

## **INNOVATION, TECHNICAL PROGRESS AND ECONOMIC DEVELOPMENT**

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**Abstract.** The aim of the article is to show through a theoretical overview that there is an inextricable link between economic growth, technological progress, innovation and intellectual property. This connection has been realized since the dawn of economic science, by economist theorists who, even without mathematical models, and some of them even before a terminological and legal framework covering the matter was created, managed to prove that without innovations and technologization of production and labor skills, it is not possible to achieve sustainable economic growth. The relationship between innovation and economic growth is also depicted through the EC's innovation development index, where the difference in assessment between the developed economies of the so-called "Western world" and developing, commodity economies.

**Keywords:** innovation; technological progress; economic growth; intellectual property

### **1. Introduction**

Theories that try to explain why some countries are richer than others and why some economies develop better and faster than others are numerous. Economists have been trying to explain this phenomenon since the dawn of economic science. In today's developed world, when making a retrospective analysis, it can be concluded that the reason for these differences in the development of different economies in the world are new technologies, innovations and the intellectual property behind them. In industrialized and developed countries, various forms of intangible assets such as knowledge, information, ingenuity and creativity are rapidly displacing the traditional and tangible assets that have driven the world for centuries – land, labor and capital. Intellectual property has become a driver of economic health and social well-being. In today's increasingly digital world, „innovation is the driving force of the new economic reality“ (Stoyanova 2022), and „intellectual property continues to be the main tool for achieving technical progress, and hence economic growth“ (Petrova 2021).

## **2. The economists for technological progress**

A quick and brief look at some of the theories of economic thought in history immediately shows that not only in more modern times, but also at the dawn of economic science, technological development was considered one of the main building blocks of economic prosperity. Even in times when the economy was built on land, labor and capital, economists put the need for innovation into the equation, albeit as a secondary element.

Even Adam Smith (2010[1776]) believed that technology would contribute to the increase in labor productivity. For him, the division of labor acts as a catalyst for invention and hence for technical progress.

Joseph Schumpeter (Schumpeter, 1939) was among the first twentieth-century economists to recognize the fundamental importance of technological change in modern capitalist economies. His theory of growth focuses on invention and entrepreneurship. Schumpeter points out three ways of influencing innovations on the economic cycle, and hence on growth:

1. Major innovations, as well as numerous smaller ones, lead to the construction of new plants and equipment, or to the restoration of such, requiring considerable time and expense;

2. Most new companies are created with a specific purpose – to embody new technologies and innovations. When this goal is fulfilled, or no longer relevant, or no longer likely to be achieved, firms cease to exist;

3. Innovation is always associated with new entrepreneurs and investors taking the lead.

According to Schumpeter (Schumpeter 1939), innovations are the factor that brings the economy out of equilibrium. Entrepreneurs take advantage of a newly discovered and developed technology by making it work for the market. Their main goal is the opportunity to make a profit. Thus, by bringing the new technology to market, the economy becomes unbalanced, bringing large profits to the entrepreneur and increasing market asymmetry. Subsequently, new technologies that entered the market are copied and further developed, which leads to a decrease in the profit opportunities of entrepreneurs and, accordingly, to the gradual balancing of the economy and the market. As a result of their profits starting to decline, entrepreneurs start looking for new investment opportunities in new technologies, rebalancing the economy and starting the next business cycle. The economy goes out of balance because the relevant innovations have an impact in a specific industry or a group of industries that are related to each other, and the random nature of the emergence of innovations gives rise to the uneven development of the economy.

The Stockholm School of Economics also gives its view on the role of technological progress and innovation in economic growth. According to Gustav Cassel (Cassel 1967), economic cyclicity is the price humanity pays for technical progress, because only in this way the transition from one technology to another,

the emergence of new industries and the restructuring of production, and hence the maintenance of the periodicity of economic development can be ensured. Knut Wicksell (Wicksell, 1936[1898]) defines the unstable dynamics of technological development as one of the factors that have a significant impact on the cyclical fluctuations of the economy.

