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# INTELLECTUAL CAPITAL AS A DRIVER OF ECONOMIC GROWTH

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**Abstract.** The article examines the role of intellectual capital as a key driver of economic growth in the context of the global knowledge economy. It explores the scientific aspects of the formation and utilization of intellectual capital, including human, structural, and market capital. Particular attention is paid to the relationship between the development of intellectual capital and the enhancement of economic competitiveness, as well as the impact of knowledge, innovations, and technological progress on economic processes. The relevance of the topic lies in the fact that the level of development of intellectual capital components varies across countries, and strengthening these components can ensure economic growth. The development of national welfare directly depends on the level of scientific and technological progress, new developments, as well as the adoption of technologies and the advancement of human capital. The development of the economy is determined by its innovative orientation. The aim of the article is to substantiate the role of intellectual capital as a key driver of economic growth and, based on scientific research, to determine its structure, functions, and significance for economic and innovative development. Drawing on scientific studies, the authors identified the main mechanisms for integrating intellectual capital into economic processes and emphasized its importance in ensuring sustainable development within the modern knowledge economy.

The results of the study confirm a direct correlation between the level of intellectual capital development and the pace of economic growth. It was also established that intellectual capital operates with varying efficiency in developed and developing countries. In developing countries, particular attention should be paid not only to ensuring access to education but also to improving its quality. Any efforts aimed at accelerating economic growth must be based on intellectual capital.

**Keywords**: intellectual capital, economic growth, innovative economy, human capital, education.

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## ЗИЯТКЕРЛІК КАПИТАЛ ЭКОНОМИКАЛЫҚ ӨСІМНІҢ ДРАЙВЕРІ РЕТІНДЕ

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**Аннотация.** Мақалада зияткерлік капиталдың ғаламдық білім экономикасы жағдайында экономикалық өсімнің негізгі драйвері ретіндегі рөлі зерттеледі. Зияткерлік капиталды, оның ішінде адами, құрылымдық және нарықтық капиталды қалыптастыру мен пайдаланудың ғылыми аспектілері қарастырылады. Зияткерлік капиталды дамыту мен экономиканың бәсекеге қабілеттілігін арттыру арасындағы өзара байланысқа, сондай-ақ білімнің, инновациялардың және технологиялық прогрестің экономикалық үдерістерге әсеріне ерекше назар аударылған. Тақырыптың өзектілігі – зияткерлік капиталдың компоненттерінің даму деңгейі әр елде әртүрлі болуымен және оларды күшейту арқылы экономикалық өсімді қамтамасыз етуге болатындығын дәлелдеуде. Ұлттық әл-ауқатты дамыту тікелей ғылыми-техникалық прогрестің, жаңа әзірлемелердің, сондай-ақ технологияларды енгізу мен адами капиталды дамытудың деңгейіне тәуелді. Экономиканың дамуы инновациялық бағытқа байланысты анықталады. Мақаланың мақсаты – зияткерлік капиталдың экономикалық өсімнің негізгі драйвері ретіндегі рөлін негіздеу, сондай-ақ

оның құрылымы, функциялары, экономикалық және инновациялық дамудағы маңызын ғылыми зерттеулерге сүйене отырып, тұжырымдау. Ғылыми зерттеулерге сүйене отырып, авторлар зияткерлік капиталды экономикалық үдерістерге біріктірудің негізгі механизмдерін анықтап, қазіргі білім экономикасы жағдайында тұрақты даму үшін оның маңыздылығын атап өтті. Зерттеу нәтижелері зияткерлік капиталдың даму деңгейі мен экономикалық өсім қарқыны арасындағы тікелей тәуелділікті растайды. Сондай-ақ, зияткерлік капитал дамыған және дамушы елдерде әртүрлі тиімділікпен жұмыс жасайды. Дамушы мемлекеттерде біліммен қамтудан бұрын білімнің сапасын арттыру маңыздылығына назар аудара отырып, экономикалық өсімнің қарқынын арттыруға бағытталған кез-келген күш-жігері зияткерлік капиталға сүйене отырып жүзеге асырылуы керек.

