

## FORMATION OF THE INTELLECTUAL DATA BASE FOR THE PURPOSES OF THE DEVELOPMENT OF INNOVATION ECONOMY AND MANAGING COSTS OF THE ENTERPRISE



**Olga Mnykh**

*Lviv Polytechnic National University,  
Doctor of Economics, professor*



**Volodymyr Dalyk**

*Lviv Polytechnic National University,  
Candidate of Sciences (Economics)  
Associate Professor*

**Abstract.** The emphasis is on the urgency of the development of the intellectual database and information technologies for the development of an innovative economy, increasing the elasticity of productive resources, and the flexibility of management. This is a description of the main trends in the market of IT services and a description of the new conditions of the University - a world in which the world and domestic economy functions. The necessity of improving the models of economic management is proved, in which the quality of economic growth and the value of intangible assets, which includes the intellectual database and data management technologies, are more valuable. The features of the combination of methods of correlation-regression analysis, cluster analysis, fuzzy sets method in the management of the cost of the enterprise and the client's capital are determined.

**Keywords:** *VUCA–world, intellectual database, market environment, enterprise cost management, economic and mathematical models, regression analysis, cluster analysis, fuzzy sets method.*

### 1. Introduction

Developing countries, including Ukraine, serve the needs of global leaders and their economic growth rates are highly correlated with the dynamics of the level of natural capital exploitation. In such countries, the impact of the IT sector on structural changes in the economy, digitization of

logistics technologies, production and marketing, and rationalization of assets towards increasing intangible assets as the dominant intellectual capital is weaker. Therefore, the exclusion of outdated models of economic development at different levels of management and the formation of an innovative competitive economy involves a qualitative restructuring of strategic thinking of all actors that decide on: the definition of development priorities, information provision solutions for the functional components of diversified development, the investment of strategically important objects, which demonstrate elements of the intellectual database and computer technology. So problems in the study of modern information technologies, in particular, systematization, filtration of intellectual data, opportunities for wide-scale degradation (digitization) of marketing technologies and the discovery of valuable marketing primary information as an intellectual product are promising directions and subjects of applied and applied research.

## 2. Analysis of recent research and development

The complexity of socio-economic systems and their management, the strengthening of the interaction of external and internal factors, the multivariate creation of preconditions for development and market situations - all these social phenomena have increased the scientific and practical interest in the study of VUCA - the world (volatility, uncertainty, complexity, ambiguity) and the study of the behavior of economic entities in certain types of economic activity [1]. Data volumes in the 21st century grow in geometric progression. So, according to Cisco forecasts [2], published in the Cisco Visual Networking Index™ Complete Forecast (Cisco VNI) report, the global volume of IP traffic in the forecast period will triple, and by 2021 it will reach 3,3 zettabytes (in 2016 the similar indicator was 1.2 zettabyte; 1 zettabyte =  $10^{21}$  bytes). Artificial intelligence, virtual and augmented reality, the technology of Big Data and Data Science are becoming strategic directions for the development of today's world-class companies: virtual technologies have attracted Walmart for training employees; Sotheby's with VR will show real estate; Sotheby's with VR will display real estate; Ford is exploring the use of VR to test production lines; optimizing budgets, including marketing, deeper audience awareness and focused work with the segment of the audience that needs additional motivation or persuasion are key achievements of Cambridge Analytica. According to experts, the VR market will grow to \$ 75 billion by 2021, and the number of VR headsets in 2021 will reach 257 million devices [3]. For 25 years, SoftServe, a company with significant experience in software development from Cloud, Security and UX Design to Big Analytics and the *Internet of Things*, has been actively operating and leading IT services. The main areas for which the company develops software solutions are healthcare, retail, financial services and software. In December 2017 resource focus.ua