The theory of real business cycles takes shocks in aggregate supply as the cause of cyclicalities in the economy, and shocks can be positive or negative in nature. For shocks of a positive nature, the theory accepts new inventions, innovations, the discovery of new deposits of natural resources, etc. These positive supply shocks lead to increases in productivity and GDP (Ganev 2015). A key factor is technological progress, which determines long-term growth and the business cycle (Kydland and Prescott 1988).

Neoclassical economists led by Robert Solow (Solow 1994) focus their attention on technical progress as an important variable in economic growth. In his research, he came to the conclusion that only about 20% of GDP growth was due to an increase in capital investment. The remaining unexplained portion of growth, which became known as the „Solow residual“, he attributes to technical progress. Solow introduced technical improvements as an exogenous variable in his growth model and changed the way economists perceived the contribution of technical progress to the economic growth of countries. According to him, how much an economy will grow depends on the growth of capital, labor and technological improvements. Solow is trying to prove that an economy will grow when most of its total output is diverted for investment or if there is a large growth in the technological level. In Solow's model, technical progress is the key factor that causes economic growth. The economic policy of the state does not have a significant impact on scientific and technical progress, and the growth itself is weakly influenced by the economic situation. In other words, for Solow, technological progress is an exogenous variable that can influence economic policy, but the direct relationship is only one-way. Solow makes no attempt to explain where technology comes from, but the very inclusion of technological progress in his model shows that a country with a higher rate of technological development (and hence productivity) will enjoy a higher standard per life compared to countries that do not have such growth. Nowadays, this is particularly evident when comparing the standard of living in the developed countries of the “Western world” and developing economies that rely mainly on natural resources to sustain their economies.

Paul Romer (Romer 1986) also introduced a model in which the accumulation of knowledge is the driving force behind economic growth. The model assumes a monopolistically competitive environment and assumes that research activity, together with the accumulation of human capital through education and training, has an important role in generating long-term growth in per capita income.

### **3. Intellectual property, innovation, technological progress, economic growth**

There is an inextricable link between the terms intellectual property, innovation and technological progress. In essence, each of them is a building block of a larger whole. Technological progress can be defined as the process of the invention of new machines, the introduction of new technologies, methods and products, as it represents a building block of economic growth and the improvement of economic well-being.

Innovations are one of the building blocks of technological progress, and hence of long-term economic growth and stable and sustainable development of an economy. Many definitions of what innovation is can be given, and none of them can be singled out as the only true one: innovation often arises from new combinations of existing knowledge (Schumpeter 1934); innovation is the practical application of ideas that leads to the introduction of new goods or services or the improvement of the supply of goods or services (Schumpeter 1934); innovation focuses on the concepts of renewal, modernization and change (King and Anderson 2002); innovation is something new and intentional with an often uncertain, risky and unpredictable outcome (Angle 2000); ISO 56000:2020(en) defines innovation as „a new or changed entity realizing or redistributing value“ (Iso.org).

Economic prosperity is not possible without technological progress, technological progress is not possible without innovation, likewise innovation is not possible without intellectual property. Intellectual property is the building block of innovation, and hence, along the chain, of economic development.

In order for intellectual property to be a building block of economic development, it must be protected. In order to be able to protect intellectual property, it must be part of the economic policy of the state. According to Promo Braga (1998), there are two main things that differentiate countries in their economic development – on the one hand, the amount of resources a country devotes to the creation of intellectual property and, on the other hand, the amount of protected knowledge and information that is used in production and consumption.

The role that intellectual property rights have on economic development is the subject of a number of models and studies that reach similar conclusions. Maskus (2000) emphasizes that how effective intellectual property rights will be in development and growth depends on various circumstances, which can vary greatly from country to country. Too strict, but also too soft intellectual property protection systems can both have a positive impact and stimulate creativity, and hence growth, and stifle the creative impulse in society, resulting in limiting the potential for economic growth. The effects on economic growth and technological progress are positive only if intellectual property protection systems are structured in such a way as to promote competition, as „well-structured intellectual property protection policy stimulates economic growth“ (Strijlev 2019). But in this direction the relationship is two-way.

