

# **A Framework to Assess a Knowledge-Based Economy: Special Focus to Higher Educational Institutions**

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## **Abstract**

The term ‘Knowledge-Based Economy (KBE)’ is considered as an important strategy for the development of a country. It plays a crucial role to develop economic processes. It is therefore, critical to assess the KBE based on predefined Key Performance Indicators (KPI). The aim of this research is to give an overview of the KPIs, which are accumulated based on extensive literature survey and can be usable to assess the Knowledge-Based Economies. This assessment process was specially focused to measure the influence of higher education institutions on corresponding process of transition towards a knowledge-based economy. The research also explores a number of currently available KPI frameworks that are introduced by international organizations (e.g. World Bank Institute, Organization for Economic Co-operation and Development, Asia-Pacific Economic Cooperation, Australian Bureau of Statistics and European Commission) to assess KBE. Based on the shortcomings of available frameworks, this research proposes a hybrid framework that can be used to assess KBE. This proposed framework is more comprehensive in addressing the role of the higher education institutions such as colleges and universities in the development of knowledge based economy.

## **Keywords**

Higher education, Knowledge based economy, Key performance indicator, Innovation

## **1. Introduction**

The concept of KBE attempts to incorporate economic, social, and political influences that affect the ability of an organization or a higher institutions or universities to both create new knowledge and deploy that knowledge in economically useful ways. This approach therefore certainly contribute to economic growth and prosperity of a country (Bercovitz and Feldman, 2006). It offers to build a more general understanding of the relationships between the knowledge and its impact on economic development through knowledge-based innovation systems. Due to the accompanied benefits, over the past two decades, the economies of leading countries have increasingly evolved toward

knowledge-based economies (Tchamyou, 2017). It is widely agreed that the creation of new knowledge, innovation, and technological changes drive prosperity of any nations globally (Dahlman 2007; Chavula 2010; Chandra and Yokoyama 2011; Asongu and Tchamyou, 2016). By adopting a KBE approach, any country can be beneficial through providing extended employment opportunities, higher wages, and ultimately enhance the country's competitiveness globally (African Development Bank 2007).

Understanding the concept of a knowledge-based economy (KBE) and developing a strategy for its achievement is a building block for any country to compete in the global knowledge marketplace (Wood, 2003). In order to compete in the global economy, developing countries will need to ensure that their higher education systems help to create a skilled workforce to respond to the changing needs of the new KBE. Thus, higher education plays an important role in countries making the transition between different stages of growth. This work addresses the question of how higher education can contribute to the emergence of knowledge-based societies where activities and decisions across all domains of life are based on acquisition, utilization, and dissemination of knowledge (Leung, 2004).

While new knowledge will generally increase the economy's potential output, the quantity and quality of its impact are not known in advance (Kriščiūnas and Daugėlienė, R. (2006). There is no production function, no input-output "recipe" that tells, even approximately, the effect of a "unit" of knowledge on economic performance. To help understand the degree to which an economy is a KBE, various compilations of KBE statistics have been developed. Unfortunately, there is so far no internationally agreed framework for measuring a KBE (Afzal and Lawrey, 2012). Moreover, most of these frameworks are defined in terms of the statistics, which they present rather than being derived on the basis of theory or empirical evidence. The authors strongly believe, before such statistical indicators can be developed, an analytical framework on the subject is needed.

The remainder of the paper is organized as follows. Section 2 will briefly discuss some of the existing framework around Key Performance Indicators (KPI) of Knowledge-Based Economies. In Section 3, a new framework will be proposed. The new framework is based on the shortcomings of frameworks that will be discussed in section 2. Finally, section 4 will conclude the research work and discuss the possible avenue for future research expansion.

