ORIGINAL PAPER

DIGITAL ECONOMY A BRIDGE TO ROMANIAN COMPETITIVENESS FROM REGIONAL TO GLOBAL

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Abstract. *Today, digital has invaded all areas and the sectors of the economy of information and communication contributes to the largest share of wealth. The trend accelerated during the last 15 years of the digital economy and the new Information and Communication Technology (NICT) diffusion affect the enterprise competitiveness and the country level on the international market also.*
This work aims briefly the theoretical competitiveness concept and NICT impact under the development and innovation of a country competitiveness process. Secondly, this paper aims the empirical findings within a data analysis for the 35 countries sample during 2012-2015 years in order to examine the relationship between NICT development and the global competitiveness of the Euro-Mediterranean region, issues related in the productivity evolution and enabling innovation as key indicators of the overall countries competitiveness of this area.

Keywords: *competitiveness concept; Euro-Mediterranean area, Economic Intelligence model, digital economy.*

1. INTRODUCTION

For over two decades, competitiveness has become the watchword of both companies and territories. Directly, correlated with increasing globalization, the business competitiveness and the attractiveness of the regions invite their competitiveness in the global space and business strategies to become a principal burden.

The competitiveness concept is complex and the various definitions often used to express different situations: "competitiveness is the ability to produce goods and services that meet the international market requirements while providing citizens with a standard of living that at once rises and can be preserved for a long term; it also refers to "the ability of companies/ industries/regions/nations or supranational groups to generate sustainable income and a relatively high level in employment, and while remaining exposed to international competition".

Often used by economists, the concept was firstly defined and understood in terms of the business and then transposed to the macroeconomic level, at an industry or country and by this reason may be two types of competitiveness : the company competitiveness and that a territory or country competitiveness [1].

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According to Michael Porter the regional competitiveness has become a watchword of public policy. Competitiveness is the ability of jurisdictions to assist in the creation and development of economic activities, to attract and retain people and capital. It also refers to "the ability of companies, industries, regions, nations or supranational groups to generate sustainable income and a relatively high level of employment, and while remaining exposed to international competition The best known competitiveness is one that occurs between nations: “it goes through multiple levers such as taxation, manipulation of exchange rates, flexibility of resources ...” [2].

As for the competitiveness of a country or region it can be enjoyed by the living standards of its inhabitants (e.g. GDP / capita). By OECD and European Union, competitiveness translated by "the ability to produce goods and services that meet the test of international markets while maintaining high levels of income and sustainable" or "the ability of companies, regions , nations or supranational geographic regions to generate, while being exposed to international competition, income levels and employment relatively high”. The regional competitiveness linked to its attractiveness, its ability to attract activities on the territorial area. The final goal of the all countries is the improvement of the life standard and the guaranteeing of the welfare of their population.

According to F. Peraux the economic growth is the increase - sustained through one or more long time periods of an indicator which shows the dimension of a nation, the net product in real terms” [3]. Even Krugman affirmed that “the competitiveness is merely the poetic to express the productivity of a country” [4].

During the recent economic recession, the global economy suffers and a worsening problem of unemployment deriving from the USA financial crisis. The recession lefts deep scars and it seems hard to quantify them with precision. A key feature is the competitiveness losses in the economies of many countries including transitions countries. This problem persists for several years and the economic literature shows that the economic performance and competitiveness recovery demand the **reactivation in innovation and productivity.** The conditions of mobilization of these components were now more than 15 or even 20 years.

Today, digital has invaded all areas and sectors of the economy of information and communication contributes to the largest share of wealth and the trend accelerated during the last 15 years to tangibility economy. This diffusion of Information and Communication Technology (ICT) affects the competitiveness of the firms and country level on the international markets. Hence, our problematic here is how ICT development affects the global competitiveness? To give an answer at this question this work analyze the impact of the ICT development on competitiveness through effects on innovation and productivity of the countries panel of the Euro-Mediterranean are tend to propose solution and recommendations around this field.