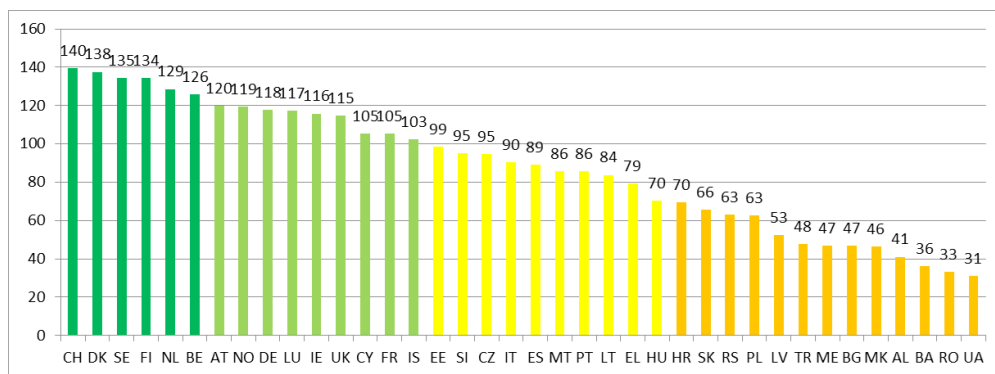
National intellectual property protection systems are highly dependent on the level of economic development. Technology and innovation develop at a much faster and larger rate in economically stronger countries than in less wealthy economies. A similar analysis is made by Aleksandrov (2022), examining the role of patents for economic growth at the micro and macro level, comparing highly technological and rich countries and companies with those that are highly dependent on natural resources and raw materials. Similar conclusions are reached by Straus (2006) and Maskus (2002), according to which the strengthening of intellectual property protection in developing countries, particularly in Brazil, China, India and South Africa, has led to a dramatic increase in foreign direct investment, which is believed to have contributed to economic growth.

Innovation, in the form of the introduction of a new or significantly improved product, process or method, is at the heart of driving economic growth and productivity. Innovation can help accelerate economic recovery and put countries on the path to sustainable and greener growth. Innovation and economic growth are closely related. Each drives the other, so innovation is a key component in governments' policy agenda (Hsu et al. 2014). This is observed in technologically developed countries such as Japan, South Korea, and in the last decade also in China, where investments in innovation and technological development are not just part of company policy, but also part of the state policy for economic development of the country. As the main economic agents of the modern world economy, the well-structured and guided policy of private companies is the basis of the functioning of world markets „...those enterprises that invest in creating new, patentable technological solutions and seek protection through the intellectual property system are competitive and well positioned in a technological and economic aspect in the global market. Intellectual property is a key factor in their leadership market positions.“ (Konstantinov 2023). The use of intellectual property in the activity is a strategic decision for any company, and „choosing the most effective strategy is one of the fundamental decisions for any company. In a global, highly saturated and very well-developed digital market, strategic guidance and evaluation of the most effective strategy are needed. Adequate strategy and proper management of intellectual property help companies recover their investments.“ (Todorova 2020).

The two-way relationship between the economy and innovation can develop at different levels – company, regional, state. „In a free market economy, the products of creative labor have the characteristics of an economic good intended for market exchange and consumption. The international legal system of intellectual property, in turn, is designed to protect creators and creativity, recognizing for a certain period the exclusive rights of creators over the results of their creative work. Protection and exclusive rights are granted because of investing in the unknown, taking risks and entering 'territory' where the unknown does not allow accurate calculation of the chances of market success.”

(Krushkov 2020). In their study, Atun et al. (2007) show that the management and regulation of intellectual property benefits economic growth by providing incentives for innovation without hindering knowledge transfer. Rossberger and Krause (2015) show that countries that have a large share of a highly educated workforce achieve higher welfare and a higher availability of resources that are used for investment in innovation. Traditionally, the population of economically more developed countries have better access to education at all educational levels, which, therefore, results in the causal relationship - higher education – developed innovation activity – economic growth. Gurry notes that with the increasing importance of knowledge as a driver of innovation and economic growth worldwide, intellectual property rights are becoming central to the modern economy. „The positive thing about intellectual property is that it is of an intangible nature and is therefore highly mobile, for this reason the physical crossing of borders and its relocation to other territories is significantly easier, especially in the era of the information society.“ (Nachev 2022).

