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# The Dawn of Knowledge Economy: Revolutionizing the Role of Higher Educational Institutions



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# Abstract

## The Dawn of Knowledge Economy: Revolutionizing the Role of Higher Educational Institutions

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The emergence of knowledge as a new practice in production has excelled in several top-tier economies. In its basic meaning, a knowledge society is a place where people value intellect and knowledge to prioritize skills and abilities based on the same. The World Bank has established four pillars of knowledge economies on which it should withstand –Education & Training, Information Infrastructure, Innovation Systems, and Economic Incentive & Institutional Regime. Knowledge centric jobs and occupations are on a rise which exposes the increase in demand side in major economies. It is important to study the concept of knowledge economies in this post- modern era as to how it triggers knowledge production, innovation, and research. While there are quite a few components in a knowledge society and there are several factors influencing it, higher education plays one of the most crucial roles in fabricating and devising it. This paper is premised on understanding how knowledge is revolutionizing the economies. It further extends in examining the function of higher education in the creation of knowledge economy by taking into consideration the evolving role of facilitators and universities. Contingent on the findings, the author structures a pathway to highlight the future of knowledge economies and its sustainability in context to the developmental changes.

# List of Abbreviations

| Sr. No. | Acronym | Full Form |
|---|---|---|
| 1. | HEI | Higher Educational Institutions |
| 2. | ICT | Information & Communications Technology |
| 3. | KAM | Knowledge Assessment Methodology |
| 4. | KBE | Knowledge Based Economy |
| 5. | KE | Knowledge Economy |
| 6. | KEI | Knowledge Economy Index |
| 7. | OECD | Organization for Economic Co-operation and Development |

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# CHAPTER 1

# INTRODUCTION

## 1.1 Conceptual Background

"Success in the knowledge economy comes to those who know themselves - their strengths, their values, and how they best perform."

— Peter F. Drucker

Knowledge is an extremely complex resource which is presently playing a role of an important constituent in the rapid economic growth in almost every nation. Developed nations have a vision in producing knowledge economies. A Knowledge Economy (KE) is one that creates, disseminates, and uses knowledge to enhance its growth and development (World Bank, 2005). A substantial investment in Research & Development, strong network between science and technology, greater open access in attaining knowledge, and good standard of higher education are a few essential characteristics of a KE. The rudimentary economic resource is no longer capital, or natural resources, nor labour. It is and always will be knowledge (Drucker, 1996). By this, the author does not actually consider humans to be unimportant, rather, quite the reverse; he emphasizes that as knowledge is embodied in a person it makes humans invaluable.



After having mentioned the role and vitality of knowledge on economy in today's world, it is time to proceed to how knowledge economies are being formed which then affects the society positively. However, before moving forward it is crucial to understand the difference between information and knowledge and why we consider knowledge to be highly eminent with respect to this research domain. There is surely interplay between information and knowledge but what distinguishes the latter from the former is complexity. While information is readily available via various sources such as books, magazines and internet, knowledge is imbibed in a person's mind. Distinct scholars and authors have termed it as a combination of several affairs. For example, authors Davenport & Prusak (1998) regard knowledge as an amalgamation of strong intuitions, structural information, thoughtful experiences, etc. Information can be established outside the human arena whereas creation of knowledge requires a direct influence of individuals. Possessors of

knowledge have the capability for action- intellectual or physical. Diversely, information stays dormant and passive unless utilized by knowledge which then makes it useful in elucidation (Raghavan & Neelameghan, 2016).

Termed by the World Bank, KE has four pillars which stand as critical requisites for the formation. They are namely – *Education & Training, Information Infrastructure, Innovation Systems, and Economic Incentive & Institutional Regime.*

Pillar 1: Education & Training

This pillar basically comprises of innate skills and talents of individuals. The recent global expansion has been placing a lot of demand on the labours' skills. In a KE lifelong learning plays a very vital role which helps in improving an individual's performance ability (Gorji & Alipourian, 2011). According to Enache, Marin, & Vechiu (2009) earning systems take different approaches for example – Adaptive learning (that specifies changing of working environment where only knowledge is needed for the business firms and organization to adapt to contextual evolution), transformational learning (a step more than adaption where cognitive processes takes place enabling permanent interaction between organization and its economical environment), and lastly the trickiest is learning how to learn (it is the most evolved where utilisation of knowledge takes place permanently and not only during occurrences of certain changes).



Using cross-country time-series data on educational attainment or average years of school, it was found that statistically there are significant positive effects of education on economic growth (Cohen & Soto, 2001). Most empirical studies have focused on the role of human capital in economic development (Mankiw, Romer & Weil, 1992; Benhabib & Spiegel, 1994; Hall & Jones, 1999). Barro (1991), using cross-section data for 98 countries for the period 1960 to 1985, found that both school enrollment rates had statistically significant positive effects on growth of per capita real GDP.

Pillar 2: Information Infrastructure

Information Infrastructure can be explained with the help of Information and communications technology (ICT). Influence of ICT on economic growth can be measured with the help of multifactor productivity factor (MPF). This influence is mainly channeled in two ways – one is by greater investment in ICT and the other by swift production of ICT

goods (Gorji & Alipourian, 2011). An up-to-date and efficient Information Infrastructure which will stimulate the propogation, creation, and effective management of knowledge is a requisite (Chen & Dahlman, 2004). Although crucial, Information Infrastructure as a pillar is very complex. Empirical Findings show that even though in long term the output would be a tangible benefit, to create them is an arduous task both from the point of view of financing related activities, as well as due to the need to overcome many often very serious structural, legal, technical, and mental barriers (Grochowska, 2016).

Pillar 3: Innovation Systems

The speedier the process within an organization in innovating, the faster it will be able to respond to market changes. Various empirical studies prove how innovation has solid and considerable constructively pragmatic outcome on economic growth or productivity growth. For instance, Lederman and Maloney (2003), using regressions with data panels of five-year averages between 1975 to 2000 over 53 countries, find that a one-percentage point increase in the ratio of total R&D expenditure to GDP increases the growth rate of GDP by 0.78 percentage points. Guellec and Pottelsberghe (2001) investigated the long-term effects of various types of R&D on multifactor productivity growth using panel data for the OECD over the period 1980-98. The British sociologist, Roy Rothwell distinguishes 5 generations of innovation process models:

1. “Technology push” model (from 1950 to the mid-1960’s).
2. “Market pull” model (from the mid 1960’s to early 1970).
3. “Coupling of R&D and marketing” model (from the mid 1970’s to the mid-1980’s).
4. “Integrated business processes” model (from the early 1980’s to the mid-90’s).
5. “System integration & networking” model (from the 1990’s).

The models mentioned above along with few newly introduced theories and models help elucidate this pillar. Tacit knowledge is regarded as a company’s asset and should be treated well (Bilous, 2014).

Pillar 4: Economic Incentive & Institutional Regime

An economic incentive & institutional regime that furnishes stable economic policies and also provides good decision making system and efficient mobilization of resources to

encourage healthy innovation and creativity is central to knowledge economy. Protectionist policies must be worn down to promote "knowledge conducive" economic regime which further stimulates competition and lastly entrepreneurship in international trade (Sachs & Warner, 1995; Bosworth & Collins, 2003). The World Bank defines it as "A regulatory and economic environment that enables the free flow of knowledge, supports investment in Information and Communications Technology (ICT), and encourages entrepreneurship". Other author, for example Barro (1991), asserts that government expenditures and budget deficits should be sustainable, and inflation should be stable and low. In all, there should be free flow of knowledge, strong protective enforcement on intellectual property, stable exchange rate and budget deficits, and efficient mobility in resources (Levine, Loayza, & Beck, 2000; Knack & Keefer 1995; Kaufmann, Kraay, & Mastruzzi, 2003; Gorji & Alipourian, 2011).

## 1.2 Significance of Study

Knowledge creation is nothing new. It has been in existence in our society since the very beginning. Then what is it now that the economists are popularizing it and the economies are craving for it? Well, it is simply revolution. Peter Drucker who is the founder of the term "knowledge economy", mentioned in his 1996 book "The executive in action" that the primary resource in production is no more the natural resources or goods but it is knowledge. Not only scholars and researchers, but many business organizations across the globe have come to the understanding of importance of inculcating knowledge in their firms for their business survival in today and tomorrow's time (Enache, Marin, & Vechiu, 2009).



However, many fail to realize that KE does not only manifest invention of new high technology or information. It is also about adapting to current technology and making use of it to produce the best output. In fact research suggests that the benefits received from intelligibly adopting the ongoing technologies and finest operations considerably supersede the gains from inventing new technologies (The World Bank, 2015). Knowledge can signal the gap that breathes between poverty and prosperity. This so, as empirical evidence established by authors Chun, Xin, Ching, Heng, & Poh (2017) suggests a substantial correlation between economic growth and knowledge. There exists a significant positive correlation amongst the two variables (~ 0.7).

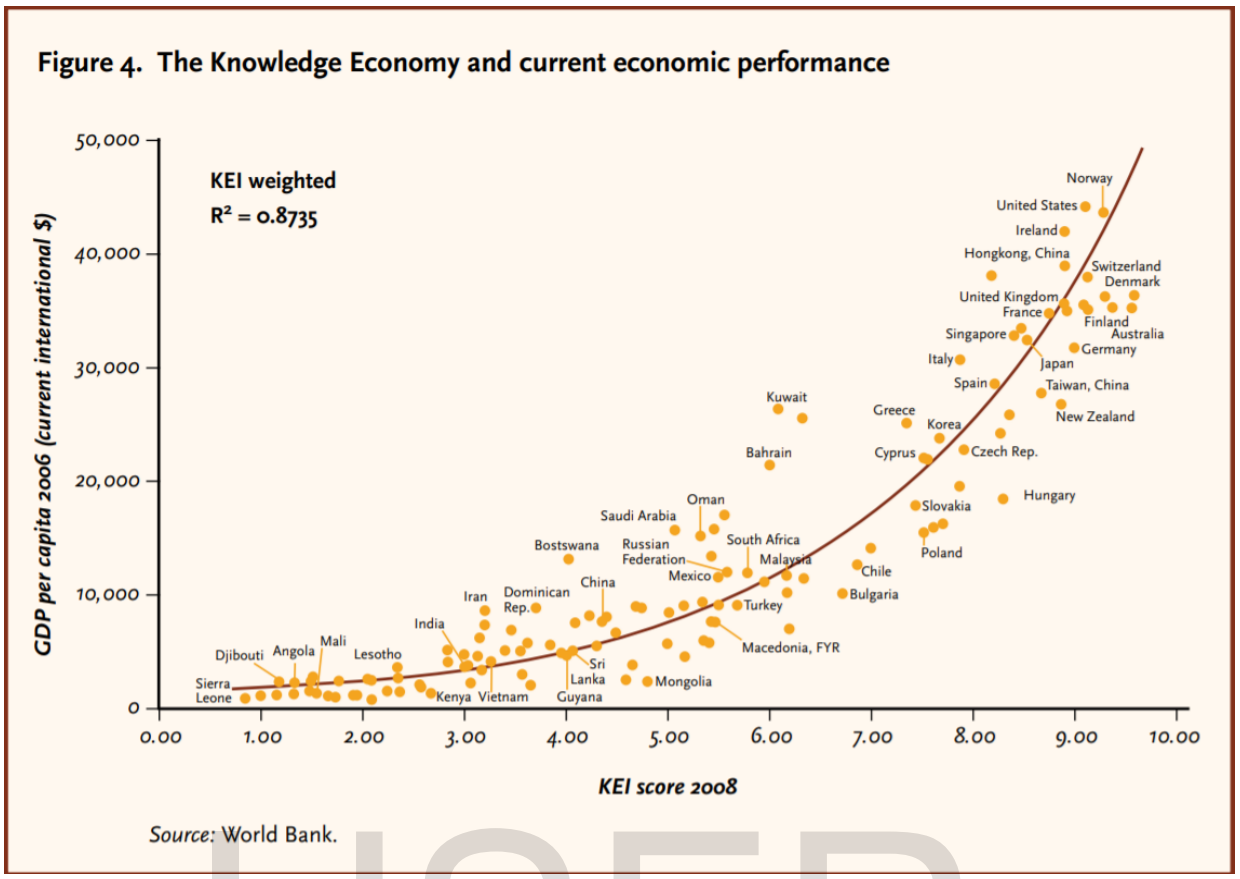



*Figure 1*. Positive link between knowledge and economic development. Reproduced from "Measuring Knowledge in the World's Economies" (p.7), The World Bank. Retrieved from http://web.worldbank.org/archive/website01030/WEB/IMAGES/KAM_V4.PDF

The character that knowledge plays in a knowledge-based economy is of course, as the name suggests very large. Knowledge influences an economy in several ways such as knowledge as a subset in technology, investments, and labour. However, knowledge undoubtedly is predominantly imparted within individuals during their years of education. Amongst this, schooling essentially covers all the basic elements required at an early stage but the KE's main focus is the relevant skills and talents which are nurtured at an advance level, that is, during the higher studies. Hence, the role that higher education plays directly affects the economic growth. For instance, the author Finegold (2006) states that the role of Higher Educational Institutions (HEI) helps in building high-skilled-ecosystems that then prepares the young minds in becoming future leaders.

University can be defined as an institution of higher learning that provides facilities for teaching and research, and is authorized to grant academic degrees (Merriam-Webster, 2019). At present, tertiary education is regarded to have a dual mandate as it promotes social cohesion, tolerance and democracy, and at the same time fuels economic development through the creation of knowledge and skills (OECD, 2006). According to upcoming theories, traditional factors do not have as considerable an impact as they did before. As conventional factors no longer play the equivalent role of knowledge in economic development, it is important to create a well-educated and highly skilled workforce (Djonlagic & Kurtic, 2016). This is possible only en-route HEI. Knowledge as a resource is a balance between explicit knowledge and implicit knowledge (Figure 2). While explicit knowledge relies on technology, implicit knowledge is delivered via human resource and ultimately skills.

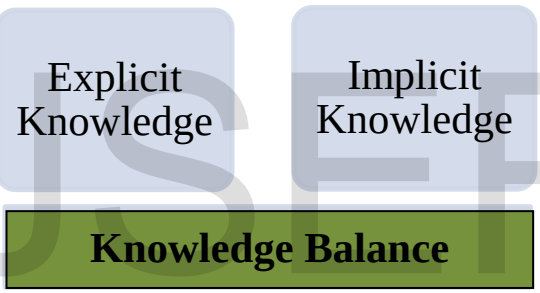



*Figure 2*. Knowledge Balance. Adapted from "The Importance of the Knowledge Based Economy" (p. 3), by Enache, Marin, & Vechiu, 2009.
Retrieved from https://www.semanticscholar.org/paper/The-Knowledge-Based-Economy-Enache-Mar%C3%ADn/dff4acb9bc3cbbf2423c67026d76dc5d6a170561

As mentioned earlier and depicted in the figure above (2), knowledge has two forms, essentially equal. However, when it comes to the long run, it is generally regarded that implicit knowledge, that is inbuilt within humans, will prove to be more advantageous and shall enhance the growth (Enache, Marin, & Vechiu, 2009). Hence, for consistent output of implicit knowledge there is a subsequent need for development in HEI and research. This will not only help generate ecosystems which will further act as catalysts for growth but will build knowledge communities for prosperous outreach. Examples of a few ecosystems like such are Silicon Valley, the biotech clusters of Cambridge, Massachusetts and San Diego, California (Finegold, 2006). These are highly prominent in nature, whereas, many exist

which are yet untapped or are in an ongoing process.

