World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:11, No:4, 2017

The Impact of Innovation Best Practices in Economic Development

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Open Science Index, Economics and Management Engineering Vol:11, No:4, 2017 publications.waset.org/10007179/pdf

***Abstract*—**Innovation is the process of making changes, differences, and novelties in the products and services, adding values and business practices to create economic and social benefit. The purpose of this paper is to identify the strengths and weaknesses of innovation programs in developed and developing countries. We used a mixed-methods approach, quantitative as survey and qualitative as a multi-case study to examine innovation best practices in developed and developing countries. In addition, four case studies of innovation organisations based on the best practices and successful implementation in the developed and developing countries are selected for examination. The research findings provide guidance, suggestions, and recommendations for future implementation in developed and developing countries for practitioners such as policy makers, governments, funded organizations, and strategic institutions. In conclusion, innovation programs are vital tools for economic growth, knowledge, and technology transfer based on the several indicators such as creativity, entrepreneurship, role of government, role of university, strategic focus, new products, survival rate, job creation, start-up companies, and number of patents. The authors aim to conduct future research which will include a comparative study of innovation case studies between developed and developing countries for policy implications worldwide. The originality of this study makes a contribution to the current literature about the innovation best practice in developed and developing countries.

***Keywords*—**Economic development, entrepreneurship, developed countries, innovation program.

I. Introduction

THERE are many outcomes for the innovation programs (1) enhanced economic development through job creation, (2) the entrepreneurship climate, (3) the technology commercialization and transfer, (4) sustainability of graduated companies in the market with high rate of survival, (5) innovation helps the smart product and services, and (6) diversification of the economy from companies' outcomes such as innovation and technology.

Innovation is an important factor for economic diversification, and a success driver of economic growth. The main goal of innovation strategy is to create an innovation climate.

The objective of this paper is twofold: 1) to discuss and analyze the adaptation of the innovation program in the United States (US) and United Kingdom (UK) through an examination of four successful case studies, and 2) to identify the strengths, weaknesses of innovation programs.

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The remainder of the paper is as follows: Section II provides a thorough review of the literature. In Section III, the authors briefly discuss the research methodology used to facilitate the objectives. Section IV discusses the study's findings. Section V gives the conclusions.

The research questions as follows:

1) What are the ranking of innovation programs ?
2) What are the strengths and weakness of innovation programs?

II. Literature Review

The report of Global Innovation Index [16] provided an active tool for decision makers on innovation. This index included 141 countries with several pillars of innovation which monitored the impact of innovation policies. The Global Innovation Index consists of two groups: 1) Innovation input, sub-index included infrastructure, market sophistication, institutions, business sophistication, human capital and research, and 2) Innovation output, sub-index included creative outputs, knowledge and technology outputs.

The OECD report [23] discussed the importance of innovation at all stages of development, while innovation plays different roles adoption of foreign technology and social innovation can improve the effectiveness of business and services. Although, development of high-technology R&D-based innovation. Further, in European countries, innovation grows the knowledge economy. The European Commission [14] issued the annual report about innovation performance, in which the European Innovation Scoreboard (EIS) provided an assessment of innovation performance using 25 indicators as shown in Fig. 1. Innovation performance increased 2.5% within two years in the European Union. The report [14] indicated the innovation leaders; the countries based on Summary Innovation Index include Denmark, Finland, Germany, the Netherlands, and Sweden, see Fig. 2.

Many countries worldwide developed key indicators to measure the innovation key performance, including the United States, the United Kingdom, European countries, and Australia [20] see Table I. In this respect, Carayannis et al. [13] indicated that innovation is producing sustainability in the market through introducing new processes and products. The study also presented the impact of innovation on economic, political and socio-technical context that can be shaped in the businesses form as success or failure. In addition, from international perspectives, there are four impact points that shape the innovation, creativity, and competitiveness. First is the coordination of relationships for several parties such as governments, universities, small and medium enterprises (SMEs), enterprises and research laboratories. Second is the

networking of communication technology and information. Third, communication between managerial and organizational systems shall provide the commerce and production. And fourth, the rules, regulations and international agreements effect on innovation.

