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Innovation as imperative for increasing productivity and economic growth: The case of the selected EU member countries and non-EU member countries

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Abstract. *In the changeable environment of increasingly powerful and multiplex competition, it becomes one of the key preconditions for an appropriate reaction to worldwide challenges. The productivity and economic growth have to be recognized as a multi-dimensional mechanism containing various interlinked components accomplished through investments in innovation. The purpose of this paper is to explore the link between the components of innovation, productivity and economic growth in selected EU- member countries and non-EU member countries. The research results have shown that the productivity and economic growth in selected countries are significantly linked with their innovation rank. The innovation capability indicators measured by the innovation indices can be beneficial in comparative analysis between countries, and provide valuable information for countries to identify their own strengths and weaknesses, compare themselves with similar countries, and create consensus about fields of future actions.*

Keywords: innovation, productivity, economic growth, EU-member countries, non-EU member countries.

JEL Classification: C8, E0, O10, O57.

1. Introduction

The economic background and conditions that bring innovation to the leading edge are relevant in the survey of the innovation accomplishment of countries. To classify the priorities and to determine appropriate innovation policies, it is very important to mention the impact of the government institutions, academics and individual entrepreneurs in the innovation accomplishment. In the past decade, different paths to economic growth with different scale of success have been detected worldwide. Nonetheless, all countries faced the identical problems: poverty and inequality in the world economy.

Economic theory has long ago identified productivity as the crucial determinant of economic growth. Different economic surveys have accentuated the relevance of innovation in increasing productivity and economic growth. The innovation capability indicator measured by the innovation indices can be precious in comparative analysis between countries, and they assure relevant information for economists, government, academic institutions, stakeholders, etc. This paper explores the primary characteristics that, while not promising, are increasing and differentiate the innovation accomplishment in selected EU member countries and non-EU member countries, also containing their effects on aggregated innovation indicators. Accordingly, an investigation was performed of the constitutional elements of innovation indices influencing productivity and economic growth in selected countries. The idea for this research aftermath from recognizing the tenacity of indicators that variously affected innovation in the EU member and non-EU member countries, a theme that had not received adequate consideration in past decade by economists and government, but still persists to restraints productivity, economic growth and innovation. So, a comparative analysis of innovation, productivity and economic growth in selected countries was performed, identifying and highlighting the relevant differences in connection to different countries, and concentrating basically on components of innovation indicators.

The paper indicates that the innovation accomplishment in selected countries is significantly linked with their innovation rank. The similar indices answerable for feeble productivity and economic growth are connected with feeble innovation capability indices. This scheme, in comparison with the EU-member countries average indicators, shows differences in each innovation component. The conducted exploration deliberates that the application of suitable economic instruments could mitigate the problems that remain in non-EU member countries.

2. Theoretical overview of the literature: Innovation as crucial component for increasing productivity and economic growth

Innovation was identified as a significant by many famous economists. Adam Smith (1776) indicated that new team of professionals could increase productivity by usage of adequate knowledge. Friedrich List (1841) anticipated adequate institutions and infrastructure that could assure economic growth and development by creating and allocating knowledge. Joseph Schumpeter (1934) identified innovation as a tremendous force of the economic performance.

At the leading edge of examination in modern growth economics are the forthcoming and basic elements of technological development, that along with human capital development, is seen as the fundamental driver of the system and a basic cause of increasing standards of living. The most relevant instruments involve the formation of new high-tech knowledge in Reasearch & Development sections of enterprises (Romer, 1986) and the creation of human capital in learning activities (Lucas, 1988). The above-mentioned instruments rapidly got approved as the basic drivers of economic growth. Numerous authors (Cassiolato and Lastres, 2008; Rosenberg, 2004; Castellacci et al., 2005; Fagerberg and Saprasert, 2011) showed that innovation represents the engine of the economic growth, and a crucial component of the development accomplishments. According to Grossman and Helpman (1991) innovation plays a crucial role in accelerating economic growth. They analyzed innovation and economic growth in the global economy, and investigated the elements that affect long term economic growth. In the last few years, many economists highlight the role of innovation in stimulating socioeconomic renewal of developing economies. Innovation is fostering economic growth and competitiveness, and the governments are investing in innovation with an extensive set of future aims (Bozeman and Sarewitz, 2011; Mazzucato and Semieniuk, 2017).

