

# Business Innovation Policy and the ICT Phenomenon

Amalia-Elena ION<sup>1</sup>  
Ana-Maria ZAMFIR<sup>2</sup>  
Cristina MOCANU<sup>3</sup>

## **Abstract**

*The attributes of globalization have underlined the ultimate reasoning process – the knowledge economy is driven by innovation, and the ICT phenomenon, while the successful finality of this new premise must be reduced to the measures a country is instituting, and to the capabilities and potential of private entities.*

*The current regression analysis performed on the World Bank datasets on 11 countries from 4 continents managed to underline the correlations established between the expenditure in R&D as an innovation premise, and the potentially incentivized business sector toward developing new medium and high-tech products and services. Moreover, the study looked into the ICT sector and the extent to which the local governments are directing policies and funds to developing the former.*

*The results are conclusive with the implementation of innovation policies, and the investment programs each country created for the optimization of the business performance and the development of the R&D sector.*

**Keywords:** *business innovation policy; research and development expenditure; information and communication technology; regression analysis.*

**JEL classification:** *M 10, M 15, M 54*

**DOI:** 10.24818/RMCI.2022.4.480

## **1. Introduction**

As encompassed in the field of knowledge economy, the concepts of knowledge, information, technology, and abilities represent the prime resources of a valuable contemporary system, which relies on the capability of both human society and the modern technologies to perform effective and efficient economic activities at large scale, across the globe. It is, however, an acknowledged standard for the description of this new type of economic system, available in the real business world only in niche markets, scattered mostly across the developed countries' economies (Mangabeira Unger, 2019). At the same time, the concept of

---

<sup>1</sup> Amalia-Elena ION, National University of Political Studies and Public Administration, Romania, e-mail: amalia.ion@live.com

<sup>2</sup> Ana-Maria ZAMFIR, National Scientific Research Institute for Labour and Social Protection – INCSMPS, Romania, e-mail: anazamfir@incsmmps.ro

<sup>3</sup> Cristina MOCANU, National Scientific Research Institute for Labour and Social Protection – INCSMPS, Romania, e-mail: mocanu@incsmmps.ro

knowledge economy can plausibly be related to the general economic activity carried out in the last two centuries. Even the industrial economy and the development that it determined can be attributed to a wide range of information gathered, analysed, and implemented across different fields of activity. The knowledge accumulates over extensive time periods and has a profound effect on the quality and quantity of output generated at any given time (Lytras et al., 2019). Therefore, comparing the available business power and capacity of knowledge in production today to that created in the last century, for instance, it can be assessed that this particular sector has grown to an unprecedented level. During the same timeframe, the society has been progressing through the same disruptions, growth, and intensity, arriving at a level where it demands something else.

The last three decades have showcased profound changes both in terms of social movements, cultural standards, environmental awareness, and in terms of business, decision-making processes, public policy, public-private affairs. What the world witnesses today is a dynamic, transitioning knowledge economy, where the public sector is pushing forward with policies that inflict growth and efficiency in the business market, and where the private enterprises fight for a high-quality, high-performance product/service, directed towards specialized, knowledgeable market segments (Dolfsma, Soete, 2006). With state-of-the-art technology, the private sector has pushed outside the boundaries set in place by the old system, and the introduction (almost forced) of the ICT phenomenon by the public policies, especially in the least attended economic sectors, determined a rupture in the business models. The new knowledge necessary for understanding and operating with these concepts in the dynamic profile of the economy possesses fundamental theoretical problems and causality.

The conceptualization of the information available, which is created at never-foreseen speed each day, and the individuals which must perform with the big data within the premises set up by the public and private entities imply the realization among the operators and decision-makers of the impacts determined by the institutionalization of the *new society* (Chan, 2015).

Although the norm will be that underlined above, there are still no clear answers to the questions related to the knowledge economy, including those asked by academics, policy decision-makers, entrepreneurs, or citizens. Loet Leydesdorff (2006) addresses the fact that knowledge and information are being exchanged between parties that are represented in a certain context, determining each other's expectations. Knowledge becomes, therefore, a mean of interaction and outcome, and it is used and activated through codification, routines, and rules. Those elements will offer a pattern for the identification of regularities and trajectories of new establishments and policies that create opportunity within the economic environment. The availability of means or facilitators for enterprises to grow extends through the application and development of high-tech software and hardware (Carayannis, Formica, 2008). The process and the outcome of such a dynamic influence the group efforts of all parties involved – public entities, private entities, citizens, or the society.