## 1.3 Purpose of Research

The intent of research on knowledge economy and the role of HEI in that economy is concerned with the thought that how in the long term knowledge is and will be regarded as the only prime resource in the economy. The fact that almost each developed and developing nation is thriving to build knowledge communities and societies via the growth of knowledge economy is an important field of research. Few of the world's leading and most prosperous economies are also ranked high in the knowledge economy index. They are the ones which are highly innovative and have a strong base in (1) advanced education levels, (2) well-functioning science and technology (S&T), and also (3) infrastructure. A most distinguished example of this is Korea, the country did not possess much in the way of mineral resources other than coal. Nonetheless, significant investments in science and technology, and research as well as a strategic science policy contributed to GDP increases of 6.8% per year between 1966 and 1996 (The World Bank, 2006).



## 1.4 Research Objectives

The research objectives of the paper are primarily associated with two aspects –

I. To understand how Higher Educational Institutions (HEI) assist in shaping a knowledge economy.

   Education has been performing as a silver bullet that policymakers are using to fire at a wide range of targets – from augmenting global competitiveness and creating and preserving high-quality jobs, to narrowing wage inequality and promoting innovation (Finegold, 2006). Maintaining and leveraging the high-class standard of higher education is gaining more and more recognition as countries which have large enough pool of skilled, flexible, mobile and networked individuals have a competitive edge in the global market (The World Bank, 2006). Through this paper, the author will reflect upon the influence of HEI in a knowledge based economy and how it plays a pivotal role in molding it.

2. What measures should be taken or inculcated in the HEI system to achieve higher rank in the KEI?

   It has been proven before with the help of empirical studies that KEI has a positive correlation on economic growth (figure 1). Hence, as Education and Training is one of the pillars of KE, it is extremely important to decipher which operations and course of action is required in the Education and Training pillar for executing an overall better performance on the KEI. This will represent a future roadmap for countries with respect to the Education and Training pillar of knowledge based economy.

## 1.5 Limitations

The factors limiting this study majorly revolve around the fact that this subject domain is fairly new and unexplored. As it is a less researched area, it poses a problem of data collection. While there exists quite a few studies based on KE, studies related to individual pillars are relatively unavailable.



A second difficulty hindering this study is that comparing countries with respect to a certain subject does not always result in a just and equitable result. This is because there are multiple external elements clouding and influencing the research subject. For instance in this paper, the result of comparison between Sweden and India in the case of education and training pillar of KE will reflect output which probably cannot be adapted due to differences in demography, geography and political scenario.

Lastly, knowledge yet is a highly subjective term for a great proportion of world population which leads to incredibility and scattered data. This is also due to the complexity of understanding of the subject.

## 1.6 Assumptions

As established in the paper earlier, KE has four acclaimed pillars based on which the KEI is determined. Knowledge Assessment Methodology (KAM) also uses data gathered on these four pillars. The weightage given to all the pillars is equal and there is no bias formulated while treating the data. However, research work shows that government incentive and

institutional regime pillars have more direct and larger impact on economic growth in an overall comparison (Chun, Xin, Ching, Heng, & Poh, 2017). The assumption underlying in the paper is that all pillars are considered and measured equally. No bias or unequal weightage has been attached to any individual pillar.

Secondly, few empirical studies suggest that there is no substantial positive correlation between knowledge and economic growth and there still exists certain ambiguity in this field of concern (Paličková, 2014). Notwithstanding these works, the paper is built on the contrary fact that knowledge does positively impact economic growth. This so because the fraction of studies which prove otherwise, that is, knowledge does not propagate economic growth is very less and is dependent on regional segregation.

### 1.7 Organization of Dissertation Chapters

This thesis composes of five chapters which are divided as follows –

The first chapter manifests an overview of the field of study by providing the meaning, history and presence of the topic. Along with this, it generalizes as to why the chosen topic holds immense importance in research and the author's motivation behind its study. The second chapter comprises of literature retrieved from various research works that helps in creating a framework for the paper. It also includes notable works by different authors that contribute in enhancing the field of study. Chapter three solely focuses on the methodology adopted in the paper to obtain steady conclusive results and then also elucidates the chosen methods for a clearer understanding. The fourth chapter executes all the findings and shows the results with valid interpretations supporting the research objective. The last chapter, chapter five primarily aims at showcasing the summary of results, future work, remarks and conclusion.

# CHAPTER 2

# LITERATURE REVIEW
# &
# RESEARCH GAPS

## 2.1 Growing importance of knowledge and reasons why economies are endeavouring it

A Knowledge Economy (KE) is one that utilizes knowledge as the key engine of economic growth. It is an economy where knowledge is acquired, created, disseminated and used effectively to enhance economic development (Chen & Dahlman, 2006). While, there are various definitions of knowledge economy, the essence is primarily about converting knowledge to value. Rapid changes, depending on the magnitude and speed, will soon differentiate knowledge economies with the rest giving the former leverage (Sullivan, 2017). All nations, especially developing countries aspire to being a part of the global transformation to a knowledge economy. The advanced industrial economies which are on track, due to this global creative knowledge markets are being established which offer a comparative edge to the developed economies, for example the United Kingdom, from the cutting competition from low wage economies (Brinkley, 2008).

The knowledge paradigm which though has a complex and enigmatic history and future just the same, it is regarded as the “miracle of human universe”. In today’s time all businesses are knowledge businesses based on data, and all managers are knowledge managers (Enache, Marin, & Vechiu, 2009). However, according to the studies conducted by authors Petrovic & Stanisic (2015), with respect to transitional countries the correlation between Knowledge Economy and GDP value of a country is very low for the year 2012. Many transition countries do not construct or support their economic growth on knowledge economy. Due to such kind of disparity in studies, it becomes necessary for a better proof examination of this subject.

After having successfully transitioned to market economies, Europe and Central Asia (ECA) regions need to modernize and reorient themselves towards the knowledge economies' global innovation and technology framework so as to build an efficient communication with the world and better entrance to knowledge (The World Bank, 2006). One of the main reasons for knowledge based economy gaining popularity is that tangible evidence demonstrates knowledge as a resource is capable of helping nations to successfully attain development goals (Kefela, 2010). Via studies and practical implementations, it has been discovered that a fortunate transition to knowledge economy almost often includes elements such as expanding innovation capability, modernizing the information infrastructure, long-term investments in education, and having an economic environment that is conducive to market transactions (Gorji & Alipourian, 2011).

In today's globalized world, around seventy percent of employment opportunities are information based already. Knowledge economy is a solution to many economies. For example, Middle East which is highly reputed for extremism and considered as underperforming economy, if transforms to knowledge economy, it will completely be a revamp (Erdemir, 2015). Knowledge economies are not created overnight. South Korea, a knowledge economy, with a capital K, which has transformed into a high-tech, consumer electronic and manufacturing powerhouse over the past 50 years, with the likes of home-grown giants Samsung, LG, and Hyundai. This transformation is in large part due to the country's focus on investing in knowledge-intensive industries (Sullivan, 2017).



## 2.2 Role of higher education as an intellectual device

The role of universities in the educational system has changed a lot in utmost fundamental ways over the past few years (Dundestadt, Wulf, & Zemsky, 2005). According to the author Snellman (2015) this is due to the evolution of knowledge economy. Also, in the ongoing decade, policymakers have given great amount of consideration higher education (Brennan & Naidoo, 2007). In a knowledge based economy, research is created and generated in a complex procedure of networks and alliances (Castells & Cardoso, 2005; Neubauer, 2012). Higher education serves the interests of all by providing opportunities to everyone and, subsequently, waste of talent to the detriment of the economy is avoided (UNESCO, 2009).

The role of higher education in our society should be more standardized, certain, and focused. In the era of turbulence and uncertainties, it is crucial to develop innovative approaches to maintain educational clientele (UNESCO, 1999). According to the Lisbon 2020 agenda, the European Union (EU) is now converting its economy to knowledge based which will then trigger sustainable employment, education and innovation. Governments across the globe are attempting to gain high-skilled labours and there exists high demand in the workforce for individuals with a university degree (Djonlagic & Kurtic, 2016).

HEI plays several roles in the modern times. To name a few – as a provider of lifelong learning, building communities, tenant for economic development, focal point of high-skill ecosystem and more (Finegold, 2006). The reform of higher education systems to provide the necessary resources is an important priority for all countries (The World Bank, 2006). However, the role of HEI is not limited to economic growth as it also promotes cultural diversity, political democracy and enhances international cooperation (Marginson, 2010). HEI in a knowledge economy plays a key role in generating conditions for investing in creation and utilization of new knowledge and technologies which are crucial for increasing productivity and achieving economic growth.



This contributes to an economy's increased competitiveness (Djonlagic & Kurtic, 2016). Education and economic growth have shown positive long run relationship. In an empirical study it showed that a $1 increase of spending in education will result in almost $20.85 incline in the Gross Domestic Product (GDP) (Idress & Siddiqi, 2013). Lastly, education is also highly renowned for reducing and closing the gap between income distributions in a country (Chandra, 2011).

## 2.3 Challenges faced by universities in creation of knowledge

In the era of knowledge economies, universities are expected to contribute more and more towards the economic growth and social development (Jongbloed, Enders, & Salerno, 2007). Drawn together, in the context of knowledge-based economy and knowledge society, creative universities that provide quality and excellence in teaching, learning, research and innovation, are called for at national, European and increasingly at global level. Thereby, in the context knowledge society, the traditional role of university may be seriously challenged (Snellman, 2015). Today, one of the main issues HEI face is that of anti-intellectualism (mistrust of intellect and opposing or hostile to intellectual view or

literature).

This is mainly due to lower satisfaction of students from college education and they also have relatively lesser interest in analytical and critical thinking (Frunzaru, Vătămănescu, Gazzola, & Bolisani, 2018). Education is also challenged by knowledge's characteristic of being generated massively in multiple ways and by diverse organizations and institutions (Beerkens, 2008). In EU, the HEI are been suggested to improvise and update higher education system in order to attain competitive edge. And one of the ways of successfully achieving this is through Research & Development (R&D). Enhancing R&D and improving generation of innovation means that Europe will have to increase the number researchers, and make changes in educational system and will thereby gain competitive processes, products, and services (Eurydice, 2012).

In few countries, for instance India, political unrest in the country impacts the educational system which in turn is unable to meet the demands of individuals in gaining access to knowledge and greater economic opportunities (Finegold, 2006). The relatively minor conflicts faced by the HEI are –
Avoid creating a "hierarchy of affluence" or a "salary divide" between faculty member, Monitoring scientific misconduct and Intellectual Property Rights (Ramkissoon, 2008). According to the author Maret (2007), there is a persistent chain called "Slaughter & Leslie the academic capitalism" which is prevalent in the educational market. Here, transformation goes like this: the researcher becomes an 'entrepreneur', knowledge becomes a 'product', and the student becomes a 'customer'. The university holds the responsibility to partake in the creation of business and society's future.

And not least the university should partake as a key stakeholder in the development of the arenas for research and innovation (Petrusson, 2009). The core changes of the universities' role has been promptly mentioned in The World Bank Report (2002), identified four essential functions of higher education to support knowledge driven economic growth: a) the capacity to train a qualified and adaptable labour force including high level scientists, professionals, technicians, teachers for basic and secondary education, as well as future government; b) the capacity to generate new knowledge; c) the capacity to access existing stores of global knowledge and adapt it to local use; and d) the transmission of norms, values, attitudes, and ethics as the foundation

of the social capital necessary to construct healthy civil societies and cohesive cultures, which are essentials for better government and political democracy.

## 2.4 What future does knowledge economy holds for India

One of the world's mighty economies, India has made remarkable growth in economic as well as in its social development. India has a wealthy choice set in ascertaining its future economic growth road (Dahlman & Utz, 2001). In the KEI, in the year 2003 India is roughly ranked in the sixth decile in the rank allocation which is lower than where it was in 1995 (The World Bank). India's biggest asset is its IT (Information Technology) sector which it can use as a bandwagon and make its way into the transformation of knowledge economy. However, it cannot compensate for the insufficiency of primary infrastructure and quality education. To determine the impact of IT, it is vital to recognize the difference between industrial (investments in large-scale infrastructure such as railways) and knowledge-intensive (production of knowledge-intensive goods like software) ventures (Balasubramanian & Konana, 2002).



After analyzing the KAM scorecard of India, it is suggested that more inducement and support is needed in primary and secondary education. Along with this, an overall efficiency is required not only in STEM (Science, Technology, Engineering, and Math) but also in various other fields of study which acknowledges overall growth (Sharma, 2017). Apart from this, various reports namely, the Indian Planning Commission's reports on India as Knowledge Superpower: Strategy for Transformation (2001) and India Vision 2020 (2002c); the former President's (Dr. A. P. J. Abdul Kalam's) 2002 strategy India 2020: A Vision for the New Millennium (Kalam and Rajan 2002); and the High-Level Strategic Group's India's New Opportunity, 2020 (AIMA 2003) (Box 6) underline ways to address India's transition to the knowledge economy (Dahlman & Utz, 2001).

Given that the success rate of ideas is pretty low, India needs to do more than just fund money into the HEI. For this reason, ideas need to be tested and experimented occasionally and then the funding part should come into the picture. The role of HEI is mainly in building an ecosystem which comprises of information gathering, planning, research, teaching, credit supply, and ensuring that people are filled with hope rather than derision, innovation and collaboration (Rajivlochan, 2017). In the population context, India's

workforce will surpass China's in 2030 and also reach its crest by the year 2050. Having realized this, the current window frame is the most opportunistic for India to transition and empower itself as a knowledge economy (Mehdi, 2016).

## ➢ Research Gaps

Being one of the least explored topics, "knowledge economy" certainly comes along with a lot of gaps in research. Identification of these gaps via literature review forms the basis and objective of this paper. The following gaps have been diagnosed. Firstly, there exists quite a lot of research on importance of education for multiple reasons such as lesser criminal activities, developmental growth, reducing poverty, increase in GDP, etc. At the same time there prevails research on rise and vitality of knowledge society and economy. However, there is no robust data available on the linkage between the two and exactly what composites within the broad spectrum of education which will boost the knowledge economy.



Secondly, the awareness of knowledge as an economy or a society amongst the general public is too low. Primary data analysis even today in this domain is next to impossible considering the common humans. The belief that knowledge economy is the future is the future is unknown to many, mainly because they yet do not know its meaning. Although, there are wonderful economies who have transformed and many who are also transitioning towards a knowledge intensive economy, the examples of such are not recognized. For this reason, the paper also focuses on countries such as Finland and Sweden which have outdone themselves on KEI and are progressively doing very well. By taking these cases into report, the author studies them as well as compares them to the Indian Economy scenario.

