



INNOVATIONS AND INDUSTRIES OF THE FUTURE: EXAMPLES OF THE DEVELOPMENT OF BULGARIA

Цветан Илиев
Tsvetan Iliev

Международно бизнес училище – Ботевград
International Business School – Botevgrad

Abstract: The article aims to present the main guidelines for the development of innovation activity in the industries of the future – genomics, robotics, and cybersecurity. In this context, the possibilities for shaping innovation centres as perceived by certain cities and regions in the world are presented. The role of “big data” in the information of such centres is substantiated, and, on this basis, a trend is outlined for the establishment of companies for processing large information arrays, which combine the expert potential in the field of informatics and computers and expert resource in the specific industrial field. Factors and conditions of the external and internal environment have been identified in the implementation of innovation activity by the companies which support or hold back the innovation process.

Keywords: innovation; industries of the future; innovation process.

JEL: O31, O32

Introduction

The innovation processes that unfolded in the second half of the 20th century in the conditions of the Third Wave (Toffler, 1992, pp. 50–57), defined as the information and communication era, as well as the accelerated globalization on this basis, created conditions for achieving significant progress in many different spheres of social and economic life. The progress made a number of companies, countries and regions profitable, and it gave them the impetus to accelerate their innovation activities. A part of the benefits was appropriated by investors, entrepreneurs, and highly skilled labour associated with the fast-growing markets and new industries that had emerged as a result of the accelerated adoption of invention. Another set of benefits was felt by a significant portion of the world’s population that moved from the poor to the middle class. This is due to the fact that relatively low-paid labour was realized as an advantage when their countries opened up to the world and with their closer participation in the global economy.

On the threshold of the Fourth Industrial Revolution (Schwab, 2016), we are witnessing a deepening of innovation processes and the emergence of a number of industries based on them, which predetermine a new direction of development at a company, national, regional and global level.

1. The Industries of the Future: A Field of Innovation Growth

Modern innovation potential and activities are inherent primarily to transnational corporations (TNCs). In the development of innovations today, territorial concentration is only characteristic of a limited part of them. As far as the industries of the future are concerned, no such trend exists yet. The most

interesting innovations occur at a much greater geographical fragmentation. There are already leaders in each of the innovative fields. (Ross, 2017, pp. 6–11)

The development of innovation in each of the industries of the future has its own characteristics. In genomics, for instance, the work to make it widely accessible is concentrated in the university campus where much of the development took place. It means Boston because of Harvard and MIT, Baltimore because of John Hopkins, Silicon Valley because of Stanford and the University of California at San Francisco and Berkeley. The other main wing of genomics is in China. Despite not having a university programme in genetics, this country does a good job of attracting its citizens back home after studying abroad. This is also why Beijing is quickly becoming a centre of expert genomics resources. (Prodanov, 2021, pp. 98–99)

In robotics, expert resources, as well as initial commercial leadership, are generally concentrated where expertise already existed in electronics and high-tech manufacturing. This includes countries such as Japan, South Korea, and Germany.

In the realm of the cyber industry, companies are usually located close to governments, as the best cyber experts have been developed in the military industrial complex and law enforcement institutions. The centres of this industry are Washington, Tel Aviv, London, and Moscow. Europe's first Cylon cybersecurity accelerator was created by two foreign policy advisers to British Prime Ministers. One of the largest cybersecurity companies in the world, Kaspersky Lab, is made up of former Russian military intelligence officers.

In Israel, these companies were founded by people who took their first steps in cyberspace in the defence forces, and especially in the Yehuda Shemoneh-Matayim Squad 8200 of the intelligence. (Prodanov, 2021, pp. 103–104)

Although the industries of the future offer new opportunities to create centres of innovation around the world, Silicon Valley continues to attract new high-tech companies from almost every industry. The reason is that the region's expertise in software and computer analytics spans entire industries, which leads to centralization (Ross, 2017). In other words, Silicon Valley companies are gradually beginning to lead activities that require software and big data, which are practically inherent in a wide range of industries today. Countries with many young people with higher education and low wages actively export intellectual potential. Examples of such a process can be given with Lithuania, Estonia, Latvia, India, China, etc. (Harari, 2019, pp. 36–40)

In short, the countries that possess the largest amounts of data, the fastest servers and the most processing power will lead the entire economic growth of the world in the future. (Kramarenko, 2021) The data on the companies that registered the most patents in the USA in the period 2020–2021 are indicative in this regard. Among them, above all, the ones from the field of high technologies and the software industry stand out; they are the main generators of world growth (Figure 1).