TABLE I
SUMMARY OF COUNTRIES' INNOVATION INDICATORS

Country	Innovation Indicators	Reference
USA	1) Total R&D personnel 2) Total R&D investment 3) Percentage of R&D funded by private industry 4) Percentage of R&D performed by the university sector 5) Spending on higher education 6) Strength of intellectual property protection 7) Openness to international competition 8) Nation's per capita GDP	[25]
Canada	1. Knowledge performance – Gross domestic expenditure on R&D as a percentage of GDP (GERD/GDP); business enterprise expenditure on R&D as a percentage of GDP (BERD/GDP); publication of scientific papers per 1 million population; triadic patent families; university-industry collaboration in R&D; and technology balance of payments 2. Skills Performance – Educational attainment in the labour force and adult participation in continuing education 3. Innovation Environment – Economy-wide regulatory environment; total corporate tax as a percentage of GDP; R&D tax treatment; Investment in venture capital; world competitiveness ranking; relocation of R&D facilities; and FDI confidence Index 4. Community-Based Innovation Broadband subscribers per 100 population	[12]
UK	1) World-class excellence 2) Financial sustainability 3) Responsiveness 4) Business investment and engagement Skills 5) Public engagement	[31]
Australia	1) Knowledge creation-the ability to generate new ideas and technologies; 2) Human resources-the capacity of the labour force to transform these ideas and technologies into tangible economic outcomes; 3) Finance-the pool of funds available to commercialise ideas and technologies; 4) Knowledge diffusion-the capacity of the economy to transfer new ideas and technologies to other firms; 5) Collaboration-the international linkages of Australia's innovation system; and 6) Market outcomes - economic return on the investment in innovation.	[8]
Europe	1) Non-technological innovation 2) Sector specific innovation 3) Differences between types of innovators and innovation modes.	[15]

