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Effective Management towards Successful Knowledge-Based Economy

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Cooperation and competition with universities

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Effective Management toward Successful Knowledge-Based Economy

Executive Summary

Science and Technology Parks play an important role in developing a strong Knowledge Based Economy (KBE) for the nations. This is mainly due to the execution of different initiatives to promote innovations and support the research and development as well as the technology transfer. These initiatives would have a great effect on the national economy once an *eco-system* has been established to support the different development phases in order to progress the innovative ideas towards creating useful products. Managing this eco-system would require a well defined knowledge management process that deals with the creation and transfer of knowledge, the dissemination of knowledge, the utilization of knowledge, and the monitoring the execution of knowledge management phases. In this paper, the programs used to establish the eco-system at Riyadh Techno Valley (RTV), the process of sharing and disseminating knowledge at RTV, and an analytical method for assessing and measuring the effectiveness of the knowledge based economy has been described. This is based on a well defined set of performance indicators to verify the availability of useful knowledge forachieving a successful investment and business continuity so a strong efficient KBE can be achieved.

1. Introduction

The United States was a pioneer in a knowledge-based economy in the 1950s through establishing the Silicon Valley in California, and the Research Triangle Park (RTP) located in North Carolina. The first person to have used the expression of "knowledge-based economy" was Peter Drucker in his book *The Effective Executive* (1966)[1]. In this book, Drucker distinguished between hand labor and knowledge labor. However, this categorization of hand labor and knowledge labor is somewhat unfair since all kinds of work involve the intellect. A knowledge-based economy is a knowledge-driven one in which the production of and investment in knowledge plays a major role in generating wealth. Remember that trying to acquire the knowledge doesn't necessarily means achieving progress in the knowledge based economy, unless it links to initiatives that can be executed in a proper way according to well known criteria, in addition to healthy management process that allows monitoring the execution progress so it transfers this knowledge into valuable products.

By the mid-1990s, knowledge management initiatives were flourishing because of the wide spread of the Internet. The International Knowledge Management Network (IKMN), begun in Europe in 1989, went online in 1994 and was soon joined by the U.S.-based Knowledge Management Forum and other KM-related groups and publications. In 1994 the IKMN published the results of a knowledge management survey conducted among European firms, and the European Community began offering funding for KM-related projects through the ESPRIT program in 1995. Knowledge is not only about creation of information, but rather about developing certain pattern and distributes it efficiently to selective people. The mechanism of creation of knowledge, storing it, sharing it and dissemination and how to convey them meaningfully to some other person is called knowledge management (KM). KM is related directly to the effectiveness with which the managed knowledge enables the members of the organization to deal with today's situations and effectively envision and create their future (bel97a 2004)[2]. A sound KM depends on its effective distribution and not only on its efficient production.

This can be done through secure Wireless network that has the advantages of flexibility, mobility, easy administration, reducing the information-related risk, and support of security (G. Kbar 2005)[3]. Wireless Local Area Network (WLAN) technology is rapidly becoming a crucial component of computer networks that widely used in the past few years (Jim 2002)[4], (Rob 2001)[5], (Signa 2001)[6], and (Nortel 2001)[7]. It provides mobility as well as essential network services where wire-line installation proved impractical. The inclusion of the newer IEEE 802.11g versions of the standard offers a firm basis for high performance wireless LANs. The security factor is critical in wireless LAN. There are many research papers discussing how to improve the security of wireless system to an equivalent or better rate than wired LAN (Nortel 2011), (Lisa 2001)[8], (Schwartau 2001)[9], (Dave

[1]Peter Drucker (1966),The Effective Executive.

[2]Bellinger, G bel97a, (2004) "Knowledge Management—Emerging Perspectives", [online], Available: http://www.systems-thinking.org/kmgmt/kmgmt.htm[10 Dec 2011].

[3]Kbar G., Ubeida W.S (2005) "Wireless Network as solution for efficient distribution of Knowledge Management, ICICKM 2nd International Conference on Intellectual Capital Knowledge Management and Organizational Learning, AUD-Dubai.

[4]Geier Jim, (2002),"Assigning 802.11b Access Point Channels", [online],http://www.80211planet.com/tutorials/article/0,4000,10724_972261,00.html [10 Dec 2011].

[5]Schenk Rob, (2001), "Wireless LAN Deployment and Security basics network", [online], http://www.extremetech.com/article/0,3396,s%253D1034%2526a%253D13521,00.asp [10 Dec 2011].

[6]Signa Services (2001), "Best Practices for Deploying Wireless LANs", [online], Planet, http://www.wi-fiplanet.com/tutorials/print/0,,10724_985421,00.html [10 Dec 2011].

[7]Nortel, (2001), "IEEE 802.11 Standard For Wireless LANs",[online], http://www.nortelnetworks.com/solutions/financial/collateral/mar00_wireless.pdf [10 Dec 2011].

[8]Phife Lisa (2001), "Wireless Privacy: An Oxymoron", [online], http://www.wi-fiplanet.com/columns/article/0,4000,1781_786641,00.html [10 Dec 2011].