The main scope of this research is to discover if there are clear signs and rightful directions toward a knowledge economy under the form of business innovation policy blending with the ICT framework and infrastructure. The study has performed a quantitative analysis on a World Bank database, comprising 11 countries of the world, and assessing the general direction of their business policy, of the innovation directives they implemented, and of the impact information and communications technology could have had on the private and public sectors.

## 2. Literature review

### *The European Synergy*

It is particularly difficult to point exactly towards the moment when modern economic growth started, without surfacing the problems attached to that new wave. Apparently, the Enlightenment and the British Industrial Revolution have triggered what would have become the foundation of the current system. This transformation comprised a change in the mechanics of future economic growth, where technological progress started to swiftly dominate the processes (Dolfsma, Soete, 2006). What the modern economic system is trying to achieve, contrary to its predecessors, checks out the box of sustainability and persistence. Within the European space, the tendency to improve, innovate, and grow has been visible since the end of the 20<sup>th</sup> century. The majority of the EU public policies take into account measures to facilitate the development of the European member states, and they specifically create the premises for forward movement toward cohesion and becoming one of the three main economic powers in the world (European Commission, 2012). Two causal factors – culture and geography, have been the paths for the introduction of the states' system, by defragmenting the political power into a competitive single European market, and allowing for both restrictive and facilitating policies in order to keep in line all the national rulers of the member states. The cultural beliefs of each state and their unique imprint, alongside all historical events that have shaped individually the European member states, have represented an object of interest from an economic point of view, as well as an explanation for the end result – persuasion, diffusion, convention, norm, and change in social institutions and behaviour.

Since knowledge is the main source of the new economy, it is important to interpret the latter as a multifaceted phenomenon, comprising of movements for natural rights of humankind, concepts of religious and racial tolerance, political freedom, legal reform, human progress, etc. The common denominator is always reason and knowledge, and the material aspect of the system is that of understanding nature and controlling it (Aydogan, 2009). It is, therefore, a matter of science and technology supporting one another, with the idea of *research* as contributor to the economic and social reform. The change instituted by the progress in knowledge established the premises for future prosperity through experiences and hope. It has also been understood that growth could be possible through collective efforts, division of labour, with specialization and promotion of

expertise, arriving at the present time with the concept of Research and Development processes in both corporate and government sectors. With new technological methodologies in place, a new wave of systemic improvements has made a bent in the local and regional dimensions of the EU. Knowledge is the key to economic development, and the expansion of knowledge can solve technological problems with substantial efficiency gains (Hanushek, Woessmann, 2015). The European Union, through its authority bodies, has laid out a technological programme for economic expansion, with input from the society and public policies toward the advanced foundation of organizations. Progress, as they determined, was a variable of knowledge, which, in turn, resided in rational argument and observation. For a long time, invention and pioneering represented the fluid dynamics of what it could be and, complementary, where it should arrive. There is a connection between the dimensions of learning paths and production processes that have been congruent with economic growth, part of it being determined through direct contact and knowledge transfer, teaching, imitation, even espionage. Furthermore, the process of knowledge transfer is attributed to the communication system (Howlett, 2011). Traditionally, as exemplified above, the transfer would have been established through direct contact, such as in teaching or by experimenting. In modern days, the communication systems are high-tech, and comprise of complex dynamics both within and in relation to exterior factors. For instance, the teaching process is one that can be established between an unlimited number of people who live in completely different parts of the world. The knowledge transfer process has attained unlimited and unprecedented capability. Technology and scientific accomplishments completely transformed the world in which we live, work, and entertain today. The human capital is no longer bounded by geographical barriers, or even language barriers, for that matter. The new and improved human cloud industry possesses the power of bringing the most valuable assets – professionals and experts, remotely, to perform within projects and programmes all over the world, in an efficient and effective manner (Ross et al., 2017). If ten years ago, the world continued to seem pretty big and scary, today, probably incentivised by our need of securing our safety and health, is one cosy place, filled with things and people that we already know.

#### *Institutional Progress*

Due to the work of economic historians, it has been assessed that there is no particularly successful economic growth without good working public institutions. The particularly sensitive work of the European Council, Commission, and Parliament through its public policies ensured the centrality of human rights, the incentivizing programmes for innovation and technology, the effectiveness of norm application and law enforcement. Although examples of good practice can be observed in different parts of the world, Europe proved the acquired status of institutional progress, a movement which has also been rooted in the combination of accelerated innovation rate, efficient and expanding markets, removal of restrictions across different fields of expertise, capital and labour mobility, etc.