published the rating of the best employers of Ukraine in 14 industries, among which - the information technology and SoftServe ranked among the top 3 IT companies with Google and Microsoft [4]. Intensive changes the external international environment, including under the influence of force majeure situations, are an impetus for changing business models and policies for the adaptation of market agents. Thus, IBS, a well-known Russian integrator and developer of IT solutions [5], continues to develop a series of HyperConvergent Computing Platforms Skala-P, a joint engineering product of IBS and its partners: Depo Computers, Rostplatform, Mellanox, Raidix. The Skala-P platform is the response or reaction of IBS to the "new normality" in which the Russian IT industry has existed in recent years, which includes budget optimization and, consequently, an assessment of opportunities to meet the growing market needs in accessible, maximally rebuilt, integrated infrastructure solutions based on the universal, most commonly used mass-market server systems (commodity hardware).

## 3. Formulation of the research goals

*The purpose of this scientific work is to distinguish the value of creating new models of management of economics and business in the context of the VUCA-world on the basis of the formation and development of an intellectual database. The results of approbation of different methods are given and the prospects of their application in the field of marketing and management of the enterprise value are determined.*

## 4. Presenting main material

As the world practice of postindustrial countries shows, the development of market agents and the exit from the systemic crisis of the economy at macro and micro levels in the conditions of VUCA - the world is impossible without:

- acquire new knowledge on identifying problems at the system level and accordingly, developing system approaches to their solutions;
- building business models for bias and not just adaptation to changes in the market environment;
- the formation of competitive longterm benefits through the development of functional, technological, formal and informal ties that, on the one hand, complicates the system of direct and reciprocal links and the other hand, reduces the degree of economic freedom of each individual link in the network economy and weakens its impact on the level of risk management decisions;
- «inclusion» of the intellect of all stakeholders in various areas of the life of the subject, including in the process of transforming the information into knowledge the resource base of the business;
- the acceleration of the processes of digitization of the economy and the transformation of knowledge - in strategic assets that multiply intellectual capital and do not wear out, have no limits on their branching and accumulation;
- increasing the practical value of time as a competitive advantage in the formation of business models;
- improving analytical technologies for market monitoring and ensuring access to monitoring results by all stakeholders;
- timely acquisition of valuable primary marketing information and the organic inclusion of information security systems in marketing policies, business restructuring and management processes.

The database of clients, consumers, and target audiences has become a significant asset of foreign and domestic companies, and their organic combination with other intangible assets (patents, licenses, know-how, software, etc.) - a factor in the growth of their market value on stock exchanges. Understanding the impact of modern trends in the market of information services increases the level of competence of the decision maker, in particular, marketing, and reflects his skills:

- non-standard think;
- work in a dynamic flow of marketing and financial information;
- quickly make a decision on changing the technology of monitoring the target market;
- change the priorities in distribution of marketing budget in favor of pre-investment

- marketing researches of perspective markets with using of modern computer programs;
- access the riskiness of marketing decisions and their socio-economic or environmental impacts in the spatial-temporal dimension;
- identify new trends in the industry based on computer analysis of a wide array of intellectual data, etc.

For example, the marketing concept of cost formation and multiplication of public value is based on:

- strengthening the intellectual power of internal energy marketing management in all spheres of enterprise life;
- ensuring an appropriate concentration of intellectual resources to strengthen the image of society (and not only to increase market power) and to reduce the pressure on natural resources;
- a combination of financial and non-financial indicators that reflect the dynamics of commodity producer activity in the industrial, consumer and stock markets;
- widespread use of methods of economic-maths modelling.

In the management of the market value of the enterprise methods of economic and mathematical modeling are used, in particular: regression analysis - to identify significant factors of influence on market value and capitalization of the economy at macro and micro levels, forecasting the future value of net cash flows; construction of trends - the value of intangible assets, intellectual capital, capitalization, etc. ; cluster analysis - for identifying homogeneous groups of potential consumers, similar in marketing potential, level of readiness for consumption of innovative products, structure of real assets, including intangible, for diversification of certain types of economic activity; methods of fuzzy sets-for assessing the quality of the processes of formation of value, belonging to the fuzzy knowledge base, etc. In work on [6, p. 344-352;7] shows the toolkit for assessing the quality of the process of forming the value of an enterprise considered as a complex integrated investment, based on the theory of fuzzy logic. For this purpose input information was formed – the meaning of terms (N-lower, NA-lower than average, A-average, AA-above average, H-high) according to the specified ranges of changes in their values and boundaries (limits) of terms of terms. For each branch enterprise, depending on its marketing and technological experience, there will be a list of the resulting variables and