2002)[10], and (Blackwell 2002)[11]. Successful collaborative platform strategies provide value for users by improving knowledge sharing. This encourages many enterprises that have been tantalized by the promise of collaborative technologies claiming to offer everything from better innovation to streamlined workflows. However successful sustainable collaborative platform strategies must be designed, from the ground up, around three major factors, which are usability, impact on end user, and organizational readiness. Collaborative platform success is dependent on user adoption and adoption is based on thoughtful design and forward-thinking enterprise processes (nGenera Insight 2010)[12]. A knowledge society is an indication of the ability of society to produce and use of knowledge as well as sharing of knowledge using the proper technology (Paul 2003)[13]. Networks encourage sharing of knowledge and play an important role for bringing innovation-specific resources and expertise for entrepreneurial teams to create new opportunities (Rothwell 1991)[14], and (Zaheer 2005)[15]. Stakeholders such as government agencies, universities, science parks, suppliers and competitors have a great influence on innovation (Gibb 1995)[16]. In addition, partnership between industry and universities has been considered in many countries as part of national policies to strengthen innovation. Most innovative firms, around 90%, had formal links with universities according to study done by Wilkinson et al. (1996)[17]. Additionally, a significant relationship was found between the introduction of new products and university networking (Freel 2003)[18]. Hence, collaboration among universities and industries as well as government agencies, science parks and investors is highly recommended for successful innovative products. In order to benefit from the innovations through creating or enhancing the characteristics of associated products at science parks, investors need to be encouraged for spending enough funds for the development. This can be done by providing a fair partnership model that intends to identify the role, right, and responsibility of each party as described in (kbar 2011)[19], in addition to providing a good incentive program to attract the Venture Capital (VC) fund to support the project development .Technology incubators have had a tremendous impact on economies either in terms of activating them or turning them into knowledge-based economies. They have contributed to creating a great deal of outstanding job opportunities, and made nascent companies, especially

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[9]Schwartau, (2001), "How to Break Into a Network with Only Three Keystrokes", [online], http://searchsoa.techtarget.com/news/770991/How-to-Break-Into-a-Network-with-Only-Three-Keystrokes [10 Dec 2011].

[10]Molta Dave, (2002), "WLAN Security on the Rise", [online],http://www.networkcomputing.com/1303/1303ws2.html [10 Dec 2011].

[11]Blackwell (2002), "Assessing WLAN Security Threats", [online],http://www.80211planet.com/tutorials/article/04000,10724_95348100.html[10 Dec 2011].

[12]nGenera Insight (2010), "Enabling Collaborative Platform Adoption", [online], http://www.moxiesoft.com [10 Dec 2011].

[13]David Paul A. & Foray Dominique (2003), Economic Fundamentals of the knowledge Society Policy Futures in Education, Volume 1.

[14]Rothwell R. (1991),"External networking and innovation in small and medium size manufacturing firms in Europe", *Technovation*, 11(2). pp. 93-112.

[15]Zaheer, A. and Bell, G.G.(2005) "Benefits from network position: Firm capabilities, structural holes and performance", Strategic Management Journal, 26, 809-825.

[16]Gibb, A. (1995) "Learning skills for all: The key to success in small business development", ICSB Annual Conference Proceedings, 1-21.

[17]Wilkinson, F., Lawson, C, Keeble, D., Lawton-Smith, H. and Moore, B. (1996) "Innovative behaviour of technology-based SMEs", joint CBR/Warwick SME Centre conference on innovation in small firms, University of Cambridge, Cambridge.

[18]Freel, M. (2000) "External linkages and product innovation in small manufacturing firms", *Entrepreneurship and Regional Development*, 12, 245-266

[19]Kbar G, (2011), Fair Partnership Model by Sharing the Benefit of Knowledge Creation, ECIME the 5th European Conference on Information Management and Evaluation, Como, Italy

science and technology-based ones, more likely to survive through creating new outstanding job opportunities.

Successful sustainable collaborative platform strategies must be designed, from the ground up in order to have an effective KM. A READINESS ASSESSMENT is a necessary part of 'due diligence' in any serious new initiative, most especially so in corporate business, where a failed initiative is more often than not painfully costly. There are methods used worldwideto determine the organization's readiness not only to implement KM, but also its readiness to be truly a knowledge-based, knowledge driven organization. However, this method focuses on the descriptive question/answer approach to determine the gap, which can't be quantified to measure the organization performance.There is other method used by the World Bank to assess the knowledge which is known as "Knowledge Assessment Methodology (KAM)" (Worldbank 2011)[20]. This method includes 109 parameters which can be used to assess the core of knowledge. There is no correlation among the different parameters used in this assessment so we can measure properly the overall performance indicator for a particular nation.These parameters used for measuring the effectiveness are grouped in 8 elements. These elements are economical performance, system of economy, government, innovation system, education system, workers, equal employment opportunities, and ICT. Evaluation of these parameters is subjective and is based sometime on absolute values, or relative values.In order tocomplete the assessment of a particular country,the KAM method requires covering the 109 parameters, where many variables have to be considered. These variables include some of the indexes such as; annual GDP growth, human development index, capital formation, tariff, IP, export, interest rate, regulatory quality, research, publication, employment, technology, and many other parameters. The World Bank had also reduced the grouping to six which are Knowledge Economy Index, Knowledge Index, Economic Incentive, Innovation, Human capital, and ICT.

In this paper a new analytical method that is based on how the probability of the knowledge factors can occur in a certain environment has been suggested to quantify the performance of certain organization. This new method would allow managers to evaluate the performance of knowledge based economy of different nations or organizations and assist them in identifying problems and guide them on how to plan for improvement.

