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The Role of Intangible Capital Investment and Intangible Assets in Improving Competitiveness*

Magdolna Csath

Based on international literature and data, this essay examines the conditions for improving competitiveness in Hungary in relation to intangible assets and capital investment. The link between productivity – as the basis for competitiveness – and intangible capital investment is also discussed. The essay argues that, although there is no consensus on the interpretation of the concepts examined and further analysis and modelling are needed, the relationships presented suggest that higher levels of intangible asset and capital investment would contribute to improving the productivity and competitiveness of the Hungarian economy. First, because this would improve the overall operational efficiency of tangible investments, and second, because it would support the transition to a knowledge economy, the key condition for boosting competitiveness.

Journal of Economic Literature (JEL) codes: E22, F63, I25, J24, O34

Keywords: intangible capital investment, intangible asset, intellectual capital, competitiveness, productivity

1. Introduction

In today's rapidly changing economic environment, characterised by new technological development and disruption, the conditions for improving competitiveness are also changing. A high rate of investment in intangible capital and a significant level of intangible assets are preconditions for a country to move away from competing by way of "cheapness" and towards embarking on a competitive path that is based on knowledge and innovation, i.e. to advance and become a knowledge economy. Intangible assets (stock) and intangible capital investment (flow) are closely related concepts. There is a time lag between the investment activity representing the flow and the size of the assets. Both concepts can be interpreted at the level of the national economy and at the corporate level. One common problem, however, is that in our ever-changing world, these are difficult to measure, and there is even debate as to what exactly is meant by these concepts.

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

Magdolna Csath: Pázmány Péter Catholic University, Research Professor. Email: csath.magdolna@ppke.hu

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The most commonly used definitions, alongside intangible capital investment and intangible capital, are knowledge capital and knowledge assets. Other terms used are intellectual capital investment and intellectual assets. Hungarian literature also uses the expression 'smart capital' (*Matolcsy 2022*), although sometimes it is primarily meant to refer to the achievements of digitalisation (*Várnai 2022*). International literature widely uses the term 'intangible', as the author of this paper has in several articles (e.g. *Csath 2022*).

Finally, at the corporate level, there is a concept of immaterial assets in accounting, but its content is not the same as that of intellectual capital. Therefore, its total value cannot be included in standard corporate accounting, even though its impact on results can be demonstrated. There is no doubt, however, that there are still methodological uncertainties regarding the measurability of intangible assets and capital investment and how their economic effects can be described. Nonetheless, the amount of new value added increasingly depends on intangible capital investment and assets, both at the level of the national economy and at the corporate level. Referring to immaterial assets at the corporate level, which represents only a part of intangible assets, the *Hungarian Intellectual Property Office* put it this way in a release of the Hungarian Telegraph Office (MTI) on 2 December 2022:[1] *"One generation ago, material assets represented about 80 per cent of companies' assets, while immaterial assets accounted for only 20 per cent. By the turn of the millennium, this ratio had reversed, and today immaterial assets, i.e. intellectual property rights, account for around three quarters of a company's market value. IP* (*intellectual property*) *in its various forms* (*e.g. patents, trademarks, industrial designs, copyrights, trade secrets, licensing contracts*) *and the effective management and exploitation of R&D results can generate significant business benefits even in times of recession. IP savvy businesses can see up to 20 per cent more revenue than firms operating without IP protection".*

This awareness is therefore stronger at the company level, as companies look for new sources to improve competitiveness and profit growth. This recognition would also be much needed at the level of the national economy, as the opportunities for economic growth based on investment in machinery and technology and the involvement of cheap labour are being exhausted. Meanwhile, Hungary compares poorly with advanced economies in terms of intangible capital investment, and the state is also not sufficiently effective in building knowledge capital. The aim of this essay is to draw attention to the links between intangible capital investment and assets and competitiveness and productivity, as well as to present some of the relationships that are not usually the focus of macro- or micro-level research. However, analysing and modelling these relationships may help to more objectively identify the levels and ratios of tangible and intangible capital investment and assets

[1] http://os.mti.hu/hirek/173869/os-a_szellemi_tulajdon_nemzeti_hivatalanak_kozlemenye-1_resz

that lead to improvements in competitiveness, thus contributing to a more reliable selection of indicators for possible development policy models aimed at improving competitiveness and to a more systematic verification of model calculations. This paper defines intangible capital and intangible assets broadly to include all investments and assets that can be linked to knowledge and skills.

2. Overview of the literature

The first major work on intellectual resources was published in 1995 (*Nonaka – Takeuchi 1995*). The two Japanese authors wrote about two types of knowledge: knowledge that is explicit, measurable and transferable, and knowledge that is non-measurable and therefore difficult to transfer (tacit). They argued that an organisation with a considerable amount of knowledge that is hard to measure and with the capability of disseminating this knowledge has a significant competitive advantage that is difficult to replicate. "Tacit" knowledge can be considered as a concept closely related to intangible capital.