factors, the order of placing priorities in relation to dependent variables. The terms are used for the linguistic assessment of the influential factors and the ranges of their changes (the rejection of these changes will depend on the stability of the economy in the last years and expert assessments of their change in perspective).

Using one of the simplest methods of intellectual database - regression analysis, for the purpose of controlling the formation of value, we will show, for example, one of the powerful and innovative active machine-building enterprises - PJSC "Concern-Electron". It should be noted that its complex organizational and production structure covers 14 subsidiaries and enterprises with substantial participation: Television Plant "Electron"; Polymer-Electron Plant; Scientific enterprise "Karat"; Plant "ElektronMash" and others. In addition, it is

worthwhile constructing trends in the value of intangible assets based on asset data displayed on the issuer's website [8]. In Fig. 1. shows a trend that reflects the dynamics of intangible assets (IA) for PJSC "Electron" for 2011-16. The logarithmic function successfully describes this trend, gives that the determination coefficient is relatively high ( $R^2 = 0,697$ ). However, the share of IA in PJSC "Electron" at the end of 2016. was negligible and amounted to only 0.11%, indicating their underestimation in the cost management model. Although in 2014 four trolleybuses and an electric bus in Lviv were put in Lviv, which became a revolutionary development of specialists and able to compete with a few European counterparts, but such achievements were not reflected in balance indicators, in particular, in the structure of real assets and IA.

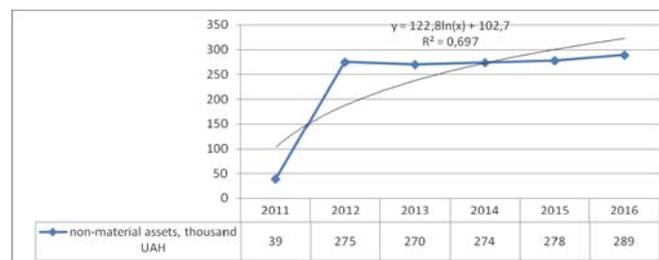


Fig.1 Trend, reflecting the change in intangible assets at PJSC "Electron" for 2011-16

The practice of domestic business confirms that knowledge and demand for intelligent products must be demanded by life. On the absence of a long-term strategy for the development of transport engineering, including on the domestic production of trams on an innovative basis, which would stimulate the investment of elements of intangible assets (the acquisition of patents, promotion of its own brand, the purchase of modern software products, investment projects aimed at monitoring the target market, etc.) the plans of the city authorities of Lviv in 2018 indicate the purchase of 30 old German trams and other vehicles [9].

To assess the effect of net income (X) on the change in gross profit (Y) in PJSC "Electron" for 2011-16. According to the source [7], a regression model such as:  $y = 10,416 + 0.179 X$  (a determination coefficient is very high ( $R^2=0,999$ )). Despite the weighty assumptions made when using statistical methods (as components of an intellectual database), namely, the normal law of the distribution of random variables - factor and resultant variables and extrapolation of the results obtained in the future, it is nevertheless possible to determine generalized conclusions regarding the parameters of the obtained regression model. Financial results (gross profit) are significantly dependent on the growth rate of net income (the effect of scale, market capacity and target segments), that is, the possibilities of enterprises in the distribution / redistribution of market power; with an increase in net income of 1%, gross profit increases by 0.179 %.