Lastly, the major research gap was found with respect to the variables which must be taken into consideration under education and HEI for this transition to successfully take place. This data is purely qualitative and hence required a peek into the policies and objectives of the countries which rank in the top most scale of KEI. The paper hence, proposes and advocates multiple guidelines which can be incorporated owing to India's demography and political and social structure. Along with this, it also presents other challenges which may be faced by India and other economies during this revolution.

# CHAPTER 3

# RESEARCH METHODOLOGY

In the very old times the world was driven by muscle power, later by money power and now it is driven by the power of knowledge!

- APJ Abdul Kalam

## 3.1 Research Design

The paper uses combination of both –qualitative and quantitative data to gain the breadth and depth of the research topic. Qualitative data is administered where relationship between collected data and observation is established. Whereas, quantitative data inculcated is to achieve statistical conclusions and actionable insights. For additional classification, correlation research design is used to study the correlation between variables such as knowledge and economic growth and HEI and knowledge economy. In conclusion, mixed data is largely carried forward in the paper.



## 3.2 Data Collection

To assess and fulfill the research objectives, the information articulated in the paper is mainly obtained by extracting **secondary data**. This is being generated from various published research papers, online books, and from organizations like the World Bank Group and UNESCO. The secondary data, in essence, reviews and studies KE's growing trend and functions.

The World Bank has put forward criteria and variables which measure the knowledge facilitation in a nation. Premised on these criteria, there exists a **Knowledge Economy Index** (KEI) that ranks the countries based on how "knowledge conducive" they are and how close is their development reign towards knowledge economy. The World Bank for the purposes of calculating KEI, represents each pillar by three key variables: The Economic Incentive and Institutional Regime include: Tariff & Nontariff Barriers; Regulatory Quality;

Rule of Law. Education and Human Resources include: Adult Literacy Rate; Secondary Enrollment Tertiary Enrollment. The Innovation System include: Royalty and License Fees Payments and Receipts; Patent Applications Granted by the US Patent and Trademark Office; Scientific and Technical Journal Article. Information and Communication Technology (ICT) include: Telephones per 1,000 people; Computers per 1,000 people; Internet Users per 10,000 people.

The **Knowledge Assessment Methodology** (KAM) is a benchmarking tool designed by the World Bank to facilitate the transition to becoming a knowledge economy and to help countries understand their strengths and weaknesses by comparing themselves with neighbor countries, competitors and other which they may wish to emulate based on the four knowledge economy pillars (Gorji & Alipourian, 2011). KAM maintains transparency and is user-friendly and highly interactive. It is a graphical interface which gives the scholars and common individuals an understanding, whereas it helps the policy makers in assessing countries' challenges and opportunities. It also pinpoints areas where policy attention or investment may be required (World Bank Institute). The World Bank's complete version of the KAM, KAM 2008 makes comparisons based on 83 structural and qualitative variables that serve as proxies for the four knowledge-economy pillars described above. Some 140 countries can be compared—among them most of the developed economies of the Organisation for Economic Co-operation and Development (OECD) and about 100 developing countries. All 83 variables are normalized on a scale from 0 (weakest) to 10 (strongest), and all 140 countries are ranked on an ordinal scale. The KAM therefore reports the relative performance of countries on the knowledge economy.



### 3.3 Data Analysis

The paper with the help of the KEI index scrutinizes the variables affecting knowledge economy. It uses a **comparative study** between nations and analyzes and interprets the reasons for gap in the rankings between the leading countries and India. According to the latest rankings, KAM 2012, Sweden is in the number one position and scores 9.43 out of 10, whereas India ranks 110 and its score is 3.06 (10 = highest and 0 = lowest). India is chosen specifically in this study as the second country of comparison simply because of an existing paradox. It secures lower rank in the KEI even though it has massive potential to transform into a knowledge economy (Balasubramanian & Konana, 2002; Dahlman & Utz, 2001;

Saikia, 2018; Dahlman, 2007; Murthy, 2007). This comparative study will help determine the lag countries like India are facing and where those economies must improvise upon by following the footsteps of the leaders. The following formula is used in KEI to normalize the scores for every country relation to the total Number of countries in the sample (Nc) For each specific country, the Number of countries that ranks lower or below it (Nw) is calculated:

Normalized (u) = $10\left(\frac{Nw}{Nc}\right)$ (Gorji & Alipourian, 2011).

Further, to examine the role of HEI in knowledge economy, the Education & Training pillar of Knowledge Economy Index is being studied separately. The differences and relationship between the two mentioned countries with respect to KAM is examined which will help attain the paper's first objective. Several educational policies implemented by the government of India (Ministry of Human Resource Development) and Sweden (Ministry of Education and Research) are also being investigated and tested. To achieve the second research objective the paper will delve into the variables of HEI. KAM scorecard displays the extent of gains in all the variables. Hence, by studying the differences between KAM scorecard with respect to HEI variables amongst leading countries and India, the author will interpret the findings and list down the measures or course of action which is needed and is well suited for higher rankings. Here, the geographical factors and certain limitations and resource constraints will be taken into consideration.



### 3.4 Data Set

The data for the sake of this study is collected mainly from The World Bank repository and archives. The most recent calculation of KEI has been done in the year 2018. The data analysis process includes 2018 KEI data and rankings to obtain its objectives. Sweden's most recent popular education and training policies are collected through the country's ministry department and also via credible research papers. The same applies to India. This includes both qualitative and quantitative data. For segregation and in-depth quantitative analysis of Education and Training pillar data has been collected from Knoema, the world's largest integrated database for statistics.

### 3.5 Limitations

The study faces limitations in terms of availability of data. Data on Sweden and leading countries in KEI with respect to fourth pillar policies is limited and in some cases also confidential. Those are policies or schemes closely related to sub variables of Education and Training pillar– knowledge creation, higher education, availability of management education, years of schooling, internet access and research dominance. Other than this there are minor influences of cultural and demographic variables on Education and Training pillar, however, in regards to this paper these variables are considered to remain dormant.

# CHAPTER 4

# FINDINGS
# &
# DATA ANALYSIS

"Knowledge is our most powerful engine of production"

— Alfred Marshall, 1890

The paper re-establishes the objectives of research based on which the findings and analysis will be conducted. The research objectives of the paper are primarily associated with two aspects –

1. To understand how Higher Educational Institutions (HEI) assist in shaping a knowledge economy.
2. What measures should be taken or inculcated in the HEI system to achieve higher rank in the KEI?



## 4.1 Catering to research objective 1

The role of HEI in today's world has to be given much more thought than ever as contributors of human capital and engineers of innovation. A further distinction is between 'tacit' and 'codified' knowledge. The latter is written down in for example, in manuals, guides, instructions, statements and is easily reproduced. Tacit knowledge however resides with the individual in the form of expertise and experience that often cannot be written down and is expensive to transfer to others. In many respects, codified knowledge and information are indistinguishable. The significant difference is therefore between tacit knowledge and information.

### A. **Correlation between educational indicators with respect to other eminent indicators necessary for analysis.**

## A1. EU Countries (including top 5)

Here, the researcher extracts data on educational variables which are a part of the Knowledge Economy Index's one pillar "Education & Training" and correlate it with other variables important to decipher substantial results with respect to research objective 1. In the figure below (3), the relationships which we have to pay attention have been marked in red boxes for special emphasis. The correlation between Labor force with tertiary education (% of total) with Total number of universities and other HEIs, The Global Competitiveness Index Ranking with R&D expenditure, Percentage of universities ranked in Academic Ranking of World Universities by country with GDP total reflect extreme positive correlation. Apart from this other variables like Patent Granted, Population and ICT exposure also assist in providing a clear picture. In this work, only correlation (R) of above 0.5 is determined to be an indicator of a strong correlation between the indicators: if a correlation of above 0.5 is found (whether positive or negative), it indicates that there is a strong relationship between selected knowledge economy indicators and tertiary educational indicators.



| | RES | R&D | LFT | ICTEXPO | ICTEX | TEREX | GDPTOT | GDPCAP | TERAT | COMPET | ARWU | THE | POP | UNIV | PATAP | PATGR | HTEXPO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RES | 1.000 | | | | | | | | | | | | | | | | |
| R&D | 0.892 | 1.000 | | | | | | | | | | | | | | | |
| LFT | 0.542 | 0.460 | 1.000 | | | | | | | | | | | | | | |
| ICTEXPO | 0.043 | 0.088 | 0.121 | 1.000 | | | | | | | | | | | | | |
| ICTEX | 0.044 | 0.160 | 0.093 | 0.597 | 1.000 | | | | | | | | | | | | |
| TEREX | 0.311 | 0.349 | 0.120 | -0.112 | 0.064 | 1.000 | | | | | | | | | | | |
| GDPTOT | 0.285 | 0.398 | 0.640 | 0.064 | 0.168 | N/A | 1.000 | | | | | | | | | | |
| GDPCAP | 0.601 | 0.516 | 0.436 | 0.016 | -0.143 | 0.487 | 0.216 | 1.000 | | | | | | | | | |
| TERAT | 0.597 | 0.492 | 0.850 | -0.091 | -0.187 | 0.492 | 0.069 | 0.518 | 1.000 | | | | | | | | |
| COMPET | 0.834 | 0.852 | 0.539 | 0.111 | 0.124 | 0.539 | 0.407 | 0.608 | 0.617 | 1.000 | | | | | | | |
| ARWU | 0.246 | 0.394 | 0.671 | 0.084 | 0.169 | -0.119 | 0.985 | 0.252 | 0.138 | 0.431 | 1.000 | | | | | | |
| THE | 0.259 | 0.433 | 0.623 | 0.093 | 0.187 | 0.028 | 0.882 | 0.281 | 0.275 | 0.509 | 0.929 | 1.000 | | | | | |
| POP | -0.057 | 0.188 | -0.081 | -0.175 | -0.111 | -0.230 | 0.950 | 0.002 | -0.048 | 0.085 | 0.869 | 0.557 | 1.000 | | | | |
| UNIV | 0.307 | 0.343 | 0.680 | 0.160 | 0.236 | -0.150 | N/A | 0.238 | 0.058 | N/A | N/A | N/A | 0.928 | 1.000 | | | |
| PATAP | 0.711 | 0.799 | 0.327 | 0.004 | 0.155 | 0.422 | 0.111 | 0.575 | 0.393 | 0.703 | 0.342 | 0.382 | 0.119 | 0.108 | 1.000 | | |
| PATGR | 0.758 | 0.809 | 0.506 | 0.092 | 0.240 | 0.391 | N/A | 0.575 | 0.475 | 0.721 | 0.182 | 0.294 | 0.130 | 0.736 | 0.497 | 1.000 | |
| HTEXPO | 0.099 | 0.186 | 0.117 | 0.791 | 0.532 | N/A | 0.119 | 0.457 | 0.162 | 0.227 | 0.134 | 0.176 | -0.117 | N/A | 0.288 | N/A | 1.00 |
| ECOM | 0.431 | 0.248 | 0.436 | 0.284 | -0.206 | -0.026 | 0.169 | 0.556 | 0.439 | 0.526 | 0.165 | 0.287 | -0.057 | -0.354 | 0.169 | 0.185 | 0.36 |

Figure 3. Correlation between various indicators (panel data) expressed by correlation coefficient (R). Reproduced from Exploring the Relationship Between Higher Education and Knowledge Economy Indicator, 2012.
Retrieved from Eurostat, OECD Education at a Glance, World Bank, ARWU, THE.

The **advantage** of the correlation analysis is that, unlike the regression analysis, it shows how those variables affect each other regardless of the direction. On the other hand, the **limitation** is that it does not suffice in determining whether there is a cause-and-effect link between the variables. But whatsoever, at this stage, the correlation analysis suffices as we are interested in testing whether there is a correlation of any kind in between selected two variables and if so, how strong (Bušíková, 2012).

Table 1: Description of variables used in the correlation analysis based on the panel data

| Sr. No. | Abbreviation | INDICATORS OF KNOWLEDGE ECONOMY |
|---|---|---|
| 1. | R&D | R&D expenditure (both public and private expressed as % of GDP) |
| 2. | GDPCAP | GDP per capita |
| 3. | COMPET | The Global Competitiveness Index Ranking |
| 4. | ARWU | Percentage of universities ranked in Academic Ranking of World Universities by country |
| 5. | THE | Percentage of universities ranked in Times Higher Education by country |
| 6. | UNIV | Total number of universities and other HEIs |
| 7. | LFT | Labor force with tertiary education (% of total) |
| 8. | GDPTOT | Percentage of World GDP |
| 9. | PATGR | Total number of patents granted |
| 10. | RES | Number of Researchers in R&D (per million people) |



COUNTRIES INCLUDED IN THE ANALYSIS

Austria Finland Italy Norway Spain Belgium France Latvia Poland Sweden Bulgaria Germany Lithuania Portugal Switzerland Cyprus Greece Luxembourg Romania United Kingdom Czech Republic Hungary Malta Slovak Republic United States Denmark Ireland Netherlands Slovenia Japan Estonia

Table 2: Categorization of ranking of countries on Knowledge Economy Index with respect to colours.

| | |
|---|---|
| Green | Countries in top 5 |
| Yellow | Countries between 6-48 |
| Orange | Countries between 49-96 |
| Red | Countries between 99-144 |

## A2. Asian and Middle-Eastern Countries (including bottom and lower ranked)

Here, the researcher extracts data to compare and analyze the relationship between spending on research and development (R&D) and number of published documents, number of

documents and GDP per capita, number of universities and number of research documents and a few more. This analysis is solely to focus on the Middle Eastern and Asian region as opposed to European region studied before. The main sources of information used by S.A. Meo, A. A. Al Masri, A. M. Usmani, A. N. Memon, S. Z. Zaidi, 2013., was extracted from World Bank, SCI-mago/Scopus and Web of Science; Thomson Reuters.

The figure below (4) demonstrates the Pearson correlation coefficient between the mean GDP per capita, spending on R&D, number of universities, indexed journals and total number of research documents, citations per document, H-index in various science and social sciences subjects among Asian countries during the period 1996–2011.