2. Establishing eco-System at RTV

RTV Research and Business Development department is aiming to develop an eco-system for the knowledge based economy at King Saud University at all phases that deals with the creation or transfer of knowledge, dissemination of knowledge, utilization of knowledge, and monitoring the knowledge management.Section 2.1 describes how to optimize the phases of knowledge creation dissemination, and utilization, by having effective collaboration and partnership programs between KSU researchers, national and international companies and universities, as well as government and fund institutions. In addition innovation/knowledge economy eco-system would be established through building a smart city forattracting R&D companies to invest at RTV. Furthermore, dissemination of knowledge through events would allow sharing of knowledge and educating researchers and society for better skills. The realization of this eco-system would allow the transfer and habitat of technology to RTV and the Kingdom of Saudi Arabia towards creating useful products for achieving a strong knowledge based economy as shown in figure 1.This eco-system that is established at RTV involves the integration of all R&D units at the university along with collaboration and partnership with private and public sector in order to support the innovation

[20]Worldbank,(2011),http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/EXTUNIKAM/0,,menuPK:1414738~pagePK:64168427~piPK:64168435~theSitePK:1414721,00.html [10 Dec 2011].

toward creating useful products. Furthermore, an effective KBE requires a proper monitoring and auditing process to measure the performance of organizations as described in section 2.2.

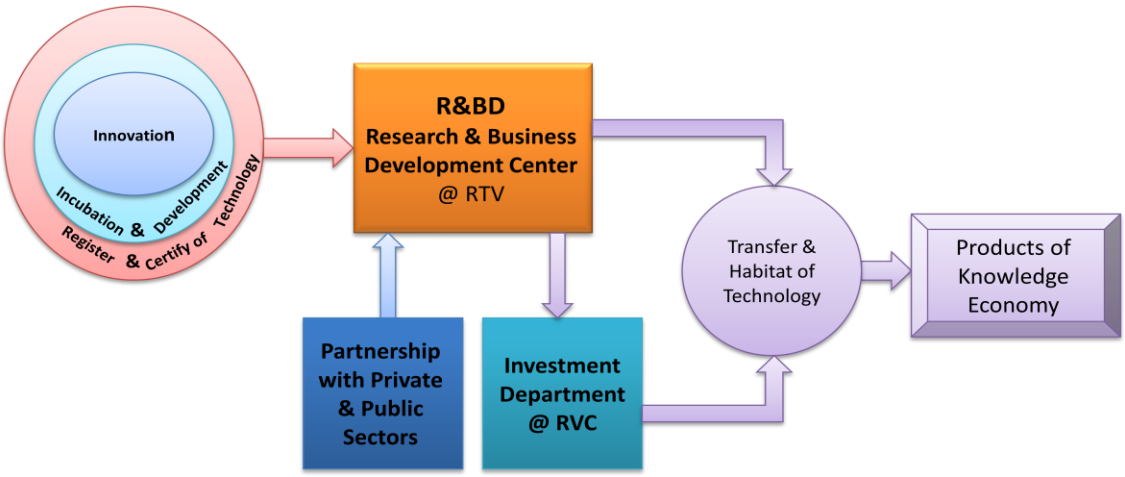

Figure1. RTV eco-system towards strong Knowledge based Economy

2.1 Creation dissemination and utilization of Knowledge at RTV

Knowledge Creation:

The education system plays an important role in creating the required knowledge for knowledge based economy. In order to maximize the knowledge creation, the education system should have a high standard level that is related to core based education and publication, contributing to the creation of new ideas that leads to innovation, transfer of technology through the help and support of incubators, creating products through the help of industrialization and startup companies, and government support through facilitating the procedures and regulations as shown in Figure 2.

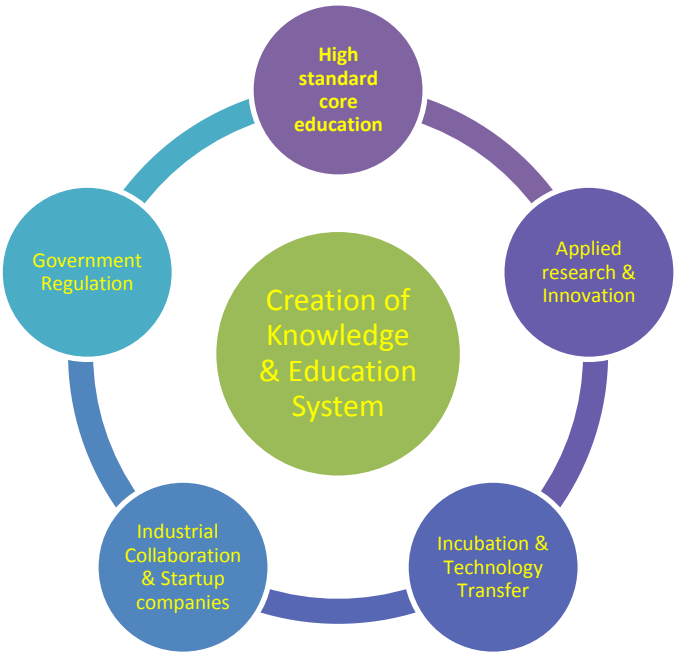

Figure2. Key factors for the creation of Knowledge for good education system

Innovation environment and culture, business oriented and incubators would assist in technology transfer as well as in the support of entrepreneurship. Science parks on the other hand with complete infrastructure, good incentives, and aproper procedure for creating partnership with local

and international companies, support the incubators and proper management would play important role in creating a strong KBE. In addition to diversification of sources of funding the National Innovation System, diversifying the sources of financial support, as well as improving the legislations would increase the chance of successful businesses and strong KBE.