Wolters (*2007*) concludes that countries that rely on and invest in intangible knowledge and skills assets achieve better competitive positions than those that compete with cheap resources, be they raw material or cheap labour. This finding has since been confirmed in practice by the examples of countries that have topped competitiveness rankings based on knowledge and innovation. Denmark, Switzerland or Sweden can be cited here as examples.

Krogh et al. (*2000*) find a close link between intangible (tacit) knowledge and innovation. And innovation is a key condition for competitiveness. They argue that in order to mobilise knowledge assets, a supportive environment and a motivating organisational culture is needed, which itself can be considered as an intangible asset.

According to *Steward* (*1997*), the most important types of knowledge assets are information, business relationships, efficient organisations and the skills of employees.

Other authors speak of intellectual assets or intellectual capital. *Edvinsson and Malone* (*1997*) point out that the real value of a company also includes intellectual assets such as organisational capital, customer relations, employee morale, patents and trademarks.

Thum-Thysen et al. (*2017*) suggest that relying on intangible assets is a better way to increase new added value created locally than investing in machinery and infrastructure.

Palotai – Virág (*2016*) emphasise the key role of knowledge as an intangible asset, while *Baksay et al.* (*2022*) highlight the importance of the contribution of knowledge, talent and creativity to growth.

Intangible assets can also be increased through investments, which also have mutually reinforcing synergies. Adult education is an important investment that generates synergy effects, contributing to productivity growth in the short term and increasing the value of intangible knowledge assets in the longer term. Generally speaking, the knowledge component of the future intellectual wealth stock is determined by the current expenditures on education, the proportion of people in education and the quality of education. Education and training, but also organisational development, can lead to productivity growth in the shorter term.

Based on a survey of US firms, *McAfee – Brynjolfsson* (*2012*) found that the successful adoption of new machines and technologies required additional investments, mainly in changing business models and organisational systems and in training employees.

Brynjolfsson et al. (*2017*) argue that artificial intelligence (AI), the new technology of the future, will only be able to contribute to significant productivity growth if it is accompanied by intangible capital investment such as the expansion of knowledge and skills and organisational development. *Goodridge et al.* (*2016*) and *Corrado et al.* (*2017*) point out that the size of intangible assets affects the potential for productivity growth.

In an analysis of 10 European countries, *Roth – Tsakanikas* (*2021*) found that around 40 per cent of productivity growth was driven by knowledge investment. *Elnasri – Fox* (*2017*) show that investment in intangible assets also has spillover effects that increase total factor productivity.

Total factor productivity represents the additional productivity growth that cannot be explained by the effects of additional physical (machinery, technology) investment and changes in the employed labour force. Such additional productivity growth comes from training and the use of more efficient organisational and management systems, i.e. intangible capital investment. It is important to note, however, as mentioned above, that – precisely because of their spillover and usual synergy effects – investments in tangible and intangible assets contribute together to improving productivity and thus competitiveness, since economic output is produced from the combination of different inputs. These inputs include machinery and equipment, labour, software and data, but also organisational and management methods. Therefore, when countries or firms make investments in order to increase economic results, they should not forget any single important input: i.e. they should also invest in the related inputs in order to create synergies. This is confirmed by EU research which found that physical (machinery, technology) investments are only effective if they are complemented by investments in knowledge and organisation. The research verified this relationship both at the level of companies and the national economy. Researchers therefore pointed out that, for government subsidy to stimulate innovation, the two types of investment need to be linked in order for government subsidy to be effective. For example, the subsidy should be conditional on organisational development and employee training. The ratios between the two types of investment, however, can be sector- and company-specific (*EC 2021*).

Measurement problems, however, do arise. In the case of macroeconomic intangible capital investment, it is even more difficult to measure the expected effects, mainly because of the longer time horizons. Investment in education today will only pay off in the form of an increase in intangible assets over a long period of time. On the other hand, intangible assets are also subject to amortisation. Knowledge becomes obsolete, and the novelty of a patent that is not implemented for a long time is lost as new developments occur in the field. There are no generally accepted methods for measuring the loss of value due to amortisation. It is precisely this measurement problem that explains the perceived lack of funding for intangible capital investment at both the public and corporate level. Furthermore, tangible investments such as machinery can be sold if necessary, so that at least part of their cost can be recovered. However, the costs of intangible knowledge and capital investment are, as *Haskel and Westlake* (*2018*) put it, “sunk costs”, i.e. they cannot be recovered. At the same time, some intangible capital investments, such as intellectual property, can be protected, which can give an organisation a distinctive advantage in the longer term.

