of higher education in general. Nevertheless, despite the numerous discussions, measuring productivity of digital and distance learning alone has been “a difficult topic” [1] to the practitioners as well as for the government and the HEIs.

When productivity is defined as an outcome relative to input then there is a need for elaborating which components come under outcome and which fall under input in higher education, especially in digital and distance learning.

Input

In general, the term input in productivity in higher education can be elaborated to include capital (budget and asset), cost (expenditure), and labor that could be converted into an equivalent cost figure labeled as input. These components have been one way of counting the input. Each component can be elaborated further, e.g., labor can be elaborated into teaching time, interaction time between faculty and learners, research time, community services time, and personal development time. It is this elaboration of the components that will be distinctive for digital and distance learning, and it requires different measures. For example, the teaching time and interaction time in digital and distance learning covers faculty preparation time in developing (multimedia) instructional materials, devising the learning management system, and doing virtual or technology-mediated interactions with students. The digital and distance learning course development has been counted at 15–20% of the overall cost of an online course [2].

Since digital and distance learning rely heavily on the use of technology, should investment in technology and human support be considered as a measure of input? Some have put heavy emphasis on the technology cost, seeing digital and distance learning as a mere delivery system of education. Nevertheless, some other scholars argue that digital course delivery cost, including learning supports and assessment, accounts only for 37% of the overall cost of an online course [2].

Furthermore, the massive nature of digital and distance learning requires the existence of distributed learning support, i.e., interaction with tutors, interaction with experts, educational resources, access to labs and practice sites, access to exams sites, and exams proctors and administrators. Should these measures also be included in counting input for digital and distance learning? Bates [1] argues that the method and strategy of teaching and multiple other factors, such as interaction or engagement between students and lecturers or tutors, and learners' support are more important than mode of delivery in digital and distance learning.

Some scholars state that the measurement of input with regard to digital and distance learning is not conceptually difficult. For example, for Universitas Terbuka, which has been in operation for more than 30 years, these measures are actually readily available. Nevertheless, measuring the productivity of digital and distance learning comprehensively has not been done up till date. The HEI providers of SPADA Indonesia found difficulties when they were requested to determine the costs of their online courses and the course fees for students.

Outputs

With different aims and goals of digital and distance learning, measuring its output is conceptually as well as practically difficult. The concept of output in higher education productivity has been elaborated to include, among others, coursework completions, graduate employment, credit hours, and learning outcomes. OECD uses measures such as participation rates, graduation rates, and standardized tests. Nevertheless, some factors need to be considered in measuring outputs in digital and distance learning as elicited by a number of scholars, including Bates [1]:

- The learning flexibility offered by digital and distance learning usually comes in the form of 'multi-exit and multi-entry' system. Thus, mobility of students in any period of study must be well-considered. Further, the dropout rate cannot be counted as a measure based on this multi-exit and multi-entry system. As such, participation rates would be changing all the time, and would not follow any cohort at all. Universitas Terbuka has used the terms 'registered students' versus 'active students' as measures of participation rates, indicating those students who are in the registration database versus those students who are actively engaging in a learning process through courses in a period of study.
- Heterogeneity of students of digital and distance learning is quite high, and HEIs are expected to be able to cater to all the needs and learning styles of those diverse students. This means that digital and distance learning offerings must be similar to a supermarket offering, where everything is available, and it depends on the buyer to autonomously mix and match the offerings. The use of technology alone does not guarantee that digital and distance learning can fulfil its purpose, since some students have got access to technology, while others have not. Do digital and distance learning

serve one group of students better than another? Will digital or distance learning lend itself to better learning outcomes that till date have not been targeted in classroom teaching? These are some of the questions that need to be addressed.

