

# Evaluation of intellectual capital as a factor in the development of business systems industries

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**Abstract** — This paper analyzes the role of intellectual capital ie intellectual property in economic and social development, as well as its function within the company as an important and often crucial development factor. Furthermore, this paper explains the knowledge-based economy as a fundamental change in the economy and its logical path of development. The focus of this paper is on methods and models for measuring intellectual capital. The authors present and analyze quantitative and qualitative methods and approaches, and in the conclusion, they provide a critical review and propose a new direction for measuring intellectual capital. Apart from the above, an example of assessing the value of intangible assets of small and medium-sized enterprises from the countries of the European Economic Area is provided.

**Keywords** - intellectual capital, knowledge economy, indicators, quantitative, qualitative

## I. INTRODUCTION

Intellectual property, with its two components - industrial property, on the one hand, and copyright and other related rights, on the other hand, is one of the basic levers of economic and social development. Science, technology and innovation are areas that continuously produce technical progress, ensuring the sustainability of development raising the level of economic competitiveness. Apart from that, innovation and technology transfer are solutions for getting out of economic

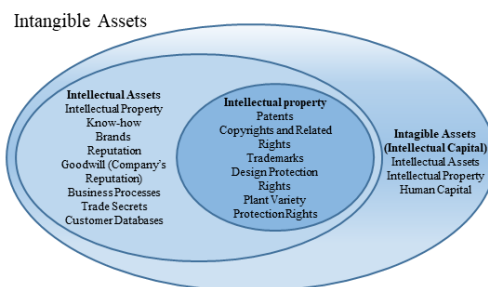
crises that occur more and more frequently under the influence of various factors. They are also the solution for the permanent renewal of necessary technologies by directing research according to the needs and demands of the growing market in globalization situation.

In the process of reforming the area of intellectual property, it is necessary to make a turn regarding the exchange of technologies and new models of economic management, towards models that can include the issue of intellectual property as an element of economic cohesion between large producers and small and medium-sized enterprises. In financial evaluations as well as in organizational management, each of the categories of goods and their complexity are taken into account as an economic resource.

Intangible goods are defined as intangible factors that favorably affect the results of the company's operations, the production of goods or the provision of services. According to Roos, Pike and Fernstrom, "Intellectual Capital can be defined as a non-monetary and non-physical resource that is fully or partially controlled by the organization thus contributing to the organization's value creation" [1]. Economic activities based on the production of knowledge, its distribution and consumption are not something that is new to the economy. However, what is new is the vision that such activities will become the most important factors of the entire economy. That is why the increasingly dominant

role of knowledge as a production factor indicates significant structural economic changes and the transition of the industrial economy towards an economy intensively based on knowledge [2]. Intellectual capital is becoming a crucial performance and growth factor in a knowledge-based economy where companies with modern management tend to identify their core competence as intangible assets rather than tangible assets [3] [4]. "The key value of the concept of knowledge economy is that it connects the creative potentials of the human factor, innovation potential and technology, as generators of growth, institutions and economic actors, which is crucial for initiating and sustainability of economic growth and development" [2].

Figure 1. Intangible Assets of Intellectual Capital



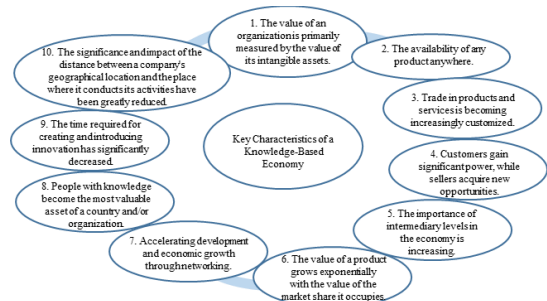
Source: Authors

## II. KNOWLEDGE-BASED ECONOMY

The knowledge economy represents a fundamental change from the economy that was based primarily on physical resources to an economy that is predominantly based on knowledge (knowledge that controls and directs physical resources, in addition to human, intellectual and other resources). The basis of this (r)evolution is the decisive role that knowledge plays in the modern economy. In the past decades, the increase in the economic importance of technologies, information, economic processes, human capital, organizational skills and abilities, i.e. factors that are essential in relation to knowledge have increasingly influenced world, regional and national economies, and as such these factors have been integrated into economic theory and management theory in parallel with current practice. Each of these factors, considered individually, reveals elements that are particularly valuable and have significant

practical applications. Nevertheless, their common denominator is knowledge, while these elements actually represent methods of individualization and operationalization.