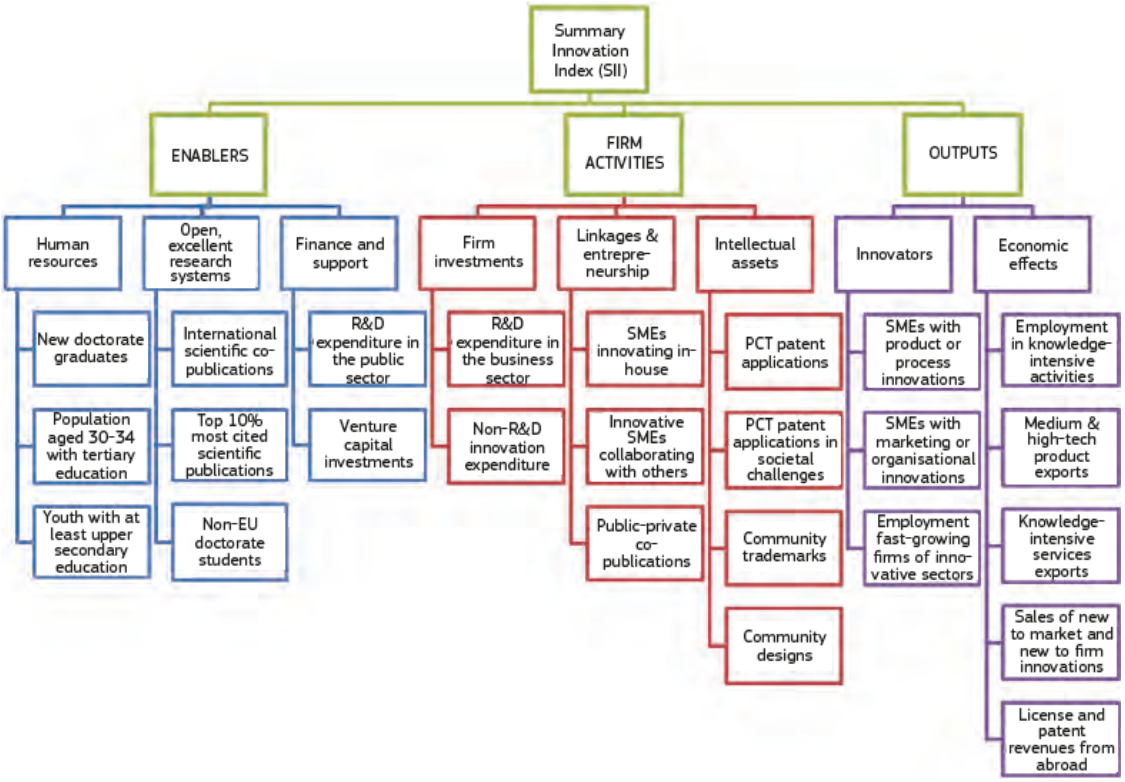


Fig. 1 European Innovation Scoreboard

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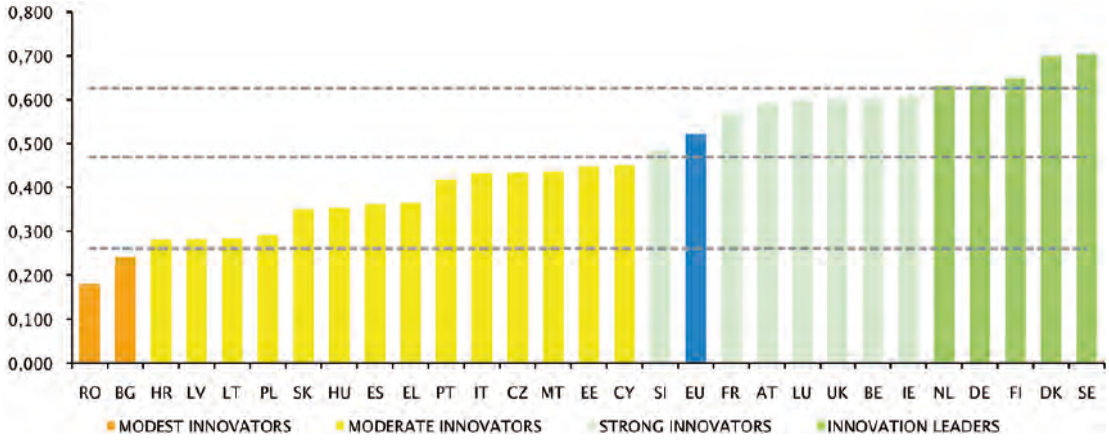


Fig. 2 Innovation Performance of European Countries

Cefis and Marsili [14] and Robertson et al. [26] demonstrate that innovation is important for both competitiveness and survival rate. Other studies [28], [27], [17] presented that the successful firms are based on the adaptation of changes to provide new products or services. Also, Romijn and Albaladejo [27] indicated the identification of new sectors for example, high technology. Moreover, Hadjimanolis and Dickson [18] and Blackburn et al. [10] demonstrated that innovation can create a new market to improve the innovation performance through survival of SMEs and growth. Furthermore, SMEs can be identified as the jobs creation which leads to economic growth [9], [1], [7]. In another study, Parker [24] indicated that SMEs can promote economic development.

Rosenbusch et al. [27] indicated that there are relationships between innovation and SMEs performance as well as positive relationships between innovation and growth. Innovation can provide knowledge networking, which leads to businesses growth [19].

There are several studies suggesting the positive impact of innovation programs. First, Al-Mubaraki and Busler [2] indicated that innovation programs are developed to accelerate the successful entrepreneurial companies through a set of services and business support resources. Second, another study by Al-Mubaraki and Busler [3] clearly demonstrated that the innovation programs provide support for innovation, entrepreneurship and technology commercialization (IET) towards 21st century growth. This is evident in the developed and developing countries including the GCC member states. Third, Al-Mubaraki et al. [6] presented that innovation is a long-term investment to establish self-sustaining technology to speed up the success of innovation outcomes and technology commercialization through development of R&D which fosters high-quality products. Fourth, the qualitative study used semi-structured interviews based in the UK [5]. This research suggested high ratings for indicators in all four categories of culture, policy, economy, industry, averaging 90%, 90%, 90%, and 100%, respectively. Fifth, Al-Mubaraki et al. [4] concluded their study by stating that innovation programs are vital tools for economic growth, knowledge, and technology transfer based on six indicators: 1) creativity, 2) entrepreneurship, 3) survival rate, 4) job creation, 5) start-up companies, and 6) number of patents.

