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The Impacts of some Types of Government Expenditure on National Innovation Output

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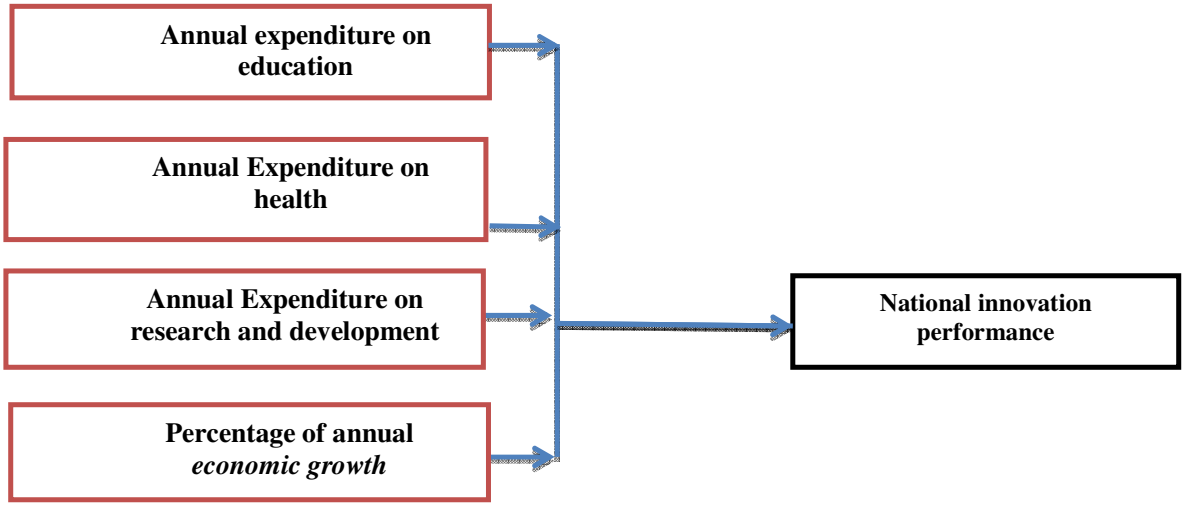
Abstract
Innovation is one of the key elements for national economic growth, creation of new jobs and prosperity. Activating national innovation process and maintain a sustainable national economic growth, needs inputs improvement of input to achieve those objectives. The required inputs are government expenditures on health, education, and research & development that might have a considerable impact on national innovation output at country level. This paper examines the relationship between the previously mentioned government expenditures and the country national innovation output .The main results of the statistical tests and analysis suggest that there is a statistically significant impact of government expenditures on national innovation output .This result highlights the necessity for paying extra attention, specially by developing countries governments to the fields of national health, education and R&D to facilitate the improvement of the country national innovation output .
Keywords: Government health Expenditure, Government education Expenditure, Government R&D Expenditure, National Innovation, and economic growth.

1-Introduction:
Innovation is one of the main distinctive characteristics of the current era. It is an essential factor for survival and prosperity of business organizations and societies .It has become one of the most important components of the company's competitive advantage and effective element for sales expansion. Innovation is an efficient mean for maintaining a continuous economic growth and creating new jobs nationally. Therefore it might be true to say that business organizations have to look at the outcomes of innovation process as a base for creating competitive advantages and survival. This might indicate the necessity for paying extra attention to innovation process improvement by societies, governments and business organizations. This task requires assigning extra resources to innovation programs at organization and country levels. Innovation of new products, services, processes and methods has contributed significantly to the world annual economic growth which account for a high percentage of that growth. For instance the total cellphone business value for 2013 was about $276.39 billion, which account for about 0.36% of the world total GDP in 2013 with an annual growth of 18%. This might clearly indicate the importance of innovation for the whole world economy.(Faunce, and Nguyen, (*2010*))
This study aims to developing an overview of innovation importance at country level to be a base for how to direct the national efforts and providing the required resources for undertaking successful national innovation program .

2-The Model of the study:
Figure (1) illustrates the model of this study.

The Model of the study Figure (1)



3-The variables of the study:

Depending on the study model, the study variables are:

a- The dependent variable (y) is the country's innovation score value for 2010. ("The Global Innovation Index (2014))

b-The independent variables are:

- The % of the GDP annual growth of the country for 2010 (X1) (Roughead et al, (2007))
- The government annual expenditure on education as a % of GDP for 2010 (X_2)
- The government annual expenditure on health as a % of GDP for 2010 (X_3)
- The government annual expenditure on R & D as a % of GDP for (X_4)

The total number of observations is 62 (n= 62). This is due to the availability of the above adopted indicators which were fully available only for 62 countries out of 203 countries according to the world bank database) (http://www.merriam-webster.com)

4-The question of the study:

This study attempts to find out a feasible answer to the following question:

"Is there any statistically significant impacts of the following indicators on the national innovation achievements." (Innovation annual score value) .