We can infer the following from it:-

1) R&D has a strong positive correlation with H-Index

2) R&D has a low positive correlation with total number of published documents (r=0.480; P=0.002)

3) Number of Universities has a strong positive correlation with number of research documents (r=0.841; P=0.0001).



| Parameters | Research Documents | Citation per documents | H-Index |
|---|---|---|---|
| **GDP per capita US$** | r=0.050 | r=0.064 | r=0.189 |
| | p=0.761 | p=0.694 | p=0.242 |
| **Spending on R&D** | r=0.480 | r=0.429 | r=0.805 |
| | p=0.002 | p=0.006 | p=0.0001 |
| **Universities** | r=0.841 | r=0.063 | r=0.755 |
| | p=0.0001 | p=0.699 | p=0.0001 |
| **Indexed journals** | r=0.893 | r=0.085 | r=0.801 |
| | p=0.0001 | p=0.602 | p=0.0001 |

r=Pearson correlation coefficient
p=p-value

Figure 4. Pearson correlation coefficient between various factors in Asian and Middle Eastern Economies.
Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3688761/

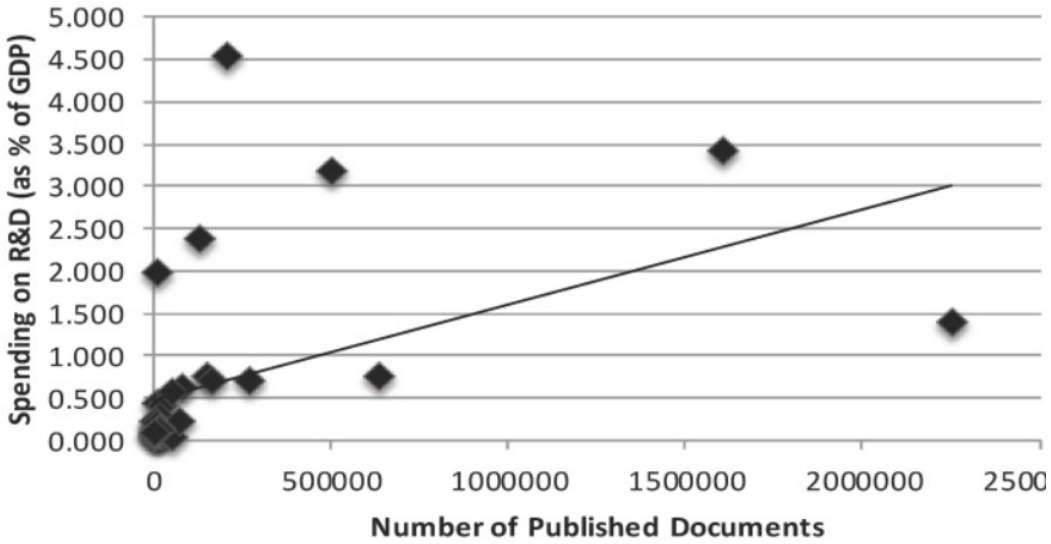



Figure 5. Pearson correlation coefficient between various factors in Asian and Middle Eastern Economies.
Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3688761/

The figure (5) depicts the Correlation coefficient between spending on R&D and total number of research documents in various science and social science subjects among Asian countries during the period 1996–2011.



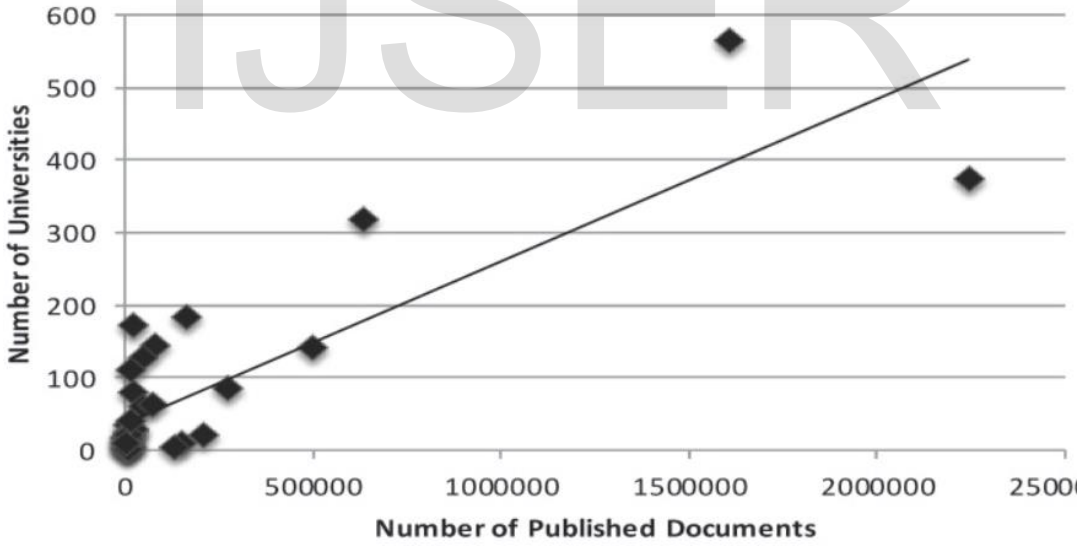



Figure 6. Pearson correlation coefficient between various factors in Asian and Middle Eastern Economies.
Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3688761/

The figure above (6) depicts the correlation coefficient between the number of universities and total number of research documents in various science and social science subjects among Asian countries during the period 1996–2011.

The h-index is an author-level metric that attempts to measure both the productivity and citation impact of the publications of a scientist or scholar. The h-index correlates with obvious success. .indicators such as winning the Nobel Prize, being accepted for research fellowships and holding positions at top universities.

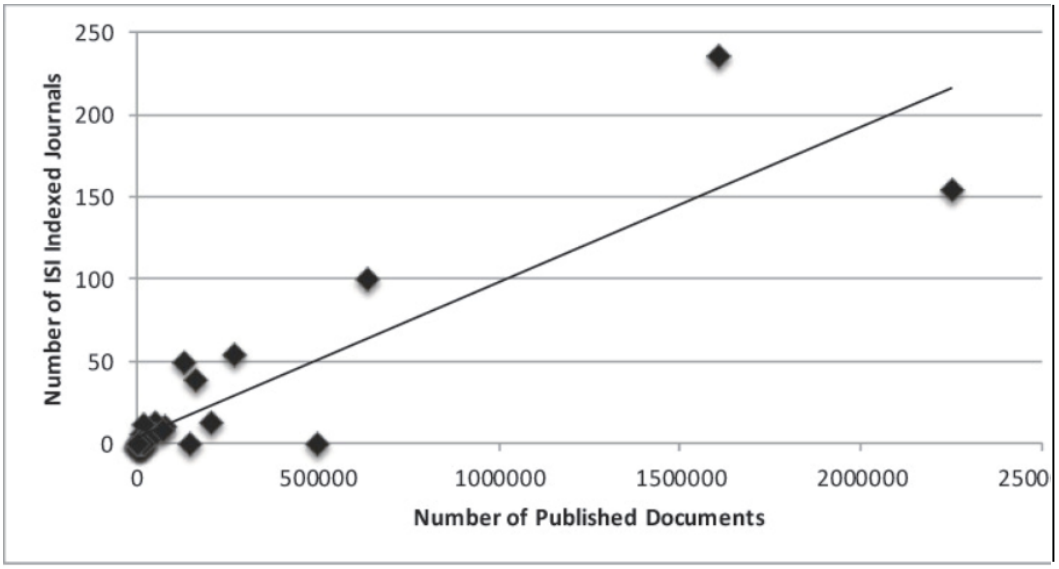



Figure 7. Pearson correlation coefficient between various factors in Asian and Middle Eastern Economies.
Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3688761/

The figure (7) depicts the correlation coefficient between scientific indexed journals and total number of research documents in various science and social science subjects among Asian countries during the period 1996–2011.



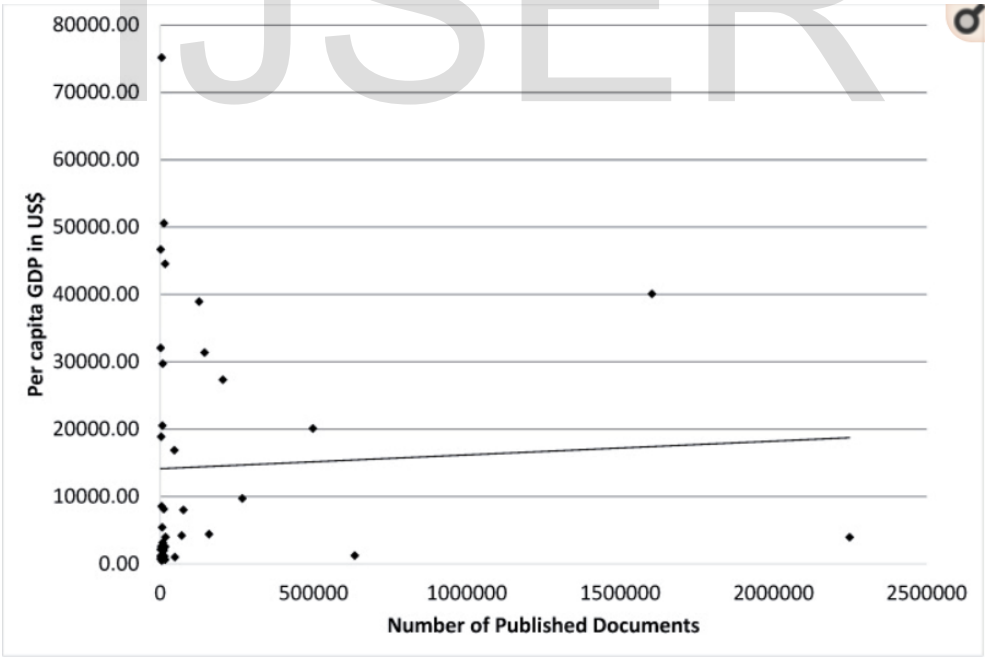



Figure 8. Pearson correlation coefficient between various factors in Asian and Middle Eastern Economies.
Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3688761/

The figure (8) depicts the correlation coefficient between per capita GDP and total number of research documents in various science and social science subjects among Asian countries

during the period 1996–2011.

In today's time, it is observed that there is no differential research outcome with respect to correlation of the two given factors – 1) GDP per capita and 2) R&D as depicted in the figure below (9) between countries with high GDP per capita and lower GDP per capita. Basically, it does not depend on the GDP as whole but rather on the fraction of GDP which is allotted and spent on R&D, according to various authors and publications. For example, a study conducted by Halpenny D, Burke J, McNeill G, Snow A, Torreggiani WC (2010) suggests that the correlation between R&D expenditure of GDP with number of publications was positive ( $r=0.603$, $P<.001$). Israel, Japan, South Korea, Singapore, and to some extent, China, Saudi Arabia, India, Iran and Turkey have great number of research outcomes as their spending on R&D is large. However, few of them have a smaller GDP per capita to a large extent. Whereas, the opposite is true for the rest of the countries in the study.

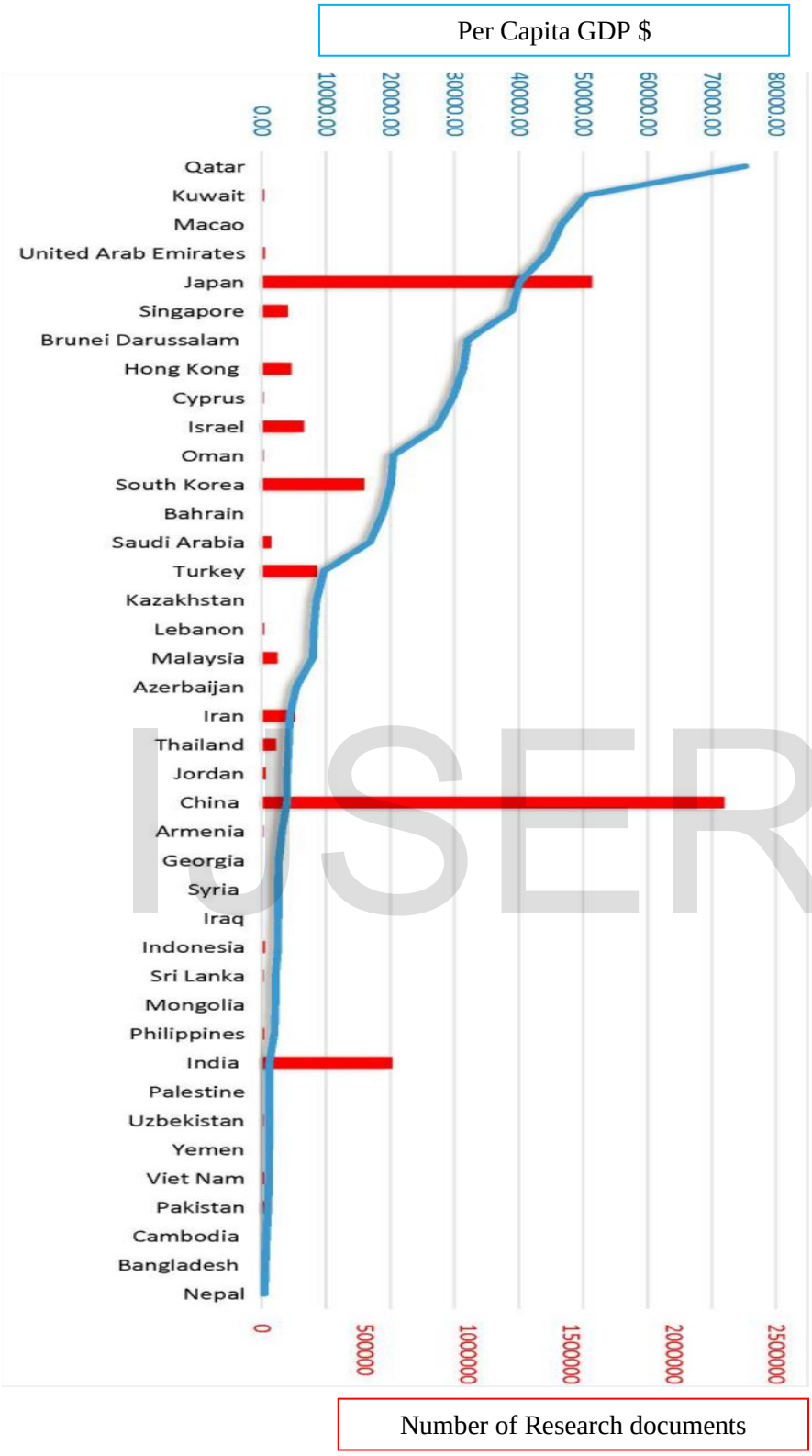



Figure 9. Association between per capita GDP and total number of research documents published in various science and social sciences subjects among Asian countries.

Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3688761/

COUNTRIES INCLUDED IN THE ANALYSIS

Armenia Azerbaijan Bahrain Bangladesh Brunei Darussalam Cambodia China Cyprus Georgia Hong Kong India Indonesia Iran Iraq Israel Japan Jordan Kazakhstan Kuwait Lebanon Macao Malaysia Mongolia Nepal Oman Pakistan Philippines Qatar Saudi Arabia Singapore South Korea Sri Lanka Syria Thailand Turkey United Arab Emirates Uzbekistan Vietnam Yemen

Table 3: Categorization of ranking of countries on Knowledge Economy Index with respect to colours.

| | |
|---|---|
| Green | Countries in top 5 |
| Yellow | Countries between 6-48 |
| Orange | Countries between 49-96 |
| Red | Countries between 99-144 |



The part A (including A1 and A2) of research objective 1 comes to an end. Here is what we understand from it.

Inference:

Research in terms of development, published papers, journals, innovation, etc has a huge impact on economic development of a nation irrespective of whether the economy is developed or developing. We see that all the countries in the EU stand in green and yellow regions indicating highly knowledge intensive base. The percentage of population placed in tertiary education in such regions is high and is positively correlated with the number of top ranking academic institutions prevalent in that region. Number of research documents also positively correlates with the per capita GDP of such countries, not perfectly however, more than the weak correlation present between these same two factors in the developing regions comparatively. The A2 focuses on few yellow and more of orange and red regions indicating low knowledge intensive economy based on the KEI rankings. Lastly, the figures in both – A1 and A2 depict the relationship which the variables of HEI have with other economic variables to better determine between which variables and in how much intensity the mutuality exists.