Figure 2. Key Characteristics of a Knowledge-Based Economy



Source: Authors

We bear witness to the fact that competition and permanent changes in technology have caused the need to transform and develop all areas of human life. The planet is faced with several massive changes: while resources are obviously limited, human ambitions and desires make them unlimited. Visibility of processes, transactions, and relations, enabled by the Internet and social networks, calls for even greater responsibility so as to make communication, business solutions, and cooperation as quality as possible. Survival of each organization, and even nations, depends on the possibility to keep in permanent contact with progress and changes in all spheres [5]. As a result of globalization and digitalization, companies can build around a thinking model instead of a production/service delivery model. To be effective, the most important key is how effective human resources, as intangible assets, are allocated to be more innovative and creative. There are numerous case studies that indicate that increased employee commitment to the company contributes to greater customer loyalty and, as a consequence, profitability. In direct contact with clients, employees can use appropriate skills and knowledge to complement technical solutions, creating an emotional connection with clients. Intangible assets of a company, such as employee relations and reputation, are those aspects of a company's competitiveness that cannot be copied and thus provide an indisputable competitive advantage. [6] Companies are constantly looking for new

and talented employees in a market where there is a strong struggle to acquire talented employees. It is not enough for companies to focus on introducing new talented employees into the company, there is also the challenge of retaining talented employees [7].

Opportunities for changing evaluation of innovativeness, with implementation of leadership strategies based on employee knowledge, are growing. In the current stage of economic life, business will be developed after the thinking model rather than the product development and service rendering model [6]. A competitive organization based on knowledge must integrate aspects related to intangible assets and it must orientate itself towards the issues related to design and quality creation, knowledge development, organizational image, ability to activate human resources in the long term, etc. The management of intangible resources primarily depends on who manages the intellectual capital (that is, its ability to manage knowledge), and to what extent that capital can generate profit and enable the trade of intellectual goods. Management of intangible resources must articulate components such as resources and competencies, functions, processes.

Intangible assets play a very important, and often crucial, role in ensuring the competitiveness of small and medium-sized enterprises, since in the financial sense (appearance on the market, marketing, etc.) they cannot compete with large enterprises and companies. Intangible assets are considered key factors in creating the value of organizations and are associated with a new management approach aimed at long-term profit. Within such a view of management, an ethical and long-term approach is more important than meeting the demands of financial investors [8].

### III. EVALUATION OF INTELLECTUAL CAPITAL

What is crucial for intellectual capital is the fact that it has the role of potential for creating surplus value in the company, which will be realized as much as the company successfully manages its intellectual capital. In the case of intellectual capital (as opposed to other types of capital), more is not always better, because companies do not need a larger stock of knowledge, but more productive knowledge that

creates added value. [9] In order to understand how intangible assets create value in companies, various frameworks and reporting approaches have been developed. At the same time, intangible assets are incorporated into evaluation models applied by banks and investment funds that contribute to increasing the transparency of business operations and their higher rating [10].

The authors single out four basic approaches for measuring intangible assets. Based on a broader insight into the literature and approaches of different authors [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] we herewith highlight the division accepted by many of the authors which was proposed by Luthy as early as the end of the last century [20]:

- *Methods of direct evaluation of knowledge capital (DIC)* estimate the monetary value of intangible assets by identifying their various components. Once these components are identified, they can be directly evaluated, either individually or as an aggregated coefficient.
- *Market capitalization methods (MCM)* calculate the difference between the company's market capitalization and capital (its share capital) as the value of its intangible assets.
- *Return on assets (ROA) method*, the company's average pre-tax earnings for a certain period of time is divided by the company's average tangible assets. The result is the company's ROA, which is then compared to its industry average. The difference is multiplied by the company's average tangible assets to calculate the average annual earnings from intangible assets. By dividing the average profit by the company's average cost of capital or interest rate, the value of its intangible assets can be estimated.
- *Scoring methods (SC)*. Different components of intangible assets or knowledge capital are identified and indicators and indices can be presented in score reports.