- Annual governmental expenditure on education.
- Annual governmental Expenditure on health.
- Annual governmental Expenditure on research and development.
- Percentage of annual growth.

5-Hypothesis of the Study:

The main hypotheses of this study are the following:

- -There is a statistically insignificant impact of the country GDP annual growth on country innovation score.
- -There is a statistically insignificant impact of country expenditure on education on the country innovation score.
- -There is a statistically insignificant impact of country expenditure on health on the country innovation score.
- -There is statistically insignificant impact of country expenditure on R & D on the country innovation score.
- -There is no multiple statistical impact of all independent variables on the country Innovation score.

6- The objectives of the study:

This study is an academic effort attempted to specify the nature of the statistical impacts and relationships between national innovation index with each of the following indicators:

- Annual governmental expenditure on education as a % of GDP
- Annual governmental expenditure on health as a % of GDP
- Annual governmental expenditure on R & D as a % of GDP
- Annual percentage of national economic growth

7-Methodology:

To develop the theoretical framework for this study, a literature review was carried out concerning the innovation and all related concepts. Based on this step, the model of the study was developed and its main variables were specified.

The empirical side of the study includes carrying out a statistical analysis to identify the impacts, if any, of the independent variables on the dependent variable. Multiple and simple correlation coefficients, were calculated and the related regression model was formulated. All were at statistically significant level.

a- Data Collection:

The World Bank database was used as a valid source for the data that is suitable to conduct the necessary statistical analysis. A country annual innovation score value publishes by the Global innovation index for 2010 was considered as the dependent variable of the study. Other indicators for 2010 were used as measures of the independent variables according to their availability in the database.

b-*The Sample of the Study:*

The sample of this study covers all those countries for which the required indicators and data were available in the World Bank database for 2010. According to the World Bank Statistics, there are only 62 countries for which the required indicators for 2010 were available.

c-Data *Analysis:* to specify the impacts of the independent variables on the dependent variable, the regression model was developed ,and the relationships between variables were identified. The results were carefully discussed, the related inferences were developed and the general conclusion was formulated. Relying upon the discussion of the statistical testing results, the related conclusion and inferences the main recommendations of the study were formed.

8-Innovation Definition:

The available literature implies more than 40 definitions for innovation. The researcher focus on the most commonly used definitions which are the following:

- Innovation is the process of translating an idea or invention into a good or service that creates value or for which customers will pay. (http://www.merriam-webster.com)
- Innovation is prodution or adoption, assimilation and exploitation of value added novelty in economic and social spheres; renewal and enlargement of product, service and market; development of new methods of production; and establishment of new Management system .(Edison & Torkar, (2013))
- Innovation is a new idea, device or process(http://www.merriam-webster.com)
- Innovation can be viewed as the application of better solutions that meet new requirement, inertial needs, or existing market needs (Frankelius, (2009))

Rely upon the available definitions the researcher has extracted the following innovation definition:

- Innovation is any creation of new product, service, process, method, system or procedures that generate an economic return or facilitate human life.

9-Innovation Management:

The objective to activating, accelerating and expanding innovation, definitely, needs the efforts and commitments of those who have diversified skills and expertise to handle the required tasks, through the execution of the planning, organizing and directing managerial functions to make the general performance and activities fruitful. This sort of efforts and activities refer to as innovation management (Trott, (2005))

The necessary question that needs to be asked here is; what is innovation management?

The pioneer of innovation Management was the Austrian economist Joseph Schumpeter (working during the 1930s) who identified innovation as a significant factor in economic growth (Trott, (2005)).The following are some of the most broadly used innovation management definitions:

- Innovation Management is the management of innovation processes. It refers both to product and organizational innovation .(Tidd and Bessant, (2009))

- Innovation Management includes a set of tools that allow managers and engineers to cooperate with a common understanding of the process and goals. Innovation Management allows the organization to respond to external or internal opportunities, and use its creativity to introduce new ideas, processes or products .(Frankelius, (2009))
- Innovation Management brings together collaboration and social software, with a clear focus on generating results and developing a culture of knowledge sharing and innovation (Hype Innovation management). (Wong, (2012))
- Innovation Management helps an organization hold any opportunity and use it to create and introduce new ideas, processes, or products industriously. (Heyne, et al, (2010))
- Innovation Management allows the organization to respond to external or internal opportunities, and use its creativity to introduce new ides process or product. (Von Hippel, (1988))

10-Types of Innovations:

Innovation literature exhibits a broad diversity of innovation classification. This classification can be summarized as follows:

- *Evolutionary Innovations:* continuous or dynamic evolutionary innovations that are brought about by many incremental advances in technology or process.
- *Revolutionary Innovations*: also called discontinuous innovations, which are often disruptive and new.(Godin, (2008))