## B. Business & Education

The reallocation of investment from tangible assets to intangible assets is the driver and also of central motive to the story of knowledge economy. This is so as more and more companies and organizations are increasingly counting on exploitation of knowledge to obtain comparative advantage and efficient execution. Hence, the investment in Research & Development (R&D), new process invention, education, and software is escalating (Brinkley, 2008).

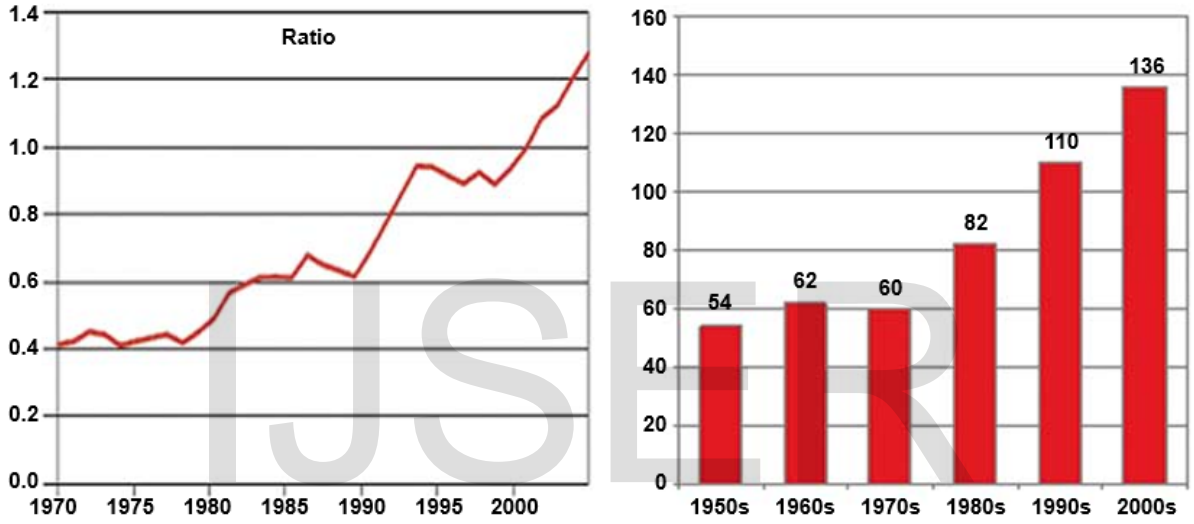



*Figure 10.* How business investment priorities change in a knowledge based economy, example of US (right hand graph) and UK (left hand graph). Reproduced from HMT, 2007 and US Fed, 2006.

The above figures show us how in the United Kingdom and the United States the rate and ratio of intangible asset to tangible asset has risen. This is in accordance to the investment made by businesses, i.e. the corporate sector of the economy in knowledge. The accurate data for the year 2000 onwards is not available; however, it is sure to say that it is ever increasing.

## C. Wages/Income & Education

A contradictory pattern was noticed in the industrial regions from 1980s onwards. Up until

then the trend of declining rewards to higher education and falling rates of return to schooling occurred in the United States and other industrial market economies. The disparity in wages received amongst the educated and (relatively) uneducated mass augmented noticeably during the 1980s.

| *Decade* | *Country* | *Year* | *Wage ratio (higher/secondary)* | *Year* | *Wage ratio (higher/secondary)* |
|---|---|---|---|---|---|
| 1970s | Canada | 1970 | 1.65 | 1980 | 1.40 |
| | Sweden | 1968 | 1.40 | 1981 | 1.16 |
| | United Kingdom | 1974 | 1.64 | 1980 | 1.53 |
| | United States | 1969 | 1.49 | 1978 | 1.35 |
| 1980s | Canada | 1980 | 1.29 | 1989 | 1.35 |
| | Sweden | 1981 | 1.16 | 1986 | 1.19 |
| | United Kingdom | 1980 | 1.33 | 1989 | 1.46 |
| | United States | 1979 | 1.47 | 1987 | 1.52 |
| 1990s | Canada | 1992 | 1.62 | 1997 | 1.48 |
| | Sweden | 1992 | 1.60 | 1998 | 1.36 |
| | United Kingdom | 1992 | 1.71 | 1999 | 1.59 |
| | United States | 1992 | 1.64 | 1999 | 1.83 |

*Figure 11.* Value of Higher Education in Industrial Countries, 1970s–1990s. Reproduced from Patrinos 2001a; OECD 1992, 2001b.
Retrieved from http://siteresources.worldbank.org/INTLL/Resources/Lifelong-Learning-in-the-Global-Knowledge-Economy/chapter1.pdf



The average rate of return, especially with respect to male workers rose from 7.9% to 9.2%. Increasing wage disparity was particularly severe in the rapidly expanding service sector, where the decline in the variance in schooling was most dramatic. Ryscavage and Henle (1990) found that among white-collar workers classified as administrators, officials, and sales workers, more educated workers increased their earnings advantage over less educated workers.

## D. Returns to Investment on Education & Level of Education

As we can observe, the returns in low-income countries (for which comparative data is available) to primary education are far more than the returns in high-income countries for the same. As universal primary education is achieved, shortages of skills in the labor force occur more at the junior and senior secondary levels, and the relative returns to these levels of education rise. Same happens later where, as universal secondary education is nearly

achieved, relative shortages occur for people with still more advanced skills, and the rates of return to two- and four-year college degrees are highest (Bušíková, 2012).

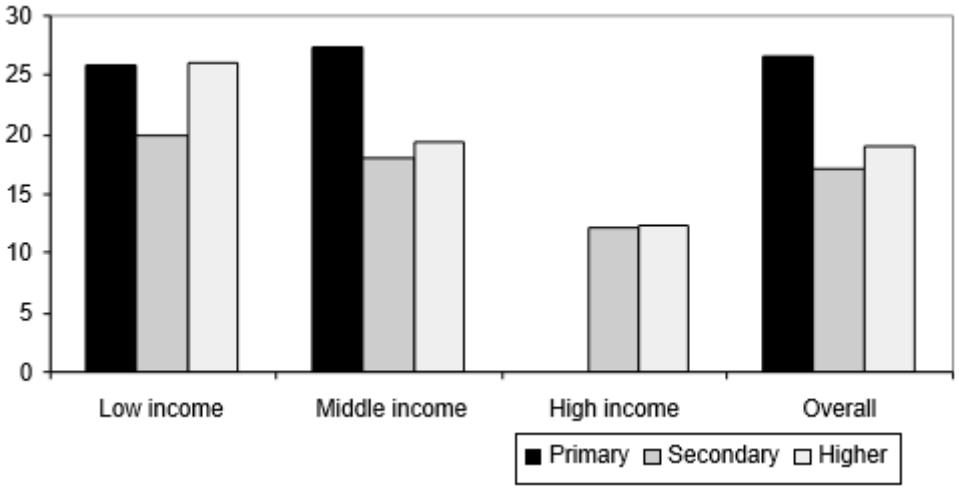



*Figure 12*. Private Returns to Investment in Education, by Level of Education and Country Income Group (percent). Resourced from Psacharopulos and Patrinos 2012.
Retrieved from http://siteresources.worldbank.org/INTLL/Resources/Lifelong-Learning-in-the-Global-Knowledge-Economy/chapter1.pdf



Research Objective 1, especially, required a lot of quantitative data to provide the empirical proof which thereby catered to answer the research objective in detail and with examples.
In case of Research Objective 2, along with some quantitative data more degree of qualitative datasets had to be analyzed.
This is so as the 2nd objective delves into solutions in terms of plan of actions and policies.

## 4.2 Catering to research objective 2

Post providing empirical evidence on how the role of HEI impacts, manipulates, strengthens and fosters growth of an economy, the paper will now move to establishing the variables which should be inculcated for countries to achieve this transformation. In this study, the researcher will lay special emphasis on comparative studies between top ranked economies in KEI (example: Sweden and Denmark) and the countries which have the potential to become knowledge intensive, however, are currently ranked lower on the KEI. For this the researcher

incorporates various variables masqueraded in terms of laws & regulations, policies, incentives and steps as to how to go about it.

## A. How the top ranking economies of KEI achieved the transformation?

As one can observe in figure 13, Sweden and Finland the top two economies in terms of KEI have outdone themselves and left a huge differential gap for the developing countries, specifically in the Asian region. To understand how these economies reached this higher level following data is presented.

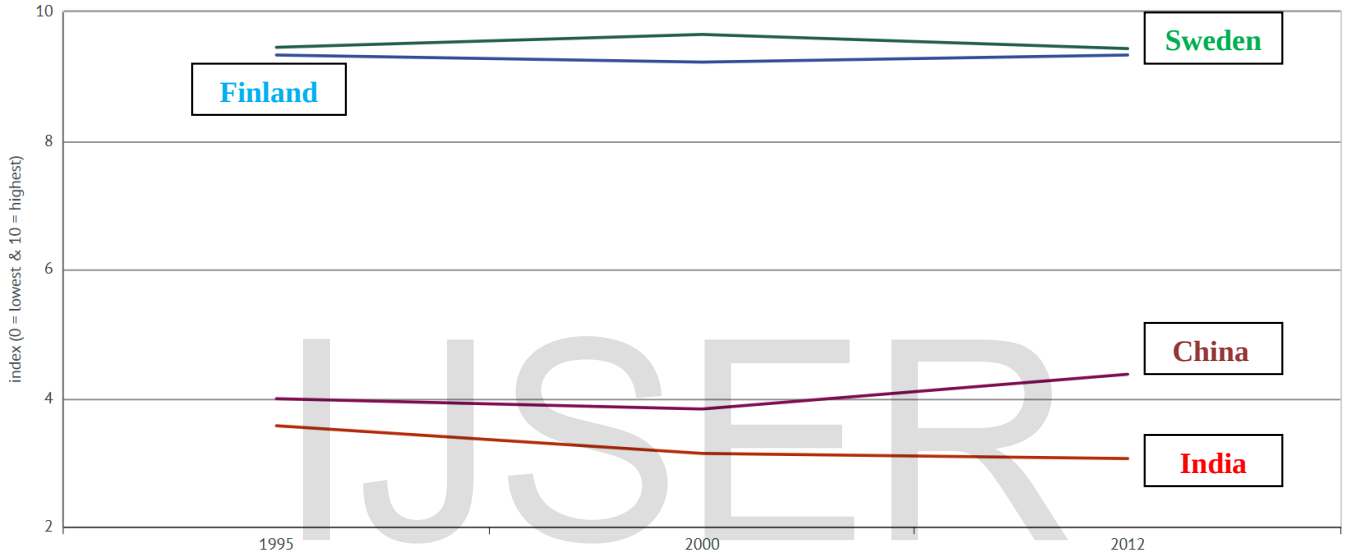





Figure 13 . Comparison between Sweden, Finland, China and India in Knowledge Economy Index. Reproduced from Knowledge Economy Index, World Bank (discontinued). Retrieved from https://knoema.com/atlas/Sweden/topics/World-Rankings/World-Rankings/Knowledge-economy-index?compareTo=IN,FI,CN

### *FINLAND'S TRANSITION*

Finland, the small country in the north-eastern Europe became the epitome of transformation based on the economical revolution it saw in the last ten to fifteen years. The Finnish economy has transformed from a resource-based economy to a knowledge based economy, using education as the key component for their success. During the early 1990's Finland saw a great economic decline and a high unemployment rate of 18%, with soaring debt of 60% (Cambridge Business and Economic Conference, 2013). The initial and groundbreaking measure followed by the country was by building 800+ knowledge intensive companies along

with the transformation of NOKIA. Sixty-four percent of Finland's triumph with respect to the growth in GDP is attributed to this company. The economy is now a hub of major Information and Communication Technology markets as well as represents as an Educational Center and Research dominant country. They strategically invested money and resources on two things – 1) Human Capital and 2) High-tech Innovation which led to a considerate rise on the KEI and GCI (Global Competitiveness Index). On GCI scoreboard, Finland climbed to rank sixth from rank nineteenth in mere ten years. Whereas, on KEI scoreboard it now stands on top; preceding only Sweden. The figure below (), shows the generic transformation carried forward by the Finnish economy.

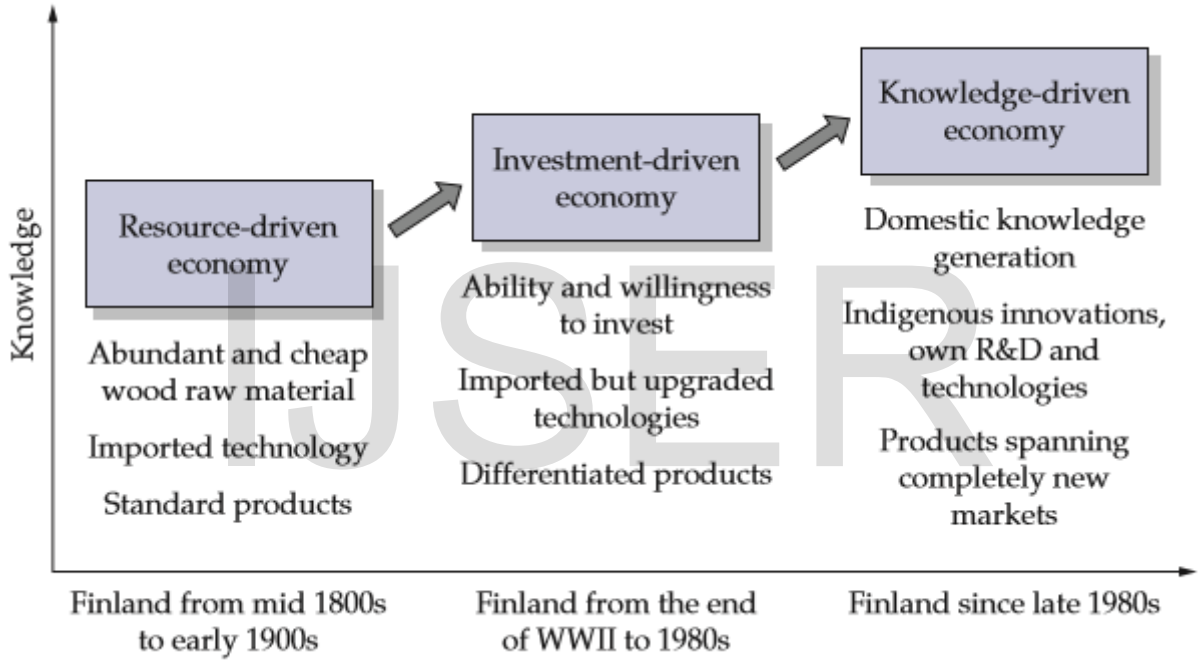



Figure 14. Stages of industrial and economic development in Finland. Reproduced from Adapted from Porter 1990 and Hernesniemi and others 1996.
Retrieved from
https://openknowledge.worldbank.org/bitstream/handle/10986/17869/869430PUB0Finl00Box382171B00PUBLIC0.pdf

According to the Global Competitiveness Report published by the World Economic Forum for 2009-2010, the answer to what exactly makes an economy competitive domestically and internationally ranges from Adam Smith's proposition on specialization by division of labour to neo-classical school of thought's encouragement in investment in tangible infrastructure as well equally in intangible human capital.