(European Commission, 2017). The economic significance of the political and institutional reforms of today will be fully realized in the following decades, when the Single European Market assumes economic activities that originate in innovative and high-tech processes and ensembles.

During the 20<sup>th</sup> century, there was a particular narrative to the way in which the interaction between the public and private sector would take place. The framework for the managerial organization to establish relationships with the public policy stakeholders and issues was created through the availability of public affairs (Fleisher, Harris, 2016). The complexity, dynamism and uncertainty of the global convergence were responsible for the crafted managerial responses, which determined the growth of interdependence of financial markets, information and technology. Some of the international policy concerns have been trade agreements, flows of human capital, financial resources and goods, opening of or restricting markets across the world, and the reeling against market offenders. Today, the problems or issues that public institutions must take into account are far more sustainable, and they are mostly directed toward environmental scanning and monitoring, intelligence and/or knowledge development, socio-political and legal counselling, communications and marketing of CSR, promotion of processes of safety and health at work, incentivising programmes for innovation, etc. The policy formulation on behalf of the public institutions resides in the environmental assessment, the social and political developments, but also in the feedback from the citizens, from the business managers, and corporate opinion leaders (Howlett, Mukherjee, 2017). By working together, the involvement of the public institutions in the policy decision-making is continued through the active interest of the citizens and the other stakeholders, including the corporate sector. The input from the corporate sector represents the advantage of a clear real business outcome and the transparent understanding of what the market needs and how the public policy can add to its development. For instance, the US and the EU directives and regulations on product markets result after the proper assessment of the manufacturers' interest in the areas the public institutions decided to regulate. The government and all the public institutions have de facto and de jure power to make decisions that affect the business sector (Sholts, 2005).

Nevertheless, a modern and progressive institutional system is decidedly allowing the inputs of all the stakeholders of any given public policy before the practices are recognized and implemented. Moreover, this new institutional system is based on innovative processes, relies heavily on communication and information technologies, and understands its significance for the capital market and ultimately for the global economy. Since businesses (especially the majority of the market, which is represented by the SMEs) do not have the know-how or the understanding of the various government processes, the public sector stands also as a knowledge transfer entity, with a general strategy of global assessment and local operation. The impact of different ICT instruments is recognizable in the growth of the public awareness on unlimited topics, which determined the increase of the societal expectation toward the public policies, but also toward the best practices of the

private sector. The macro-environmental context of public policy processes and institutions include the social, political, and legal arrangements that structure the interactions and exchanges outside of and within the private markets, especially with the extensive usage of information technology and innovation processes (Hill, Varone, 2017).

#### *Innovation Systems and Policy*

The concept of innovation systems takes into account the interactions between a variety of different agents, different levels, and dimensions of innovation, as well as a wide range of economic and institutional conditions in the decision-making process of public policy. One interesting approach to innovation policy resides in the understanding that knowledge represents a diverse domain, that it is unevenly distributed throughout the society, and that the government should be able to collect, organize, and mobilize the knowledge in the form of policy interventions (Feldman, Link, 2001). Although innovation is not a straightforward, mainstream concept, it is prone to unpredictability, and is only compatible with a system's perspective, the government and public institutions should respect the variety and distribution of knowledge, and should yield a policy perspective that works with an open possibility in relation to innovation.

There are four dimensions to the innovation policy: one in which there is an open communication system between the parties involved in the innovation process, one which recognizes the changes of direction during R&D and innovation projects (Nooteboom, Stam, 2008), one that pertains to the inputs of the capital market, especially tech entrepreneurs, and one that assesses the variables from a global perspective, where there is no specific industry, no specific country, or specific region. Moreover, it is quite generally accepted that any radical, outstanding innovation is rare, and that the highest level of innovation globally encountered is incremental, diffused, or simply imitation. The innovation policy must conclude on the perspective of what is the pattern for initially approaching the radical innovation process, what are the lines that need to be followed, and where should the attention be directed – towards winners or losers.