A number of prominent economists, including Joseph Stiglitz (2008), believe that the differences between developed and developing countries are not only gaps in resources, but also gaps in knowledge and information. Therefore, the success of economic development will be the reduction of this gap. In Europe and in the EU in particular, there are significant differences between countries with high innovation capacity and countries with low innovation capacity, and the process of convergence between them is very slow and highly uneven (Veugelers 2016). This is also confirmed by the annual European Innovation Index, which is prepared by the European Commission for the innovative development of the countries in Europe. Figure 1 shows the results of all European countries.



**Figure 1.** European Innovation Index (whole Europe)

Source: [https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard\\_en](https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en)

Measuring the innovativeness of an economy is a very difficult undertaking, there are various models and assessment methods, but none of them can claim absolute accuracy. The most frequently used and probably the most reliable of all is the European Innovation Index, which is developed annually by the European Commission. The European Innovation Index (EII) is a composite indicator that reflects both the innovation capacity and the innovation position of the economy (Kowalski 2020a).

The annual EII, shown in Figure 1, with EU member states plus the rest of non-EU European countries included, provides a comparative assessment of research and innovation output and the relative strengths and weaknesses of their research and development and innovation systems. It is based on certain evaluation rules and helps countries to assess the areas where they should focus their efforts to increase their innovation performance.

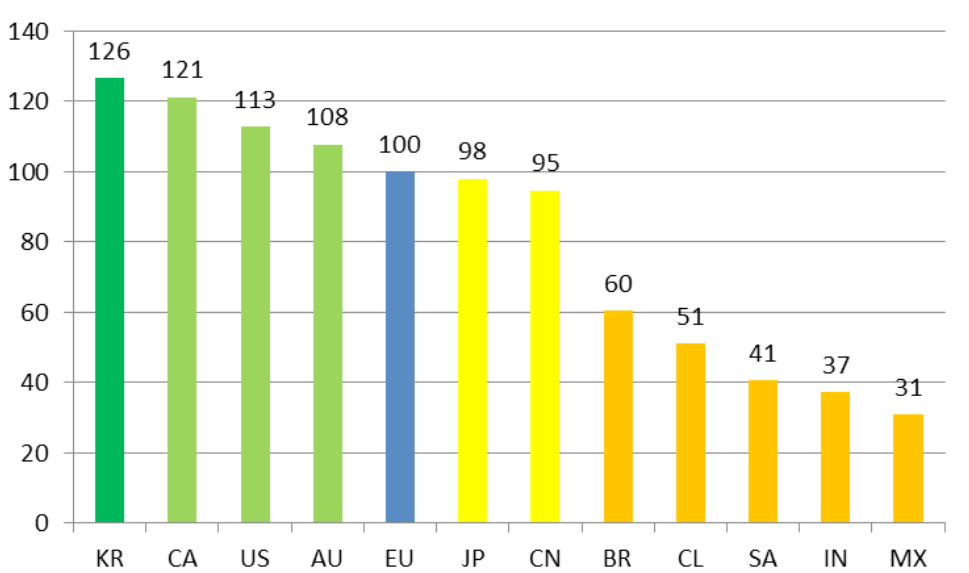
Innovation performance is measured using a composite indicator that summarizes the results of a number of different indicators. The EII distinguishes between four main types of activities – Framework Conditions, Investments, Innovation Activities and Impacts – and ten innovation dimensions covering a total of 27 indicators. However, even with this index, the role of intellectual property for the innovation process remains understudied and cannot receive a sufficiently adequate evaluation. Some researchers (Gantchev 2022) suggest that such indices to include different analyzes that can measure „the elasticity of competitiveness with respect to the regime of intellectual property and the real economic contribution of the creative economy“ in order to make an adequate assessment of „the contribution of intellectual property for macroeconomic competitiveness“.