**Finland's Economic transformation through Education**

Various reports and sources suggest that Finland possesses incredible quality of human based capital. From 18% of unemployment in the early 1990s to a stable whopping reduction to 4% is what the country observed due to shift of resource driven economy to investment driven economy and finally to a knowledge driven economy. Its higher education attainment percentage is higher than the OECD average. The adult literacy rate (age 15 and above) of Finland currently stands remarkably high at 86.30% and has seen a steady yet constant upward graph. The secondary enrolment rate stands at high 96.105% and the tertiary stands at 88.109% which is its own low, relatively (World Bank Data). Equality by gender, region, and socio-economic background are fundamental principles of Finland's education policy (Dahlman & Routti, 2007).

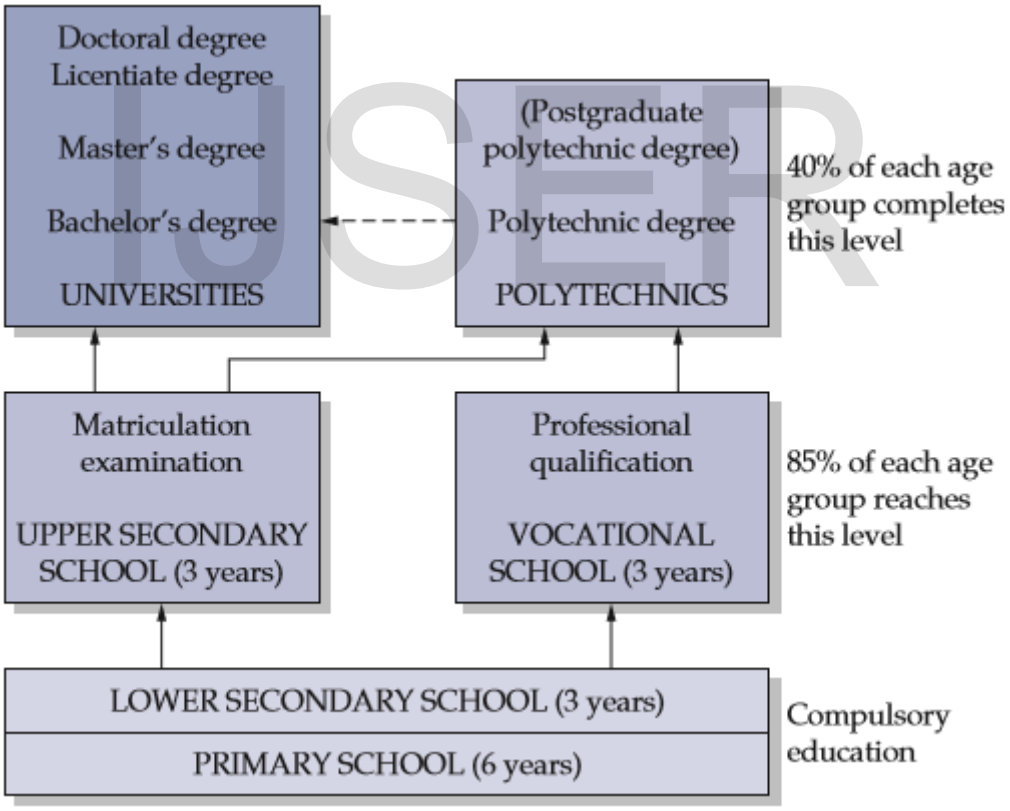



Figure 15. Reproduced from Ministry of Education, 2003a & Leijola, 2004. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/7138/393780FI0Knowledge0economy01PUBLIC1.pdf?sequence=1&isAllowed=y

*Education is the key to both the supply of and demand for innovation.*

### *SWEDEN'S TRANSITION*

The Swedish transition case is a wee bit more complex, however, stands out to be successfully stable. It is undoubtedly a high standard knowledge intensive economy with an extensive industrial base which it owes to large swedish multinational companies as well as foreign businesses. It is known for its highly comducive business and educational environment. Although it is at the top, it is has been known that maintaining the position is way more difficult and important than reaching that position. The main challenge which lies currently in front of Sweden is for it to ensure that its rank and repute is retained and perpetuated alongside.

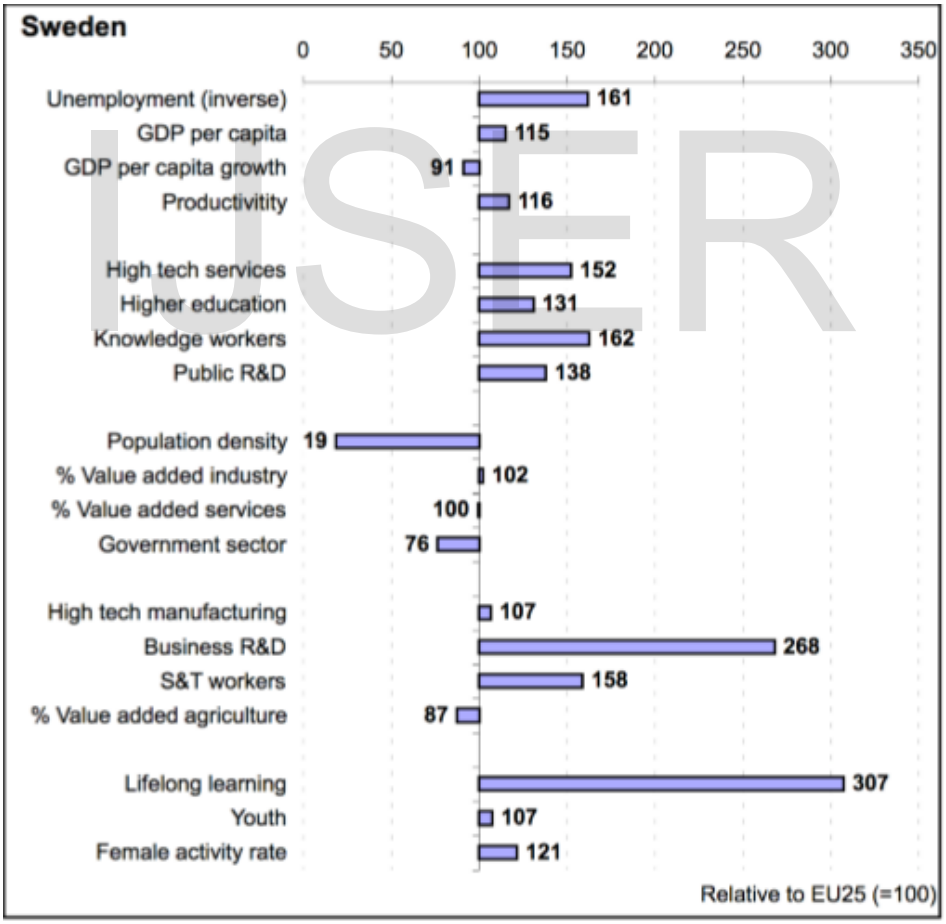



Figure 16: Relative country performance for key knowledge economy indicators.

Reproduced from "Strategic Evaluation on Innovation and the Knowledge Based Economy in relation to the Structural and Cohesion Funds" (p.3) by Åström, Eduards, Varga & Segerpalm, 2007-2013

Retrieved from: Eurostat and national data

Sweden is the third largest country in the European Union (EU) with a moderate population of approximately 9.9 million. As the figure above illustrates, Sweden is pretty much ahead of almost all the member countries of EU, particularly in the domain of R&D and Lifelong learning. In recent years the R&D expenditure has reduced owing to its powerful economic growth and more dependence on in-house expertise of consultants (Åström, Eduards, Varga & Segerpalm, 2006).

**"Stability Through Reform"**

In 1990s, a storm like financial and banking crisis was injected in Sweden. In the past, Sweden's economy underwent low economic growth and high inflation due to series of devalution of the Swedish krona. But Sweden hit back with its plan to create a dynamic economic model where it now exhibits world class facilities and high-tech growth. According to The World Economic Forum Sweden stands in the top ten list of most competitive economies of the world and according to the World Bank it is one of the easiest countries to do business with (Chipperfield, 2018 & Sutherland, 2013).



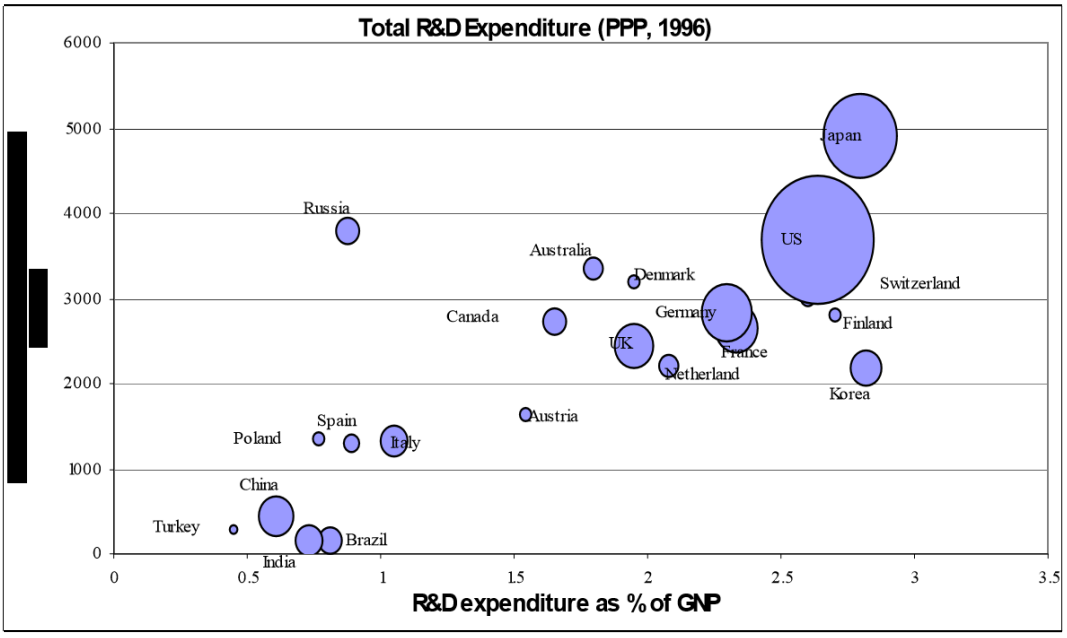
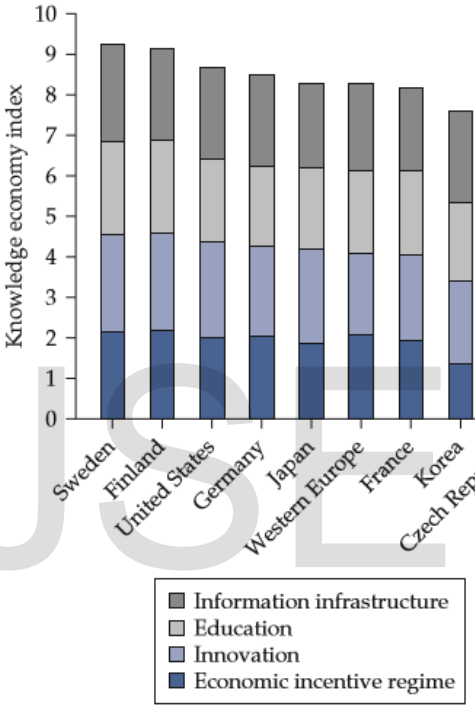



Figure 17. Total R&D Expenditure country-wise. Retrieved from World Bank Data.

The figure above (17) depicts the R&D expenditure of a country. It shows both, the

expenditure in term of percentage of GNP (x axis) as well as in monetary terms for more clarity (y axis). Here, we can observe the different variations with respect to countries. India's R&D expenditure stands at mere approximately 0.6% of its GNP, while that of Finland stands at a good 2.7%. However, the researcher does take into consideration the other factors vital for analysis and most of important of which is that the difference in priorities and invetsments for developed and developing nations. In finland and Sweden, an increase in R&D intensity was facilitated through national consensus building.

**POWER OF BALANCE**






| *Country* | *KEI* | *Economic incentive regime* | *Innovation* | *Education* | *Information infrastructure* |
|---|---|---|---|---|---|
| Sweden | 9.24 | 8.49 | 9.62 | 9.16 | 9.68 |
| **Finland** | **9.16** | **8.73** | **9.65** | **9.21** | **9.07** |
| United States | 8.69 | 7.97 | 9.42 | 8.28 | 9.09 |
| Germany | 8.47 | 8.10 | 8.88 | 7.88 | 9.01 |
| Japan | 8.29 | 7.42 | 9.30 | 8.09 | 8.35 |
| Western Europe | 8.24 | 8.15 | 8.12 | 8.09 | 8.62 |
| France | 8.18 | 7.68 | 8.46 | 8.38 | 8.19 |
| Korea | 7.59 | 5.39 | 8.11 | 7.86 | 9.00 |
| Czech Republic | 7.03 | 6.26 | 7.05 | 7.07 | 7.73 |

Figure 18. Power of Balance. Reproduced from World Bank. Knowledge Assessment Methodology, www.worldbank.org/kam.

Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/7138/393780FI0Knowledge0economy01PUBLIC1.pdf?sequence=1&isAllowed=y

The “unit of measurement” for Figure 18 and the accompanying table is based on the World Bank Knowledge Economy Index, which is valued from 0.0 to 10.0.

For specialization in knowledge intensive activities and high-tech innovation to take place, it is of utmost importance for countries to undergo radical and extensive social and economical structural change. Recent research seems to indicate consistently that while poor countries get richer with this specialization, their sectoral production and employment become more diversified or less concentrated. On the contrary, countries with high levels of income that specialize in high tech and R&D intensive production are characterized by concentrated sectoral specialization. These conclusions are supported by cross-sectional analysis of countries and apply well to the development of Finland and Sweden over the past few decades (Dahlman, Routti, & Anttila, 2007). These countries have made big via turning crisis to opportunities. Countries like South Korea and Finland, while undergoing recession during 1990s incurred a major downfall. However, after liberalization and expansion and diversification of export market the performance improved considerably. According to various Swedish and Finnish government reports, knowledge economy is a conglomeration of various elements that must be implemented in balance. The figure above (18), indicates how the balance is maintained in the top performing countries. This is what majorly lacks when the paper takes a country like India into the picture.