The economic importance of innovation lies in the fact that the latter is a source of productivity growth, which, in turn, is only available through knowledge and learning. The knowledge economy must comprise of all features of the innovation system, including the connections between R&D, higher education, and innovation processes, entrepreneurship, institutional conditions and the forms of organizing innovation and organizational innovation, as well as the structure of the network combining public/private sector and the regional systems of innovation (Jaffe et al., 2006). When implementing innovation systems, especially from the perspective of allowing for consistent, transparent, and growth-related public policies, it is fundamental to address the issues that might arise from any given strategic direction. Conclusively, there must be a firm understanding of the partnerships that are to be established between the stakeholders of the public policy (here are included the society at large, the capital market, the government and

public institutions, as well as the providers of education and knowledge). Moreover, innovation will be a long-lasting process, and its results might not be evident right away, so it is important to create a vision of global strategy and cohesion between states, to promote the openness of entrepreneurship at an international level, to safeguard and promote government-funded programmes and to account for any changes in direction. At the same time, the communication systems, the alliances, and networks that it forms should be based on trust and transparency, so that the strengths of local forces combine with global ones and conclude in the most desired innovation form.

Although there is a basic understanding of what innovation is and how it operates, the underlying process of innovation is still evasive. As a result, the innovation policy might only be a matter of improvisation, of trial and error; hence, the need for a social and complex perspective. Innovation is not singular (Cunningham, 2013). It is the activity as much as it is the outcome. By performing a new function, which is in itself innovative, the process will determine a new output, which, again, is an innovation. The latter concept is, therefore, very complex and it does mean novelty, but at the same time, should not be reduced to novelty. Schumpeter considers innovation as any combination of novelty. Nevertheless, innovation will be that which is both original, and valuable. It transforms a product, a condition, a system, or a function by changing its perspective and increasing its application. If one assesses the environment in which one functions daily, one can observe and discuss about all different types of innovation by categorizing it in terms of domain of application – it can be technology related, such as artificial intelligence added to the usability of an online platform, or it can be societal, such as the human cloud industry.

Innovation is also subjective, as its performance and intrinsic value depend on the interpretation and view of its stakeholders. The effect of subjectivity for innovation policy resides in the fact that one might look only into its value for application and use and dismiss the importance of innovation as discovery or invention. The innovation policy must, therefore, to address the idea creation, as well as its application. The performance of innovation, which should be encompassed by the public policy, will also depend on the social judgement. Innovation, although seen primarily of economic value, can also solve societal problems, being a means for world peace or eco-friendly practices and preservation, for instance. Moreover, innovation is determined by the intrinsic motivation and autonomy of the teams directing the process. The complexity of innovation can also be assessed from the perspective of macroeconomic applications, where its significance is fundamental in global competition or ageing problems. In simple terms, innovation is both technological change (Dodgson et al., 2008), as it is organizational change, it is both incremental and radical, it determines both economic and social growth and evolution, and it can also be both absolute and individual.

### 3. Research Data and Testing Method

The study was based on the results obtained from a linear regression analysis, which allows for the establishment of potential relationships between the tested variables and even explaining the behaviour of the dependent variable by observing the influences from the independent variables (Seber, Lee, 2012). Within the database testing, 11 countries have been included – Brazil, China, France, Germany, Japan, Mexico, Nigeria, Singapore, South Africa, United Kingdom, and the United States of America. The dependent variables used for the study were Research and development expenditure (% of GDP), and ICT service exports (% of service exports, BoP) or ICT service exports (BoP, current US\$) – given that for some countries the database did not include sufficient information for some of the variables, which could alter the results of the research. The databases were extracted from the World Bank datasets, and the observations have been assessed in the period 2000-2019. The position of each country in terms of expenditure in innovation and R&D and/or capacity to export ICT services has been tested in correlation with the following independent variables: cost of business start-up procedures (% of GNI per capita), foreign direct investment, net (BoP, current US\$), GDP (current US\$), general government final consumption expenditure (annual % growth), high technology exports (current US\$), individuals using the Internet (% of population), listed domestic companies, total, medium and high-tech exports (% manufactured exports), net official development assistance and official aid received (current US\$), new companies registered (number), profit tax (% of commercial profits), proportion of people living below 50% of median income (%), researchers in R&D (per million people), start-up procedures to register a business (number), time required to start a business (days).