What can be seen in the figure is that the leading countries in terms of innovation, the green sectors, are mainly Western European, with the exception of Cyprus, where the protection of intellectual property rights is highly developed and the rulers make efforts, and accordingly the policy of management is aimed at stimulating investment activity in innovative development.

On the other hand, in the sectors colored in yellow and orange are positioned the countries that perform poorly in terms of innovation, which are mainly Eastern European countries, with the exception of Italy, Spain, Portugal and Malta, which are known to have suffered from various economic, social and political problems that obviously put serious pressure on their innovative development capabilities. The lack of sufficient political capacity to stimulate innovation activity in countries in these two sectors is indicative of their economic development. All the countries in the right half of the figure are part of the developed world, but economically they lag significantly behind the countries in the left half of the table. It is obvious that the scissor that Stiglitz talked about above applies fully not only to the difference in economic development between the developed and developing world, but also within the developed world itself, and Europe is the clear proof of this.



The European Commission makes a similar index on a global basis, in order to compare the results of the EU with its main competitors in terms of innovation. Figure 2 depicts these results.



**Figure 2.** Innovation index of the EU's main competitors in innovation activity.

Source: [https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard\\_en](https://research-and-innovation.ec.europa.eu/statistics/performance-indicators/european-innovation-scoreboard_en)

The figure clearly shows the results for the innovative development of the countries that are the EU's main competitors in this area. Blue shows the EU with a base value of 100, and the rest of the countries are ranked against it. It can be seen that the countries of the so-called The "Western world" or developed economies are leading in terms of innovation – South Korea, Canada, the USA and Australia, with Japan and China trailing only slightly behind the EU. On the other hand, large countries, but with highly resource-dependent economies – Brazil, Chile, South Africa, India and Mexico, representatives of the so-called developing economies, are lagging far behind in their innovation development. These developing economies can also include a large number of other countries that, for one reason or another, are not included in the index prepared by the EC, but are also large and highly dependent on natural resources developing economies that lag behind, even more, in its innovation activity than the developed countries of the "Western World".



## **Conclusion**

In the last few years, the world situation offers major economic, social and political upheavals caused by pandemics, wars, disrupted supply channels, severely restricted access to important raw material sources, „...decline in final demand for goods and services, restrictions in some productions, reduction of employment and income from labor“ (Tsankova 2023), increasing, as a result of all this, price levels and the risk of falling into recession for many countries. However, every single crisis, be it economic or social, provides an opportunity for the realization of a new technological and innovative leap for society, through which countries can take a new, more effective path in their development.

In order for this technological and innovation leap to take place, investments are needed, which, to be both effective and sufficient in size, need to come from the private sector. History has shown that the state is a bad manager and for the world to move forward, it must be driven by the private entrepreneurial spirit. This does not mean, of course, that states should not intervene in any way. It depends on national policies whether entrepreneurs and companies will have the opportunity to invest, develop and implement their innovations and how they will be protected. The state must create and maintain the legal framework and ensure that it is not violated. „The importance of the intellectual property system in the modern economy is constantly growing, which is reflected in the adoption of various international and regional directives and regulations aimed at harmonizing legislation in the field, as well as legislative changes not only in specialized legislation on various intellectual property objects, but also of other normative acts.“ (Papagalska 2022).

However, whatever legislative changes are adopted and whatever laws are put into effect in different countries around the world, the problem of comparing developed and developing economies will remain very strong. Uneven innovation potential will limit growth opportunities in emerging markets and reinforce well-known middle-income traps. A strong gap in scientific and research potential will also remain a problem, a phenomenon that can lead to a problem of brain drain and migration of qualified individuals from peripheral countries to leading innovation centers.

One thing is certain, and that is that developing economies, big or small, have a very long and difficult way to go before improving their innovation status and reaching the standard of the leading economies of the “Western world”.

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