## **2. Existing frameworks for measuring KBE**

Universities by virtue of their role in generation, dissemination and validation of knowledge are able to make significant contributions to the knowledge and skills of local communities. In order to understand how a university could contribute to the value of a nation, it is necessary to first explore how value in a KBE can be measured. There are many different international systems available for this purpose. However, the means for measuring the performance of a KBE are in their infancy (Karahana, 2012). Following section will explore more into some of the characteristics of the different internationally available framework for measuring KBE.

### **2.1 World Bank Institute (WBI)**

Without better higher education, developing countries will find it increasingly difficult to benefit from the global knowledge economy [3]. To facilitate this transition process, the World Bank Institute's Knowledge for Development (K4D) Program has developed the Knowledge Assessment Methodology (KAM). The KAM consists of four pillars of knowledge economy. As shown in Figure 1, these pillars are related to Economic and institutional regime, Education and skills of people, Information and communication infrastructure and innovation system adopted by the country. There are two frequently used modes of the KAM: The Basic Scorecard and Knowledge-based Economy Index. The KAM Basic Scorecard provides an overview of the performance of a country in terms of the pillars of the knowledge economy. The KAM Knowledge Economy Index (KEI) is a numerical aggregate index that represents the overall level of development of a country or region in the Knowledge Economy.

The WBI reflects on three statistical-based variables for its educational dimension, which are average years of schooling, Gross secondary enrolment rate, and Gross tertiary enrolment rate. Such data might not be available on a regional level. Furthermore, the average years of schooling are not a good indication for the level of literacy and numeracy in a society. Therefore, this could result in a misleading picture of a country's capabilities for the transition into a knowledge-based economy.

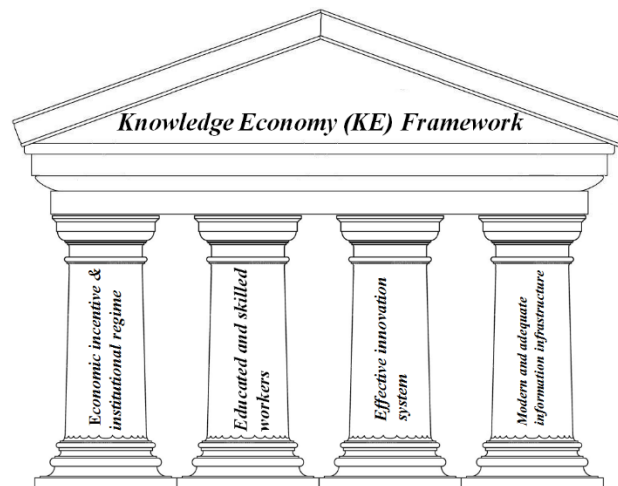


Figure 1. The World Bank Four Pillars of the Knowledge Economy (Chen and Dahlman, 2005)

The shortcoming of WBI framework is that it does not give a systematic process for the transition towards a knowledge economy and society given the contextual factors of a particular country including higher educational factors.

## **2.2 Asia-Pacific Economic Cooperation (APEC)**

APEC approached the KBE from a perspective similar to that of the OECD Growth Project (APEC, 2000). APEC concluded that KBE should have four dimensions, which are as follows:

- Pervasive innovation and technological change, supported by an effective national innovation system;
- Pervasive human resource development, in which education and training are of high standard, widespread and continue “throughout a person’s working life”;
- Efficient infrastructure, operating particularly in information and communications technology (ICT); and
- A business environment supportive of enterprise and innovation.

However, APEC only chose those indicators that were available for context of their own economies. This somehow tended to limit the choice of indicators.

## **2.3 Australian Bureau of Statistics (ABS)**

The ABS framework model has three core dimensions (Trewin, 2002). These dimensions are Innovation and entrepreneurship, Human capital, and Information and communications technology. In addition, as shown in Figure 2, there are two supporting dimensions, a context dimension and an economic and social impacts dimension. Within each dimension are characteristics and indicators that are chosen to provide measures of the characteristics. The main advantage of the ABS framework is that the context dimension is broad and it can give a better insight into the interdependency between knowledge economy factors especially higher educational factors since they have implication on cultural and social dimensions amongst others. Its main shortcoming is that it lacks a systematic approach on how to guide a transition process towards a knowledge economy.