The overall regression analysis, performed individually for each country included in the study, was meant to underline the involvement and capacity of individual states to develop their business innovation policies, and their usage potential of information and communication systems technology. By combining the two elements, a country could be considered forward thinking and one step toward realising the implementation and adherence to the knowledge economy. For the interpretation of the results, the statistical significance of the test through the p-value indicator, the measure of the overall fit of the model through the percentage of variance explained, and the magnitude of the effect through the coefficients have been assessed. The results were expected to showcase no significant correlations, since the knowledge economy is even in developed economies a niche phenomenon, adherent to some specific high-tech markets. Nevertheless, the study included the discovery of some interesting predictions, although it is quite clear that the research should be extended both in terms of observations, and in terms of methodology approach.

#### 4. Research Results and Interpretation

##### *European Countries – France, Germany, and the United Kingdom*

The expenditure on research and development by the French government is correlated to the incentives and appeal of the market to foreign investors, which are keen on starting up new businesses in order to radically or incrementally innovate the given economic sector. At the same time, the degree of innovation in the French business sector is observable through the amount of high-technology exports. Apparently, the more high-technology is being exported from France, the more investments are made into the innovation and research sector, to the extent where new technology is incentivising more human capital into the sector, and more start-ups to be founded.

As the number of new businesses registered in Germany increases, so does the expenditure of GDP that is directed toward R&D. It is widely recognized that Germany is a start-up hub, and that its efforts are put into investing and incentivising the wave of innovation in business, as well as the introduction of high-technology systems within the given sector of the economy. There is also a correlation between the high technology manufacturing exports and the expenditure in innovation processes, as more human capital is employed in research. The ICT export sector is correlated to the cost of business start-up procedures, meaning that as the associated costs of founding a business drop, the information and communications technology sector will export at levels of tens of billion dollars.

In the United Kingdom, the expenditure in research and development is not influenced by FDIs and the GDP. Moreover, the statistical significance of the regression analysis between the dependent variable and the new business-related independent variables is weak. On the other hand, considering the ICT service exports as dependent variable, the FDIs and GDP have a significant influence on the former. The negative relationship with the FDIs showcase that the foreign investments are not directed toward exploiting the ICT sector, but the funds come from the gross domestic product.

The findings are consistent with the general OECD direction regarding the innovation policy. According to their study from 2011 regarding the global R&D sector, Germany had invested a value of almost 10% of their GDP in the innovation field, all of the money coming from the direct government funding of BERD. France, which in this study showcased the capacity to perform a great deal of investments in the innovation/R&D sector, incentivized by its general legislative approach, had funded innovation both through direct government funding of BERD and indirect government support through R&D tax incentives, at a total value of 22% of its GDP. The UK government also invested in the R&D from both sources, but distributing funds of a total value of 14% of its GDP. As predicted, the EU countries, especially those tested in this research, are adhering to principles and behaviours compatible with the knowledge economy, and they are focusing on developing entrepreneurship and innovation through significant investments in

R&D. Moreover, the United Kingdom has a number of programmes that make grants and support schemes available for different activities – Matched Grant funds, Funding by the Technology Strategy Board, Innovation, Research and Development Grants, etc.

*Asian Countries – China, Japan, Singapore*

In China, the R&D expenditure is influenced by the ease of doing business, from the perspective of bureaucratic procedures for start-ups. The latter are considered worldwide the hub of creativity and innovation, and, consistent with this research, the probability of investing and financing start-ups is correlated to the extent of expenditure directed toward R&D. If the procedures to open a start-up are increasing by 1 procedure extra, the R&D expenditure will drop by 2% of the GDP. Moreover, the number of listed domestic companies positively influences the expenditures in R&D, therefore, incentivising innovation in business. There is also a negative correlation between the FDIIs and the investments in innovation, while the GDP growth and the high-technology exports positively influence the research and development expenditures. Almost 40% of the large Chinese companies are receiving aid from the government to innovate. At the same time, 20% of the SMEs benefit from the same support.

The regression analysis resulted in a correlation between the Japanese R&D expenditure as percentage of the GDP and the costs associated with the business start-up procedures. The negative correlation showcases that the capability of a country to invest in research and development, and, conclusively, in innovation, resides in the potential of the market to harbour more entrepreneurship, especially that activates in the technology sector. Japan is famous across the globe for its capacity to innovate and to develop radical technology, for overall business and economic performance, and mostly for its potential to optimize business models and management styles. Moreover, the exports in the sector of ICT are negatively correlated with FDIIs, GDP, and the profit tax as a percentage of the commercial profits. This is aligned with the implications of information and communication technology being directly and positively affected by innovation and entrepreneurship, rather than foreign investments or the level of gross national product. It also means that ICT exports are not manufactured locally, they are only repurposed and exported. The OECD study on the innovation policy and R&D expenditures from 2011, presents Japan, as confirmed also by this study, in the position where a value of more than 15% of its GDP has been directed toward business R&D, the majority of the funds coming from indirect government support through R&D tax incentives. This is particularly interesting because it shows that the business innovation and fiscal policies in Japan are consistent and are significantly shaping the market into a knowledge economy, with 20% of the large companies and 20% of the SMEs in Japan benefiting from the government aid to innovate.