**Түйін сөздер:** зияткерлік капитал, экономикалық өсім, инновациялық экономика, адами капитал, білім.

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## ИНТЕЛЛЕКТУАЛЬНЫЙ КАПИТАЛ КАК ДРАЙВЕР ЭКОНОМИЧЕСКОГО РОСТА

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**Аннотация.** В статье исследуется роль интеллектуального капитала как основного драйвера экономического роста в условиях глобальной экономики знаний. Рассматриваются научные аспекты формирования и использования интеллектуального капитала, включая человеческий, структурный и рыночный капитал. Особое внимание уделяется взаимосвязи между развитием интеллектуального капитала и повышением конкурентоспособности экономики, а также влиянию знаний, инноваций и технологического прогресса на экономические процессы. Актуальность темы заключается в том, что уровень развития компонентов интеллектуального капитала различается в каждой стране, и его усиление может обеспечить экономический рост. Развитие национального благосостояния напрямую зависит от уровня научно-технического прогресса, новых разработок, а также внедрения технологий и развития человеческого капитала. Развитие экономики определяется

ее инновационной направленностью. Цель статьи - обосновать роль интеллектуального капитала как основного драйвера экономического роста, а также, опираясь на научные исследования, определить его структуру, функции и значение для экономического и инновационного развития. Опираясь на научные исследования ученых, авторы выявили основные механизмы интеграции интеллектуального капитала в экономические процессы и подчеркнули его значимость для обеспечения устойчивого развития в условиях современной экономики знаний. Результаты исследования подтверждают прямую зависимость между уровнем развития интеллектуального капитала и темпами экономического роста. Также установлено, что интеллектуальный капитал функционирует с разной эффективностью в развитых и развивающихся странах. В развивающихся странах особое внимание следует уделять не только обеспечению доступа к образованию, но и повышению его качества. Любые усилия, направленные на ускорение темпов экономического роста, должны основываться на интеллектуальном капитале.

**Ключевые слова:** интеллектуальный капитал, экономический рост, инновационная экономика, человеческий капитал, образование.

**Introduction.** Economic growth is characterized by the increase in the quantity and quality of goods and services that a country's national economy can produce, reflecting the extent of its economic development. This growth indicates the degree of progress within the economy and has a positive impact on improving the standard of living and quality of life for the population.

Two types of economic growth are recognized: extensive and intensive.

- Extensive economic growth involves an increase in the number of goods and services produced while maintaining the technical structure of production at a certain level.

- Intensive economic growth, on the other hand, is associated with qualitative improvements in production processes.

In today's world, it is challenging to find examples of growth driven solely by one of these types.

The factors influencing economic growth into three categories:

Supply factors: Including the quantity and quality of resources (natural, human, and capital) as well as technology.

Demand factors: The level of aggregate demand in the economy, which ensures full employment of resources.

Efficiency factors: The effective use of resources (McConnell, et al., 1992:36).

Numerous economic growth models analyze the interaction and influence of these and other factors, with several earning Nobel Prizes for their contributions.

In recent decades, education has been considered the primary driver of economic development, surpassing traditional factors such as land, labor, and capital. Consequently, the World Bank has posited that to achieve high developmental benchmarks, countries must construct knowledge-based economies. The World Bank identifies four pillars of the «knowledge economy»:

Economic incentives and institutional regime
Educated and skilled workers
Effective innovation systems
Information infrastructure

Investing in these areas is believed to foster the creation of a knowledge economy (Chen Derek, et al., 2006). Nations are encouraged to allocate resources to education, research and development and advanced technologies. By doing so, they can stimulate innovation, boost productivity, increase income levels, and improve living standards.

A knowledge-based economy is not merely a manifestation of economic growth but also a product of economic development, achieved through structural changes in a country's national economy.

Endogenous Model of Economic Growth. The endogenous model of economic growth provides a framework distinct from traditional neoclassical theories. It posits that economic growth stems from internal factors, such as human capital, technological advancements, and innovation accumulation. In this model, education and technology are regarded not as public goods but as «private goods» that individuals and firms can acquire. Policies that encourage the development of knowledge and innovation can lead to sustained economic growth.