2. MATERIALS AND METHODS

2.1. MATERIALS

In an open economy, countries’ competitiveness offers invaluable insights into the policies, institutions, and factors driving productivity and, thus, enables sustained economic growth and long-term prosperity.

The Information Technologies revolution has sharply reduced the cost of information and increased its availability. To create a New Economy where the old rules of economics no longer apply, ICT is one of the fastest growing areas in terms of innovation and is

increasingly adopted in a wide variety of applications. As such, educators and researchers in this area need to spend extra effort to keep up with its rapid growth and to be current with its trends. Indeed, the ICT was integrated in a wide range of new economy in different areas, such as e-business, e-commerce, e-banking and health care and bioinformatics. It also includes information security, strategic information technology and risk management in ICT. Communication technologies and networking is also covered in terms of its applications and technology development.

ICT plays two basic roles in this process, first through capital deepening which is the result of increasing the overall investment, second by contributing to Total Factor Productivity (TFP) growth. Many empirical studies confirmed the ICT effect investment on the growth performance [5]. Commonly ICT investment is associated with rapid technological progress and competition in the production of ICT goods and services, which have contributed to a steep fall in ICT prices and encourage investment in ICT. Oliner and Sichel conclude that the USA growth resurgence in the 1990s is largely an information technology story [6]. They calculated that about two-thirds of the rise in US labour productivity in 1996-99 is due to the increased use and production of information technology. On the other hand, there is some optimistic view which suggests that developing countries may have an advantage over advanced countries with respect to ICT diffusion.

Antonelli mention that switching from the predominant technology paradigm called "ICT new paradigm" imposed significant costs to developed countries and simultaneously, important opportunities open up for less-industrialized countries. Farhadi and Ismail studied the impact of ICT development in the economic growth of different countries and regions of the world. They improved a positive relationship between real Gross Domestic Production (GDP) growth and ICT development (as measured by the ICT Development Index) for 153 countries over the world. This study also finds that ICT development in the upper-middle income group has a higher effect on economic growth than other countries. This implies that if these countries seek to enhance their economic growth, they need to implement specific policies that facilitate ICT development [7].

Although many researchers have provided empirical evidences for the correlation between ICT investment and economic growth, study on the impact of ICT development on economic growth is still an unexplored area.

According to Porter, innovation is a main determinant of the growth and performance in the global economy. It gives origin to new technologies and new products that help address global challenges such as health or the competitive environment. Transforming the conditions of production of goods and provision of services, it boosts productivity, creates jobs and improves the global competitiveness of nation and the quality of life of citizens. Several studies have yielded support for these perspectives. The importance of innovation and its role in the growth has been much discussed in the economic literature. Also, it is confirmed by a number of empirical studies applied to some countries. Jacques Mairesse and Pierre Mohnen have highlighted the innovation role, that these are new production technologies or new products, in economic growth. They also required quantifying the effects of these innovations. Ph. Lebel proposes a measure of economic growth through innovation, thus from a sample of 103 countries in different regions for the period 1980-2005. The results provide empirical evidence of the positive role of creative innovation in economic growth.

The empirically study of Hassan and Tucci link innovation to economic growth and their works analyze the importance of the quality and quantity of innovation upon the economic growth [8].

2.2. METHODS

This section defines the methodology of the examining the global competitiveness determinants in order to test the relationship between innovation & ICT development & economic performance by the global competitiveness index.

ICT development Index (Fig.1) is a composite index built from 11 basic indicators (a scale from 0 to 10) that monitor and compare developments in ICT across countries divided in three sub-categories (access, skills and ICT using) within the proposed indicators by the International Telecommunication Union (ITU) in Table 1.