The FDIIs and GDP in Singapore do not affect in any way the R&D expenditure and activities. Also, the general government final consumption

expenditure has no correlation with the research and development expenditures. The results confirm no apparent correlation with the ICT exports, or any entrepreneurial activity. The R&D sector in Singapore and the ICT domain seem to have no connection with the private innovation wave.

#### *African Countries – Nigeria, South Africa*

The correlation between the Nigerian ICT service exports, the high technology exports and the government final consumption expenditure is statistically significant at 5%, and the null hypothesis is rejected with extremely high confidence of 99.99%. There is a negative correlation between the ICT service exports – balance of payments at current USD value, and the high-tech exports at current USD value, stating that in Nigeria the manufacturing industry is not heavily invested in this field of technology. Moreover, the ICT service exports increase as the general government final consumption expenditure grows, which means that the individual and collective needs in Nigeria tend to be comforted by products and services from the technology field.

Although the magnitude of the correlation between South African R&D expenditures and the general government final consumption, the high-tech exports, and the ICT service exports is significant at 63%, the p-value does not support the statistical significance of the test. Therefore, there are no apparent influences from the three independent variables on the R&D expenditures of the South African government. There is, nonetheless, a correlation between the dependent variable and the medium- and high- technology manufactured exports, rejecting the null hypothesis with 80% confidence levels. Each 1% increase in the manufactured high-tech exports determines a 1.5% increase in the R&D expenditure. South Africa is one of the countries in the world which has an almost equal proportion of large companies and SMEs that innovate through public support and funding.

#### *American Countries – Brazil, Mexico, the United States of America*

It was established that the capacity of a state to become a knowledge economy resides in a number of adaptations in relation to its public institutions, and in relation to the business sector, by promoting innovative behaviour through transparent and competitive public policies. When assessing the role of R&D in the development of innovation, it can be concluded that the latter represents ground zero, a fundamental process that can promise economic growth. In this particular case of Brazil, by observing the results of the regression analysis on the data gathered from 2000 to 2019, it is obvious that investments in R&D do not come from FDIs, but rather from the state, and interested business counterparts are determined to push funds into different programmes for the creative development of entrepreneurship. There is a positive connection between the R&D and the ICT service exports in Brazil, as every 1% increase of the ICT service exports will determine a 2% increase in the funds allocated to research and development.

The expenditure of GDP directed by the Mexican government toward R&D is correlated to the level of FDI and GDP. Apparently, the developing economy of

Mexico does showcase the appeal it has to foreign investors, not particularly for innovation, but with side effects on it. For instance, it is clear from the regression analysis that, in Mexico, SMEs are not necessary the source of entrepreneurship, creativity, and innovation, as there is a negative relationship between the variables R&D expenditures and domestic listed companies. Nevertheless, start-ups are still a source of innovation, as there is a positive and statistically significant correlation between the expenditure in R&D and the number of new registered businesses. From the perspective of information and communications technology, the exports in this sector are mainly services rather than goods, and the high-technology exported is mainly manufactured locally. The OECD report on business innovation policy (2011) measured the tax incentives for businesses that invest in R&D, and the results are consistent with those of this particular study, which underline the general business innovation policy in Mexico together with its behavior-altering capacity of the whole Mexican economy. It is a country that clearly directs a consistent proportion of its direct government funding in the direction of business innovation and R&D.

The US government expenditures are directly and positively influencing the R&D sector, while the ICT service exports are not coming from the domestic manufacturing. Even though there is a worldwide agreement on the impact the US economy has on both the innovation and the ICT phenomenon, the results from the last two decades are not conclusive, and the SME public policy was not updated with measures and directives to pertain to the growing and evolving competitive global market. The US seem to lag behind in comparison to other countries in the world, but their efforts are also in part directed toward business innovation and R&D (OECD, 2011).