A significant principle of endogenous growth theory is that increasing education and technological advancement drives higher income levels. The more abundant and accessible education and technology become, the greater their availability, creating a feedback loop where the system's outputs are reinvested as inputs.

Governments can amplify human capital potential by investing in education and generate new knowledge and technologies through research and development investment. As a result, intellectual capital incorporates the key endogenous factors of human capital and renewal capital.

**Materials and methods**

Intellectual capital is the product of a knowledge-based economy. Since the late 1990s, it has been studied as a factor influencing economic indicators and wealth creation. This section will explore some of these studies, their metrics, methodologies, and findings, serving as a foundation for further research.

From this, we observe that intellectual capital encompasses significant endogenous factors, such as human capital and renewal capital, essential for economic growth.

The First National Intellectual Capital Assessment: Sweden's Experience. Sweden was the first country to evaluate its national intellectual capital, publishing a report titled «Welfare and Security» in 1999. This document included data on human, market, process, renewal, and development capital. In the same year, Israel also published a report on intellectual capital. These initiatives marked the beginning of comparative assessments among multiple countries. The studies relied on the Scandia Navigator Model, which posits that the synergistic interaction of various types of capital drives the growth of national wealth (Edvinsson, 2012).

C.Y. Lin and L. Edvinsson conducted an analysis of national intellectual capital

in 40 countries, using data spanning 1994 to 2005 (Lin, et al., 2014:16). Their assessment utilized 29 indicators grouped into five categories: human capital, market capital, process capital, renewal capital, and financial capital (Table 1). These indicators were selected through a two-round filtering process.

Table 1 - Indicators of National Intellectual Capital

| Human Capital Index | Market Capital Index |
|---|---|
| Skilled labor force<br>Employee training<br>Literacy rate<br>Access to higher education<br>Student-to-teacher ratio<br>Internet subscribers<br>Budgetary allocation for education | Corporate taxes<br>Cross-border ventures<br>Cultural openness<br>Globalization<br>Transparency<br>Country's image<br>Export and import of services |
| Process Capital Index | Renewal Capital Index |
| Business environment<br>Government efficiency<br>Intellectual property protection<br>Access to capital<br>Computers per capita<br>Ease of starting new businesses<br>Mobile phone subscribers | Business R&D expenditure<br>Fundamental research<br>Share of R&D expenditure in GDP<br>Number of R&D researchers<br>Collaboration between universities and businesses<br>Scientific publications<br>Patents per capita (USPTO, EPO) |
| Financial Capital | |
| GDP per capita adjusted by purchasing power parity (logarithmic scale) | |

The analysis revealed that Northern European countries had the highest levels of intellectual capital among the 40 nations evaluated. However, the development of specific components varied across countries.

For the five Northern European countries examined, financial capital ranked highest in terms of performance. In Germany, Iceland, Norway, and Sweden, human capital ranked second, followed by process capital in third and market capital in fourth. Sweden stood out, with renewal capital in third place, followed by process capital and market capital in fourth and fifth positions, respectively. In Finland, financial capital ranked first, followed by process capital, human capital, renewal capital, and market capital in that order. Resilience of Northern European Nations. Are Northern European countries prepared to overcome potential economic stagnation? Can their accumulated intangible assets sustain the region's competitive advantage? The study concluded that Northern Europe has a robust foundation for continued advancement.

Key Findings from the Analysis

The authors made the following observations:

Financial indicators do not clearly demonstrate the contribution of intellectual capital to national wealth growth.

Intellectual capital does not always translate into financial results.

A combination of human capital and renewal capital best characterizes intellectual capital.

These insights underline the importance of intellectual capital and its diverse components in driving economic progress.

P. Ståhle and A. Bounfour analyzed the dynamics of national intellectual capital using the 2005 World Competitiveness Report, which comprised 331 indicators (Ståhle, et al., 2008:76). The study classified countries into three groups: developed economies, transitional economies, and developing economies. The findings revealed the following:

Four Types of Impact on GDP Growth

Sustained Effect**:** Current indicator levels align with the present annual GDP growth.

Accelerating Effect**:** Current indicator levels correspond with GDP growth trends.