ICT access	**Re. value**	**%**
1. Fixed-telephone lines per 100 inhabitants	60	20
2. Mobile-cellular telephone subscriptions per 100 inhabitants	180	20
3. International Internet bandwidth (bit/s) per Internet user	280’337*	20
4. Percentage of households with a computer	100	20
5. Percentage of households with Internet access	100	20

ICT use	**Ref. value**	**%**
6. Percentage of individuals using the Internet	100	33
7. Fixed (wired)-broadband Internet subscriptions per 100 inhabitants.	60	33
8. Active mobile-broadband subscriptions per 100 inhabitants	100	33

ICT skills	**Ref. value**	**%**
9. Adult literacy rate	100	33
10. Secondary gross enrolment ratio	100	33
11. Tertiary gross enrolment ratio	100	33

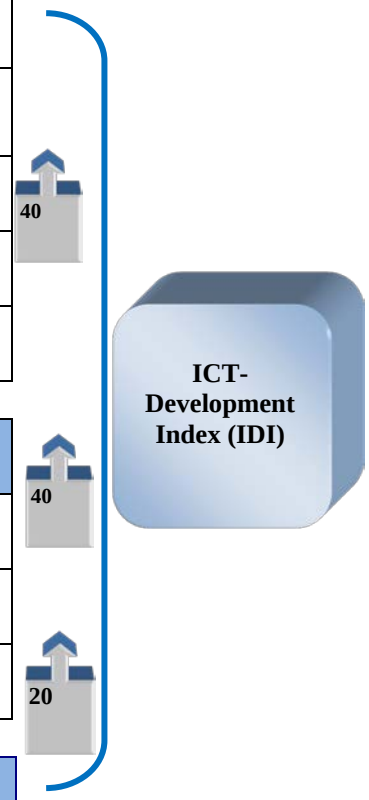

Figure 1. ICT Development Index composition
Source: ITU, Measuring the Information Society [7]

Global Innovation Index (GII) design the innovation role (Fig. 2) as an engine of the economic growth and prosperity and also it shows a need for an overview of innovation applied to both developed and emerging countries as the added indicators which go beyond the traditional indicators used.

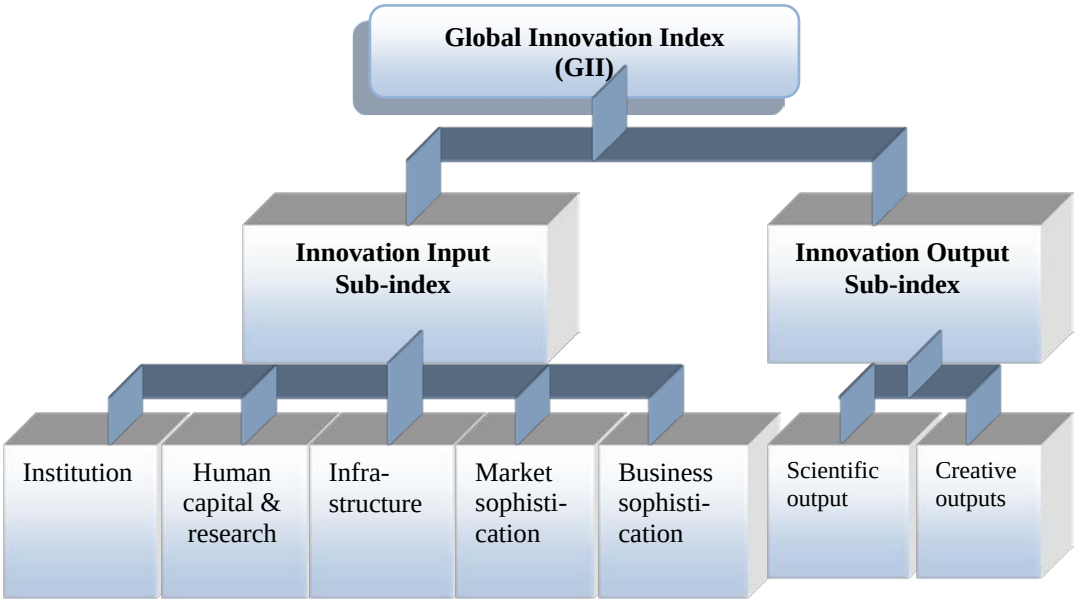

Figure 2.Global Innovation Index composition [9].

