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## IMPACT OF INFORMATION TECHNOLOGIES ON THE DEVELOPMENT OF INTELLECTUAL CAPITAL OF ENTERPRISES

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**Key words:**
assessment of intellectual capital, competitiveness, innovative health, personal expertise.

The article examines the impact of the implementation and adaptation of advanced information technologies by personnel for the development of intellectual capital (IC) of enterprises. The author describes the importance of information technology skills in the arsenal of a modern person for successful employment and professional career development, provides statistical data on the development of the IT sector over 5 years, which indicate dynamic growth and significant investments in this area. The writer of the article defines the essence and components of IC that ensure competitive advantages in the market, analyzes the effects of information technology implementation on the efficiency of production processes, highlighting both positive and negative aspects. He presents the results of previous studies that allowed forming the most accurate definition of intellectual capital, which is based on human, structural and consumer capital, demonstrates the results of MIT and IBM research, which argue that human data analysis is necessary to increase net operating income at the enterprise. The author lists the most effective options for the development of IC through the implementation of trainings to enhance proficiency, improve production processes and increase the share of intellectual activity. Based on the popular methods for assessing intellectual capital, the writer proposes his own approach of measuring this indicator, which includes personal expertise and innovative health of the enterprise. In conclusion, the writer emphasizes the close connection between the development of these indicators based on the proposed methods of increasing IC. The article repeatedly states that it is difficult to define a single portfolio of indicators for assessing intellectual capital through the adoption of information technologies. The author emphasizes the formation of a comprehensive indicator and conducting an experiment to confirm the hypothesis about the impact of IT on the formation of IC.

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## ВПЛИВ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ НА РОЗВИТОК ІНТЕЛЕКТУАЛЬНОГО КАПІТАЛУ ПІДПРИЄМСТВ

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**Ключові слова:**
інноваційне здоров'я, конкурентоспроможність, особистісна експертиза, оцінка інтелектуального капіталу.

В статті досліджується вплив впровадження та адаптації персоналом сучасних інформаційних технологій для розвитку інтелектуального капіталу (ІК) підприємств. Автор описує важливість навичок користування інформаційними технологіями в арсеналі сучасної людини задля успішного працевлаштування та розвитку професійної кар'єри; наводить статистичні дані розвитку ІТ-сектору за 5 років, які свідчать про динамічне зростання та значні інвестиції в цю сферу; визначає сутність та компоненти ІК, які забезпечують конкурентні переваги на ринку; аналізує наслідки впровадження

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інформаційних технологій на ефективність виробничих процесів, виділяючи як позитивні, так і негативні аспекти; наводить результати попередніх досліджень, які дозволили сформувати найбільш точне визначення інтелектуального капіталу, в основі якого лежать людський, структурний та споживчий капітали; демонструє результати дослідження MIT та IBM, які стверджують про необхідність аналізу людських даних для збільшення чистого операційного доходу на підприємстві; перелічує найбільш ефективні варіанти розвитку ІК шляхом запровадження тренінгів для підвищення кваліфікації, вдосконалення виробничих процесів та збільшення частки інтелектуальної діяльності; наводить приклади популярних методів оцінки інтелектуального капіталу, які враховують різні напрямки діяльності та пропонує власний метод його вимірювання, в основі якого лежать показники особистісної експертизи та інноваційного здоров'я підприємства. У підсумку автор підкреслює тісний зв'язок розвитку цих показників виходячи із запропонованих методів підвищення ІК. У статті неодноразово простежується твердження про складність визначення єдиного портфеля показників для оцінки інтелектуального капіталу шляхом впровадження інформаційних технологій. Автор наголошує на формуванні комплексного показника та проведенні експерименту задля підтвердження гіпотези щодо впливу ІТ на формування ІК.