Sharing and utilization of Knowledge:
Sharing knowledge and learning from other nation best practices would avoid making similar mistakes. Based on analyzing the success stories for the successful transfer of technologies inorder to builda strong knowledge based economy which has been done at developed countries, we can conclude the following important practices:

- Focusing on attracting advanced researches to match the strategic direction towards strong postgraduate studies including PhD and Masters, and outstanding professional experiences that rely on latest technologies, in addition to attract the best professional people.
- The existence of proper funding from governments and private sectors at different scale according to potential researches and strong trust in the research outcome by the funders.
- The existence of well known defined procedures for encouraging the transfer and apply of technologies.
- Attracting foreign investors through varieties of incentives and free tax mechanisms as well as big facilitating mechanisms through relevant investment regulations.
- The existence of tax incentive regulations and enforceable regulations for having partnerships in research and development.
- Good infrastructure and availability of different services including consultation, proper support and funds through incubating the applied researches at science parks.
- The creation of entrepreneurship projects with support and sponsor of governments.
- The proper unique management that is based on professional team with proper outstanding experiences who are able to create relevant plans, and monitor the execution of work to improve the performance.

To provide the best environment for the transfer and habitat of technologies towards achieving an eco-system that is relevant for the creation and establishment of new technologies at Riyadh Techno Valley and the Kingdom of Saudi Arabia (KSA), the following initiatives associated with different collaboration programs are being implemented:

- Strengthen the relationship with leading companies to establish R&D centers at RTV and develop joint research projects with KSU researchers.
- Attract leading companies to have partnership and investment with RTV.
- Collaborate with established service and infrastructure companies at RTV to provide the best solution, support the knowledge transfer, and support the R&D projects in collaboration with KSU researchers.
- Collaborate with KSA organizations which support the R&D in the domain of ICT, Energy and other important applications to support projects sponsored by RTV.
- Collaborate with KSA universities to attract R&D projects to transfer of technology to RTV.
- Prepare for workshop and conference events in relevant domains to RTV.
- Establish a smart innovation center to provide smart solution to the kingdom.
- Sharing of knowledge and experience with the community and developing solution for interactive environment.

2.2 Measuring the effectiveness of Knowledge Based Economy (KBE)

In this paper to validate the performance of Knowledge based Economy forcertain nation, a quantitative Knowledge Base Economy (KBE) assessment methodologyhas been used to evaluate the outcome based on identified Key Performance Indicators(KPI). This new method try to simplify the measurement performance procedure based on defining a new set of groups and parameters. To achieve a sustainable nation's knowledge based economy, the following three main indicators which affect the KBE performance can be studied and they are; knowledge, investment, and Business

continuity or sustainability.As shown in Figure 3,the intersection of the three KBE performance domains gives an indication of valuable useful products. Each of these indicators is associated with different elements. The first KPI can be used to check the probability of having the required useful knowledge, where KPI=100% means a nation would have all the required knowledge factors to build its economy. The second KPI is the ability to invest which can be measured by the different factors as explained below, where the total KPI of 100% would mean a high success in the project investment. The third KPI is the ability to maintain the success of the business which can be measured by the different factors as explained below, where the total KPI of 100% would mean of having high business project success continuity.

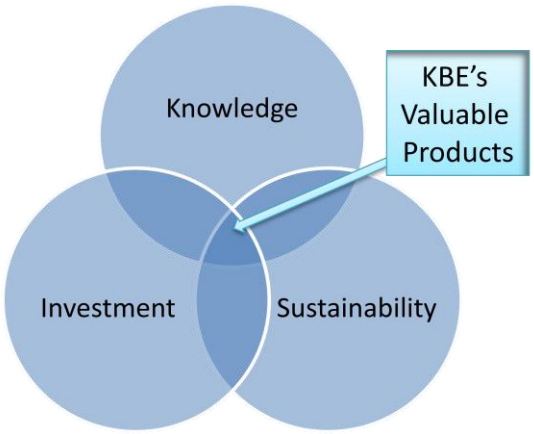

Figure3. KBE area of operation toward creating useful products

A strong KBE would require an optimum value of the three indicators. Each of these indicators is composed of elements or sub-indicators which can be assessed by linking them to the relevant goals of a particular organization. For example, the goals of universities can be linked to the sub-indicators of the knowledge indicator, the goals of the university's science park can be linked to the sub-indicators of the investment indicator, and the goals of business arm of the science park can be linked to the sub-indicators of the business continuity indicator. Linking these goals to elements or sub-indicators would allow us to measure them by in putting weight for each element in order to optimize the KBE creation. First, the elements or sub-indictors that constitute each of the three indicators (knowledge, investment and business continuity or sustainability) have to be determined. Then, the weight of each sub-indicator would be identified according to the goal-matching mechanism. In this mechanism, by looking at the relevant goals, we can determine which of the sub-indicatorsare required to achieve them. Then, we can determine the repetition and percentage of these sub-indicators and therefore we can assign a weight for these sub-indictors as explained in following subsections.The first indicator of successful KBE is the Availability of Useful Knowledge (AUK). The elements associated with AUK are; *core knowledge* that can be linked to the Ability to Discover New Idea (DNI), *valuable knowledge* that is linked to the Characteristic of Additional Value (CAV) which is related to (innovation, quality of research), *recorded knowledge* that is linked to Registering of Information (RI), *applied knowledge* that is linked to Prove of New Information (PNI), *profitable knowledge* that is linked to Protecting of Knowledge (PK), and *shared knowledge* that is linked to Absolute Sharing of Information (ASI). In order to quantify the value of knowledge indicator, the effect of AUK's elements on the knowledge indicator has to be assessed, and the percentage or the weight of these elements has to be determined. To determine the percentage of each element in the knowledge indicator, we can refer to the goals that have been identified for a particular national education institution which can contribute to the nation's KBE, and try to match these elements to the goals and then identify the repetition of each element in the defined goals as explained in next sub-sections. The second main indicator of successful KBE is investment indicator which directly affects the national growth economy. However, in order to quantify the investment

indicator value, the effect of its elements including the knowledge indicator has to be assessed. The elements affect the value of investment indicator are *knowledge*, *fund, technology infrastructure, skills/experience*, and *management*. The percentage or the value of these elements has to be determined, and their values need to be maximized in order to maximize the overall investment indicator value to be close to 100%. To determine the percentage of each element in the investment indicator, we can refer to the goals of a science park that contributes to the investment success for a particular nation's KBE, and try to match these elements to the goals and then identify the repetition of each element in the defined goals. The third indicator of successful KBE is business continuity. The elements associated with Business Project Continuity (BPC) are; *entrepreneurship* that is linked to Entrepreneurship Ability, *existing of support and technology* that is linked to Developing the Technology Infrastructure, and *leadership management* that is linked to the Management & Leadership Performance .