Linear Growth Potential**:** Indicator trends align with current GDP growth levels.

Exponential Growth Potential**:** Indicator trends align with GDP growth trends.

Limitations of Intellectual Capital's Impact

The study identified that the effectiveness of intellectual capital has limits:

- Critical Components**:** Some components of intellectual capital, such as education, may become pivotal for development. However, if these components are underdeveloped, production efficiency declines.

- Contextual Relevance**:** Intellectual capital components are context-dependent, with a limited lifespan. For instance, technological components require continual updates to remain effective.

Evaluation of Economic Indicators

The value and efficiency of intellectual capital cannot be assessed without considering its economic context. This makes intellectual capital a variable and context-sensitive parameter. Evaluation should account for its strategic environment and utilization potential.

Impact of Development Stages

The driving forces of intellectual capital vary across different stages of economic development:

- in developing economies, increasing the volume of intellectual capital components yields significant benefits.

- in developed economies, further increases in intellectual capital components show diminishing returns due to saturation.

For instance, in developing countries, primary education coverage may range from 20% to 50%, leaving room for improvement. In contrast, developed countries already achieve 90% to 100% coverage, limiting further enhancement. According to S. Bergenheim, enhancing education can increase per capita GDP by 10% (Bergheim, 2005).

Strengthening intellectual capital components positively affects economic growth. Developed countries benefit more from these components compared to developing countries. For example, research and development activities investments are particularly effective in developed economies, where their impact on GDP growth is more pronounced.

A. Navarro, L. José, R. López Ruiz, R. Victor, and D. Nevado Peña developed a formula to measure the national intellectual capital of EU countries in 2006:

$$IC_i = HC_i + SC_i + NEC_i \quad (1)$$

Where:

- $IC_i$ - Intellectual capital of entity i;

$HC_i$ - Human capital, including employee education, skills, motivation, training, and related factors such as compensation systems and contract policies that enable enterprises to maintain a qualified workforce;

- $SC_i$ - Structural capital, defined as a combination of internal processes such as customer and supplier relations, marketing, research and development and innovations contributing to operational quality.

- $NEC_i$ - Non-explicit capital, comprising components of human and structural capital that do not fit into the other categories. These are harder to quantify but remain important as a whole (Navarro, et al., 2011:109).

To evaluate intellectual capital, two types of metrics were used:

Absolute Indicators (AI): Measured in monetary units.

Efficiency Indicators (EI): Expressed as percentage indices.

The model for forming national or regional intellectual capital through human and structural capital is summarized as follows:

$$AI = \sum_{i=1}^{N} AI_i \quad (2)$$

$$EI = \sum_{i=1}^{k} w_{ji} EI_i \quad (3)$$

$$con \sum w_j = 1 \quad (4)$$

Where:

- N -Total number of absolute capital units.
- K- Efficiency metrics related to capital.
- w - Weights, ranging from 0 to 1, summing up to 1.

$$XC = \sum_{c=1}^{m} AI_c \times EI_c \quad (5)$$

- X - Capital comprising m generators.

Thus, by regulating and calculating numerous indicators, A.Navarro and others have drawn the following conclusions:

Northern European countries exhibit high intellectual capital potential, explaining their superior productivity and wealth. These countries also demonstrate high technological efficiency due to better management and application of new technologies.

Southern European countries display lower intellectual capital indicators compared to Northern Europe.

Eastern European countries have high efficiency in human capital but show average absolute indicator values compared to the European average. While these countries boast well-trained populations, they do not use technology as efficiently as Northern European nations.

**Results**

The 2016 study conducted by Lithuanian scientists can be specifically highlighted in determining the impact of intellectual capital on the economic growth of countries.

The study covered 25 countries of the European Union. The national intellectual capital model consists of four components: human capital, structural capital, social capital, and relational capital. The calculation methodology is based on the model developed by Macerinskienė and others (Mačerinskienė, et al., 2017:573).

The indicators of national intellectual capital (Table 2) are divided into three levels. Two aggregation methods were used to consolidate the values. First, the indicators were aggregated using a refined method for calculating factor values, considering standardized regression coefficients. Then, the values of the latent variables were aggregated using the SAW method. As a result, the level of national intellectual capital was calculated. For the second level, the SAW method was also applied with equal weights for the factors. For the third level, the factor weights were determined through expert evaluation.