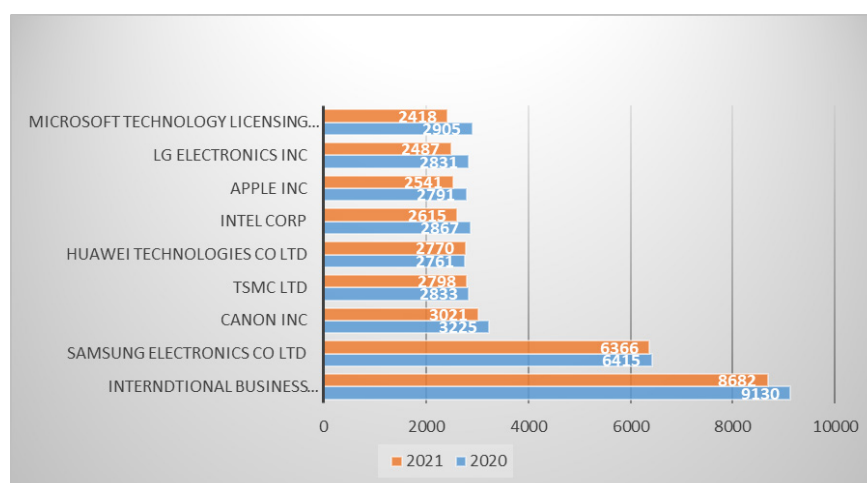


Figure 1. Companies with the Most Patents in the USA Granted in 2020 and 2021

(Source: <http://www.statista.com/statistics/274825/companies-with-the-most-assigned-patents/>)

There is no doubt that the big data economy will reach far beyond the confines of Silicon Valley. Moreover, in the next few decades, the big data market may become a source of revival and revitalization of old industrial centres where there is already enough expert potential.

The establishment of companies for the processing of large information arrays require a combination of expert potential in the field of informatics and computers and an expert resource in a specific industrial field. Germany, for instance, uses its expert resources in logistics and home appliances to gain a foothold in the analogue market in this traditionally strong field of activity (Kagermann, N., Wolfgang, J. H., 2013).

The experience of New Zealand is also of interest, where the combination of large datasets and expert resources is a typical example of the industries of the future. The country's precise Pasture Meter agriculture technology uses modern sensors, with the help of which 200 measurements per second are made on huge pasture areas and support agribusiness.

The system informs farmers about the amount of forage they have available and identifies low-yielding areas that need farmer intervention (e.g. additional fertilization). Traditional pasture evaluation technology, such as ultrasonic devices, typically takes 250 measurements per pasture, while the Pasture Meter system takes 18 500. The technology can be used by anyone with a phone and works regardless of external factors like charge of time.

From the examples given, it can be concluded that the development strategies rely much more on building on strengths than on attempts to compensate for weaknesses. In practice, this means stopping attempts to catch up with Silicon Valley and the like, and focusing efforts on the skills and processes that will generate the next wave of innovation in areas and activities where the expertise is already available.

2. Spatial Aspect of Innovation Processes

The geographical spread of expert resources in the innovation economy ensures that the next stage of globalization will create centres of innovation and mass production with far greater geographical diversity than the previous stage in which California, for example, enjoyed twenty years of dominance. As big data become more widespread, it will take on more of a commodity or raw material that could be used by any industry. For stakeholders with a sufficiently high level of expertise, opportunities also exist for significant personal innovation.