In order to quantify the knowledge indicator, the investment indicator, and the business continuity indicator for King Saud University programs which contributed to the Kingdom of Saudi Arabia (KSA)'s KBE, the goals of the university would be used to identify the weight factors of the knowledge sub-indicators, the goals of Riyadh Techno Valley (RTV) science park would be used to identify the weight factors of the investment sub-indicators, and the goals of Riyadh Valley Company (RVC) would be used to identify the weight factors of the business continuity sub-indicators. In addition to the main indicators that affect the KBE performance, the elements related to them and how they are correlated to each other need also to be identified.

Quantifying the knowledge indicator

To determine the percentage of each element in the knowledge indicator, we can refer to the education system for a particular university and schools, and match these elements to their goals as explained below. For instance, let's analyze the goals of King Saud University that are listed below (ksu 2011), and match them to the elements of the knowledge indicator.

Goals of (Ksu 2011)[21]:

- Establish excellence in all fields of scholarship and research; (requires core knowledge, and valuable knowledge)
- Maintain a distinctive faculty possessing the highest credentials and abilities; (requires core knowledge, valuable knowledge, applied knowledge, and profitable knowledge)
- Provide graduate students with the best education and opportunities that will enhance their knowledge, skills and relevant experience; (requires core knowledge, and recorded knowledge)
- Building bridges locally, nationally and internationally; (requires shared knowledge, and profitable knowledge)
- Provide a supportive learning environment for faculty, staff and students; (requires core knowledge, and recorded knowledge)
- Ensuring a sustainable environment for the pursuit of excellence; (requires recorded knowledge, core knowledge, profitable knowledge, applied knowledge, and valuable knowledge)
- Establishing flexibility and accountability. (requires applied knowledge, profitable knowledge, and shared knowledge)

By looking at the above example, we can find that the core knowledge is repeated 5 times, valuable knowledge 3 times, applied knowledge 3 times, recorded knowledge 3 times, profitable knowledge 4 times, and shared knowledge 2 times. Assuming that the weights of the above sub-goals are equally weighted, then by considering the percentage of the 6 elements, the percentage of a particular element becomes equal: element repetition/ total num of elements' repetition X 100. Therefore, the core knowledge or Ability to Discover New Idea (DNI) indicator would be (element repetition/ total num of repetition X 100 = 5/20X100= 25%) of the knowledge indicator. The valuable knowledge or Characteristic of Additional Value (CAV) indicator would be (= 3/20X100=

[21]Ksu, (2011), http://www.ksu.edu.sa/Pages/default.aspx [10 Dec 2011].

15%) of the knowledge indicator. The applied knowledge or Prove of New Information (PNI) indicator would be (= 3/20X100= 15%) of the knowledge indicator. The profitable knowledge or Protecting of Knowledge (PK) indicator would be (= 4/20X100= 20%) of the knowledge indicator. The recorded knowledge or Registering of Information (RI) indicator would be (= 3/20X100= 15%) of the knowledge indicator. The shared knowledge or Absolute Sharing of Information (ABI) indicator would be (= 2/20X100= 10%) of the knowledge indicator. The summary of the value of the sub-indicators of the knowledge indicator is listed in Table 1.

Quantifying the investment indicator

To determine the percentage of each element in the investment indicator, we can refer to the business and research development system for a particular science park that is belongs to university, and match these elements to its goals as explained below. For instance, let's analyze the goals of Riyadh Techno Valley of KSU that are listed below (rtv 2011), and match them to the elements of the investment indicator.

Goals of (Rtv 2011)[22]:

- Increase the level of interaction between KSU and Saudi knowledge-based industry, business and commerce. (requires management)
- Diversify the employment opportunities for graduates and post graduates. (requires knowledge, and skills)
- Create a site that can be groomed to encourage foreign direct investment in the form of technology-based companies. (requires fund, and technology infrastructure)
- Raise the profile of KSU as modern industry and business facing centre of learning. (requires knowledge)
- Create a source of independent income from KSU from its estate and from investments in technology-Based companies. (requires fund, and management)
- Create an appropriate environment for establishing and developing a school of entrepreneurship. (requires knowledge)

By looking at the above example, we can find that knowledge is repeated 3 times, management 2 times, fund 2 times, skills and technology infrastructure one time. This can be related to percentage of the 5 elements, where the percentage of a particular element equal: element repetition/ total num of repetition X 100. Therefore, the knowledge or Metric Knowledge Investment (MKI) indicator would be (element repetition/ total num of repetition X 100 = 3/9X100= 30%) of the investment indicator, the fund or MKI indicator would be (2/9X100= 25%), the skills/experiences affects the MKI indicator by (1/9X100= 10%), the technology infrastructure affects the MKI indicator by (1/9X100= 10%), and the management affects the MKI indicator by (2/9X100= 25%). The summary of the value of the sub-indicators of the investment indicator is listed in Table 1.