## 5 Conclusions

During the last two decades, the information and communication technology has completely transformed each and every sphere of the world, including that of business. The entire ICT phenomenon revolves around the concept of radical changes in services and business models, with the introduction of user experiences such as AR and VR, the digitalization of services and analytics, with big data and innovation, and in the regulations, with net neutrality agreements, security of data, machine learning behaviour. According to the World Bank, the telecommunications, as part of the ICT, represent an essential element in any country's economic development and performance, and it goes further into tested behaviour on the real market, where increases in the Internet connectivity, for instance, have determined waves of growth in the overall economy. Nevertheless, the forces of the ICT context are both powerfully disruptive as they are of benefit, determining the need for a complex regulatory framework for the new reworked business world.

The current research browses through correlations between the innovation spending (R&D expenditure and ICT goods/service exports/imports) and the

worldwide business behaviour influenced by the policy-making process, by addressing variables such as cost of business start-up procedures, general final government consumption expenditure, or high-technology exports. Ultimately, the paper regards the capability of the ICT for innovation within existing business models to increase market size, to reduce entry barriers, and to leverage the knowledge in each business sector, determining the re-engineering of all business processes. Considering the results of the regression analysis, it can be concluded that the European countries – France, Germany, and the UK – have been facilitated toward the principles of knowledge economy through the expansive and consistent European innovation public policy and programmes for development. Among the three European countries, France and Germany proved, by the results of this study, that FDIs and proportions of GDP are directed toward the R&D sector, which, in turn, determines a significant level of high-technology being exported from those two countries. The UK is also actively developing and implementing programmes to help with the innovation processes, their attention being mostly covered by the ICT service exports which attracts a significant proportion of the UK's GDP. Moreover, the results of this study are aligned with the data from OECD, as well as with the extensive research regarding the business innovation policy in the European Union.

Since there are not too many studies on the topic at a global level, the results of this research have also shed a light on the performance of other economies than those of the EU in relation to their innovation policy and ICT absorption. For instance, the Asian continent has been represented in this study by China, Singapore, and Japan. Although the results might also be consistent with the quantity of data, Singapore is a country where the R&D and ICT sectors seem to have no connection with the effects of any public policy incentivising the development of the two fields. On the other hand, China is leading in Asia as a powerful economy, a global manufacturer, but also, as this study determined, a consistent amount of the GDP expenditure is directed toward R&D and innovation development. Moreover, the Chinese government is diminishing the bureaucratic burden on domestic companies, with the scope of incentivising entrepreneurship and innovation. Japan is also associating proportions of its GDP with the field of R&D, especially in the high-tech sector, and it proved by the results of this study that the ICT sector is directly and positively influenced by the overall performance of businesses. From the perspective gained on the results from the African countries, Nigeria does not appear to be politically active in promoting entrepreneurship and innovation. The manufacturing industry in Nigeria is not investing in the technology sector, although given the correlation between ICT services and the government final consumption expenditure, the citizens are very much expected to invest in technology products and services. In South Africa, the government is somewhat more persistent than in Nigeria in directing funds toward innovation and R&D. Given that the OECD study showed that the South African companies are receiving public and private funds to innovate, this study also proved that the high-tech manufacturing in this country is gaining ground. The

most promising countries with developing economies active in investing in the R&D and the ICT sectors have been from the American continent. The United States of America, as demonstrated by this study, direct portions of the GDP into R&D, but their ICT products and services are not an outcome of their high-tech manufacturing industry. The surprise came from Brazil and Mexico. In Brazil, according to this study, the government has considered and directed funds toward R&D, and had managed to develop a manufacturing industry of medium- and high-technology. At the same time, Mexico has managed to attract both government funds and FDIs to the R&D sector, determining a positive correlation between the expenditure in R&D and the number of new businesses in the Latin American country. Moreover, the Mexican economy is partly based on the medium and high-tech manufacturing industry and exports.

The world is, therefore, one step closer to the knowledge economy, as countries all over the globe, including developing countries, consider the sector of business innovation and public policy reform. It is considered by many researchers that our world is currently passing through the fourth Industrial Revolution, characterized by deep transformation, fused by knowledge and digital technologies. The potential of innovation through the intensive expenditure in R&D and the development of high-tech devices and machinery is the embedded catalyst for accelerated business architecture. It is, therefore, the velocity of transformation that stands witness for the magnificent power of the unified communications technologies, and their effect on the business momentum, through the usage of R&D expenditure, and the impact of policy making on the latter.