When an organization is too slow to adapt, it is likely to be displaced by more efficient, albeit less expert organizations with computer and IT expertise such as Uber. Companies of this nature are able to carry out subversive actions against organizational structures with decades of professional experience in the specific field. (Prodanov, 2021, pp. 135–140, 157–160, 163–165)

On the other hand, expert potential is always concentrated in cities. Geographically, the focus of innovation is almost always centered on cities. This is understandable, considering that, since the age of feudalism through industrialism to today, cities have been incubators of growth. They create the conditions and facilitate the rapid and efficient flow of ideas, labour and capital. In them, talent is directed in a much more specialized way. According to the specified characteristics, research on the spatial positioning of innovations classifies cities into three groups: alpha-, beta-, and gamma-cities. From an economic point of view, alpha-cities are the most important. For example, Shanghai, London, New York and Tokyo are accepted as such. With their export of modern goods and services all over the globe, they have formed and established themselves as a kind of mini economies (Eduard, 1994, pp. 9–47). One is much more likely to come across an American who is a leading global innovator in an alpha-city like Shanghai or Dubai than to see him in St. Louis (Missouri) or Manchester (England). Such people are concentrated in a limited number of cities, forming a kind of circle that includes New York, San Francisco, Seoul, Singapore, Hong Kong, Tel Aviv, and London. Among researchers of the spatial positioning of innovation, they are known as globally engaged cities (Athley, G. et al. 2007). The most innovative cities in the UK, for instance, are those with the most registered patents. From what is presented in Figure 2, it is clear that these are Cambridge, Coventry, Oxford, Derby, Swindon, and Aberdeen.

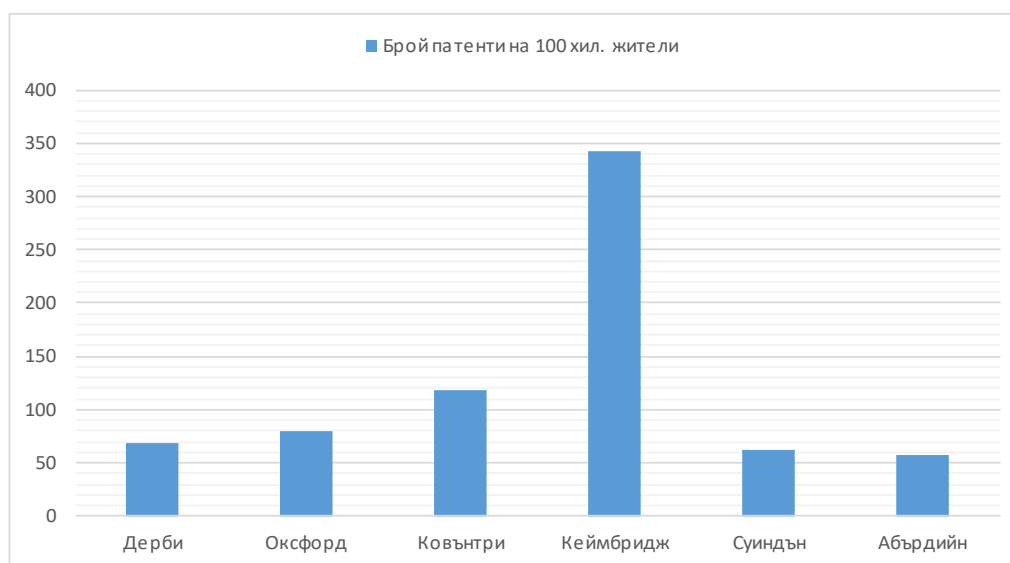


Figure 2. Most Innovative Cities in the UK
According to the Number of Patents per 100 000 Inhabitants
 (Source: <https://www.statista.com/chart/7943/the-uks-most-innovative-cities/>)

As for beta- and gamma-cities, they connect smaller regions such as Berlin, Frankfurt and Munich. Although they are not in themselves economic centres of the rank of alpha-cities, they nevertheless make a significant contribution to the regional network that drives Germany's national success. Each of them occupies a specific niche of material production and services and together they lead Germany to prosperity. (Beaverstock, 2011, pp. 213–217)

An important aspect of the development of large cities is the infrastructure along with the software programs that allow people to use it more efficiently. This in turn is related to the structural timetable of passenger transport, electronic service, receiving information in real time, etc.