Quantifying the business continuity indicator:

To determine the percentage of each element in the business continuity indicator, we can refer to the business start-up or sustainable investment system for a particular investment arm that is belongs to university, and match these elements to its goals as explained below. For instance, let's analyze the goals of Riyadh Valley company of RTV that are listed below (rvc 2011), and match them to the elements of the business continuity indicator.

Goals of (Rvc 2011)[23]:

- Establishing a diversified knowledge-based investment to support the kingdom's plans towards a knowledge-based economy. (requires management & leadership)
- Transfer, settlement and development of technology to serve the national economic growth needs. (requires entrepreneurship, management & leadership, and technology infrastructure)

[22]Rtv, (2011), http://www.rtv.com.sa, [10 Dec 2011].

[23]Rvc, (2011), http://www.rvc.com.sa/Default.aspx [10 Dec 2011].

- Growing a solid foundation of investment assets. (requires entrepreneurship, and management & leadership)
- Establishing and growing a network of strategic partnerships & alliances to attract sources of venture and low-risk funds in support of company's initiatives and objectives. (requires management & leadership, entrepreneurship, and technology infrastructure)
- Establishing the ecosystem to attract local and international technology investments and to foster the knowledge-based industries. (requires entrepreneurship, management & leadership, and technology infrastructure)
- Supporting technology innovation-based start-ups through incubation services. (requires entrepreneurship, and technology infrastructure)
- Investing in the development of human capital in the domains of technology, finance and knowledge investment. (requires management & leadership)
- Increasing the adoption of innovation, IP and knowledge economy culture. (requires entrepreneurship, management & leadership, and technology infrastructure)

By looking at the above example, we can find that entrepreneurship is repeated 6 times, management & leadership 7 times, and developing technology infrastructure 5 time. This can be related to percentage of the 3 elements, where the percentage of a particular element equal: element repetition/ total num of repetition X 100. Therefore, the Entrepreneurship Ability (EA) indicator would be (element repetition/ total num of repetition X 100 = 6/18X100= 33%) of the Business Project Continuity (BPC) indicator, the technology infrastructure or Developing the Technology Infrastructure (DTI) indicator would be (5/18X100= 28%), and the Management & Leadership Performance (MLP) indicator affects the BPC indicator by (7/18X100= 39%).

Table 1 summarizes the PKI weight of the three main indictors (AUK, MKI, and BPC) and their sub-indictors, where each of these sub-indicators have also been broken down into relevant associated sub-sub-indicators. The value of sub-indicators have been determined according to the goal-matching mechanism as explained before, whereas the actual value of sub-sub-indicators have been assigned according to the average of two estimations that have been done by two experts at RTV.

Based on the conducted study done at Riyadh Techno Valley, and the experiences of two experts working at RTV who have exposure to practices atdeveloped and developing countries, Figure 4 presents a comparison between developed and developing countries where the weight of each sub-indicator is normalized to 10%. This comparison highlights the average key performance indicators in order to measure the availability of useful knowledge AUK. It is clear from this figure that developing countries suffer from low creativity, low competition, low research capability, lack of partnership, little documentation, and difficulty in implementing the right solution and generating IP. In addition to the average base knowledge and education system, average experiences, medium standard, weak review process, and not contributing much to knowledge events. The AUK value in developing countries is 42.3%, which is nearly halfofthe value 93.3 of developed countries.

As shown in Figure 5, a comparison between developed and developing countries based on the average metric of knowledge investment MKI performance indicator is presented where the weight of each sub-indicator is normalized to 10%. It is clear from this figure that low AUK in developing countries as well as problems in providing enough variety of funding for technological projects, slow in completing the technology infrastructure, lack of right legist elation, and inadequate management experiences in these countries would lead to an average indicator for investment in the knowledge based projects. In addition, developing countries suffer from very low KPIs of variety of funds, mechanisms of acquiring funds, partnership strategy and experienced staffs. The MKI value in developing countries is 45.7%, which is close to half of the value 81.1 of developed countries, where developed countries also suffer from providing adequate fund, and ability to attract new skills.

As shown in Figure 6, a comparison between developed and developing countries based on the Business Continuity Performance (BPC) indicator is presented where the weight of each sub-indicator is normalized to 10%. It is clear from this figure that low value of management & leadership performance, as well as entrepreneurship ability are the main causes for lowering the BPC indicator in developing countries. The lack of management skills, not executing according to plan, problem in monitoring and auditing, as well as not appointing of relevant people for the right

position in developing countries, makes the BPC indicator to be low. In addition to the average communication and entrepreneurship skills, would cause more lowering of BPC indicator for some countries. The BPC value in developing countries is 47.7%, which is almost half of the value 84.7 of developed countries. The above result gives an indication that businesses for KBE at developing countries suffer from sustainability and continuity. However, this can improve by employing the right people with the right management skills or training the existing staff to gain better management skills as well as learning from other science park's best practices.