GII project was launched by INSEAD in 2007 with the simple goal of determining how to find metrics and approaches to better capture the richness of innovation in society and it's a valuable tool for comparing to encourage dialogue between the public and private sectors, enabling policy makers, business leaders and other stakeholders to evaluate continuous progress. GII is an indicator with has an important role, that innovation plays as an engine of economic growth and prosperity. Also, it's showing a need for an overview of innovation applies to both developed and emerging countries, which are added indicators that go beyond traditional indicators used to gauge innovation (such as the level of research and development in a given country).

In Fig. 1 may see the GII composition based on two sub-indices: "Innovation input sub-Index" and "Innovation output sub-Index", each built around pillars. Innovation Input Sub-Index, is composed by five pillars capture elements of the national economy that enable innovative activities: Institutions; Human capital and research; Infrastructure; Market sophistication, and Business sophistication. The second sub-Index (Innovation output) is the results of the innovative activities of the country economy. There're two out pillars: Outputs knowledge and technology and Creative outputs. The output of the innovation sub-index is the simple average of the last two pillar scores.

Global Competitiveness Index (GCI)

Competitiveness is defined as the set of institutions, policies and factors that determine the level of productivity of a country that determines, in turn, the level of economic prosperity. The productivity level also determines the rates of return obtained by investments which are the factors behind the growth potential of an economy.

The central role of the competitiveness as engine of the economic growth is supported by a large body of data, macroeconomic and sectoral, which composed by World Economic Forum (2012). GCI was designed by twelve pillars arranged in three sub-Index basic requirements sub-index, efficiency enhancers sub-index and Innovation and sophistication factors sub-index as given Fig. 3.

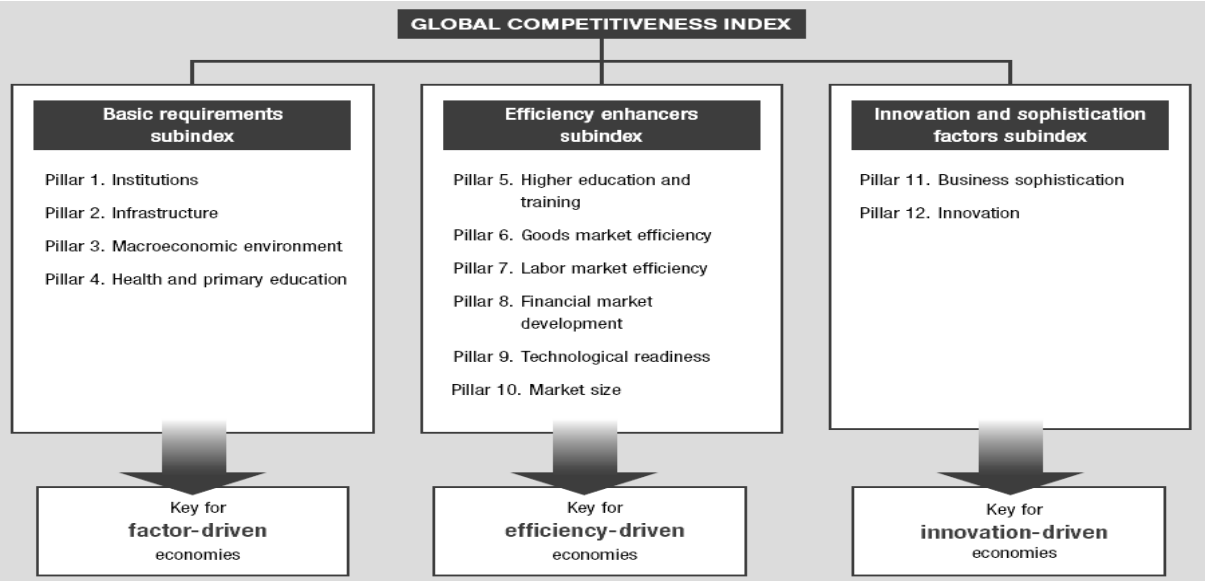

Figure 3.Global Competitiveness Index (GCI) composition [10].