Table 2- Indicators of National Intellectual Capital

| | | | |
|---|---|---|---|
| 1 | Human Capital | | Social Capital |
| 2 | Quality of education | Accessibility of education | |
| 3 | 1. Student performance (PISA)<br>2. Advanced computer skills<br>3. Life-long learning<br>4. Satisfaction with education | 1. Percentage of population with higher or secondary education<br>2. Youth participation in education<br>3. Advanced internet skills | 1.Institutional levels<br>2. Satisfaction with government performance<br>3. Trust levels |
| 1 | Relational Capital | | Structural Capital |
| 2 | 1. Openness of the country<br>2. Intensity of foreign direct investments<br>3. Number of students studying in EU-27 (ISCED 5-6)<br>4. Flow of students (ISCED 5-6)<br>5. Immigration rate per capita<br>6. Emigration rate<br>7. Enterprises engaged in innovation partnerships with non-EU countries<br>8. Export of goods and services as a percentage of GDP | 1. Intensity of technological transfers<br>2. Collaboration in innovation with non-EU countries | 1. Applications to the European Patent Office<br>2. Applications to the U.S. Patent and Trademark Office<br>3. Applications for community trademarks<br>4. Share of innovative enterprises<br>5. Access to stable broadband<br>6. Households with internet access<br>7. Enterprises with internet access<br>8. Number of researchers and scientists |

The authors conducted calculations based on indicators over a ten-year period and found that national intellectual capital positively impacts economic growth. Additionally:

- Among the four components, human capital was identified as having the most significant impact on economic development.
- In countries with a high level of economic development, the knowledge factor demonstrated a positive influence. In these countries, structural capital and relational capital also positively affect the level of economic growth, while the impact of social capital was found to be insignificant.
- In countries with a low level of economic development, the knowledge factor was found to have less significant influence. In such countries, only the quality of education positively impacts economic growth.

T. Stevanović, M. Ivanović-Đukić, T. Rađenović and O. Radović explored the effects of intellectual capital on economic growth in Southeast European countries (Stevanović, et al., 2018:777). They based their analysis on Al-Ali's theory of three intellectual capital management phases (Al-Ali, 2003:14):

Managing knowledge

Managing innovation

Managing intellectual property

To measure knowledge, the gross enrollment ratio in higher education was used as a key indicator.

**Discussion**

The main hypothesis is that national intellectual capital is a significant determinant of economic growth in Southeast European countries. To confirm this hypothesis, correlation and regression analyses were applied.

The research results indicated that knowledge management and innovation management positively influence economic growth. However, problems in intellectual property management did not demonstrate a positive impact on economic growth.

The findings also revealed that the increase in high-tech exports, the growth in the number of research and development researchers**,** and the rise in mobile phone subscribers had a positive and significant impact on the economic growth of the 15 analyzed countries. Conversely, while the percentage of research and development activities expenditures relative to GDP and the gross enrollment ratio in higher education showed positive effects, their statistical significance was minimal. Additionally, the impact of patent applications was found to be negative.

The calculations revealed a correlation between national intellectual capital and economic development. A statistically strong positive correlation was observed between national intellectual capital**,** the Human Development Index ($r=0.806$)**,** and the Global Competitiveness Index ($r=0.905$)**,** with $p<0.01$**.** However, the positive correlation between national intellectual capital and GDP based on purchasing power parity was found to be statistically insignificant.

The study by Jednak S. et al. showed that intangible assets constitute 45% of global GDP**,** with this figure reaching 70% in the United States and 52% in the European Union**.** Northern European countries such as Denmark, Sweden, Finland,

Norway, and the Netherlands demonstrated the highest levels of national intellectual capital**,** Human Development Index**,** and Global Competitiveness Index**.**

Regarding developing countries, two key findings were identified:

a) A positive correlation between national intellectual capital and unemployment was observed, which was not evident in developed countries.

b) Although national intellectual capital is a driver of economic development, it is not the primary factor (Jednak, et al., 2018:77).