At the same time, the entry of big cities into the world of high technology means that it is the global centres, rich in financial terms and with many opportunities, that are most likely to take advantage of the most attractive applications of large bases for their citizens' data. Cities aspiring to become global hubs, such as Jakarta, São Paulo and Bombay, are required to simultaneously invest in the physical infrastructure and big data software products that typically go into such infrastructure. This helps to create conditions for attracting large investments.

In addition to infrastructure, other drivers of growth in the world's leading urban centres can be identified. Such is, for example, the culture of openness, characteristic even of those of them located in counties with more conservative social orders. The cities that move forward in the global economy are those that are most open to the outside world. Historically, cities open to the world have been connected by a culture that welcomes people from all corners of the earth and that encourages the free exchange of ideas and goods to make them attractive places to work and live (Braudel, 2014, pp. 61–62). The combination of efficient infrastructure and acceptable population density provides free access to other people – the communication and exchange of ideas are greatly facilitated. Economic openness does the same in the realm of business. Political openness ensures that everyone in a society can meet, gather, work and speak without restriction. These degrees of openness provide insight into what it takes for a city to become a hub for the industries of the future, even in countries where there are currently no alpha-cities.

3. Innovation Activity and Technology Transfer at the Company Level

According to T. Georgieva, “in the implantation activity by companies, factors and conditions of the external and internal environment act that support or restrain the innovation process.” (Georgieva, 2018, p. 52)

The innovation process includes the systemic interactions between the following institutions: scientific and academic institutions; technology intermediaries and consulting organizations; public institutions and governance; financial infrastructure; market demand.

The framework conditions for the implementation of the innovation process include a propensity for innovation activity, the presence of a certain educational level, a favourable financial environment, the amount of taxes and the existence of tax preferences, trust between partners, mobility of material and human resources and capital.

L. Mateeva divides the factors affecting the innovation activity of the companies into two main groups: micro-level factors and macro-level factors. Each of these groups includes two streams of sub-factors: institutional and economic. (Mateeva, 2002, pp. 105–134)

Micro-level institutional subfactors include subject of activity, legal status, age of companies, and size of companies. In turn, the economic subfactors at this level include: innovation activity (including the share of research and development costs in the total company turnover and implementation of innovation – new machines and equipment, new processor technologies, new products and services, innovations in organization, and new information and communication technologies) and markets for the realization of company products.

At the macro-level, the group of institutional subfactors refers to: interaction of companies with institutions from the innovation system at the national, European and international levels; companies' use of programmes promoting technological transfer at the national and international levels; companies' use of institutional sources to finance technology transfer at the national, European and international levels; legislation regarding foreign investors; intellectual property protection; educational level; scientific potential; technological development in the sector of economic activity of the respective company; and level of infrastructure development.

Economic subfactors include: level of economic reforms; market size; availability of free production facilities; level of labour costs; opportunities to extend the life cycle of technologies; level of duties, taxes and fees; level of capital market development; and existence of natural resources for production activity.

Institutional factors influencing the implementation of innovation processes and technological transfer in particular are of significant importance (Adams, 1994, pp. 424–425). Much greater depth for both the innovator entity and the adopter entity, as well as a new interaction between science, technology, knowledge acquisition, production, politics and consumption are required. In the emerging new economic environment, companies cannot act independently, closed in their own frameworks, in limited spheres of relationships. They have to innovate in conditions of technological exchange and interaction with any organizations with a view to acquiring resources, developing human capital, managing knowledge, exchanging information and maintaining communication networks, as well as in a number of other aspects of economic and social relations (Hodgson, 1994, pp. 397–402). The context of the modern innovation system is built on the basis of the interactions between various institutions involved in the innovation process.