Type of KPI: Availability of Useful Knowledge (AUK)	
Sub-indicator	**Sub-sub-Indicator**
Ability to Discover New Idea **ADNI** (max 25%)	Base knowledge 7%
	Education system 8%
	Competition program 3%
	Reward 3%
	Experiences 4%
Characteristic Additional Value **CAV** (max 15%)	Research quality 5%
	Creativity 4%
	High standard 3%
	Sharing, partnership 3%
Registering of Information **RI** (max 15%)	Existing technology 3%
	Documentation 3%
	Retrieve information 4%
	High technology in laboratories 5%
Prove of New Information **PNI** (max 15%)	Review process 2%
	Proof of concept 3%
	Simulation 2%
	Implement solution 6%
	Necessary facilities 2%
Protecting of Knowledge **PK** (max 20%)	Intellectual Properties 5%
	Sharing profit 5%
	Ability to produce IP 10%
Absolute of sharing Information **ASI** (max 10%)	Share information 2%
	Knowledge Events 4%
	Presentation 2%
	Brain storm 2%
Total 100%	

Type of KPI: Metric Knowledge Investment MKI	
Sub-indicator	**Sub-sub-Indicator**
AUK Availability of Useful Knowledge (max 30%)	
APF Ability to provide Fund (max 25%)	Existing of fund 10%
	Partnership Strategy 8%
	Variety of funds 2%
	Mechanism of acquiring fund 5%
EI Existing Infrastructure (max 10%)	Services and facility 3%
	Equipments 5%
	Consultation and support 2%
ARS Availability of Required Skills (max 10%)	Local skills 3%
	Attract new skills 4%
	legistelation 3%
GMT Good Management Team (max 25%)	Experienced staff 10%
	Ability to learn and training 3%
	Sharing experience 2%
	Right person for right position 10%
Total 100%	

Type of KPI: Business Project Continuity (BPC)	
Sub-indicator	**Sub-sub-Indicator**
EA Entrepreneurship Ability (max 33%)	Entrepreneurship skills 18%
	Communication skills 8 %
	Exposing to other practices 7 %
DTI Developing the Technology Infrastructure (max 28%)	Updated Technology 8%
	Smart technology 8%
	Business Continuity Plan 12%
MLP Management & Leadership Performance (max 39%)	Management skills, qualification 13%
	Training and education 4%
	Execution according to plan 8%
	Monitoring and apply right appraisal 8%
	Having right staff with right expertise 6%
Total 100%	

Table1. Weight of PKI of the sub-indicators as have been derived from the analysis

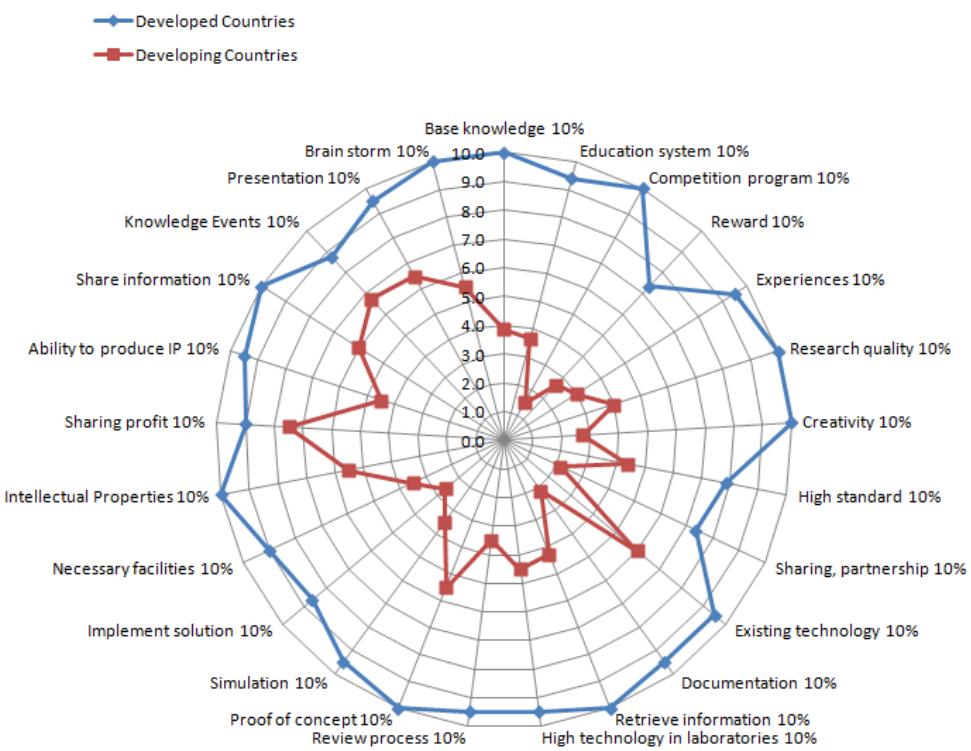

Figure 4, Comparison for the Availability of Useful Knowledge between developed and developing countries