In general, scholars argue that the accumulation of intellectual capital at the national level plays a crucial role in supporting economic growth. Productivity increases when knowledge is applied to current tasks, while innovation occurs when knowledge is applied to new tasks.

**Conclusion**

In this article, we reviewed studies that examine intellectual capital, particularly the impact of its components on economic growth, and considered the key conclusions from those studies for further investigation (Vo, et al., 2024:281).

We would like to emphasize that many studies have identified intellectual capital as a driving force for improving corporate efficiency (Ausat, et al.,2022:363), knowledge sharing (Li, et al., 2022:219), innovation (Al-Khatib, 2023:391) and enhancing innovation efficiency (Zhao, et al., 2022). Additionally, recent research has started exploring how intellectual capital is increasingly being supplemented by digital technologies.

Based on the brief review above, the following conclusions can be drawn:

- The development level of intellectual capital components varies significantly across countries. Strengthening these components can contribute to ensuring economic growth.

- Overall, intellectual capital has a positive impact on economic growth and development. However, quantifying its contribution in monetary terms is challenging, and it does not always translate into direct financial outcomes.

- Human capital and renewal capital (innovation capital) have the most significant influence on economic growth.

- Intellectual capital has limits to its development, which are defined by the development limits of its components, such as technology. For instance, technology must be continuously updated to remain effective.

- The efficiency of intellectual capital components depends on the conditions established within the country and the overall state of the economy (as shown in Figure 1). Furthermore, it is influenced by the competency to utilize these components effectively. For example, in post-socialist countries of Eastern Europe, despite a high level of professional education among the population, technologies are not used efficiently.

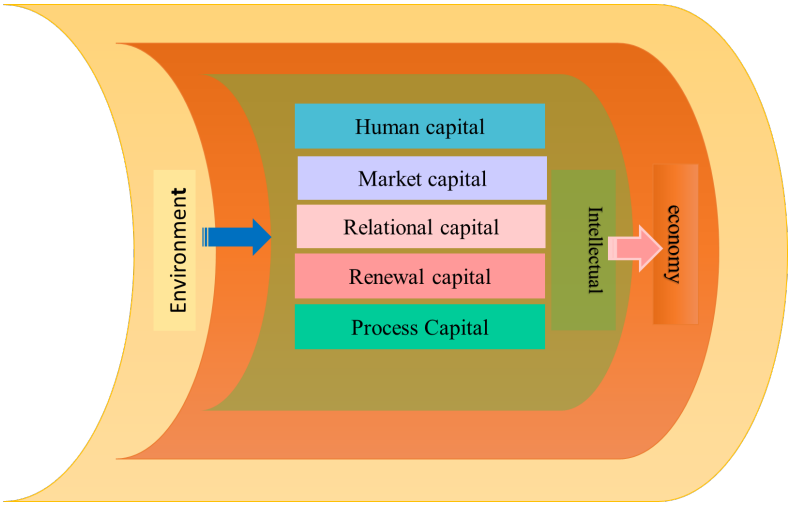


Figure 1 - Environment, economy and intellectual capital

- The increase in high-tech exports, the number of research and development researchers, and the number of mobile cellular subscriptions per 100 people positively impact the growth of GDP per capita.
- Knowledge management and innovation management have a positive effect on economic growth. However, the environment and regulations significantly influence the quality of knowledge. Therefore, in developing countries, improving the quality of education is more important than increasing access to it. Any efforts aimed at accelerating economic growth should be implemented based on intellectual capital.

For example, if government expenditures on education increase by 1%, GDP per capita decreases by 2.51% (assuming all other variables remain constant). One reason for this is that a significant portion of the funding is allocated to employee salaries rather than improving the quality of the educational process. Highly skilled workers contribute to the faster adoption of new technologies and production processes. In countries close to the technological frontier, a highly qualified workforce has a strong impact on growth. Intellectual capital functions with varying levels of efficiency in developed and developing countries. In developing countries, intellectual capital is not the primary driver of economic development. In low-income countries, market capital does not play a key role in economic growth, while the influence of renewal capital and development capital is also relatively insignificant.

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