Based on the literature, it can be concluded that the role of intangible assets and capital investment is increasing today and that they have an impact on improving productivity, and consequently competitiveness, mainly through knowledge investment and organisational development. In times of major changes, they can increase the resilience of economies exposed to shocks (*OECD 2021*). Companies are also increasingly considering their intellectual resources, assets and intellectual capital as sources of a competitive advantage. At the national level, intangible capital investments, most of which are investments in knowledge creation or knowledge acquisition, can help the transition to the knowledge economy. It is important to stress that a high investment rate does not generally improve the chances of transition to the knowledge economy: it only does so if the proportion of intangible capital investment is high enough (*Roth 2022*). There are also several definitions of the knowledge economy. According to an early definition, the knowledge economy is an economy in which the majority of knowledge workers work with their “brains” and produce ideas, knowledge and information (*Drucker 2006*). In general, however, a knowledge economy can be defined as an economy that has the capability of effectively producing, utilising and sharing knowledge for economic development (*Al-Fehaid – Shaili 2021*).

According to *EBRD* (*2019*), an economy can be described as a knowledge economy if growth is driven by innovation and improvements in total factor productivity. Based on this, the EBRD has constructed the Knowledge Economy Index, in which Hungary ranks last among the nine Central European and Baltic states surveyed. This ranking certainly justifies further analysis.

At the level of economic theories, focusing on the importance of local investment in knowledge and skills is a line of thought that can be categorised as an endogenous, resource-based growth theory.

However, the scope of the concepts is not yet sufficiently clear. Authors and research findings do not understand intangible capital investment and assets in exactly the same way, and there is also no agreed definition for intellectual capital as an intangible asset. The different definitions show that the conditions for development are increasingly linked to knowledge and innovation, and investment in machinery, technology and infrastructure is no longer sufficient. Another important conclusion is that skills and knowledge are playing an increasing role in improving productivity. Without enhancing productivity, there can be no substantial improvement in competitiveness, which is necessary for development. In the following, intangible capital investment is defined as investment in knowledge and innovation, while intangible assets refer to knowledge (human) and intellectual assets (capital) and innovation position. A more precise definition will be given later.

3. Definitions

Since our aim is to analyse characteristics that have been examined using a wide range of approaches and that do not yet have an agreed definition, we first need to define the area under study. Furthermore, comparative data are not provided for all characteristics, so the analysis can only be based on the available data. In the following, "intangible" asset are defined partly according to the European Investment Bank (EIB) definition (*EIB 2021*) and partly using the wording of the EU Innovation Scoreboard (*EC 2022*) and the Hungarian Central Statistical Office (HCSO) database. The database for the analyses is taken from Eurostat and the HCSO. The EIB only examines flow type data, while the EU Innovation Scoreboard, Eurostat and the HCSO database only contain data on specific intangible assets and capital investments. As a secondary data source, the analysis relies on the IMD Competitiveness Yearbook (*IMD 2022*) and the Magyar Nemzeti Bank (central bank of Hungary, MNB) Productivity Report (*MNB 2022*) (see *Table 1*).

Table 1
Assets and investment elements included in the analysis and secondary data sources

Source	Process/Investment (Flow)	Assets/Capital (Stock)
EIB study and database	Share of tangible and intangible investment within total investment	–
EU Innovation Scoreboard Eurostat databases	Government R&D* subsidy	Human/Knowledge asset Innovation position
	Public expenditures on education	Intellectual asset/capital
	Adult education participation rate	Share of people with tertiary education in the 25–34 year age group
HCSO databases	R&D expenditures to GDP	Number of nationally filed patents of domestic origin
Secondary sources	MNB Productivity Report (2022)	
	IMD Competitiveness Report (2022)	

*Note: * R&D: Research and Development*

The analysis focuses on the relationships between intangible capital investment and assets related to knowledge and innovation, and competitiveness and productivity positions. We do not examine all of the characteristics that describe each of the assets. For example, in the case of human assets, we do not deal with the analysis of health conditions, even though this is an obvious characteristic of human assets. Data are not analysed for all EU countries. We consider comparisons within the V4[2] countries to be important, as well as with those with closer economic links to them and those that rank particularly well in competitiveness rankings.

Finally, we use statistical methods to show the links between the indicators but do not include the indicators in mathematical models that also measure the correlation of relationships. One reason for this is that statistical data are not available for all indicators, nor are time series sufficiently long to allow a convincing analysis.