According to Fig. 3, GCI Index composition allowed the 12 pillars (in 3 boxes) this paper aims GCI score and tracking of the countries of the Euro-Mediterranean including also Romania (Table 1).

In our opinion the country global productivity by the performance indicators calculated in the World Economic Forum Annual Report (2004-2008 years and between 2012-2015 years) is an efficient macroeconomic indicator that can measure the country's competitiveness and also it gives the possibility to compare the competition level between the economies and measuring the comparative advantage of a country.

IDI Index (Fig. 1) allows comparing the information society development of 152 countries around the world. It can be considered as an indicator for measuring the digital divide. For example, according to IDI index, the world ranking is led by ITU rapport 2011: Korea ranks 1st, followed by Sweden and Iceland; Germany placed on the 15th position; France is ranked in 18th position and Belgium ranks 22nd.

However, Ranking Euro-med-35 is led by Sweden, Denmark, Luxembourg and the Netherlands which occupied the ranks. The least accessed in ICT-development was the North Africa countries: Egypt, Morocco, Syria & Algeria [11].

Table 1 aims the competitiveness level of the countries in the Euro-Mediterranean area before and after the subprime crisis within allowed calculate the regional and international development level from this area of the world [12].

The calculation of the variation among international and Euro-Mediterranean ranking "Δ rank" reveals the overall level of competitiveness of the most countries of this region has decreased. The most affected country is Greece, which fell in the world ranking with 33 places and with 5 places in the Euro-med ranking. In The same order for Denmark, Israel, Portugal, Syria, Egypt, Jordan, Latvia and Slovak Republic, ranking level was dropped with a remarkable way and this due to the effects of the contagion that has turned to a financial crisis and economic crisis and due to the Arab Spring revolutions. We also note that there are some countries that have improved their competitiveness such as, Germany, Netherlands, France, Belgium, Italy, Turkey, Romania, and Bulgaria even Poland is the country which has most improved the competitiveness level.

Table 1.Euro-Mediterranean area GCI score and international ranking

Country Index	**GCI score**		**GCI rank international**			**Rank Euro-Med region**		
country/period	2004-2008	2012-2015	2004-2008	2012-2014	Δ rank	2004-2008	2012-2014	Δ rank
Finland	5.79	5.19	3	5	2	1	2	1
Sweden	5.66	5.55	3	3	0	2	1	-1
Denmark	5.65	5.37	4	9	5	3	5	2
Germany	5.36	5.41	10	6	-4	4	3	-1
Netherlands	5.38	5.39	10	8	-3	5	4	-1
United Kingdom	5.31	5.32	11	11	0	6	6	0
Austria	5.18	5.15	17	18	1	7	8	1
Israel	5.07	4.95	20	25	5	8	11	3
France	5.06	5.13	22	18	-4	9	9	0
Belgium	5.00	5.14	23	17	-6	10	7	-3
Ireland	4.99	4.81	24	28	3	11	12	1
Luxembourg	4.97	5.03	25	22	-3	12	10	-2
Estonia	4.87	4.61	25	34	9	13	13	0
Spain	4.82	4.55	29	37	7	14	15	1
Portugal	4.74	4.40	33	46	13	15	20	5
Czech Republic	4.58	4.57	35	36	1	16	14	-2
Slovenia	4.62	4.40	36	49	13	17	22	5
Tunisia	4.53	4.54	36	37	1	18	16	-2
Lithuania	4.46	4.37	40	47	7	19	21	2
Slovak Republic	4.42	4.22	42	62	20	20	26	6
Cyprus	4.50	4.44	43	45	2	21	18	-3
Malta	4.55	4.34	43	50	7	22	23	1
Latvia	4.39	4.20	45	64	20	23	28	5
Hungary	4.42	4.30	46	55	9	24	24	0
Jordan	4.37	4.23	46	63	17	25	27	2
Italy	4.36	4.39	46	45	-1	26	19	-7
Greece	4.32	3.95	52	85	33	27	32	5
Poland	4.14	4.44	53	42	-11	28	17	-11
Turkey	3.95	4.29	61	56	-5	29	25	-4
Egypt	3.97	3.91	67	88	20	30	33	3
Morocco	3.91	4.11	68	73	5	31	31	0
Romania	**3.91**	**4.10**	**68**	**70**	**2**	**32**	**29**	**-3**
Bulgaria	3.95	4.15	69	71	2	33	30	-3
Syria	3.99	3.80	79	96	17	34	34	0
Algeria	3.69	3.90	81	91	10	35	35	0

Source: author's calculation based on Data collected by Global Competitiveness Reports between 2004-2008 years & 2012-2015 years.