## Statement of the problem

In the modern world, information technology has become an integral part of business processes in many areas. They help to increase labor efficiency, reduce resource consumption or improve the quality of the final product or service. Investing in the development of information technology at an enterprise seems to be the smart decision, as it creates a number of both tangible and intangible benefits. One of these intangible benefits is an increase in the company's intellectual capital, which allows for an overall boost in the company's competitiveness in the market. The problem is in the multi-component structure of this indicator and the difficulties in its calculation. The article proposes an alternative approach to assessing the indicators of intellectual capital formation.

## Analysis of recent studies and publications

The issue of the essence of intellectual capital is not new. Many Ukrainian and foreign scholars have devoted their works to the study of this concept. Among the most prominent are C. Swaby, T. Stewart, A. Brookings, D. Duffy, S. Legenchuk, A. Cherep, O. Nazarov, etc. At the same time, such scientists as M. Mura, L. Budovych, M. Demianchuk, M. Hetman and others have studied the issue of calculating intellectual capital in the context of tangible and intangible assets of the enterprise. However, due to the complex structure and the lack of a single definition of the IC essence, these studies cannot be considered as exhaustive, so it is necessary to study this problem in more detail by identifying additional indicators.

## Objectives of the article

The purpose of the study is to determine a portfolio of alternative quantitative indicators for measuring intellectual capital, which is formed during the implementation of information technologies in the business processes of an enterprise.

## The main material of the research

Today it is quite difficult to imagine an enterprise that does not use information technology in its business processes. The development of IT creates global trends that encourage management at various levels to attract additional investments in its implementation in enterprises. When people are constantly overwhelmed with a lot of information, rational use of mental resources by automating routine processes and delegating simple tasks to "programmable assistants" is not a whim, but a necessary step.

Statistics on the budget of the Ministry of Digital Transformation of Ukraine over the years confirms the previous opinion, as the development of information technology is taking place not only at the commercial but also at the state level (Fig. 1). We can see that there is a positive trend in this direction, and over 5 years the budget has increased almost 6 times, which indicates the prospects for investment in the IT sector [1].

Ukraine's achievements in digitalization are difficult to overestimate. It remains one of the most advanced countries in Europe in this regard, and our experience is being adopted by other European countries, notably Estonia [2]. At the same time, human intelligence is the driving force that allows information technology to develop and bring benefits. It would be incorrect not to use these achievements to improve the intellectual activity of humanity. That is why the use of IT is a powerful tool for the development of intellectual capital. However, it can lead to both positive and negative consequences. The positive ones include:

– increasing labor productivity. IT helps automate many routine tasks, which frees up employees' time for more creative and innovative work;

– improvement of collaboration and knowledge sharing. IT helps to minimize the number of unnecessary communications, keep all information up-to-date and speed up decision-making;

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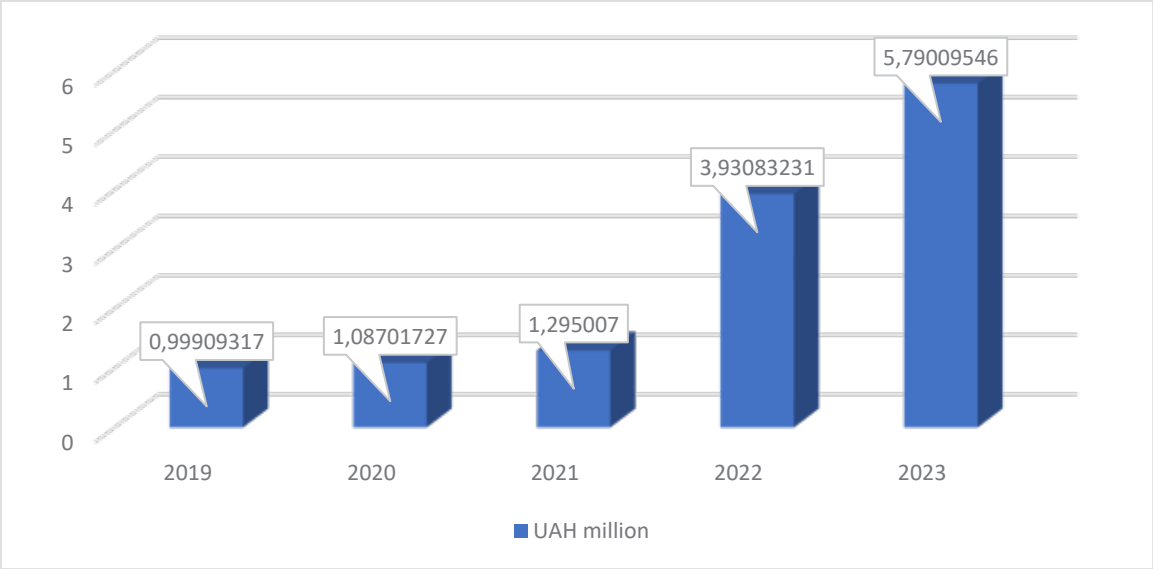