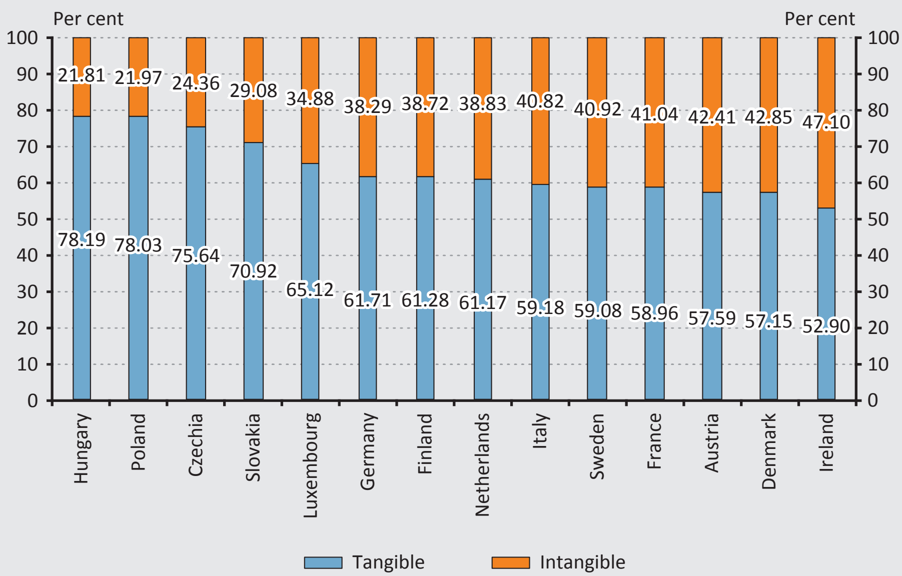
4. Analysis and conclusions

Figure 1 shows the breakdown of investments by tangible and intangible investments in 14 EU countries in 2020. The *EIB* (*2021*) defines tangible investment as investment in machinery, equipment, buildings and infrastructure. Intangible capital investment consists of investment in: research and development, software, data and website activities, training of employees and organisational and business process improvements. The results are sourced from a company survey. Note that only investment data, which are "flow" data, are included. "Stock" (status, asset value) data are not examined, even though the amount of intangible

[2] V4: Czechia, Hungary, Poland and Slovakia.

assets (e.g. patent portfolio, knowledge levels, employees with language skills, etc.) that a country or a company currently has is not irrelevant. A low asset level cannot be rapidly increased by a high investment rate, and the benefits of a high asset level are obscured by a low intangible capital investment rate. There is also a methodological problem with the treatment of R&D as intangible capital investment. R&D expenditure is an "intermediate" investment, as its result depends on what the expenditure is made on. If, for example, the R&D expenditure is transferred to foreign companies in the form of innovation grants, which result in the companies having their registered patents back home, then, although Hungarian R&D is expanding, the expenditure does not lead to patents that increase Hungarian national intellectual wealth. Or, for example, if a company buys technology from abroad with government R&D subsidy and it does not involve knowledge investment, it is in fact making a tangible investment. It should also be noted that the EIB analysis does not take into account an important intangible capital investment, namely general adult education. This is because its analysis is based on data collected from a sample of enterprises. It did, however, include expenditures on organisational and business process improvements, which are not easily measurable and which can be measured mainly in the business sector, although organisational innovation can bring significant efficiency gains in the public sector as well.

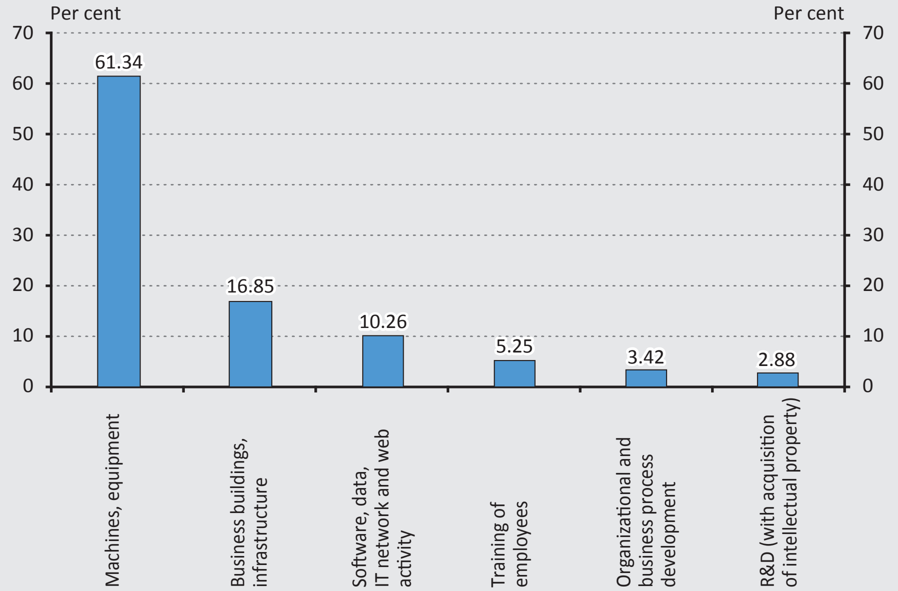
Figure 1
Share of tangible and intangible investment within total investment expenditure (2020)



Source: Calculated on the basis of EIB (2021)

Figure 1 shows that the more advanced economies are characterised by a higher share of intangible capital investment compared to the V4 countries. *Figure 2* shows that in the case of Hungary, the share of machinery and equipment within total investment is by far the highest (61.34 per cent).