The above two types of Innovations were suggested by the business dictionary. Other type of Innovation classification is the following. (ttp://www.inovation-creativity.com)

- *Incremental Innovations:* it seeks to improve the systems that exist, making them better, faster cheaper.
- *Process Innovation:* it means the implementation of a new or significantly improved production of delivery method.
- *Red Ocean Innovation:* it refers to the known market space, i.e. all the industries in existence today.
- *Service Innovation:* it can be define as a new or considerably change service concept, client interaction channel, service delivery system or technological concept that individually, but most likely in combination, leads to one or more (re) new (ed) service/ function that are new to the firm.
- *Business Mode Innovation:* it refers to the creation, or reinnovation, of a business itself.
- *Sustainable Innovation:* Eco Innovation is a term use to describe products and processes that contribute to sustainable development.
- *Frugal Innovation:* it is about doing more with less. Entrepreneurs and innovators in emerging markets have to devise two cost strategies to either tap or circumvent institutional complexities and resource limitations to innovate;
- Develop and deliver products and services to low income users with little purchasing power.
- *Blue Oceans Innovation:* represents the unknown market space, i.e. all the industries not in existence today. Blue Oceans are defined by untapped market space, demand creation, and the opportunity for highly profitable growth.
- *Radical Innovations:* provide something new to the world that we live in by uprooting industry conventions and by significantly changing customer expectations a positive way.
- *Open Source Innovation/ Crowdsourcing:* in production and development open source is a philosophy or pragmatic.
- Methodology that promotes free redistribution and access to an end product's design and implementation details.
- *Experience Innovation:* companies that try to create holistic experiences by emotionally engaging their consumers.
- *Impossible Innovation*
- *Disruptive Innovation:* a disruptive innovation is an innovation that helps create a new market and value network, and eventually goes on to disrupt an existing market and value network displacing an earlier technology.
- *User Led Innovations:* the user is king. It's a phrase that is repeated over and over again as a mantra: Companies must become user-centric.
- *Supply Chain Innovations:* it is about applying best practices and technological innovations to your own supply chain in order to reduce such cycle and wait times and other waste in your in-hours process. This classification might include all kinds of innovation that implied by the related literature.

11-Innovation Measurements:

To be able to manage innovation at any level it would be necessary to know how to measure it and assess it various process, aspects and outcomes. (Davilla, et al (2006)

The Innovation literature suggests that there are two different levels of innovation measurement: the organizational level and the political level. (Clark, (1980)

a-Organizational Level Measure: the measure of innovation at the organizational level relates to individuals, team-level assessments, and private companies from the smallest to the largest. This measure can be conducted by surveys, workshops, consultants, or internal benchmarking. Today, there is no general method that is commonly used to measure organizational Innovation. Corporate measurements are generally based on the balanced scorecards which cover several aspects of innovation such as, business measures related to finance, innovation process efficiency, employees' contribution and motivation, as well as benefits for customers. Measured values are widely varied between businesses, covering new product revenue, spending on R & D, time to market, understanding & satisfaction of customer and employees, number of patents, additional sales resulting from past innovation. (http://www.inovation-creativity.com)

B-Political Leve Measure: the political level, measures of innovation is focused on a country or region competitive advantage through innovation. In this context, organizational capabilities can be assessed through various evaluation frameworks, such as those of the European Foundation of Quality Management. These are:

- The Oslo Manual complementary to the Frascati Manual from 1963.
- The new Oslo Manual from 2005 takes a wider perspective to innovation, and includes marketing and organizational innovation. These standards are used in the European Community innovation surveys.
- Other ways of measuring innovation have traditionally been expenditure, for example, investment in R & D (Research and Development) as percentage of GNP.(OECD (1995))

12-Rate of Innovation:

There are several existing indexes that have been using to measure innovation including industrial Innovation (2011) .These are as follows:

- The innovation index, developed by the Indiana Business Research Center, to measure innovation capacity at the country or regional level in the United States.
- The state Technology and Science Index developed by the Milken institute which is a U.S. wide benchmark to the science and technology capabilities that furnish high paying jobs based around key components.
- The Oslo Manual is focused on North America, Europe, and other rich economies.
- The Bogota Manual is focused on Latin America and the Caribbean countries.
- The creative class developed by Richard Florida.
- The Innovation Capacity Index (ICI).
- The global Innovation index is a global index measuring the level of Innovation of a country, produced jointly by "The Boston Consulting Group (BCG)", the National Association of Manufactures (NAM), and the Manufacturing Institute (MI), the NAM's nonpartisan research affiliate. NAM describes this index as the "largest and most comprehensive global index of its kind".

The global Innovation index looks at both business outcomes of innovation and government's ability to encourage and support innovation through public policy. It based on a study comprised a survey of more than 1000 senior executives from NAM member companies across all industries; in-depth interviews with 30 of the executives; and a comparison of the "Innovation Friendliness" of 110 countries and all 50 U.S.