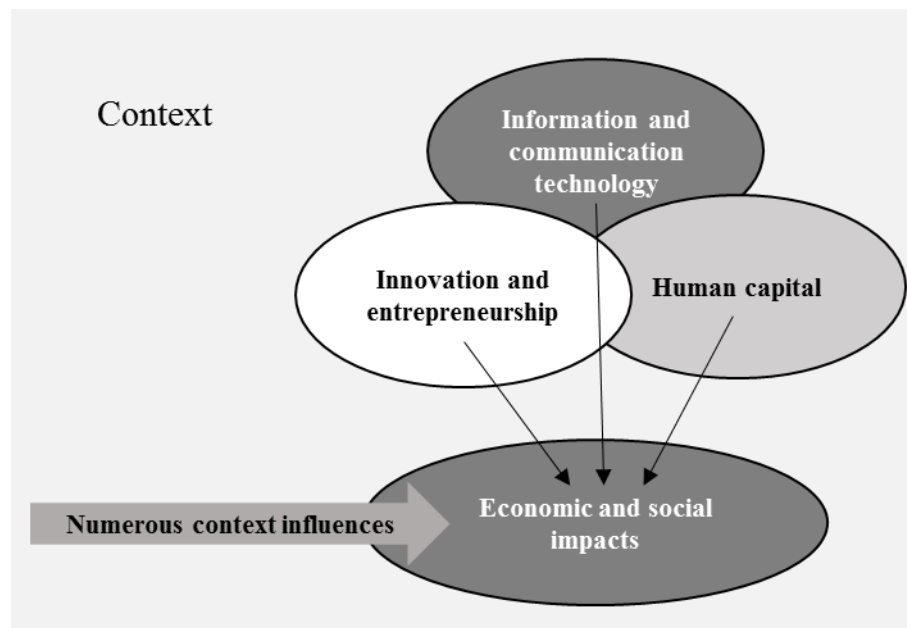


Figure 2. ABS Knowledge-based Economy/Society Framework (Europe, 2009)

An advantage of the ABS classification is the introduction of the human capital dimension, which pays a deep attention to stock of skilled people, flow of skilled people, investment in human capital, lifelong learning and access to education and training. These factors are strongly related to the role of higher education institutions. In the ABS framework, Innovation and entrepreneurship dimension has numerous characteristics such as Research Base and Potential for Knowledge Creation. These characteristic have a number of indicators, which are a combination of Enablers, Firm Activities and outputs. Some of the example enablers used in ABS framework are explained below with the objective to understand them better.

- [Enablers] - Total R&D expenditure by sector of performance (business, government, private non-profit, higher education), as a proportion of GDP
- [Enablers] - Total R&D expenditure by sector of performance
- [Enablers] - Expenditure on basic research by sector of performance (business, government, private non-profit, higher education), as a proportion of GDP
- [Enablers] - Expenditure on basic research by broad discipline, by sector of performance, as a proportion of GDP
- [Enablers] - Expenditure on business R&D by business size
- [Outputs] - Number of scientific and technical publications per capita

For each time step, each node who has at least three talking neighbors starts talking himself for two time steps. Each time an agent starts talking his contact counter is increased by one. As soon as the contact counter reaches a value higher than 20 a visiting decision is made. In case the agent chooses to visit the current state switches to positive for one time step, the number of visits is increased by one and the contact counter is reset to zero. If the agent decides not to go, he/she will proceed as before. For each node, the number of visits is recorded.