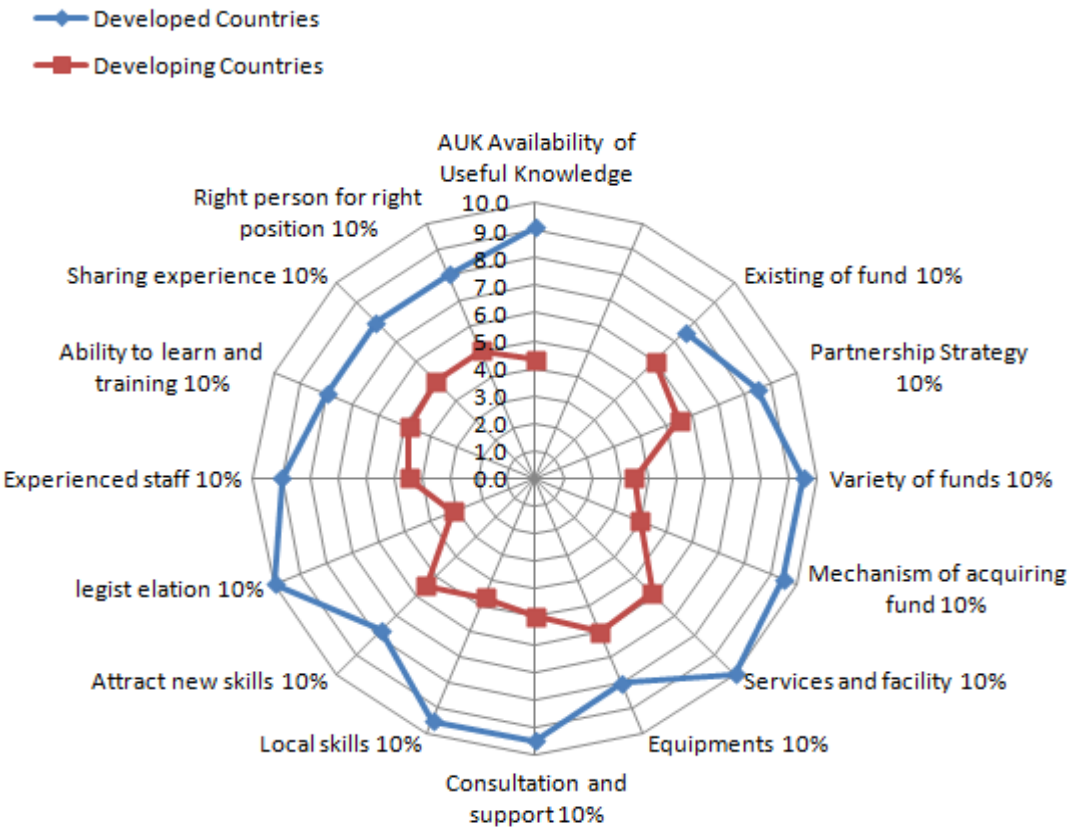

Figure 5, Comparison for the Metric Knowledge Investment between developed and developing countries

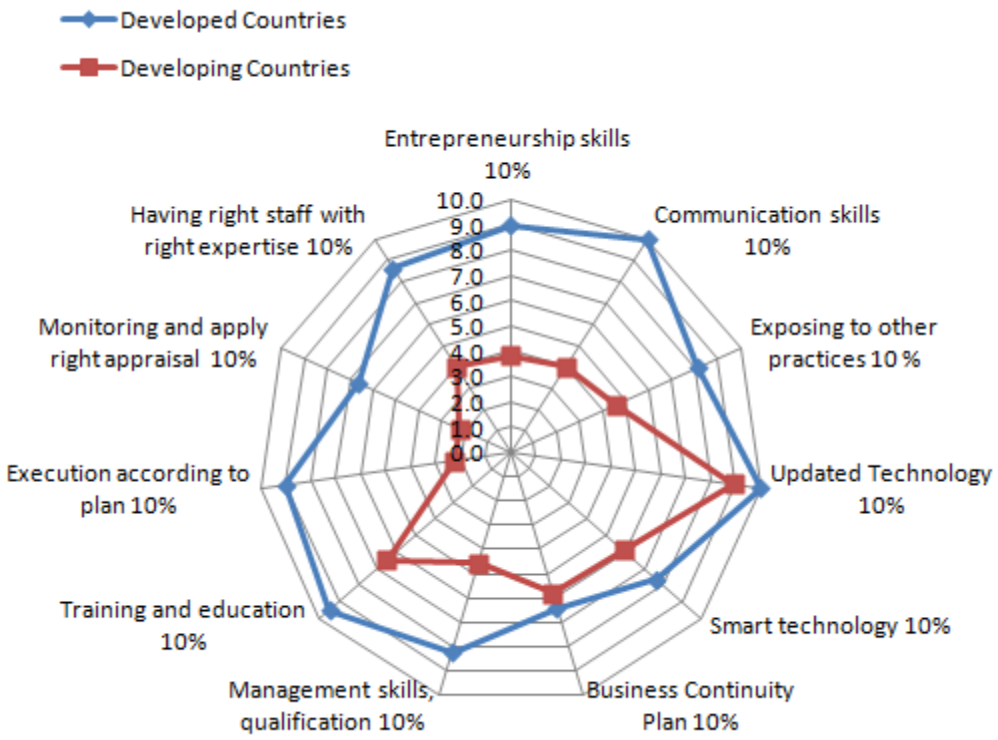

Figure 6, Comparison for the Business Project Continuity between developed and developing countries

3. Conclusion

The concept of Effective Management towards Successful Knowledge-Based Economic has been presented by highlighting the importance of establishing eco-system. This can be done through effective knowledge transfer and creation, good knowledge sharing using latest technologies and successful collaborative platform strategies, good utilization of knowledge through applying different initiatives for the successful of transfer and habitat of technologies, as well as the use of effective knowledge measurement using a novel analytical approach. Unlike the descriptive approach used in other references for checking the organization's readiness in order to identify the gap and try to fill in this gap, a better method using analytical approach called goal-matching mechanismhas been suggested in this paper. A new method for measuring the effectiveness of national knowledge-based economy has been presented, and is based on quantitatively analytical approach by comparing the goals of relevant organizations to the pre-defined sub-indicators which is related to the main KPIs in order to identify the maximum values of these sub-indicators that leads to optimized KBE performance. It uses different key performance indicators that are associated with the availability of knowledge, the knowledge investment and business project continuity. A comparison between developed and developing countries has shownrelatively low or average key performance indicators, as compared with that of the developed countries.This is due to problems in their education system, average research capabilities and Intellectual Properties, low projects funding and lack of management experience.This is also in addition to low management and leadership skills as well as low entrepreneurship capability which lead to a low Business Continuity Indicator.

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