Figure 2
Distribution of investments in Hungary, 2020

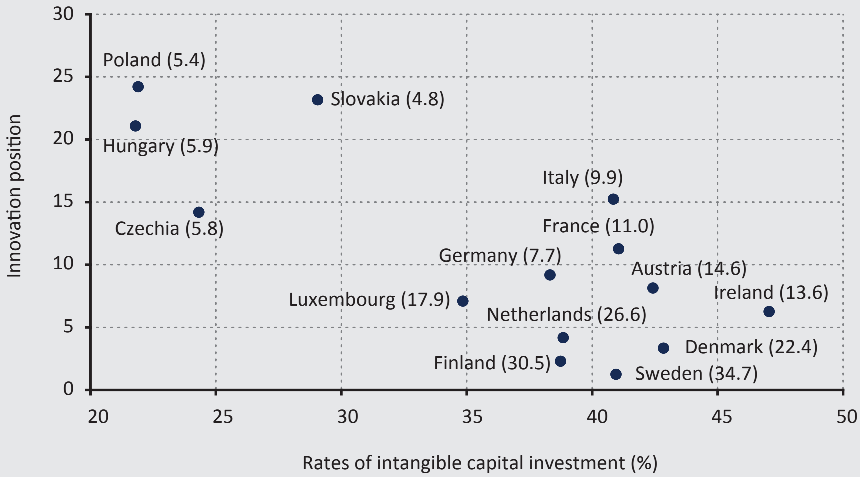


Source: EIB (2021)

The amounts devoted to the training of employees (5.25 per cent) and to organisation and business process improvements (3.42 per cent) are very low, and the share of R&D that involves knowledge investment (intellectual assets) is also not significant. As will be seen later, this lowers the chances of improving productivity, especially total factor productivity. A comparison of the ratios and competitiveness rankings makes it clear that the countries at the top of the competitiveness ranking are precisely those with high rates of knowledge investment. It would be interesting to analyse the data in terms of company size or number of employees, but these data are not available. Long time series would be needed to examine trends. It would also be worth looking at what other data are related to these data.

Figure 3 shows the relationship between intangible capital investment and innovation position, taking into account adult education data as a supporting activity.

Figure 3
Relationships between the rates of intangible capital investment, innovation position and adult education



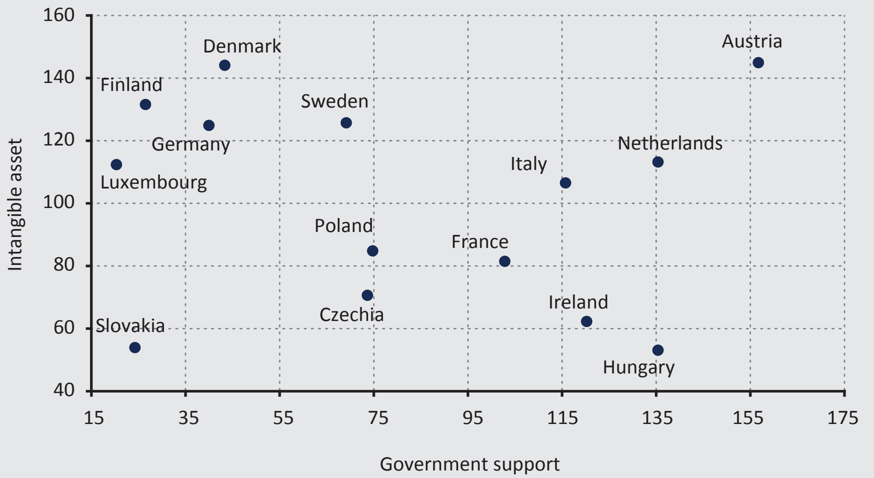
Note: In parentheses: Adult education participation rate in the 25–64 age group, 2021, in per cent.
Source: Calculated on the basis of EIB (2021), EC (2022), Eurostat (2022a)

Figure 3 shows that the innovation position relevant for competitiveness, and as measured by the ranking in the EU Innovation Scoreboard and interpreted as the “asset level” achieved, is closely related to the rate of intangible capital investment (*Figure 1, EIB 2021*) and, within that, the adult education participation rate for the 14 EU countries studied.[3] We can see that the position of the V4 countries is clearly distinct from that of the advanced economies. For the former, low levels of intangible capital investment and adult education are associated with a lower innovation position in the ranking. Only Czechia stands out slightly from the group. Countries with high rates of intangible capital investment and adult education participation are at the top of the innovation ranking.