III. Research Methodology

The research methodology that has been used in this research is a mixed-methods approach using quantitative (survey) and qualitative (multi-case study) data which was collected. Bryman and Bell [11] indicated the importance of the mixed methods approach. There are many studies in the literature discussing the importance of semi-structured interviews as an important tool for gathering qualitative data [29], [30], [22], [21].

Four interviews made up the main source of evidence used in the current study. The interviewees included the innovation program director as well as the president and vice president. Each interview was based on an in-depth discussion of the ten indicators. The knowledge of the authors led to the selection of the programs to interview, which were in the United States (two programs), and the United Kingdom (two programs), see Fig. 3.

There were convenient sample of 170 survey invitations emailed to innovation programs as members of the National Business Innovation Association (NBIA), United Kingdom Business Incubation (UKBI), and United Kingdom Science Park Association (UKSPA) via the Survey Monkey website. 76 were returned as undeliverable leaving a sample frame of 94 with a response rate (RR) of about 55%. The Statistical Package for the Social Sciences (SPSS) was used for statistical analysis and each question was used descriptive analysis, mean, standard deviation (SD) and coefficient of variation (CV).

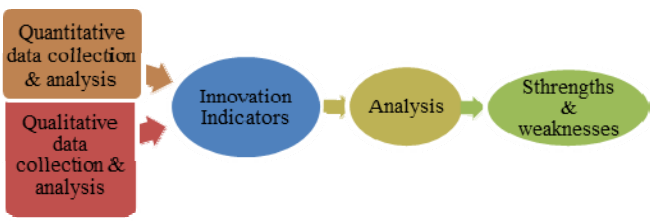


Fig. 3 Methodology Chart

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IV. Discussion

The international interview design is based on ten indicators. In addition, each indicator is measured by an independent variable [e.g., low (L), moderate (M), and high (H)] with a total of the average for each interview, measured on a scale of 100%, and the average for each indicator is measured on a scale of 10%. There are three groups of outcomes. For example, a total percentage of categories between 80% and 100% indicated a high outcome, while a total percentage of categories between 60% and 79% indicated a medium outcome, and a total percentage of categories less than 60% indicated low outcomes.

A. US Interview

Table II presents the total of 10 indicators; for example, the maximum percentage for Interview 1 (High Tech Rochester Inc.) and Interview 2 (Blue Valley Schools) indicated the high outcomes ratings of 94%, 85% respectively. Furthermore, the innovation indicators in the interview 1 demonstrated better than interview 2 with 9% difference.

TABLE II
Result of Total Indicators for US Interviews

Indicators	% 100	Interview 1 *High Tech Rochester Inc.* (US) Indicators* %	Interview 2 *Blue Valley Schools* (US) Indicators* %
1. Training program	10	10	10
2. Creativity	10	8	10
3. Entrepreneurship	10	10	10
4. Government role	10	8	8
5. Role of university	10	10	8
6. Strategic focus	10	10	10
7. Survival rate	10	10	8
8. Jobs creation	10	8	8
9. Start-up companies	10	10	8
10. Number of patents	10	10	8
Total	100	94	88

**Scale high (H) ranged 80%-100%, scale medium (M) ranged 79%-60%, scale low (L) ranged less than 60%*

The results of 2016 Global Innovation Index [16] indicated that the ranking of innovation leaders worldwide depend on the best performers and their income level. The USA has earned 4th position in the GII rank and ranks 3rd overall in the innovation input sub-Index, which includes five indicators: 1) institutions, 2) human capital and research, 3) infrastructure, 4) market sophistication, and 5) business sophistication. It also achieved 7th overall in the innovation output sub-index, which includes two indicators: 1) knowledge and technology; and 2) creativity. The USA ranks in the top 10 economies worldwide, see Table III.