The first three methods measure the financial value of intellectual capital, while the last method focuses on non-financial criteria, and the mentioned methods have various advantages and disadvantages. The ROA and MCM methods are useful in mergers and acquisitions (S&P) or stock market valuations. They can also be used to compare companies from the same industry and are suitable for displaying the

financial value of intangible assets. Because they are based on long-established accounting rules, they are easily communicated and applied within the accounting and banking sectors. Their main drawback lies in their strict financial approach. ROA methods are very sensitive to changes in interest and discount rates, and many of them are not useful for nonprofits, internal departments, and public sector organizations.

The advantages of the DIS and SC methods relate to the creation of a more complete picture of the state of the organization and can be easily applied to every level of the organization. They are very useful for non-profit organizations, internal departments and organizations from the public sector, as well as for social and environmental needs. Their disadvantages relate to the fact that the indicators are context-dependent and must be adapted for each organization and each purpose, which makes comparison very difficult. In addition, approaches that consider the entire organization can mean a lot of data that is difficult to aggregate, then analyze and finally synthesize. If it is done, it requires great commitment and a high level of expertise.

The methods, models and techniques of assessing the value of intangible assets determine their complex character and typological diversity. Starting from the general methods of determining the value of intangible assets, for each category and type of intangible assets, the method that best corresponds to the set goals must be chosen.

The first criterion of classification, the method for analysis is focused on the inclusion of intangible assets, which implies making a distinction between:

- holistic (comprehensive) method in the sense of a unique analysis of the entire system of intangible assets of a company or branches that are multiple interconnected; holistic methods suggested in scientific literature and business practice are: IC-Index<sup>TM</sup> (knowledge capital index); ratio of market and book value; Tobin's coefficient Q; VAICTM; earnings from knowledge capital; EVATM; calculated value of intangible assets; IAMVTM; AFTFTM.
- atomistic or partial method, which involves the analysis and assessment of the value of an individual intangible asset. The atomistic methods that are applied are: value

chain representation<sup>TM</sup>; Skandia navigator<sup>TM</sup>; scoring with balanced indicators; monitor of intangible assets; human capital intelligence; patents valued by the number of citations; HRCA; inclusive valuation methodology; technology broker; TVCTM; value explorer<sup>TM</sup>; valuation of intellectual property and others.

From the point of view of determining intangible assets, in terms of value and lack of value, the scientific literature suggests the following:

- non-monetary methods that approach intangible assets in terms of qualitative analysis (for example, value chain view<sup>TM</sup>, intangible asset monitor, balanced scorecard, etc.);
- monetary methods (for example, the ratio of market to book value; Tobin's coefficient Q; earnings from knowledge capital; VAICTM; EVATM; calculated value of intangible assets; IAMVTM; AFTFTM, etc.).

Eight methods are most often used in economic practice as follows:

- four monetary and holistic methods: ratio of market and book value; Tobin's coefficient Q; economic added value (EVATM); earnings from knowledge capital, proposed by Lev [21];
- four non-monetary and atomistic methods: Skandia navigator (developed by Edvinsson and Malone) [22]; monitor of intangible assets [3]; scoring with balanced indicators [23] and value chain presentation.

From the point of view of the strategic management of the company, experts state the following groups of methods, which basically represent a regrouping of the previously presented methods, namely:

- methods based on market capitalization: Tobin's coefficient (Tobin's Q); indivisible difference. Tobin's coefficient Q is the ratio of the market value of the mentioned company to the replacement value of its tangible assets. The indivisible difference is the difference between the market value of the company and its net assets;
- methods based on return on assets: economic added value (EVA); market value added (MVA); net asset value; earnings from knowledge capital.

EVA reflects residual net profit or existing economic profit only when the difference

between the return on invested capital and the weighted average cost of capital of the company gives a positive result.

MVA is calculated as the difference between the market value of the company and the subscribed capital, loans and retained earnings.