Among intangible capital investments, R&D investments are generally also supported by the government. The government usually expects this support to produce innovation results and new intangible assets. Intangible assets are measured by patent, design and trademark applications per capita. By effectiveness, we mean the extent to which government R&D subsidy provides an incentive for firms to invest in R&D and the combined effect of the two types of investment in terms of new knowledge capital, typically a patented product, process or design. *EC* (*2022*) assesses the effectiveness of government subsidies by comparing the level of government subsidies relative to the EU average and the intangible asset level relative to the EU average.

[3] The minor overlap in the data, namely that both intangible capital investment and adult education include in-company training, should not have a major distorting effect on the comparison.

Figure 4
Relationships between intangible asset levels and government R&D subsidies



Note: On horizontal and vertical axes: EU27=100

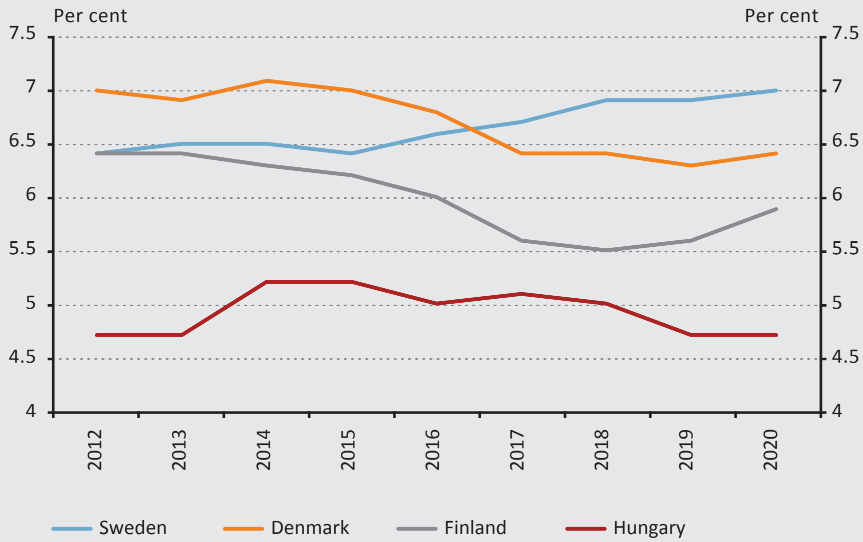
Source: EC (2022)

The relationships are illustrated in *Figure* 4. It shows that in Hungary, for example, the government R&D subsidy of 135.7 per cent, which is significant compared to the EU average, only generates an intangible asset level of 52.3 per cent. However, for countries with high intangible asset levels, government subsidies are insignificant. This is obviously in line with the data in *Figure 1*, i.e. where companies have significant intangible investment, including R&D, they generate a high level of intangible assets such as patents. This reflects inefficiencies in public spending, a phenomenon also highlighted by the *MNB* (*2022*) report. This issue will be returned to in the context of the Hungarian data (*Figure 7*).

It should be noted that, given the "flow" nature of public expenditures and the "stock" nature of intangible assets, additional valuable conclusions could be drawn by examining the relationships between longer time series. Unfortunately, however, such data are not available in this breakdown. The data suggest that corporate intangible investment contributes more to the growth of intangible assets than direct public support. This is particularly striking in the cases of Finland, Sweden and Denmark, for example, countries that create significant intellectual assets with very low levels of public support but high levels of corporate intangible capital investment (*Figure 1*).

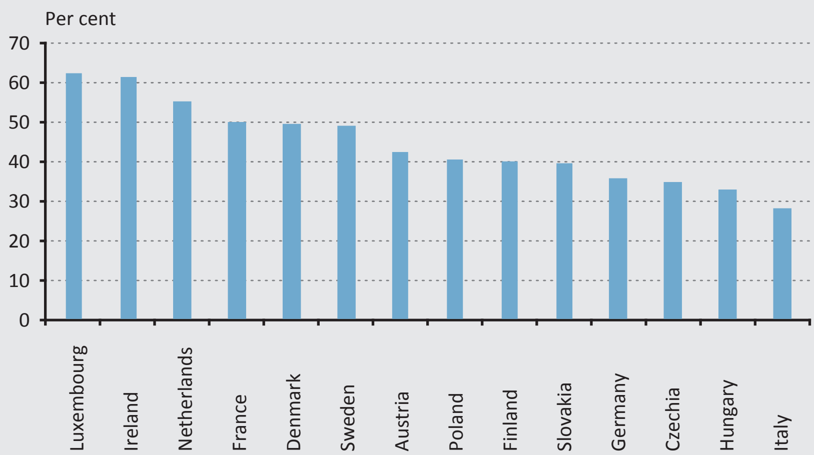
But what else can contribute to a high level of intangible assets in these countries? It can be assumed that expenditures on education as intangible investments also have an impact on the level of intangible assets. It is therefore worth looking at what percentage of their GDP these countries spend on education in the longer term. As we can see in *Figure 5*, these countries are characterised by a persistently high level of education expenditures, which obviously helps them to maintain a high intangible asset level.