B. UK Interview

Table IV presents the results of indicators for the UK Innovation Center. The maximum percentage for Interview 1 (University of Sussex) and Interview 2 (*University of Cambridge*) indicated that the high outcomes ratings of 82%, 90% respectively. Furthermore, the innovation indicators in the interview 2 demonstrated better than interview 1 with difference 8%.

TABLE III
Top 10 Global Innovation Indices

Country/ Economy	Score (0–100)	Rank	Income	Rank	Region	Rank
Switzerland	66.28	1	HI	1	EUR	1
Sweden	63.57	2	HI	2	EUR	2
UK	61.93	3	HI	3	EUR	3
USA	61.40	4	HI	4	NAC	1
Finland	59.90	5	HI	5	EUR	4
Singapore	59.16	6	HI	6	SEAO	1
Ireland	59.03	7	HI	7	EUR	5
Denmark	58.45	8	HI	8	EUR	6

TABLE IV
Result of Total Indicators for UK Interviews

Indicators	% 100	Interview 1 *University of Sussex (UK)* Indicators* %	Interview 2 *University of Cambridge (UK)* Indicators* %
1. Training program	10	8	8
2. Creativity	10	10	10
3. Entrepreneurship	10	10	10
4. Government role	10	8	8
5. Role of university	10	10	8
6. Strategic focus	10	10	8
7. Survival rate	10	10	10
8. Jobs creation	10	10	10
9. Start-up companies	10	8	10
10. Number of patents	10	8	8
Total	100	82 (H)	90 (H)

**Scale high (H) ranged 80%-100%, scale medium (M) ranged 79%-60%, scale low (L) ranged less than 60%*

The current literature as well as the European Commission [17] indicated that the United Kingdom is a strong innovator where the improvement has been risen in the period 2008-2015. The innovation performance in 2015 was increased more than 15%, which is above the average. The performance of UK is better than the EU. The average for most dimensions and indicators demonstrated modest growth, although two indicators have improved: 1) innovative SMEs collaborating with others (11%), and 2) sales of new product innovations (7.5%), see Fig. 4.

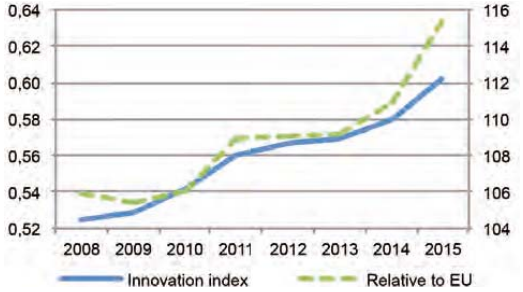


Fig. 4 Innovation Performance of United Kingdom

C. Survey Analysis

The survey sample was 94 with RR of about 55%. SPSS

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was used for statistical descriptive analysis as shown in Table V.

TABLE V
SURVEY RESULTS

No.	Question	Answer option	Response percent
1	The rate of patents	High rate	18.6%
		Medium rate	37.2%
		Low rate	44.2%
2	The rate of Licensed intellectual property	High rate	17.6%
		Medium rate	35.3%
		Low rate	47.1%
3	The innovation Added Creativity	Strongly Disagree	1.2%
		Strongly agree	54.7%
		Agree	43.0%
		Disagree	1.2%
4	The innovation help the Sustainability growth	Strongly Disagree	0.0%
		Strongly agree	51.7%
		Agree	48.3%
		Disagree	0.0%
5	The innovation create the Entrepreneurial climate	Strongly Disagree	1.1%
		Strongly agree	65.2%
		Agree	32.6%
		Disagree	1.1%
6	The innovation lead to the New product	Strongly Disagree	1.2%
		Strongly agree	45.9%
		Agree	47.1%
		Disagree	5.9%
7	The innovation lead to the New services	Strongly Disagree	1.2%
		Strongly agree	42.9%
		Agree	51.2%
		Disagree	4.8%

Table VI presents the highest results in the innovation programs with more than half (50%) indicating strongly agree, such as that innovation program can add creativity (54.7%), help the sustainability growth (51.7%) and create the entrepreneurial climate (65.2%). In addition, we found the percentage of innovation programs that led to new products (47.1%) and new services (51.2%), which indicated the highest response. However, less than half (40%) indicated low rate of patents (44.2%) and licensed intellectual property (47.1%).