The most powerful worldwide institutions (INSEAD, WIPO) publish numerous indicators that are beneficial for examining the influence of innovation in increasing productivity and economic growth. The global innovation index (GII) compiles the innovation components of a national economy. Innovation is valuable because it drives to the creation of new products, new technologies, and it increases economic growth. Gross Domestic Product measures economic growth and it rejects variables such as social cohesion or the natural environment. Still, labour productivity growth is the commonly used aggregate indicator of the economic effects of innovation performances. The most popular indicator of productivity, could be determined as value added per unit of labour. Productivity growth is the essential to achieving higher standards of living because it allows employees to produce more for the identical amount of work.

3. Data and research methodology

According to Romer (1986) who designated research technology that is depressed and comparable of individual scale,

$k_i = G(I_i, k_i)$

where: I_i represents the quantity of abstain consumption in research by enterprise i, and k_i represents the enterprise's actual quantity of knowledge. The production function of the consumption good comparative to enterprise i is equal to:

$Y_i = F(k_i, K, x_i)$

where: K is the aggregated ‘quantity of knowledge’ in the specific national economy and x_i represents the element of entire inputs distinctive from knowledge.

The production function represents homogeneous function of degree one in k_i and x_i and homogeneous function of a higher greater than one in variables k_i and K. Romer believes that determinants different than knowledge are in constant supply, that indicates that knowledge represents the specific capital good applied in the production of the goods for

consumptions. Spillovers derived from private R&D performances enhance the public quantity of knowledge. The positive externality is defined as answerable for income growth per capita. Lucas's approach of the process by measures where human capital is created is the by following variables:

$$\dot{h} = \upsilon h(1-u)$$

where υ represents a positive constant variable. The more human capital community as a comprehensive has accumulated, every individual representative will be productive. This can be presented in the ensuing macroeconomic production function:

$$Y = AK^{\beta}(uhN)^{1-\beta} h*^{\chi}$$

where the labour input represents the number of employees (*N)*, (*u)* represents the fraction of time spent working, (*h*) represents the labour input in efficiency entities, and *h** represents the externality. The most popular and suitable new growth model was the *AK linear model* admitted to which:

$$Y = C^{\alpha} H^{\beta} = A*K$$

where *K* is the variable of aggregate capital that contains a physical capital (*C)* and human capital (*H)*, and *A* represents constant productivity variable.

When looking at the augmentation of innovative performances to productivity increasement, the prevailing starting remark is to adjoin an indicator of the knowledge or intangible capital developed by innovative action to the production function:

$$Q = AC^{\alpha} L^{\beta} K^{\lambda}$$

where *K* represents type of intermediary for the knowledge stock of the specific entity. *K is* a number of visible features of the entity's innovative capability: its technological knowledge obtained by Research & Development, its capacity to transform research results in useful innovative products or processes. K can be established on innovative success or innovation capability. Traditionally, *K* has been evaluated as a stock of past Research & Development spending but as other types of data have become available, other variables involving innovation indicators have been used.

The Global Innovation Index (GII) is composed by aggregating appropriate scores. The scores linked to innovation represent greatly individual scores. The GII is foundated on two primary sub-indicators that include: the Innovation Input Sub-Index and the Innovation Output Sub-Index. Other input indicators involve elements of the national economies that implement innovative performances:

- Institutions.
- Human capital and research.
- Infrastructure.
- Market sophistication and
- Business sophistication.

The output indicators incorporate real proofs of innovation outputs that include:

- Knowledge and technology outputs and
- Creative outputs.