#### **Acknowledgment:**

This publication was realised with the EEA Financial Mechanism 2014-2021 financial support through the Project School of Knowledge Production and Transfer for Global Economy and Governance, contract number 18-COP-0032. Its content does not reflect the official opinion of the Programme Operator, the National Contact Point, and the Financial Mechanism Office. Responsibility for the information and views expressed therein lies entirely with the authors.

#### **References**

1. Aydogan, N. (ed.) (2009). *Innovation Policies, Business Creation and Economic Development: A Comparative Approach*. New York: Springer Science+Business Media, LLC.
2. Carayannis, E.G., Formica, P. (eds.) (2008). *Knowledge Matters: Technology, Innovation and Entrepreneurship in Innovation Networks and Knowledge Clusters*. New York: Palgrave Macmillan.
3. Chan, H.K. (2015). *Big Data Research for the Knowledge Economy: Industrial Management & Data Systems*. Emerald.
4. Cunningham, S. (2013). *Hidden Innovation: Policy, Industry and the Creative Sector*. St. Lucia, Queensland: University of Queensland Press.

5. Dodgson, M., Gann, D.M., Salter, A. (2008). *The Management of Technological Innovation: Strategy and Practice*. New York: Oxford University Press.
6. Dolfsma, W., Soete, L. (eds.) (2006). *Understanding the Dynamics of a Knowledge Economy*. Cheltenham: Edward Elgar Publishing Limited.
7. European Commission (2012). *Knowledge-intensive (business) services in Europe*. Directorate General for Research and Innovation. Luxembourg: Publications Office of the European Union; 58.
8. European Commission (2017). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions Europe on the Move: An agenda for a socially fair transition towards clean, competitive and connected mobility for all*. Brussels: EUR LEX; 18.
9. Feldman, M.P., Link, A.N. (eds.) (2001). *Innovation Policy in the Knowledge-based Economy*. Boston: Kluwer Academic Publishers.
10. Fleisher, C.S., Harris, P. (eds.) (2016). *The SAGE Handbook of International Corporate and Public Affairs*. London: SAGE Publications.
11. Hanushek, E.A., Woessmann, L. (2015). *The Knowledge Capital of Nations: Education and the Economics of Growth*. Cambridge, Massachusetts: MIT Press.
12. Hill, M., Varone, F. (2017). *The Public Policy Process*. Seventh Edition. Abingdon, Oxon: Routledge.
13. Howlett, M., Mukherjee, I. (eds.) (2017). *Handbook of Policy Formulation*. Cheltenham: Edward Elgar Publishing Limited.
14. Howlett, R.J. (eds.) (2011). *Innovation through Knowledge Transfer 2010*. Berlin: Springer Verlag.
15. Jaffe, A.B., Lerner, J., Stern, S. (eds.) (2006). *Innovation Policy and the Economy*. Cambridge, Massachusetts: MIT Press.
16. Leydesdorff, L. (2006). *The Knowledge-based Economy: Modeled, Measured, Simulated*. Boca Raton, Florida: Universal Publishers.
17. Lytras, D.M., Daniela, L., Visvizi, A. (eds.) (2019). *Knowledge-intensive economies and opportunities for social, organizational, and technological growth*. Hershey: IGI Global.
18. Management Association, Information Resources (2015). *Public Affairs and Administration: Concepts, Methodologies, Tools, and Applications*. Hershey: Information Science Reference – IGI Global.
19. Mangabeira Unger, R. (2019). *The Knowledge Economy*. London: Verso.
20. Nooteboom, B., Stam, E. (2008). *Micro-foundations for Innovation Policy*. The Hague/Amsterdam: Amsterdam University Press.
21. OECD (2011). *Business Innovation Policies: Selected Country Comparisons*. OECD Publishing. <http://dx.doi.org/10.1787/9789264115668-en>
22. Ross, P.K., Ressa, S., Sander, E.J. (2017). *Work in the 21<sup>st</sup> Century: How Do I Log On?* Bingley: Emerald Publishing Limited.
23. Seber, G.A.F., Lee, A.L. (2012). *Linear Regression Analysis*. Second Edition. Hoboken: John Wiley & Sons, Inc.
24. Sholts, M.T. (2005). *Public Affairs and Information Operations – A Strategy for Success*. *Air & Space Power Journal*, p. 97-106.