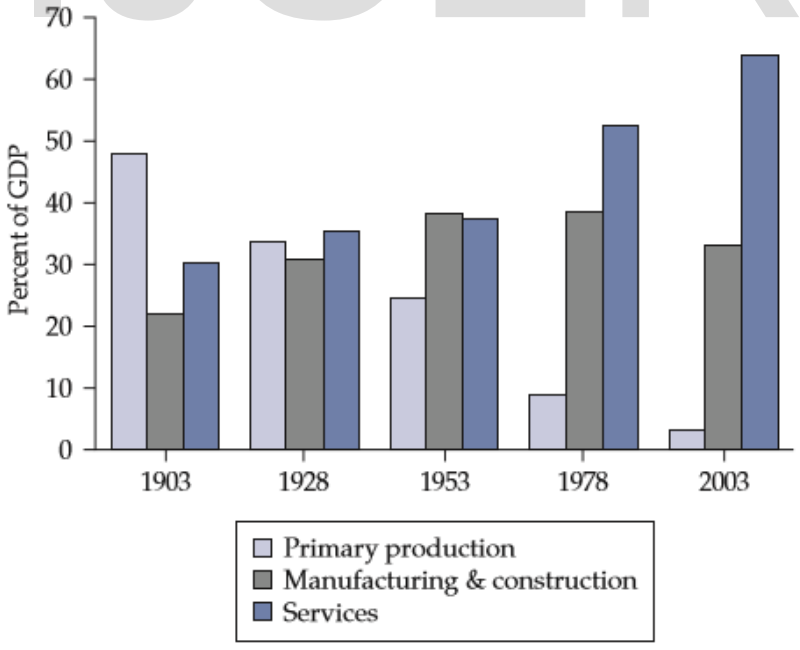



Figure 19. GDP by sectors in 1903–2003. Reproduced from Vartia and Ylä-Anttila, 2003. Data obtained from Statistics Finland. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/7138/393780FI0Knowledge0economy01PUBLIC1.pdf?sequence=1&isAllowed=

## B. Comparison of top economies on KEI with India

Attributing to its gigantic population and impressive economic growth rates, India's climb towards knowledge base is taking steady leaps. India has a huge potential with respect to scientific and technological research and innovation. The first part of this section of the paper points to focus on knowledge economy of India in relation to global state of affairs. For this it aims to analyze India's performance of economic factors and also provides a microscopic outlook on the Education and Training pillar. The second aims at comparing these factors and reforms held in the countries upholding higher rank in the KEI due to their remarkable performance. The economic growth of India rose from 6.0% to 6.2% from 2000 to 2004 and later rose at an average of above 8.0% in the subsequent few years. As per rank ordering, the World Bank assigns India to sixth decile away from the most advance economies in the KEI (Dahlman, 2007). Even though there is a drastic growth in the service sector of this economy, the pillar of education (including skills) saw a slight decline since the year 1995. The figure below (20), encompasses a spider map of all variables which make a part of the Education and Training pillar of KEI. As one can observe India majorly lacks on the front of – Secondary and Tertiary Education, Adult literacy rate and the basic average years of schooling.



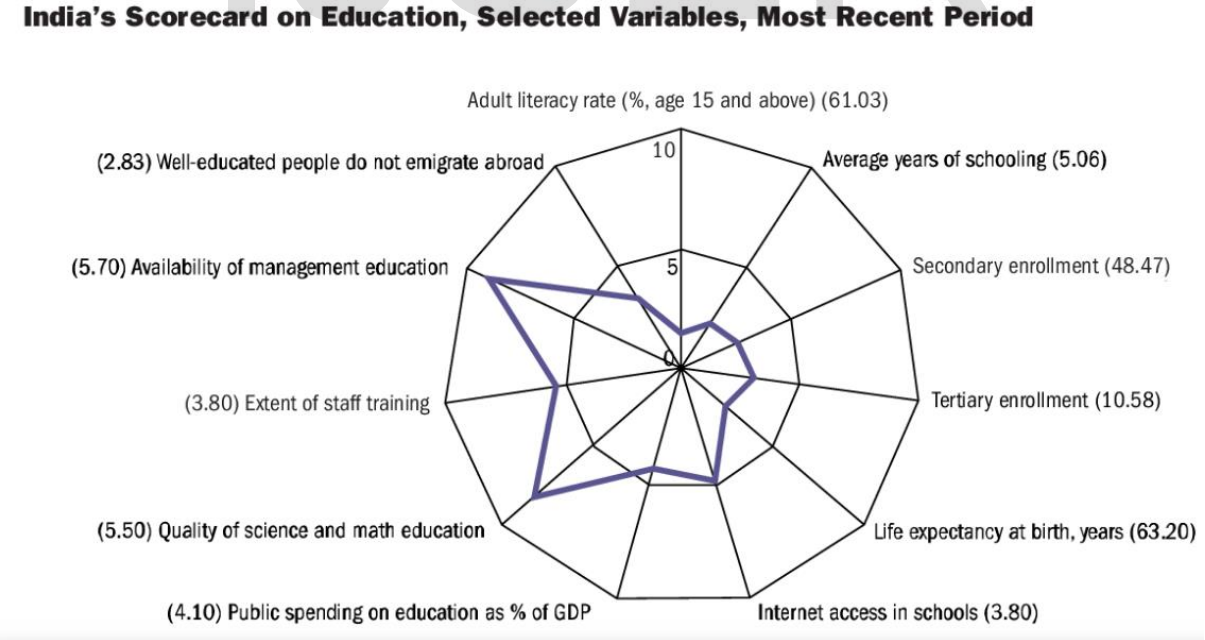



Figure 20. India's Scorecard on Education. Retrieved from World Bank. Knowledge Assessment Methodology, www.worldbank.org/kam.

Undoubtedly, it has shown immense scope and progress in quality of science, math and management education. However, what surely is to be focused upon is the variable indicating the percentage of well-educated people who do not flee abroad for better opportunities and the public spending amount on education as a part of GDP. Both these variables when compared to the other strong knowledge based countries stand distinguishingly weak.

**Has India got the Potential?**

India with its perfect demographic window and thriving ICT operations is on a marvelous road of transformation. "By leveraging its strengths in human capital and ICT services, India can become a major global knowledge-based economy," said Bindu N Lohani, ADB Vice-President for Knowledge Management and Sustainable Development. Economies like Finland, Sweden, South Korea who have excelled in this transition to knowledge intensive provide to be excellent examples for India's pathway. For this India will require crucial command and control or incentive based policies, laws and quality of service (Business Today, 2014). As the figure suggests below (21), when China and India are deemed in comparison quite often, the adult literacy and secondary enrollment rate is where India lacks the most along with trade barriers, however, that is not the focus concern in this paper.



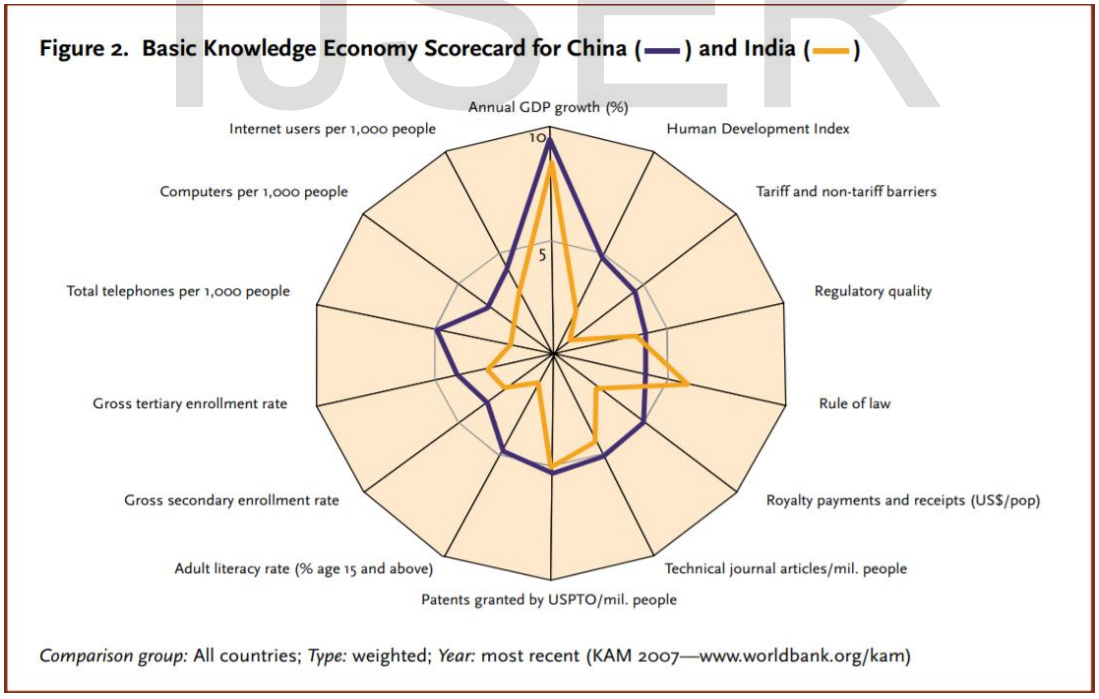



Figure 21. The KAM (Knowledge Assessment Methodology) Basic Scorecard. Reproduced from World Bank. Knowledge Assessment Methodology. Retrieved from www.worldbank.org/kam.

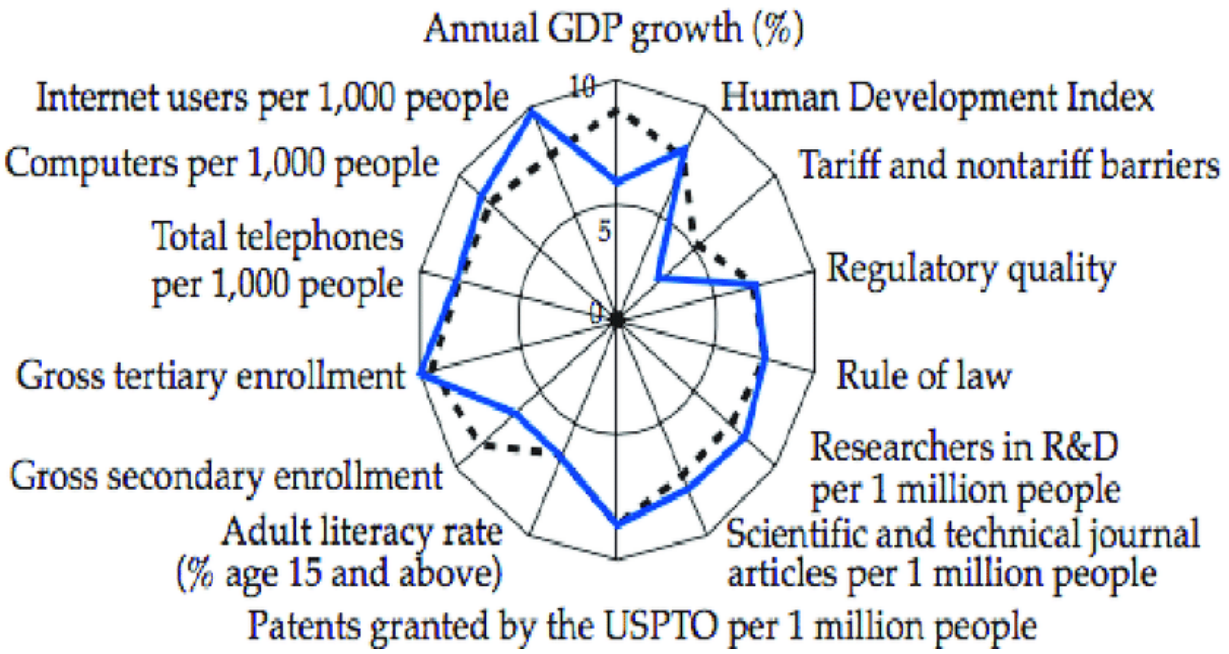



Figure 22. The KAM (Knowledge Assessment Methodology) Basic Scorecard. Reproduced from "Relationship Between Knowledge Economy Performance Indicators And Selected Macroeconomic Variables: an Application for OECD Countries" (p. 11) by İnam, Murat, & Guzel, 2017. Retrieved from The World Bank, The KAM (Knowledge Assessment Methodology)



In March 2000, the EU Heads of State and government launched an ambitious political initiative for the European Union to become "the most competitive, dynamic, knowledge-based economy by year 2010 (Åström, Eduards, Varga & Segerpalm, 2006). This agenda popularly became to be known as the "Lisbon Strategy". The above scorecard (figure 22) represents the spider map of Sweden. Since then various steps have been taken by Sweden and Finland especially towards building a knowledge intensive base.

**Policy mix assessment:**

1. Innovation poles and clusters
2. Boosting applied research and product development
3. Knowledge transfer and technology diffusion to enterprises
4. Innovation friendly environment

5. IPR ownership for university researchers
6. Funding and policy support
7. Management and coordination of innovation and knowledge measures

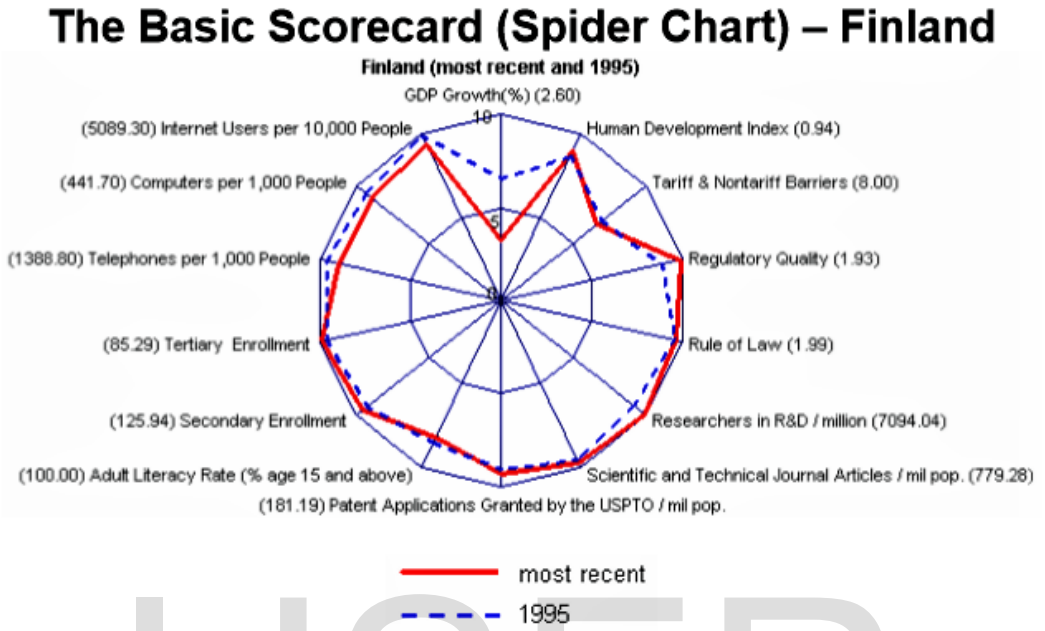



Figure 23. Finland's spiderchart. World Bank. Knowledge Assessment Methodology, www.worldbank.org/kam.

Developed nations are becoming more interested in knowledge-based economies because of globalisation. Finland can't compete against China in most manufacturing sectors, for instance, because of higher labour costs. Finland does have strengths which developing countries don't have, though, which makes knowledge-intensive sectors more advantageous. Finland has high educational standards and a robust infrastructure which allows it to compete in these high-tech industries. This has built up national human capital and given them the tools in which to compete in these sectors (Cord, 2014).

Policy-makers try to encourage an information economy through education in high-tech fields and engineering. Fostering innovation through research and development is a prime pillar of Finland's strategy. Additionally, many breakthroughs come from small enterprises, so entrepreneurship is emphasised.

Yet there is a significant problem with knowledge-based sectors, in that it is not labour-intensive. Companies rely upon relatively few workers. Even success stories like Rovio Entertainment hire dozens of specialists, not tens of thousands of factory workers to build their products.

***UNITED ARAB EMIRATES TRANSITION***

UAE to sustain its drive toward economic diversification, as this is the nation's surest path to sustainable development in a future that is less reliant on oil. This means expanding new strategic sectors to channel our energies into industries and services where we can build a long-term competitive advantage. Balanced growth must be fuelled by a sustainable range of energy sources, within which the UAE will ensure an important role for alternative and renewable options such as nuclear power.