Examination of the relevance of the previous-mentioned innovation indicators, and especially the linkage between issues captured by the seven indices, should surpass the purview of this paper. Briefly, global innovation consequences are clearly deliberated, farther regulating their capability for comprehensive policy plan of actions. The calculation of the index starts at the sub-pillar level, with each sub-pillar allocated a score of mostly the simple average of its indicators, with a few cases where explicit weights are given to specific indicators. A simple average is then taken to calculate the innovation pillars, followed by a simple average of the pillars to calculate the two sub-indices. Then the Global Innovation Index is calculated as the simple average of the Innovation Input and Output sub-indices.

4. Findings from Innovation Indices: A comparative analysis between selected EU member countries and non-EU member countries

Table 1 presents the innovation accomplishment rankings in selected EU-member and non-EU member countries according to the global innovation index. The survey was performed in the following countries: Albania, Bosnia and Herzegovina, Macedonia, Montenegro, Serbia, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia and Slovakia in the 2018.

Table 1. *Innovation accomplishment rankings according to the Global Innovation Index in selected non-EU member and EU member countries in 2018.*

	GII	INS	HCR	INF	MSO	BSO	KTO	COU
Non-EU member countries								
Albania	83	55	95	62	38	98	110	86
Bosnia and Herzegovina	77	72	37	99	85	63	74	94
Macedonia	84	49	76	83	69	99	67	107
Montenegro	52	46	55	57	87	58	96	32
Serbia	55	50	58	48	101	70	50	64
EU member countries								
Croatia	41	44	48	34	66	45	46	43
Czech Republic	27	27	35	31	48	25	17	25
Estonia	24	22	36	21	35	30	29	5
Hungary	33	40	38	49	86	32	16	44
Latvia	34	31	53	45	24	36	51	23
Lithuania	40	38	46	32	50	35	58	33
Poland	39	36	44	41	57	41	44	42
Romania	49	48	65	38	83	55	42	61
Slovenia	30	19	28	35	78	29	34	16
Slovakia	36	35	59	36	52	37	31	41

Note: INS- Institutions, HCR-Human capital and research, INF-Infrastructure, MSO- Market sophistication, BSO-Business sophistication, KTO- Knowledge and technology outputs, COU-Creative outputs.
Source: The Global Innovation Index Report 2018, INSEAD - WIPO (World Intellectual Property Organization).

Table 2 presents the indicators ranks according to innovation, economic growth and labour productivity in selected non-EU and EU member countries in 2018. Estonia has achieved the highest rank, according to innovation, infrastructure and creative outputs, compared to the other observed countries. Czech Republic has demonstrated the highest rank according to business sophistication and GDP PPP per capita.

Table 2. *Indicators ranks according to innovation, economic growth and labour productivity variables in selected non-EU and EU member countries in 2018.*

	GII	INS	HCR	INF	MSO	BSO	KTO	COU	GDP PPP pc	LP
Non-EU member countries										
Albania	14	14	15	13	3	14	15	13	14	15
B&H	13	15	4	15	12	12	13	14	13	13
Macedonia	15	12	14	14	9	15	12	15	15	14
Montenegro	11	10	10	12	14	11	14	5	11	12
Serbia	12	13	11	10	15	13	9	12	12	11
EU member countries										
Croatia	9	9	8	4	8	9	8	9	10	8
Czech Republic	2	3	2	2	4	1	2	4	1	3
Estonia	1	2	3	1	2	3	3	1	5	6
Hungary	4	8	5	11	13	4	1	10	7	7
Latvia	5	4	9	9	1	6	10	3	8	9
Lithuania	8	7	7	3	5	5	11	6	4	5
Poland	7	6	6	8	7	8	7	8	6	4
Romania	10	11	13	7	11	10	6	11	9	10
Slovenia	3	1	1	5	10	2	5	2	2	2
Slovakia	6	5	12	6	6	7	4	7	3	1

Source: Author's own calculation.

Slovakia and Slovenia had achieved the leading positions in productivity in comparison to other observed countries. Estonia and Czech Republic have accomplished the high position in innovation and assured a remarkable spotline, in comparison with the other EU member countries and non-EU member countries. Macedonia and Albania are the lowest ranked countries by Global Innovation Index GDP PPP per capita and Labour Productivity.