Figure 1 – Budget of the Ministry of Digital Transformation of Ukraine for 2019-23, UAH million

– increasing the quality of the product/service. Technologies for automating testing, improving quality control, and customer support affect the final quality of the product/service.

The negative consequences of IT implementation include:

– additional maintenance costs. Implementing and maintaining information technology in an enterprise can be an expensive investment and can hold management back;

– the necessity of training. New processes may require additional time and effort from employees to master new tools;

– employee resistance. Some employees may not share the initiative to integrate IT into their functional tasks due to the complexity of the process, lack of transparency or the threat of losing their jobs.

It is important to mention that the scale and speed of information technology adoption depends on such factors as the type and size of companies, industry sector, corporate culture etc.

Despite the factors mentioned above, it is difficult to assess the impact of information technology implementation on the development of intellectual capital. Generally, the definition of intellectual capital is divided into 2 groups: either it is identified only with the human factor; or it is a more complex system that includes various components (processes, intellectual resources etc.) and the links between them [3].

D. Duffy suggests that "intellectual capital is the aggregate knowledge possessed by an organization through its employees, as well as in the form of methodologies, patents, architecture and relationships" [4]. However, I personally like O. Davydova's definition that " intellectual capital is a set of knowledge, information, experience, qualifications and motivation of personnel, organizational capabilities, technologies that can create added value and ensure the company's competitive advantages in the market" [5].

Compared to other tangible assets, knowledge, experience and creativity cannot be physically measured, so there is no unified metric for measuring it. The best way to evaluate the development of intellectual capital is through innovation, i.e. through the creation of new or improvement of existing products or processes. That is why, in the context of comparing tangible and "mental" assets, the latter are focused on the future.

Similarly to tangible capital, intellectual capital is exposed to depreciation and eventually becomes obsolete, which means it requires costs to adjust and maintain. Companies that take into consideration intellectual capital indicators while calculating their company's success are more likely to achieve their tactical and strategic goals. I. Kaplia's research has shown that intellectual capital is not only "goodwill" (or company reputation) but a much broader concept [6].

The structure of intellectual capital is ambiguous, but one of the most popular is the classification of K. Swayby, who identified three main components [7]:

– human capital. It includes all the knowledge and experience of the organization's employees (life and work), innovative education etc.

– structural capital. It includes the company's mission and policies, work culture, organizational structure, copyrights etc.

– consumer capital. Includes the company's brand, reputation and covers the organization's relationships with employees, service providers, customers and other stakeholders.

To sum up, intellectual capital is an important component of a company's normal functional activities. At the same time, the socio-cultural characteristics of different generations (X, Y, Z) determine the actual parameters of consumer interest in a product or service [8]. That is why managers of many enterprises create appropriate conditions for the retention and development of their employees,

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taking into account current trends, because the cost of hiring and adapting a new specialist to the previous level will be more expensive for the company.

A study conducted by MIT and IBM showed that the use of human data analytics by companies could increase net operating income by 24% [9].