## 2.4 European Commission Innovation Scoreboard (EIS)

The Innovation Union Scoreboard (IUS) benchmarks the innovation performance of member states, drawing on statistics from a variety of sources (Europe, 2009). As shown in Figure 3, this methodology distinguishes between three main types of indicators (Enablers, firm activities and outputs) and eight innovation dimensions. Further, innovation dimensions capture in total 25 different indicators. The main merit of the EU framework is its systemic approach on how to guide a transition process towards a knowledge economy. However, it is not as broad in considering contextual factors as the ABS framework, including the lack of detailed consideration for higher education factors.

The EU framework adopts a linear structural logic with the assumption of that enablers are dependent of an open, excellent and attractive research systems. This assumption could restrict the flow of skilled people that can participate into the transition to a knowledge-based economy society. The main merit of the EU framework is its systemic approach on how to guide a transition process towards a knowledge economy. However, it is not as broad in considering contextual factors as the ABS framework, including the lack of detailed consideration for higher education factors.

As shown in Figure 3, this methodology distinguishes between three main types of indicators namely, enablers, firm activities and outputs and eight innovation dimensions. Further, innovation dimensions capture in total 25 different indicators used to measure KBE.

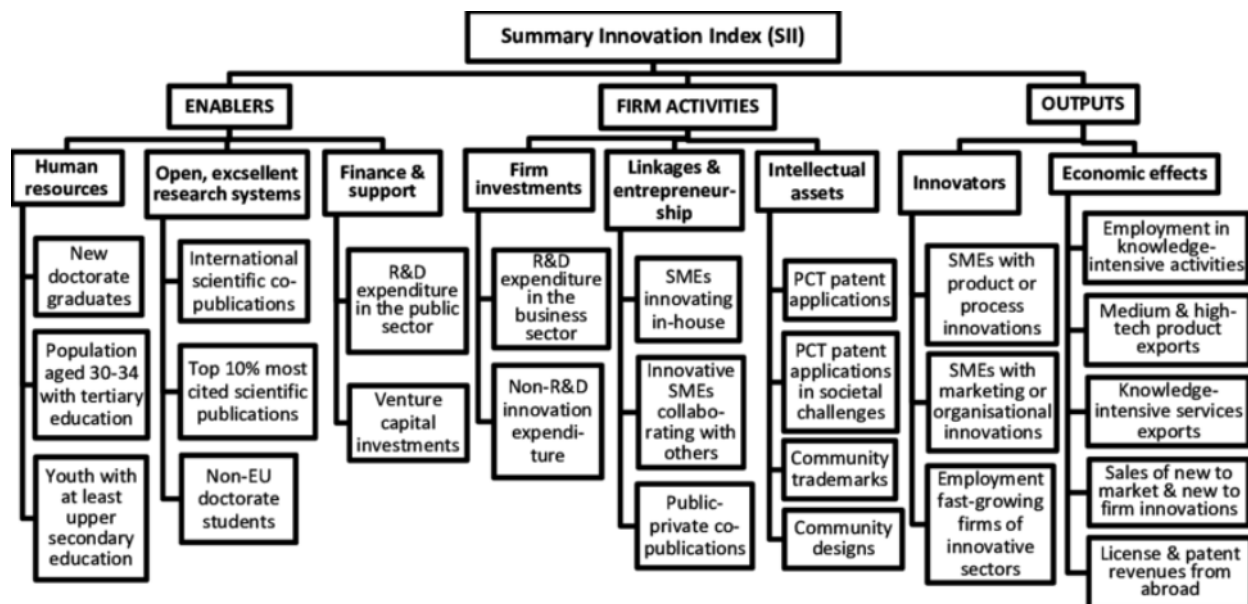


Figure 3. Framework of the Innovation Scoreboard (Europe, 2009)

## 2.5 Characteristics of the different available framework to measure the performance of a knowledge-based economy (KBE)

The various characteristics among the above mentioned five frameworks are summed up in Table 1. From the Table 1, it is noticed that there are several similarities from one framework to another to measure the overall status of knowledge-based economy. For instance, it is noticed that level of innovation and entrepreneurship is common between ABS and EIS framework, while, dynamic information structure is common between WBI and APEC. It is also noticed that creation of new knowledge with the objective to improve human capital is common to all available frameworks.