Data and variables descriptive analysis

An empirically evaluate of the NICT development in the global competitiveness based on a linear model as following:

$$GCI_{it} = \alpha_0 + \alpha_1 IDI_{it-1} + \alpha_2 GII_{it-1} + \varepsilon_{it}$$

where:
GCI = indicator to global measure of the Euro-Mediterranean area competitiveness
IDI = indicator to measure the ICT development of the same region;
GII = indicator to measure the country global innovation.

The data of variables was collected from annual Reports:

- International Telecommunication Union, "Measuring the Information Society", 2009, available on http://www.itu.int/ITU-D/ict/;
- GII calculated by INSEAD, "The Global Innovation Index", 2012, available on http://www.wipo.int/econ_stat/fr/economics/gii/;
- World Economic Forum, "The Global Competitiveness Report", 2009/2010 and 2012-2015 available on http://www.weforum.org/reports/global-competitiveness-report-2009-2010; http://reports.weforum.org/globalcompetitiveness-2011-2012/

The results of linear regression using Ordinary Least Scare (OLS) method for IDI Index and GII Index (exogenous variables) on GCI Index (endogenous variable) aim in Table 3.

Table 2.Granger Causality Test between GCI, IDI and GII for the countries of Euro-Mediterranean area during 2007-2012 years

Pairwise Granger Causality Tests

Null Hypothesis:	Nbrs. Obs.	F-Statistic	Prob.
GII does not Granger Cause GCI	105	0.49931	0.6085
GCI does not Granger Cause GII		6.70624	0.0018
IDI does not Granger Cause GCI	105	1.59707	0.2076
GCI does not Granger Cause IDI		3.70357	0.0281
IDI does not Granger Cause GII	105	8.44678	0.0004
GII does not Granger Cause IDI		3.56939	0.0318

Source: Output EViews6.1

According to Table 2 data confirmed that GCI is caused by IDI and GII.

Author improved a double sense of Granger causality between IDI and GII and these results give an idea regarding the composition of exogenous variables (IDI and GII) and endogenous one (GCI). Correlation matrix of the variable given by table 2 improves a strong correlation between GCI, IDI and GII. This empirical result confirms theoretical argument which, stipulated that the innovation and development of ICT are determinants of competitiveness. It justifies the existence of a relationship of high empirical significance of these variables (table 3).

Table 3.Correlation matrix of variable

	GCI	IDI	GII
GCI	1	0.7712	0.7311
IDI	0.7712	1	0.8246
GII	0.7311	0.8246	1

Estimation results based on the OLS estimation method are summarized in Table 4 where there are 3 regressions: all Euro-med countries regression into column two, then EU-15 and in the 4^{fh}column regression of Euro-med transition countries.

Table 4.Estimation results. Endogenous Variable (GCI)

	Euro-Mediterranean Countries (35)	European Union Countries (EU-15)	Euro-Med-20 Countries
Exogenous Variables	Coefficient	Coefficient	Coefficient
GCI	3.006*** (0.0982)	5.87*** (0.4191)	3.564*** (0.092)
IDI	**0.176*** (0.0277)	**-0.15*** (0.0815)	**0.094*** (0.024)
GII	**0.150*** (0.0417)	**0.04*** (0.0422)	**0.082*** (0.039)
R-squared	0.6231	0,94	0.43
F-statistic	142.162	53.167	36.496
Prob. (F-statistic)	0.0000	0.0000	0.0000
Nbr. Obs.	175	75	100

T-statistic in parentheses; * denotes statistically significant at 1%, respectively.*

3. CONCLUSIONS

The modern service economy development provides many opportunities and also multiple challenges.