Conclusion

Modern innovation potential and innovation activities are primarily inherent to transnational corporations. They are the main drivers for creating the industries of the future, which offer new opportunities to create centres of innovation around the world. The development of innovation in each of the industries of the future has its own characteristics. One of the features of this process is related to the location of the universities where much of the initial development activity takes place. Another feature is the presence of experience in electronics and high-tech production. A third feature is related to the possession of large amounts of data, fast servers and serious processing power. It is these things that, in the future, will predetermine the possibilities of achieving economic growth at the global level.

From the examined examples of innovation activity in the direction of developing industries of the future and achieving growth, it can be concluded that the development strategies of various countries and companies rely much more on building on strengths than on attempts to compensate for weaknesses.

In practice, this means that trying to catch up with the advanced must stop. Rather, efforts need to focus on the skills and processes that will generate the next wave of innovation in areas and activities where country- and company-level expertise is already available.

REFERENCES

- Adams, J. (1994).** International economic relations. In Hodgson, G. (Ed.). *The Elgar Companion to institutional and evolutionary economics* (pp. 424–425). Aldershot: Edward Elgar.
- Athey, G. et al. (2007).** *Innovation and the city. How innovation has developed in five city-regions*. Research report. https://media.nesta.org.uk/documents/innovation_and_the_city.pdf (viewed 10 Dec. 2022)
- Beaverstock, J. V. (2011).** German cities in the world city network. *Raumforschung und Raumordnung*, 69(3) 213–217.
- Braudel, F. (2014).** *A grammar of civilisation* (pp. 61–62). Sofia: Iztok-Zapad.
- Companies with the most U.S. patents granted to them in 2020 and 2021. <http://www.statista.com/statistics/274825/companies-with-the-most-assigned-patents/> (viewed 2 Feb. 2023)
- Eduard, L. (1994).** “Glaeser, cities, information and economic growth.” *Cityscape*, 1, 9–47. <https://www.jstor.org/stable/20868363> (viewed 22 Dec. 2022)
- Georgieva, T. (2018).** *Evaluation of the organisation’s innovation management* (p. 52). https://www.researchgate.net/publication/317168144_Ocenka_na_inovacionnia_menidzmnt_na_organizaciata/link/59282375458515e3d466744b/download (viewed 31 Jan. 2023)
- Harari, Y. (2019).** *21 lessons for the 21st century* (pp. 36–40). Sofia: Iztok-Zapad.
- Kagermann, H., & Wolfgang, J. H. (2013).** *Securing the future of German manufacturing Industrie 4.0*. Working group. Recommendations for implementing the strategic initiative INDUSTRIE 4.0. <https://www.din.de/blob/76902/e8cac883f42bf28536e7e8165993f1fd/recommendations-for-implementing-industry-4-0-data.pdf> (viewed 6 Feb. 2023)
- Kramarenko, A. (2021).** The new quality of geopolitics: ‘Cabinet Wars.’ *Geopolitics*, 18(4).
- Mateeva, L. (2002).** Technology transfer from Austrian to Bulgarian companies (Empirical study). *Economic Studies*, 3, pp. 105–134.
- Prodanov, H. (2021).** *Exponentiality, convergence and disruption of digital technologies, economies, societies* (pp. 98–99, 102–104, 135–140, 157–160, 163–165). Sofia: PH-UNWE.
- Ross, A. (2017).** *The industries of the future* (pp. 6–11). Sofia: NSM Media.
- Samuels, W. J. (1994)** “Institutionalism, ‘old’ and ‘new.’” In: Hodgson G. M. et al. (Eds.). *The Elgar companion to institutional and evolutionary economics* (pp. 397–402). Aldershot: Edward Elgar.
- Schwab, K. (2016).** *The Fourth Industrial Revolution*. Sofia: Hermes.
- Toffler, A. (1992).** *Future shock: Folk culture* (pp. 50–57). Sofia.

Contacts:

Tsvetan Iliev, Professor, PhD
International Business School – Botevgrad
Office address:
Botevgrad, 14 „Gurko“ Str.
Email: tsiliev@ibsedu.bg