Earnings from knowledge capital is calculated as the ratio of the difference between the normalized annual net profit and the net profit of tangible and current assets on the one hand, and the capitalization rate of knowledge capital, on the other.

Valuation of intangible assets using these methods is achieved through information and non-monetary valuations based on surveys or special forms of discounted cash flow.

#### IV. EXAMPLE OF EVALUATION OF INTANGIBLE ASSETS OF SMALL AND MEDIUM-SIZED ENTERPRISES FROM THE COUNTRIES OF THE EUROPEAN ECONOMIC AREA

Due to their ability to generate economic benefits, intellectual property assets today play an important role in the progress and development of small and medium-sized enterprises. The management of intangible resources includes, in a certain form, the identification and analysis of intellectual property assets, that is, the evaluation of intellectual property assets - intellectual capital.

The current quantitative and qualitative valuation methods are the ones most often used in determining the value of intellectual property assets. While quantitative methods evaluate the monetary value of intellectual property assets, qualitative methods evaluate intellectual capital assets using an assessment and scoring system.

Choosing the appropriate method for the valuation of intellectual capital goods depends on its characteristics, the medium of marketing, the target group and the expected results of the evaluation.

The main reason for evaluating the value of intellectual capital is to realize its maximum value and, consequently, the value of the organization by making optimal decisions by managers. There are certain scenarios where valuation is necessary and required: valuation of businesses (transactions, takeovers and mergers, bankruptcy, joint ventures, etc.), sales or

licensing deals, financing (bank loans, venture capital, investments), tax planning and tax compliance, external reporting and accounting, dispute resolution and related support, internal management.

The choice of evaluation methods must be in accordance with the intended objective: the right methods for objectives that have non-monetary results (for example, management decisions) are qualitative methods; objectives with monetary results (such as transactions) are suited to quantitative methods. For example, a valuation of intellectual capital for internal management will require an internal value, while a valuation for sale or licensing will require a market value. These values may differ from each other. Several valuation approaches have been proposed, each with its own strengths and weaknesses. For best results, it is important to choose the appropriate method or set of methods for each individual case. Practically every set of evaluation tools contains one or more described methods.

Important factors that must be considered when requiring intellectual capital evaluation and selecting appropriate tools based on the following questions are as follows:

1. Which intellectual capital assets need to be valued?

Valuation of intellectual capital is possible if it is identified and differentiated from other tangible or intangible assets. In practice, however, it is difficult to separate, for example, two interdependent patents or technological advances from a brand name.

2. What is the purpose of valuation?

The value assessment procedure determines the type of value (internal value, market value) and the type of required value assessment result (qualitative, quantitative).

3. Who is the valuation for?

Different valuation approaches are needed if the target group includes different investors or if the valuation is performed for internal management purposes.

4. Who conducts the value assessment?

The appraiser may have experience in a particular valuation domain and this could influence the choice of valuation methods. This can lead to bias in the valuation.

5. Date of valuation

The valuation date will affect the method chosen and, in the case of income-based methods, will affect discounting.

#### *Qualitative approach in evaluation. Methods applied in EEA countries*

Qualitative methods provide a guide to the value of IS assets through ranking and scoring systems related to various factors associated with intellectual capital assets. Those factors can have a positive or negative impact on the value of IS goods and cover all aspects that can affect an IS good (legal aspects, technological innovation level, market details and company organization).

Qualitative methods are used at the micro level to analyze the quality of intangible assets, their status and importance compared to other business aspects, the industry within which the company operates and the value of business competitors. At the macroeconomic level, qualitative methods provide a perspective of the useful life of intangible assets within the economic branch in which the company operates. A qualitative study is used to prove the justification of the basic assumptions of financial models for determining the numerical value of intellectual capital goods.

#### Qualitative assessment of patent value - Value indicators based on patent information

When it comes to patents, there is a strong correlation between patent value and standard metrics that can be found in patent information documents. For example, the number of references to earlier patents during the research and examination process and the number of citations of a patent indicate its importance and value. The result is a network of patent citations, which is a useful tool for qualitative value assessment. In addition, the number and quality of applications, the size of the patent family, and the outcome of patent application challenges can be indicators of value.