Serial no.	Name of the framework	Characteristics
1	World Bank Institute (WBI)	<ul style="list-style-type: none"> <li>• Incentive for new knowledge and flourishing of entrepreneurship</li> <li>• Level of education and skills of the people to enable them to create, share and use it well</li> <li>• Adult literacy rate of a country</li> <li>• Use of dynamic information infrastructure to facilitate effective communication</li> <li>• Capacities of higher institutions of tapping the growing stock of global knowledge</li> </ul>

2	Organization for Economic Co-operation and Development (OECD)	<ul style="list-style-type: none"> <li>• Recognition of higher education as a driver of economic competitiveness</li> <li>• Human capital forms primarily through teaching</li> <li>• Development of human capital indicators to measure education and training</li> <li>• Indicators for the KBE must go beyond measuring knowledge flows and global enterprise</li> </ul>
3	Asia-Pacific Economic Cooperation (APEC)	<ul style="list-style-type: none"> <li>• KBE is mostly responsible for economic development of a country</li> <li>• KBE strongly demands for efficient infrastructure and communication network</li> <li>• Lifelong learning is critical for KBE</li> </ul>
4	Australian Bureau of Statistics (ABS)	<ul style="list-style-type: none"> <li>• KBE articulates economic, social, cultural, legal, political, environmental and global factors</li> <li>• Innovation and entrepreneurship is one of the major milestone to develop KBE</li> <li>• Provide better insight into the interdependency between knowledge economy factors</li> </ul>
5	European Commission Innovation Scoreboard (EIS)	<ul style="list-style-type: none"> <li>• Scorecard based framework to capture main drivers of KBE and several measures of innovation outputs</li> <li>• A systematic approach to guide a transition process towards a knowledge economy</li> <li>• Application and intellectual property rights (IPR) are termed as innovation inputs to form KBE</li> <li>• Knowledge creation and entrepreneurship are considered as the output for KBE</li> </ul>

Table 1. Available characteristics among various frameworks for performance measuring of KBE

### 3. Proposed Framework to Measure the KBE

From the available frameworks as presented above to measure the KBE, it is observed that there is no commonly agreed framework that is applicable internationally for measuring the KBE. Moreover, it is also noticed that KPIs for the available frameworks do not give a systematic process for the transition towards a knowledge-based economy and society given the contextual factors of a particular country including higher educational factors. In addition, almost all the frameworks that are reviewed here have to understand the degree to which an economy is a KBE and relevant statistical indicators have to be considered by different economic organizations.

The methodologies to understand the degree of KBE of international organizations can only be viewed as a “descriptive” or “presentation” framework that uses different statistical indicators rather than trying to view those indicators within the context of a statistical framework (Leung, 2004). The proposed framework to measure the KBE is highlighted in Figure 4. From Figure 4, it is noticed that the framework is consisted of three elements namely performance indicators, institutional tasks and results and analysis. In the ‘performance indicators’ stage, necessary performance enablers are identified that can be used to measure the KBE of an organization or an educational institution. After identifying the required enablers, the next available stage of the framework is to monitor ‘institutional tasks’, which are used to measure the overall status of KBE within a firm or institution. The final stage of the proposed framework is ‘results and analyses’ which are used to display all the key findings from an investigation to measure KBE of a firm or an institution.