TABLE VI
HIGHEST PERCENTAGES

No.	Question	Answer option	Response percent
1	The rate of patents	Low rate	44.2%
2	The rate of Licensed intellectual property	Low rate	47.1%
3	The innovation Added Creativity	Strongly agree	54.7%
4	The innovation help the Sustainability growth	Strongly agree	51.7%
5	The innovation create the Entrepreneurial climate	Strongly agree	65.2%
6	The innovation lead to the New product	Agree	47.1%
7	The innovation lead to the New services	Agree	51.2%

The authors used more statistical analysis where they have found mean of response count 6, coefficient of variation 31, and the standard deviation 182. This result presented that mean magnitude is greater than standard deviation and this lead that data are more spread out.

IV. FINDINGS

Table VII presents the interview ranking of four selected innovation centers (High Tech Rochester Inc.) from the US, which presents the highest outcomes scale, ranking number 1 based on the percentage, with the average of indicators at 94%. However, the other three case studies; 1) University of Cambridge (90%), 2) Blue Valley Schools (88%), and 3) University of Sussex (82%) indicate an average of high percentage. These results lead to the successful adaptation of innovation programs.

TABLE VII
RANKING OF INTERVIEWS

Ranking	1	2	3	4
Interviews	High Tech Rochester Inc. (US)	University of Cambridge (UK)	Blue Valley Schools (US)	University of Sussex (UK)
Total Indicators %	94	90	88	82
Scale *	H	H	H	H

*Scale high (H) ranged 80%-100%, scale medium (M) ranged 79%-60%, scale low (L) ranged less than 60%

Strengths and weaknesses

From the analysis of survey and the four case studies, the results indicated that innovation programs could be effective tools for economic development, technology transfer and new technology.

The strengths can be concluded due to several points. First, the high outcomes of innovation programs led to high creativity and the creation of the entrepreneurial climate which can positively contribute to the smart growth. Second, the outcomes of innovation programs could be identified as new products and new services which allow companies to reduce operational costs to access markets and can strengthen the economic growth.

The weaknesses can also be identified from the analysis of survey and case studies. First, low training courses in the innovation programs could lead to low outcomes. Second, low rate of patents and licensed intellectual property can contribute negatively to economic development and productivity improvements.

V. CONCLUSION

Innovation Programs have become an important topic worldwide and have contributed positively to economic growth. This paper is based on a mixed-method approach using both qualitative and quantitative methods, would provide a deeper insight and understanding into the phenomenon under investigation. Interviews will be conducted with four innovation directors in the United States (two programs) and the United Kingdom (two programs). Each interview divided into 10 key performance indicators to be measured. The selection of programs was made from

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successful innovation centers worldwide. In addition, the descriptive analysis of survey result with convenient sample of 94 innovation programs worldwide selected with a response rate of about 55%. It leads to the adaptation of innovation programs worldwide. The analysis of each case study and survey reflects the strengths and weaknesses. Furthermore, the study indicated two strengths: 1) the positive contribution of innovation programs outcomes which led to high creativity, creation of the entrepreneurial climate and smart growth, and 2) the innovation programs outcomes could be presented new products, new services, and economic growth.

The two weaknesses of innovation programs can be summarized as: 1) the low outcomes of innovation programs depend on the low training, and 2) low rate of patents and licensed intellectual property can contribute negatively on the economic development.

In conclusion, the successful adaptation of the innovation program leads to high outcomes to reach a higher stage of economic development and high value-added for innovated products and services. This evidence comes from worldwide applications including the US and the UK.

ACKNOWLEDGMENT

The project team would like to express their genuine appreciation to the Kuwait Foundation for Advancement of Sciences (KFAS-2012-1103-01) for the financial support provided for the project. Special acknowledgment and appreciation are due to Prof. Rashed Al-Ajmei, Dean of the College of Business Administration, Kuwait University, and Chairman of the Center of Excellence in Management for his valuable advice and the support required for the project. The team also provides deep thanks to the National Business Incubation Association (NBIA) for providing successful international case studies to be interviewed.

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