#### Evaluation of value indicators: IPScore

IPScore is software created by the Danish Patent and Trademark Office in collaboration with Professor Jan Mouritsen, Copenhagen Business School, and some Danish companies [24] and is used for internal evaluation of the value of technology, patents and patent portfolios within an organization. This tool provides a framework for strategic patent

valuation and management. IPScore consists of five categories: legal, technology, market, financing and strategy, each with associated questions. Each question refers to a different value indicator. Each question is scored from 1 to 5 according to the strengths or weaknesses of the patent. The indicators provide a complete picture of the patent and its implicit risks and opportunities. These are then graphically displayed in various forms that are used in management decision-making.

#### Advantages and disadvantages of qualitative valuation methods

The main advantage of these methods is simplicity. After obtaining the relevant information about the valued intellectual capital assets, it is very easy to perform the classification and valuation of these assets without the need for complex methods. Another advantage is the fact that the evaluated data is available to the public. Qualitative valuation methods facilitate the comparison and classification of intellectual capital assets within a company or comparison with the intellectual capital assets of competitors.

The disadvantages of estimating value using patent information linked to value indicators are that it emphasizes simply counting citations, thereby deliberately ignoring any added value within the citation network. The engaged appraiser must have sufficient experience and decide which indicators are relevant for the valuation and which are not. The quality and realism of value estimation using IPScore software largely depends on the quality of the information used.

Qualitative evaluation methods are used for internal management of intellectual property. They are useful for comparing, categorizing and classifying intellectual capital assets within a company's portfolio or for comparison with intellectual property competitors. They are also useful for evaluating the risks and chances of intellectual capital, i.e. properties.

Some of the models that can be used by both corporations and medium-sized enterprises is the Kaplan Norton model of firm valuation. The four perspectives include financial, customer, internal processes, and learning & growth. A few different objectives will probably emerge as company creates strategy map. [25] Inadequate market research is one of the key reasons why

70% of startups fail. The model that is called the Value Net Model is a strategic framework developed by Adam Brandenburger and Barry Nalebuff [26], primarily introduced in their book "Co-Opetition." This model helps organizations analyze their business ecosystems by identifying key players and understanding their interactions. There are several key components of the model: players that influence a business (customer, suppliers, competitors, complementors); added values refers to the contribution each player makes to the ecosystem, which can include products, services, knowledge, and resources; rules encompass the regulations, norms, and agreements that govern interactions among players; scope (defines the boundaries of the business ecosystem, specifying which players are included and excluded). Situations when company or start-up could use the model: market entry (before entering new markets, businesses can analyze the existing ecosystem and potential partners or competitors); ecosystem optimization (businesses can optimize their position fostering beneficial partnerships maximizing the value of the market); innovation (introducing new products or services, understanding the value net can guide innovation by considering how it fits into the larger ecosystem).

## V. CONCLUSION

In a knowledge-based economy, the terms knowledge economy and knowledge-based economy are distinguished. The knowledge economy refers to the production of knowledge, while the knowledge-based economy uses knowledge and technology to ensure growth and development and higher engagement of the capacities. However, the way intellectual capital is managed significantly (and sometimes decisively) affects business performance, i.e. the effects of using intellectual capital are not realized automatically, but must be expertly planned and implemented.

The intellectual value of the company is part of the total value, created through the process of accumulation of various intellectual components (expertise of employees, organizational processes, and the sum of knowledge contained within the organization, etc.). Companies with large intellectual capital create new knowledge more easily than companies with little

intellectual capital or poorly managed intellectual capital, even when it exists to a significant extent. The wide coverage of intellectual capital affects the perception of the impact on the company's business performance and the complexity of its valuation [27].

The impact of intellectual capital on the business performance of companies is evident and indisputable, but in practice these cause-and-effect relationships are still not sufficiently clearly seen and unified. Professional literature offers numerous researches, models and solutions, however, there is an insufficient number of empirically verified laws that could be unconditionally accepted. The authors gave an overview of the most represented and accepted ones, but also point out significant limitations because potential models should have a holistic character and include other factors, such as national and regional culture, narrower and wider political and legal environment, and others.

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