- The aim of digital and distance learning to provide equity in higher education is materialized into higher education opportunity for those who are already working, or for those who have not been privileged to attend a conventional university. As such, digital and distance learning is known as the second-chance education. Therefore, employment rate is a very weak, if not irrelevant, measure of output, since most students are already working adults. For example, 95% of students of Universitas Terbuka, are working adults, and only 5% are fresh high school graduates.
- The principle of economies of scale has been applied to the early version of distance education, i.e., the correspondence model, where replications of printed instructional materials could be distributed across time and place, and expectedly resulted in standard learning outcomes. Nevertheless, in digital and distance learning, the replication of online course does not always guarantee standard results. There is a lot of diversification and personalization taking place in digital and distance learning, taking into account individual differences, thus making it difficult to measure a course as a mere replication from the previous or the existing one. The core content may be replicated, but the delivery depends on the teaching strategy as well as on interaction and engagement activities, and the assessments may be varied.
- While economy of scale is associated with the industrial economic model, which digital and distance learning are not, scholars are arguing for the use of economies of scope as a measure of output. Economies of scope enable many variations on a standard product to meet individual needs at a low marginal cost for each variation. An example from digital and distance learning would be a core curriculum with many optional routes through the material, using adaptive technologies that respond to the inputs from individual students in different ways, depending on the needs of the learner. Digital technology in particular allows for an almost unlimited range of 'options' at low marginal costs.
- The need for expert lecturers is expectedly reduced in a digital and distance learning environment. While learners' support is essential, the component of tutors and expert lecturers in the learners' support, which are of high costs, can be replaced with lower-cost technologies. Nevertheless, Bates [1] mentions that there will be no productivity gains by replacing labor (instructors) with technology (computer-based learning), unless outputs are maintained or improved. Prior research into credit-based online learning has established that instructors' online presence is a critical factor in students' learning. Thus, it is important to consider which aspects of student-lecturer interaction can be replaced by technology and which cannot be.
- Another way to reduce the high costs of experts and tutors is to rely on communities of practice, so that expertise and judgement can be provided by the participants themselves. Nevertheless, Bates [1] states that the team-teaching approach is preferable, with the senior academic working more as a teaching consultant for setting curriculum, designing assessments and creating rubrics, and supervising the learner support provided by a team of adjuncts or a community of practice. This can help not only reduce costs but also achieve modest economies of scale in learner support, especially when combined with best practices in course design.

- Another issue in digital and distance learning is the design and management of the process. The more one can simplify and reduce the cost of 'processing,' while maintaining or enhancing quality, the greater the productivity. In digital and distance learning, the key process is the strategy of interaction and engagement, which will be heavily influenced by the content and the design of how learners will achieve a certain learning outcome. Course design has been considered to be a major factor influencing productivity in digital and distance learning.
- A majority of digital and distance learning students are working adults that have different views of what constitutes learning, how they learn, and the nature of their learning. In this case, reading digital resources and interactively playing with online courses does not guarantee learning to take place. Learning is expected to be a process that pushes students to gain understanding of what a subject discipline is about, and behaving and thinking as a professional within that subject domain. According to various practitioners, this is possible to be achieved through digital and distance learning, but how to scale up that learning to be successful across large numbers at a lesser cost is the key.
- The new trends in digital and distance learning have been the use of social media and the wisdom of the crowd through massive interconnection and communication across the internet. According to Siemens [16] and Downes [7], learning through online communities of practice or ad hoc or informal online connections through social media, and self-learning through internet searching and networking, have massive potential for reducing the costs of education, with the content becoming increasingly freely accessible on the internet and by eliminating or dramatically reducing the need for professional teachers. Thus far, have the digital and distance learning made use of this social media and wisdom of the crowd for learning? What is the impact? Universitas Terbuka, for example, has employed social media for certain announcements and communication purposes, but has not yet measured it against its productivity.

REMARKS

As digital and distance learning is inevitably flourishing in Indonesia, it is necessary to have a profound understanding of the basic cost structure of digital and distance learning as compared to the costs of conventional face-to-face classroom teaching. For a developing country as Indonesia, it is highly risky to assume that online learning is always more cost-effective or productive. The lessons learned from various initiations by the government have proven that assumption is not always the case. The circumstances need to be right for it to happen. Pushing too hard to scale up at a low cost as promised by digital and distance learning may lead to the loss of quality of learning outcomes. Therefore, a more empirical research is needed on the relationships between online teaching strategies, modes of delivery, technologies, costs, and the types of learning outcomes that constitute the digital and distance learning. It is yet to be proven that the digital and distance learning present opportunities for major economies of scale in their current states. Furthermore, careful consideration of productivity is also expected. As the resources are going scarce and the government is supporting HEIs to be autonomous; with clear expectation of skillful educated graduates who are competitive in the employment market, and innovation that is industrially competitive; productivity of digital and distance must be accounted for better decision making by all players.

Nevertheless, the role and function of digital and distance learning in Indonesia should also be taken into consideration and interplayed with productivity measures. Currently, the government places a specific role and function on digital and distance learning in Indonesia, i.e., to widen the access to quality higher education for all Indonesians across time and space, and to provide equity in affordable quality higher education to all Indonesians. Thus, even though digital and distance learning might not be efficient, the bigger picture of provisioning of access and equity of affordable quality higher education is far more important in Indonesia. In the case of Universitas Terbuka, accessibility and equity in accessing its services by Indonesian people in the remotest area in the archipelago is valued more than productivity alone.

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