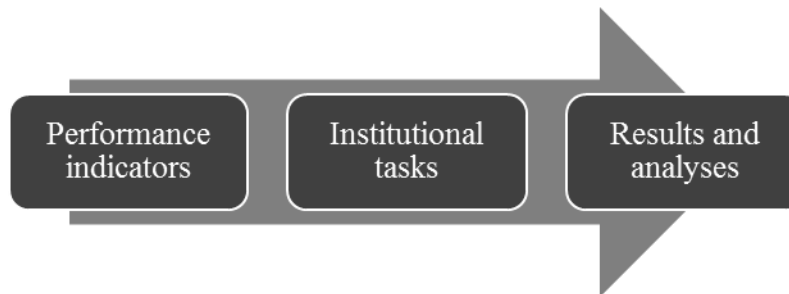


Figure 4. Proposed Framework to Measure KBE

The framework as proposed to measure the KBE can be considered as a blending between the EU framework and ABS framework. In the EU framework, there are 25 different indicators and 8 innovation dimensions that are used to measure the performance of KBE. Whereas, in the ABS framework has 3 core dimensions to measure KBE. The number of performance indicators of the proposed framework can be varied from one organization to another depending on the nature and type of organization. Similarly, institutional tasks are also varied from one organization to another based on the size and nature of the organization.

By comparing both the EU framework and ABS framework from which the proposed framework is evolved, it is noticed that there are several similarities between them. The similarities between the two frameworks are displayed in Figure 5. From Figure 5, it is observed that 3 dimensions such as context dimension, innovation and entrepreneurship dimension and human capital dimension between the two frameworks are coincided with enablers and outcomes. At the same observation, it is also noticed that innovation, entrepreneurship, and ICT dimensions are coincided with enablers, firm activities and outcomes. However, economics and social impacts are not coincided with any of the enablers, firm activities or outcomes. Figure 5 also indicates the need for understanding and measuring firm activities from a contextual point of view. This is critical especially in understanding the role of the firm activities within the value added chain in the monetization of knowledge.

European Commission Innovation Scoreboard (EIS)				
Australian Bureau of Statistics (ABS)		Enablers	Firm activities	Outcomes
	Context dimension	X		X
	Innovation and entrepreneurship dimension	X	X	X
	Human capital dimension	X	X	X
	Information and communication technology dimension	X	X	X
	Economics and social impacts			

Figure 5. Similarities of dimensions between EU framework and ABS framework

Therefore, while different sets of statistical indicators have been selected and grouped according to different aspects within the frameworks of international organization, they can be grouped into the above proposed framework. In other words, to fully understand the working of the KBE, classification of indicators are required beyond the conventional classification of international organization presented in previous section.

#### 4. Conclusions and Future Works

In order to develop a knowledge base economy, it is necessary to develop a framework. This framework can helps to identify to measure the status of KBE of a country or state. The aim of this research study was to develop such a universal framework to measure KBE, especially in higher educational institutions. To fulfil such research objective, several available frameworks are reviewed critically. Based on the literature review it is noticed that there is no universally accepted framework to measure KBE in higher educational institutions. To fulfil such research gap, this

research study proposed a framework to measure the status of KBE of a nation. The proposed framework is developed based on the available EU framework and ABS framework commonly used to measure KBE.

The proposed framework is especially applicable to assess KBE in higher educational institutions. The higher educational institutions or universities are already involved in research to discover knowledge, but they also will have to ensure that a knowledge-intensive, high-skills workforce is available to give the knowledge value by bringing it to the marketplace in order to insure economical and social impact. This implies that such highly skilled workforce has to cover the entire value added chain from innovation to market entry and growth. In addition, in order to support the addition of value to the knowledge developed in an economy a complete support structure is necessary throughout the value added chain to enable the economical and social impact through cutting-edge knowledge and high-skills. It should be added that such a highly skilled workforce and support structure could be in house within the institutions or offered through public and private sector partners. Therefore, in order to understand how a university could contribute to the value of a state or region it is necessary to explore how value in a knowledge-based economy might be measured throughout the value added chain and how it is added through highly skilled workforce and a support structure including HEIs.

Due to resource and time constraints, the proposed framework to measure KBE is not validated. In future, the proposed framework will be validated by applying it to measure KBE in organization, especially in higher institutions.

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