Figure 5
Public expenditures on education as a share of GDP, 2020



Source: Eurostat (2022b)

Figure 6
Share of people with tertiary education in the 25–34 year age group, 2021

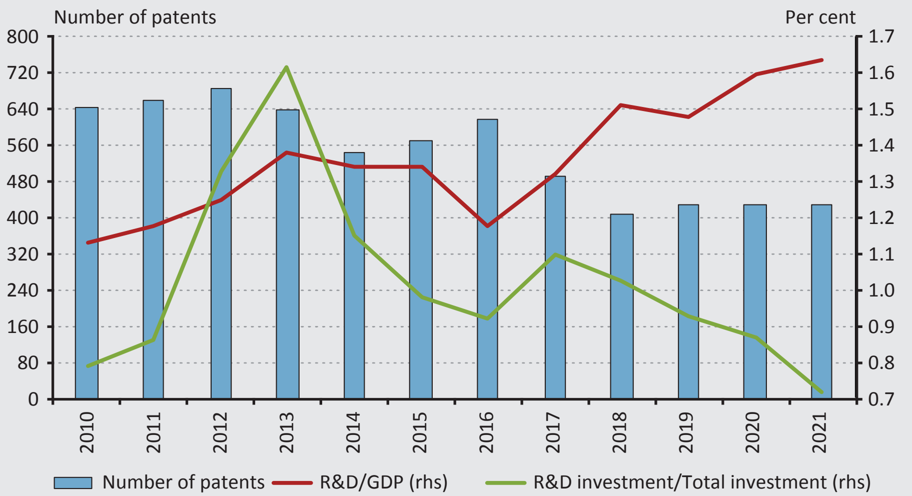


Source: Eurostat (2022c)

The share of people with tertiary education is also an important feature of knowledge assets (*Figure 6*). The Hungarian figure is the second lowest among the 14 countries surveyed, which is obviously linked to lower education expenditures to GDP (*Figure 5*).

Let us now examine the relationship between the ratio of R&D expenditures to GDP and the number of registered patents in Hungary over the longer term, between 2010 and 2021. Human/knowledge assets could be increased through higher knowledge investment – by increasing adult education expenditures and the ratio of education expenditures to GDP. This would likely contribute to higher productivity gains from investment in machinery and infrastructure.

Figure 7
Relationship between nationally filed domestic patent applications, the ratio of R&D expenditures to GDP and the share of R&D investment within total investment



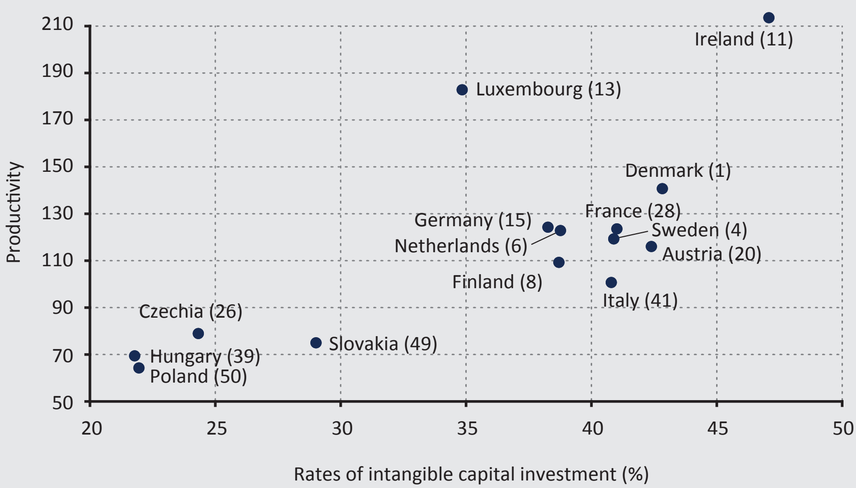
Source: HCSO (2022)

Figure 7 shows important correlations. One of the most important intangible expenditures is total R&D expenditures to GDP, which, as shown in *Figure 7*, has been steadily increasing since 2010, with the exception of one or two years, to reach 1.64 per cent by 2021, placing Hungary in the middle of the ranking in the EU (*EC 2022*). However, this positive trend is not reflected in the number of patents: on the contrary, the increasing R&D expenditure has been accompanied by a falling or stagnating number of patents. This is probably due to the two characteristics mentioned earlier. First, the support for R&D provided to foreign companies is included in the R&D-to-GDP ratio, but – if it does not result in Hungarian patents – it is not reflected in the increase in the number of patents. Second, some of the R&D expenditures do not result in any new intellectual property, as they may have been used to buy machinery or foreign technology, and these physical investments were not complemented by knowledge investments, so that no intangible capital gains could be generated. Looking at the share of R&D investment within total investment, we can also see that this ratio rose until 2013 and then fell sharply, which may be related to the fact that the majority of investment was increasingly made in machinery, equipment and infrastructure (*Figures 1 and 2*). The MNB report also points to the lack of intangible capital investment: *"The main gap can be identified in innovation-related capital goods. The latter mainly refers to intangible assets."* (*MNB 2022:34*).