13-Discussion:

The results of the statistical analysis suggest that there is a very strong significant multiple correlation between the country innovation score value and the indicators of the country annual GDP growth, annual expenditure on education, annual expenditure on health and annual expenditure on research and development. The multiple correlation coefficient was 0.815 at 0.01 level of significant (r= 0.825 and the value of R^2 is 0.662).

The correlation coefficient values between the independent variables them self were very low and insignificant, which means there is no multicollinearity between the independent variables.

This clearly indicates that the 4 indicators (independent variables) have a collective positive impact on the country annual score of innovation. The strongest simple correlation is between the annual expenditure on R & D and innovation score where, the correlation coefficient is 0.788 at 0.01 level of significant. This result clearly indicates that the annual expenditure on R & D has a positive impact on national innovation score. Other results were as follow:

- The correlation coefficient between annual expenditure on health and the national innovation score is 0.439 at 0.01 level of significant.
- The correlation coefficient between annual expenditure on education and the national innovation score is 0.343 at 0.01 level of significant.
- The correlation coefficient between annual GDP growth and the national innovation score is 0.273 at 0.05 significant levels.

The above results suggest that the entire null hypotheses must be rejected and the alternative hypotheses should be accepted. These results are portrayed by tables (1, 2, 3, 4, and 5).
The regression analysis has produced the following regression model:
$Y = 29.219 - 0.425X_1 + 0.748X_2 + 0.382X_3 + 7.184X_4$

This model could be used as a base to develop a strategy of national innovation improvement for uplifting the country national innovation score value and all related outcome.

Table (1) Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Y	62	23.04	61,36	42.8.39	10.8648
X1	62	0.00	15.20	4.1661	2.9438
X2	62	2.00	8.40	5.0645	1.2591
X3	62	3.40	19.50	8.0742	2.56035
X4	62	0.05	3.93	1.1802	1.0629
Valid N(list wise)	62	-----	------	------	------

Table (2) Correlations

		Y	X1	X2	X3	X4
Y	Person correlation	1	-0.273-	0.374	0.497	0.791
	Sig.(2-Tails)		0.032	0.003	0.000	0.000
	N	62	62	62	62	62
X1	Person correlation	-0.273-	1	-0.183-	-0.415-	-0.148-
	Sig.(2-Tails)	0.032		0.154	0.001	0.251
	N	62	62	62	62	62
X2	Person correlation	0.374	-0.183-	-0.415	-0.148-	0.331
	Sig.(2-Tails)	0.003	0.154	1	0.003	0.008
	N	62	62	62	62	62
X3	Person correlation	0.497	-0.415-	0.368	1	0.466
	Sig.(2-Tails)	0.000	0.001	0.003		0.000
	N	62	62	62	62	62
X4	Person correlation	0.791	-0.148-	0.331	0.466	1
	Sig.(2-Tails)					
	N	62	62	62	62	62

Table (3) Coefficients

Model	Unstandardized Coefficient		Standardized Coefficient	t	Significant
	B	Std. Error	Beta		
1 (constant)	29.219	4.684		6.239	0.000
X1	-0.425-	0.312	-0.115-	-1.361-	0.179
X2	0.748	0.727	0.087	1.029	0.308
X3	0.382	0.411	0.090	0.931	0.356
X4	7.184	0.906	0.703	7.932	0.000

Table (4) Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of The Estimate
1	0.815	0.664	0.641	6.5121

Predictors: (constants). X4 X1, X2, X3

-7-

Table (5) ANOVA

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	478.541	4	1195.885	28.200	0.000
	Residual	2417.234	57	42.408	--------	--------
	Total	7200.775	61	---------	--------	--------

14- Main Inferences and Conclusion:

Relying upon the above discussion the following inferences can be drowning:

- There is a multiple significant impact of all the four independent variables collectively on the dependent variable.
- There is a significant impact of the annual expenditure on R & D on national Innovation score value.
- There is a significant impact of annual expenditure on healthcare on national Innovation score value.
- There is a weak correlation, but significant, between annual education expenditure on education and national Innovation score value.
- There is a very weak correlation between annual GDP growths on national Innovation score value

15-Recommendations:

Base on the above mentioned inferences and conclusions the following recommendations can be suggested:

- To improve the national innovation performance, governments need to pay extra attention to national expenditure on health service.
- Extra resources need to be allocated to the national education services to ensure sustainable improvement of innovation score and output.
- Governments should devote extra resources to research and development in order to ensure the intended improvement in the national innovation score value.
- Universities need to expand their contribution to national innovation activities.
- Innovation centers should be initiated in each individual university at the national level to activate innovation process.
- Companies must contribute more significantly to national innovation efforts by assigning extra financial aid to research centers and universities.

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