According to the results of our research:

- the global significance of the estimated equation is justified (Prob (F-statistic) = 0.000) and there is a strong explanatory power as measured by the correlation coefficient (R-squared) between the exogenous variables (IDI and GII) and endogenous variable (GCI), especially for the EU-15 (R-squared = 0.94);
- the coefficients which measure the elasticity of IDI and GII compared to the GCI are significant and positive in the case of transition countries, while for EU-15 countries the coefficient of the IDI is significant but negative.

All economies of the Euro-Mediterranean countries area have varying economic degrees which provide:

- enabling effects: the outputs of some sectors enable economic activity in other sectors of the economy;

-supply chain effects: there are widespread supply chain effects whereby economic activity in one generates demand for goods and services produced by other sectors;

-spillover impact: some sectors are a source of knowledge and innovation spillovers which unintentionally benefit other sectors of the economy**.**

Since 1985, Michael Porter and Millar asked two main questions [2]: *"How information revolution is transforming the nature of competition?"; "How information is providing a competitive advantage for a country economy?"*

Into "Economic Intelligence Model" (Fig. 4), Information and Communication Technologies (ICT) provide opportunities to support intelligence activities and an organization should implement a so-called "intelligence infrastructure" within are including:

- technological intelligence that can support the (stages in the) intelligence cycle;
- structural intelligence concerning the definition and allocation of the competitive intelligence tasks and responsibilities;
- human intelligence resources including the selecting, training and motivating employers which should perform the intelligence activities (Fig. 4).

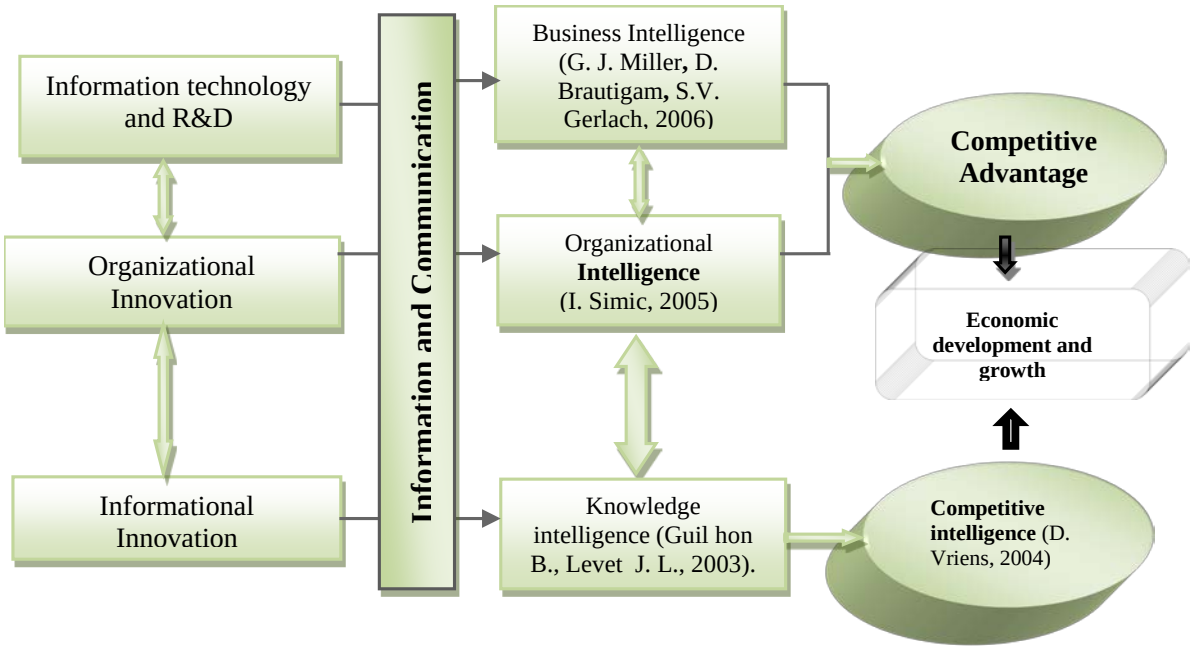

Figure 4. Economic Intelligence Model

Information designs a crucial resource for effective innovation that may provide the competitive intelligence as result of the business organizational strategies and knowledge intelligence using ICT consequences in these areas. Nowadays, in the modern service economy based in knowledge and information the companies have two sources to economic development: *competitive advantage and intelligence.*