The use of information technologies in work can contribute to the growth of the intellectual capital of an enterprise, as they allow to access information faster, analyze more resources, acquire advanced tools, i.e. increase the intellectual potential of an employee. These skills are related to human mental activity, which is more valuable than physical activity today [10] and allows rational use of intellectual resources for creative activities rather than routine tasks. Thus, in the near future, employees who are able to use the benefits of information technology in their professional field will be more in demand and attractive to companies in various industries.

It is crucial for companies to invest in the development of their employees' intellectual potential if they want to stay relevant and deliver competitive advantages. This view is confirmed by a study conducted in 2021, which shows a direct link between the importance of intellectual capital and maintaining market competitiveness in the telecommunications sector [11].

The most effective methods of preserving human resources and improving intellectual potential in terms of IT proficiency are:

– development and implementation of trainings and qualification improvement courses. Continuous training, bonuses from the company and a circle of like-minded people contribute to the professional and social growth of employees;

– improvement of work processes. The use of new technologies, best international practices and methodologies enables to increase the efficiency of operational tasks and improve customer relations;

– intellectual activity. The development of new products and patents using advanced tools and approaches contributes to the creation of intellectual assets of the enterprise.

It is important to assess changes in intellectual capital when implementing any method. The challenge is that calculating this issue is a non-trivial task, as there is no clear system of indicators (moreover, individual companies have developed their own assessment tools over time). One of the most famous analytical methods of assessment is the Skandia Navigator, developed in 1997 by the eponymous company, which uses a system of financial and human indicators (Table 1) [12].

Demianchuk M. supplemented this assessment system by introducing such quantitative criteria as "educational level of personnel", "timeliness of staff development", "digitalization coefficient" [10] etc. and thus defining the relationship between information technology and intellectual capital fairly closely.

The above assessment methods are significant, although, given the rapid development of IT, other indicators can measure intellectual capital. The above portfolio of assessments can be divided into 2 categories (table 2).

The described metrics in the "personal expertise" category are designed to measure an employee's skill in performing work tasks – the time required to solve a problem, the number of errors in the process etc. Reduction of these indicators indicates that tasks are performed at a lower cost and/or with higher quality.

The indicators of the "innovation health" category take into consideration the factor of continuous training and research activities of employees to create new products or processes, which in the long run affects the material indicators of the enterprise (innovative and market property, competitiveness etc.).

It is important to note that these indicators describe the elementary part in the calculation of the intellectual capital of an enterprise in the context of information technology implementation. However, the use of IT in practice should improve these indicators, which will lead to an increase in the intellectual capital of the enterprise. I consider further

Table 1 – Skandia Navigator intellectual capital valuation method

| Area | Key indicators |
|---|---|
| *Financial* | Revenue/employee, new customer revenue/total revenue, management revenue/costs |
| *Csutomer* | Sales funnel duration, number of lost customers, satisfaction index etc. |
| *Process* | Administrative expenses/total income, interest rate volatility rating |
| *Innovative* | Employee satisfaction index, market costs/management costs, market costs/customer etc. |
| *Human* | Number of managers with higher education, annual staff turnover rate, leadership index etc. |

Table 2 – Alternative portfolio of intellectual capital valuation metrics

| Area | Key indicators |
|---|---|
| *Personal expertise* | Number of tasks returned for revision to the total number of tasks (taking into account the employee's experience)<br>Amount of time spent on researching the issue to the total time spent on the task<br>Number of overtime hours to the total number of working hours<br>Number of hours spent on communication to the total number of hours spent on the task |
| *Innovative health* | Number of initiatives accepted from an employee to the total number of initiatives generated (taking into account the person's experience and age)<br>Number of employees who are studying/finished trainings to the total number of employees (per year)<br>Number of employees involved in cooperation with international institutions in the field of research to the total number of employees |

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research to be the development and calculation of a general (integrated) indicator for the categories of "personal expertise" and "innovative health" of the enterprise, as well as conducting an experiment and comparing these indicators before and after the integration of IT tools into work processes.