The data and relationships examined suggest that one of the key reasons for the innovation, competitiveness and productivity gap in Hungary is the lower levels of intangible assets (human assets, intellectual capital, low share of people with tertiary education, etc.) and knowledge investment that directly contributes to supporting these assets, compared to more developed economies in an international comparison. The impact of each of these factors on Hungary's competitiveness and productivity position could be quantified by further analysis, and mathematical modelling would help to identify the combined effects. Finally, let us consider a particularly important interrelationship that addresses perhaps the biggest problem facing the Hungarian economy.

Figure 8 shows the relationship between productivity data for 14 EU countries and intangible capital investment rates, with the position in the IMD 2022 Competitiveness Ranking in parentheses as an explanatory data point (*IMD 2022*).

Figure 8
Relationships between intangible capital investment rates, productivity and competitiveness



Note: Productivity: GDP/hour (PPP), EU27=100, 2021. Competitiveness position in parentheses.
Source: Calculations based on EIB (2021), Eurostat (2022d), IMD (2022)

As pointed out earlier, productivity is closely correlated with the share of intangible investment, mainly knowledge investment, within total investment, while higher productivity is associated with a better competitive position. Eurostat measures productivity by the gross value added (GVA) produced per hour worked, calculated at purchasing power parity (PPP). According to Eurostat data, Hungary's productivity is the second lowest among the countries surveyed, after Poland, at just 68.5 per cent of the EU average. Together with Poland, Hungary's intangible capital investment rate is also the lowest (*EIB 2021: Figure 1*). Hungary's competitiveness position is the 4th worst among the 14 countries surveyed (*IMD 2022*). The data and relationships examined could of course be extended, but it is clear from the above that the significant Hungarian "tangible" investments in machinery and infrastructure are not sufficient to improve innovation, competitiveness and productivity. As the literature also emphasises, without an adequate level of intangible capital investment as well as the knowledge assets and intangible assets it creates, it will not be possible to move to a more advanced knowledge-based economy, without which there will be no additional resources to further improve innovation, competitiveness and productivity.

It is also important to note that intangible capital investment not only increases the efficiency of the use of tangible investment, but also helps to accelerate the uptake, absorption and diffusion of foreign technologies (*Bruno et al. 2019*). This is an important finding, as it suggests that the impact of foreign investment on local development, mainly through productivity improvements, could be enhanced by increasing local intangible capital investment, for example in education and adult training.

5. Summary

The main aim of the paper was to draw attention to the importance of intangible capital investment and to the fact that Hungary's low level of productivity in an international comparison is related to its low level of intangible investment, especially knowledge investment, compared to developed countries. Furthermore, there is a clear link between low levels of knowledge assets and competitiveness positions.

The theory of intangible capital investment and intangible assets is still developing, and there is also a professional debate on the measurement methods. However, empirical research shows that locally generated and continuously increasing knowledge is becoming more and more important today. The importance of investing in it is therefore also growing. Of course, as with any other investment, an important condition for intangible capital investment is efficiency and return, which is even more difficult to measure in this case, where there are long time horizons, spill-over effects and synergy advantages. In the case of businesses, the market and the stock exchange are increasingly focusing on the intangible assets that can be accumulated by a company, especially knowledge and intellectual assets, which are difficult to replicate. However, there is a need to measure Hungary's intangible assets at the national level and develop a strategy to consciously increase them. Based on its knowledge, innovation and competitiveness data, the Hungarian economy cannot yet be considered a knowledge-based economy according to the definitions given so far for the knowledge economy. The transition to the knowledge economy cannot be achieved without improving all types of knowledge assets and raising the level of knowledge investment needed to support them. As the data and relationships presented suggest, competing by being "cheap" along with the low levels of productivity and innovation will not be enough to catch up with the more advanced countries in the foreseeable future. And lagging behind could entail the risk of falling into the development trap.

Progress will of course still require both theoretical and methodological discussions. Such debates and research are ongoing. For example, the MNB's professional debates and publications are also looking for indicators and methods to better describe the level of development, as there is still no consensus on how to measure development more reliably. Another line of research could be the mathematical analysis of the links between the interrelationships outlined above and the indicators selected and analysed, but this would require more extensive and time-consuming research.

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