To ensure lasting competitiveness, the nation will look beyond traditional economic models and take a more flexible perspective. Businesses will adopt an increasingly customer-centric approach to customising their products and services, and will learn to coordinate in efficient networks to meet the complex demands of the marketplace. By stimulating home-grown entrepreneurship and attracting foreign direct investment, our economy will mature into a model of sustainable and responsible growth that will ensure long-term prosperity for all Emiratis.



They will position their economy to capture developing trends and adapt to changing global realities, such as the rise of new economic powerhouses and will forge ever stronger international partnerships and capitalise on them to boost trade and commerce. They want all Emiratis to make a valuable contribution to their nation's growth by building their knowledge and applying their talent with innovation and drive. More Emiratis will enter higher education, where they will enrich their minds with the skills that their nation needs to fuel its knowledge economy. Universities will listen closely to the needs of Emiratis and of their future employers, and will balance their teaching to the demands of the workplace.

Joining the world of work is a first step towards personal fulfilment and economic empowerment. Many will show the leadership to stride much farther. Promising Emiratis must be nurtured to become captains of industry and dynamic entrepreneurs, marshalling the country's resources to bring innovative products to the marketplace. Others will be groomed as

senior public officials, trusted to hold the levers of economic change and empowered by knowledge to steer the economy to the cutting edge of innovation.

For those industries where Emiratis can learn most from global expertise, the UAE will continue to call upon the best talent from around the world. Our nation will attract and retain the finest and most productive workers and entrepreneurs by offering them fulfilling employment and an attractive place to live.

Productivity and competitiveness will come to rival the best in the world, as a result of investment in science, technology, research and development throughout the fabric of the UAE economy. Outstanding information and communication infrastructure will network our businesses together and give them a leading edge as they transact and interact with the world. Individual citizens will also reap the benefits of efficient connectedness in their digital lives as they search online for knowledge and the fulfilment of intellectual curiosity.

This shift to a knowledge economy can only be accomplished within an entrepreneurial environment that harnesses the talent and creativity of Emiratis. A new class of entrepreneurs will be nurtured and supported with the help of practical programmes such as start-up incubators. In a national effort, the UAE will cultivate a healthy risk-taking culture where hard work, boldness and innovation are rightfully rewarded.



Legal frameworks and government services will be designed to provide businesses with the efficient environment that they need in order to grow, thrive and commercialise innovative ideas. Regulations will promote efficient markets and protect intellectual property. Partnerships will flourish between the public and private sectors, spurring growth and maximising opportunities. The vision is for UAE to become one of the best places in the world to do business (UAE Vision 2021, 2018).

## C. How can India adapt the steps towards the revolutionary knowledge economy?

"India has built pockets of knowledge-based growth, but has not yet translated this into a broader economic model"

- Asisan Development Bank

Learning should be enjoyable, interactive, and experiential and technology based. There is a lot of gap between student enrollment in school and number og graduate turnout per year. To reduce such gaps it is essential to take few measures:

1. Based on the strong positive correlation found between number of universities ranked in the 'Times Higher Education' or such reputed rankings and the economic growth of the country, there is a need of better quality of education as well as maintanence of that.

2. It has been found that out of the students graduating from professional institutes (Mckinsey, 2005) only 25% of engineers, 15% of finance and accountancy professionals, and 10% of graduates with Indian degrees are employable by multinational companies. A strong flow of supply has to be met for this kind of demand.

3. "Maintenance of High Quality of Education: According to CRISIL (2007), there are 370 universities in India, out of which 131 universities have the rights to a±liate. Colleges under the affiliated system are expected to maintain the same level of quality. To standardize the quality, minimum dimensions were set which does not give enough freedom to the a±liated colleges to take a quantum leap in the improvisation of quality. Therefore, more autonomy should be given colleges on reforming the syllabus, quality of education, and recruitment of faculty to create high quality professionals" (Bhattacharya, 2010).

4. Countries with higher rank on the KEI have taken drastic measures previosuly in terms of integrating and building coherence amongst research organizations and universities.

5. In recent times it has been observed that the burden of education has been valued way more than the value of education solely due to its cost. It is vital for pillars of economy like education to be availed within affordable limits so as to ensure proper civilized growth.

6. The number of researchers in India has increased by only 20% from 1991 to 2001, as compared to China where the comparative increase was about 80% (Knowledge Commission Report). Hence, even though encouragement is provided and the human intellect is rightly placed, the conducive ambience and swift support of laws and regulations is what is required more than ever.

| | Coefficients | Standard error | t Stat | P-value |
|---|---|---|---|---|
| Intercept | −82.2487 | 39.32113 | −2.09172 | 0.041271 |
| R&D expenditure as % of GDP (2000−2005) | 76.74037 | 20.50094 | 3.74326 | 0.000449 |
| Cube of tertiary students in science, manufacturing and engineering (% of tertiary students 1999−2005) | 0.004066 | 0.001582 | 2.570225 | 0.01301 |

ANOVA

| | Df | SS | MS | F | Significance eF |
|---|---|---|---|---|---|
| Regression | 2 | 571604.2 | 285802.1 | 11.37911 | 7.73E-05 |
| Residual | 53 | 1331169 | 25116.39 | | |
| Total | 55 | 1902773 | | | |

Figure 24. Regression output indicating R&D expenditure and % of tertiary students in science, manufacturing and engineering are predictors of the number of patents generated. Reproduced from “Knowledge Economy in India” by Bhattacharya, S. 2010. Retrieved from WKCI, 2006 and UNSTAD, 2006

A regression analysis based on crosssectional data of 56 nations from the World Bank indicates that R&D expenditure as a percentage of GDP and a percentage of tertiary students in science, manufacturing and engineering are moderate indicators of the number of residential patents generated per million (with a R square of 30% and p-value of 0.00044 for R&D Expenditure as % of GDP. For example, it indicates that with a 1% increase in R&D expenditure, the number of patents generation may increase by 76 units, with all other factors remaining constants (Bhattacharya, 2010).

7. Hence, other variables which have an impact on secondary and tertiray education also rely upon patents and patents regimes.

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# CHAPTER 5

# CONCLUSION

## ➢ CHALLENGES AND SOLUTIONS

As mentioned before, in process of building a strong knowledge intensive base it is important for 'balance' to be maintained amongst the four pillars of KEI. Currently, India has an imbalancd with respect to these pillars as Education and Skills is not ranked as high as the other three. However, India has an advantage of massive research talent pool which it could use to harness benefits. India ranks among the top 20 countries/regions on science and engineering research papers with USA having the highest with a 28.9% share of research papers in the world. CSIR is again the highest contributor of research papers. In 2006, there were 3488 research papers contributed by the CSIR with average impact factor of 1.98 (Bhattacharya, 2010). Ease of Doing Business and Global Competitiveness are closely related to the HEI sector. There is a stringent need in integration of businesses with innovation and collaboration of HEIs with companies and MNCs. Apart from this, education has to be made more affordable for the citizens of the country as many universities and colleges changing to autonomous inevitably soars the costs to sky high. The quality of education and other facilities provided at the HEIs should be enhanced for more foreign participation leading to diversity, openess to ideas and opportunities and broader perspectives. The countries which transformed via knowledge dissemination, if studied showcase marvellous HEI systems. Their policies suggest education to be the root level for change which will further revolutionize other sectors thereby shifting the base to knowledge creation. More awareness and incentivized programmes should be initiated by the government in research and innovation. Because even if India has a composite of research talent pool, this pool tends to perform duly well in international organizations and in foreign nations.

## ➢ RECOMMENDATIONS

A lot of countries had soon realized the modern economic strategy of changing nature of economies – knowledge. And hence are taking plentiful steps and measures towards it. One of the aims of this paper was to establish the importance and relevance of knowledge in todays time as well as its necessity for fututristic developments. Furthermore, what was more of a research centric question was the impact of HEIs and the power vested in them towards disseminating knowledge. The author incorporates eminent empirical findings to prove the relationship and HEI's impact on economic and societal growth. For this, a comparitive case study is used between countries like Finland and Sweden which rank high in KEI and India which currently ranks lower in the KEI but at the same time has immense potential to climb up.

Since the last two decades India has been working towards it progressively though. To facilitate the transition to knowledge society, to increase per capita income and to reach desired rates of economic growth, increased efforts should be made to develop public policies towards the private sector considered as regulatory quality, R&D expenditures and improvement of qualified workforce performance indicators of knowledge economy (MURAT, İNAM & GÜZEL, 2017). In conclusion, we can positively ascertain that there is a strong relationship between various economic variables and HEI variables. However, unexpectedly there were also a few variables that did not show as strong as a correlation in the study conducted by various researchers and authors who's work has been inculcated in this paper. More emphasis on supporting R&D intensive sectors is required and increasing the ambience of India as a place to do R&D is therefore vital.

## ➢ DIRECTION FOR FUTURE RESEARCH

Research so far, though establishes the primal effect of knowledge based economies worldwide; a more thorough analysis is required in this segment. Further it is recommended that this particular domain should be studied in the growing field of underdeveloping economies too. This study too, includes only one pillar of study and hence leaves plenty of room for other pillars to be inculcated, such as *Information Infrastructure, Innovation Systems, and Economic Incentive & Institutional Regime*. Apart from this, future researchers can also conduct a primary study depending on the nature of objective of the paper to determine this subject on a micro level or in society. Overall, this domain of study leaves a scope for primary qualitative analysis where the policies and regulations of high ranking countries can be studied in a more orderly fashion. As KAM has been discontinued by the World Bank it is unfortunately truly very difficult to attain quantitative data which thereby leaves researchers scope for complicated attainment of quantitative data on this subject.

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# APPENDICES

| | GDPG | PAP | ICTGE | UR | GDPPC |
|---|---|---|---|---|---|
| EE | -0.0755 | 0.2118 | -0.2625 | -0.2203 | 0.2978 |
| RQ | 0.1364 | 0.4096* | -0.2743 | -0.4229* | 0.6918** |
| IU | 0.0822 | 0.5007** | -0.1298 | -0.4096* | 0.7030** |
| FBIS | -0.1056 | 0.4575** | -0.2190 | -0.2599 | 0.6690** |
| SWE | -0.0792 | 0.1862 | -0.3752* | -0.2079 | 0.7332** |
| RDE | 0.0167 | 0.8391** | 0.1235 | -0.3923* | 0.3126 |
| SIS | 0.1611 | 0.3915** | -0.1486 | -0.4904** | 0.7029 |

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Figure 25. Correlation between the Knowledge Economy Performance Indicators and Macroeconomic Variable Sets. Reproduced from "Relationship Between Knowledge Economy Performance Indicators And Selected Macroeconomic Variables: an Application for OECD Countries" (p. 20) by İnam, Murat, & Guzel, 2017.



| | Performance Indicators | | | | | | | Macroeconomic Variables | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EE | RQ | IU | FBIS | SWE | RDE | SIS | GDPG | PAP | ICTGE | UR | GDPPC |
| EE | 1.00 | | | | | | | | | | | |
| RQ | 0.48** | 1.00 | | | | | | | | | | |
| IU | 0.50** | 0.80** | 1.00 | | | | | | | | | |
| FBIS | 0.50** | 0.60** | 0.81** | 1.00 | | | | | | | | |
| SWE | 0.49** | 0.70** | 0.71** | 0.65** | 1.00 | | | | | | | |
| RDE | 0.35* | 0.37* | 0.54** | 0.57** | 0.31 | 1.00 | | | | | | |
| SIS | 0.48** | 0.61** | 0.82** | 0.76** | 0.60** | 0.43* | 1.00 | | | | | |
| GDPG | | | | | | | | 1.00 | | | | |
| PAP | | | | | | | | 0.07 | 1.00 | | | |
| ICTGE | | | | | | | | 0.14 | 0.14 | 1.00 | | |
| UR | | | | | | | | -0.59** | -0.35* | -0.17 | 1.00 | |
| GDPPC | | | | | | | | 0.04 | 0.33 | -0.41* | -0.36* | 1.00 |

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Figure 26. Correlation between the Knowledge Economy Performance Indicators and Macroeconomic Variable Sets. Reproduced from "Relationship Between Knowledge Economy

Performance Indicators And Selected Macroeconomic Variables: an Application for OECD Countries" (p. 20) by İnam, Murat, & Guzel, 2017.

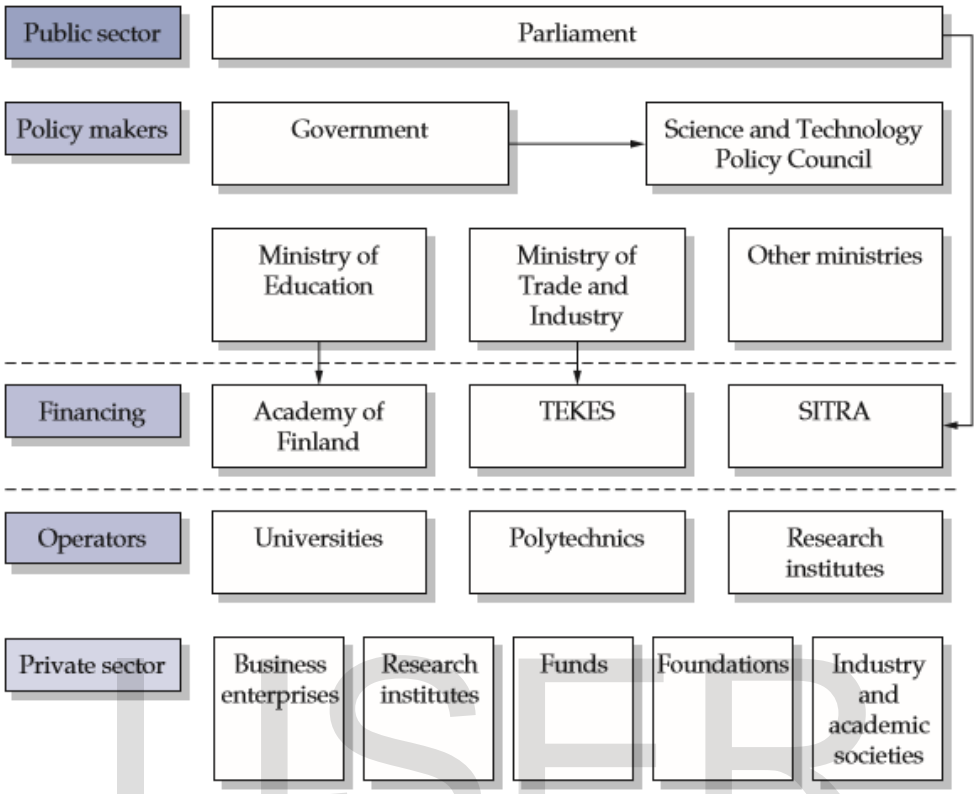




Figure 27. World Bank. Knowledge Assessment Methodology, www.worldbank.org/kam.

To facilitate the transition to knowledge society, to increase per capita income and to reach desired rates of economic growth, increased efforts should be made to develop public policies towards the private sector considered as regulatory quality, R&D expenditures and improvement of qualified workforce performance indicators of knowledge economy.