## Conclusions

Based on the analysis of the previous researchers' works, the article studies the impact of information technologies on the formation of intellectual capital of an enterprise. It is determined that information technologies serve as a powerful tool for increasing the productivity of human mental and physical labor, while intellectual activity is the engine of development of these technologies, so companies should pay attention and invest resources in the development of intellectual capital. The complexity of the study was the lack of a single definition of this concept and the lack of a generally accepted system for calculating intellectual capital. Taking into consideration the analysis of existing methods for assessing intellectual capital, a portfolio of alternative indicators was proposed, which is designed to study the impact of the implementation and maintenance of information technologies on the formation of the "mental potential" of enterprises. Further development of this topic includes the creation of a comprehensive indicator and an experiment on the relationship between IT and IC.

## References

1. Budget | Ministry of Digital Transformation of Ukraine. *thedigital.gov.ua.* Retrieved from https://thedigital.gov.ua/community/budget [in Ukrainian].
2. Diji 3 roki. Yak Ukraina otrimala mistse u svitoviy istoriji cifrovizatsiji. *epravda.com.ua.* Retrieved from https://www.epravda.com.ua/columns/2023/02/14/697034/ [in Ukrainian].
3. Klimenko I. S., Taranuha O. M. et al (2021). Intelectualniy capital i rynok intelectualnoi vlasnosti v umovah informatsiynoi economiki: problem identificatsii otsinki. *Economika i derzhava, 5, 38-43.* DOI: 10.32702/2306-6806.2021.5.38 [in Ukrainian].
4. Intelectualniy capital pidpriemstva: poniattia ta upravlinnia. *osvita.ua.* Retrieved from https://osvita.ua/vnz/reports/econom_pidpr/18716/ [in Ukrainian].
5. Davidova I. O. (2013). Realizatsia intelectualnogo capitalu: suntist, skladovi, rol systemy zayniatosti v tsiomu procesi. *Bisnes inform, 2, 177-180.* Retrieved from http://nbuv.gov.ua/UJRN/binf_ 2013_2_37 [in Ukrainian].
6. Kaplia I. V. Intelectualniy capital: economichna priroda ta problem obliku. *Oblik i financy APK: osvitniy portal.* Retrieved from https://magazine.faaf.org.ua/intelektualniy-kapital-ekonomichna-priroda-ta-problemi-obliku.html [in Ukrainian].
7. Ponidelchuk T. V. (2014). Intelectualniy capital: suntist ta metody otsinky. *Efectivna economica, 6.* Retrieved from http://www.economy.nayka.com.ua/?op=1&z=3288 [in Ukrainian].
8. Hrynko P. L. (2021). Metodolohichni pidhody do viznachennia structury intelectualnogo capitalu organizatsiy v umovah tsyfrovoi economicy. *Economicha strategia i perspectivy rozvitku sfery torhivly i poslug, 1 (33), 147-155 [in Ukrainian].*
9. Pyat prostih u rozrahunku HR-metric, yaki dopomozhut zbilshity dohid companii. *forbes.ua.* Retrieved from https://forbes.ua/leadership/5-prostikh-v-rozrakhunku-hr-analitik-yaki-dopomozhut-zbilshiti-dokhid-kompanii-04022021-958 [in Ukrainian].
10. Demyanchuk M. A. (2020). Vplyv tsifrovih transformaciy na intelectualniy potencial pidpriemstva. *Problemy systemnogo pidhody v economici, 1 (75), 98-106.* DOI: https://doi.org/10.32782/2520-2200/2020-1-14.
11. Obeidat, U., Obeidat, B., Alrowwad, A., Alshurideh, M., Masadeh, R & Abuhashesh, M. (2021). The effect of intellectual capital on competitive advantage: The mediating role of innovation. *Management Science Letters, 11 (4), 1331-1344.* DOI: 10.5267/j.msl.2020.11.006.
12. Yi An, Umesh Sharma et al. (2015). Toward a conceptual template for intellectual capital measurement and reporting. *International Journal of Business and Management, 10 (7).* DOI: https://doi.org/10.5539/ijbm.v10n7p236.