The first provided by Organizational and Business Intelligence and the second design other important factor as primary source - Informational innovation and ICT diffusion. .

The disadvantages in terms of ICT, research and capabilities' development, high cost to improve the environmental protection would make them less and less competitive compared with developed countries. They may lose an opportunity to catch up with the developed countries and become relatively poorer (Fig. 5).

Figure 5. Competitiveness pillars by World Economic Forum [12]

Digitization is transforming the business models, the policy landscape and social norms. The aim of the World Economic Forum's "*System Initiative on Shaping the Future of Digital Economy and Society"* is to cultivate a shared, trusted digital environment that is a driver of inclusion, economic development and social progress.

The digital-ready trade policy would empower new forms of commerce and cut existing frictions in our increasingly digital-driven economy. A set of digital-economy policy proposals for the next decade was launched in 2016 by the Forum's Initiative on International Trade and Investment. Developed in collaboration with the System Initiative on the Future of Digital Economy and Society, this project convenes a broad-based coalition in refining and implementing digital economy-related policy proposals. Covering data flows, digital access, ecommerce, digital coherence and competition, it ensures momentum towards a concrete package of reforms to be agreed and enacted.

The new Free Trade Agreements (FTSs) regarding the trade in service and non-trade issues would promote liberalization in trade to cover broader areas of trade, and contribute to the world economical progress. But new FTAs may be settled beyond the implementation capacity of many developing countries, the latter may lose their comparative advantages.

Considering the imbalance of political, economic and intellectual power between the developed and developing countries, big powers and small powers, multilateral negotiation such as negotiation of World Trade Organization will still be the best way in international trade and investment rules, and balance the different interests of different kind of countries.

Digital Transformation of Industries (DTI) project, launched by the WEF (2015) is a multi-year engagement with the aim to analyze the DTI impact of digital technologies on business and society, to better understand digital transformation opportunities and risks in industries and their related sectors, and provide insights and tools required for business model changes. In 2015-2016 the project focused on: Logistics, Media, Consumer Goods, Electricity, Automotive, and Health. It also explored four cross industry themes: Digital Consumption, Digital Enterprise, Societal Implications, and Platform Governance.

In order to ensure security and resilience, organizations, both public and private, must develop the capabilities to ensure their own resilience through internal governance structures and behaviors as well as work with other organizations (enterprises, governments, and civil society) in order to ensure systemic security and resilience.

World Economic Forum proposed to build a Pan-European Ecosystem for Innovation and Entrepreneurship based on a network between Europe's many vibrant digital innovation hubs (Digital Leaders of Europe) and a collaboration within the Regional Business Council Europe members on further digitizing Europe's industry to advance Europe's Digital Single Market as key factor for the region's competitiveness in the context of the Fourth Industrial Revolution.

Intelligence sharing can lead to opening all available channels to best understand the threat, and public-private partnerships broaden the tools available to deal with cyber-threats. The volume of cyber-attacks is on the rise and will continue to increase. The consequences are grave and can result in reputational loss, material loss and litigation.

Cyber-attackers are constantly inventing ways to execute their crimes and do so very quickly.

The cost to the global economy of cybercrime has been estimated at $445 billion a year and the combating cybercrime represents a greatest opportunity for collaboration between government and industry because all parties share the same interests in this field. The Forum Cybercrime Project seeks to create a unified and balanced approach between the public and private sectors, and deliver a set of common, implementable measures. In addition, these tools are not exploited to their full potential due to lack of trust between the public and private sectors, and between companies.

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