The link between various innovation, productivity and economic growth components are conferred in Table 3. Spearman's correlation coefficients have determined a linkage between important variables, specifically among different components of the Global Innovation Index – GII (Institutions – INS, Human capital and research – HCR, Infrastructure – INF, Market sophistication – MSO, Business sophistication – BSO, Knowledge and technology outputs – KTO, Creative outputs – COU), GDP PPP per capita (GDP PPP pc), and Labour productivity (LP). The data were gathered from primary and secondary sources. The research was implemented using the SPSS 24 statistical software package.

Table 3. *Link between various innovation, productivity and economic growth components*

	GII	INS	HCR	INF	MSO	BSO	KTO	COU	GDP PPP pc	LP
GII	1.000	.925**	.718**	.750**	.396	.964**	.821**	.839**	.886**	.821**
INS	.925**	1.000	.607*	.764**	.496	.896**	.671**	.904**	.886**	.846**
HCR	.718**	.607*	1.000	.475	.064	.775**	.521*	.579*	.632*	.575*
INF	.750**	.764**	.475	1.000	.468	.764**	.629*	.721**	.807**	.768**
MSO	.396	.496	.064	.468	1.000	.368	.089	.443	.354	.275
BSO	.964**	.896**	.775**	.764**	.368	1.000	.761**	.818**	.925**	.836**
KTO	.821**	.671**	.521*	.629*	.089	.761**	1.000	.443	.739**	.754**
COU	.839**	.904**	.579*	.721**	.443	.818**	.443	1.000	.775**	.675**
GDP PPP pc	.886**	.886**	.632*	.807**	.354	.925**	.739**	.775**	1.000	.957**
LP	.821**	.846**	.575*	.768**	.275	.836**	.754**	.675**	.957**	1.000

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

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

Source: Author's own calculation.

Examination results have shown the very strong and significant intercorrelation between the variables of innovation, productivity and economic growth, presented by a set of relevant and objective components. It is determined positive correlations between the Global Innovation Index (GII), Labour Productivity (LP) and Gross Domestic Product PPP per capita (GDP PPP pc) presented by correlation coefficients 0.886 and 0.821, which indicate that achieving higher productivity and faster economic growth relies on higher innovation accomplishment in selected countries. Very strong positive correlation is diagnosed between GII and BSO (0.964). The interdependence is revealed among GDP PPP per capita and following variables of innovation: Institutions (0.886), Infrastructure (0.807), Business sophistication (0.925), Knowledge and technology outputs (0.739), Creative outputs (0.775) and Labour productivity (0.957), respectively. The level of innovation performance, productivity and enhancement of economic growth between selected countries relies on Institutions, Infrastructure, Business sophistication, Knowledge and technology outputs and Creative outputs.

Conclusion

The aim of this paper was to examine the significance of innovation in increasing productivity and economic growth in the selected non-EU and EU member countries. The research results have shown positive relationships between the Global Innovation index, GDP PPP per capita, Labour Productivity and other innovation indicators: Institutions, Infrastructure, Business sophistication, Knowledge and technology outputs and Creative outputs. According to the calculated inter-correlations, it may be concluded that innovation performance in selected countries depends on institutions, infrastructure, improved environment for business sophistication, and a higher level of innovation activities related to Knowledge and technology outputs and Creative outputs.

The conducted research has proposed several insights. First, innovation presents a worldwide phenomenon. The relevance of the capability and necessity for innovation reveals the need for a global insight in understanding the innovation capability indicators measured by the innovation indices. This can help to assure not only a strong foundation for accepting the multiplicity of innovation performances, but also to increase the future theoretical foundations for adequate policies about specific countries. Second, innovation capability is linked to multi-stakeholder actions. Governments should help build institutions and infrastructure, improve better conditions for business sophistication, develop new technologies and accept policies that are helpful towards markets and technological catching-up. Third, it is important to develop plan of actions that will help increase innovation, productivity and economic growth in a particular areas of an economy. The calculated innovation indicators offer relevant avenues for action in this regard. Several “weak indicators” need strengthening in more than one economy. Countries can use the innovation indices to identify their own strengths and weaknesses, compare themselves with the similar countries and create consensus around desired fields of action.

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