Widely tested in the field of marketing and the method of cluster analysis. In particular, the DEA (Data Envelopment Analysis) method is described in [10]. The Euclidean distance, as one of the DEA-analyzes, is the most common proximity measure used in object classification tasks, with the following calculation formula applied to the distance:

$$D(A,B) = \sqrt{(X_B - X_A)^2 + (Y_B - Y_A)^2}, \quad (1)$$

where  $X_A, Y_A$  –coordinates of point A on axes X and Y;  $X_B, Y_B$  are the coordinates of point B on the axes X and Y. Thus, the definition of the Euclidean distance corresponds to the Pythagorean theorem and is a special case of the distance of Minkowski (for the dimension of space  $P=2$ ) :

$$D(A,B) = \sqrt[P]{(X_B - X_A)^2 + (Y_B - Y_A)^2} \quad (2)$$

The obtained results of cluster analysis on the example of 40 machine-building enterprises of Lviv region for different cluster numbers showed significant deviations in the efficiency of the use of resources, that is, the production potential of machine-building enterprises operating in different markets with different levels of diversification of the product range. Based on DEA-analysis, you can determine the leader in resource potential, performance, or other indicators. The constructed clusters make it possible to identify significant factors of influence on the processes of formation of value. The solution to a marketing problem is impossible without the process of structuring data, the allocation of poorly structured tasks, the formulation of those tasks for their solution with the help of modern information technologies. According to the authors of Paul R. Hamble et al. [11], about 75% of US and European companies do not fully utilize the potential of the RMS system due to the loss of valuable time for rethinking new functions, their role in the international division of labor and in the processes of capitalization of the economy. There is an urgent need for adjusting business goals (providing multiple access points to clients, keeping a unified company account in the eyes of consumers) and, accordingly, cost management models.

In innovative economies are more in demand compared with tangible assets, there are process innovations, organizational and

managerial innovations - investments in the formation of marketing and logistics databases, rationalization of the structure of real assets, including IA, promotion of the brand, active use of management options models, assessment of opportunities for obtaining emission income in stock markets through image enhancement, etc. The complex modern network business and the contradiction of the corporate goals of the participants in the chain of value creation actualize the problem of the organization of interaction with consumers at all levels of the hierarchy in the context of the development of the knowledge economy. Accordingly, marketing relationships impose high demands on the constant updating of information about potential clients and on client capital [12]. In the value management system, the role of management options that change the scope and objects of practical application and becomes "labor assets" in other structural forms of interaction of interests and in models of strengthening the competitive advantages of "yesterday's" competitors. Undervalued in the field of production and research, knowledge and experience of former "employees", as strategic assets, this knowledge "migrates" to other, more attractive sectors of entrepreneurship, where wider prospects of use and databases, and partnerships, which means the migration of the "core" and competitive advantages in the conditions of VUCA – the world with unpredictable socio-economic consequences.

## Conclusions

The new quality of economic growth, based on the use of the intellectual database, the creation of new spheres of management options as new strategic assets, weakens the impact of resource constraints due to the manifestation of higher elasticity of factors of production in the new combination of resource flows. Estimating the prospects for the development of an innovative economy and its capitalization goes into the area of financial information management and enrichment of the intellectual database. The use of new information technology to identify homogeneous and geographic markets, forecasting the needs of target markets and capital of the client improves the quality of management processes of creating value and social value.

## References

1. Popova N. V. (2016) Rozvytok pidpryemstv transportno-logistychnoi systemy v umovah VUCA – svitu [Characteristics of the development of transportation logistical enterprises in a VUCA world]. Monography/ [in Ukrainian] .

2. Za prognozamy Cisco, svitovyi obsyag IP-trafiku do 2021 r. Perevishchyt try zettabaity [Electronic source]: Electronic source: [http://www.infoportal.pp.ua/news/za\\_prognozami\\_cisco\\_svitovij\\_obsyag\\_ip\\_trafiku\\_do\\_2021\\_r\\_perevishhit\\_tri\\_zett](http://www.infoportal.pp.ua/news/za_prognozami_cisco_svitovij_obsyag_ip_trafiku_do_2021_r_perevishhit_tri_zett) .
3. IT weekend Ukraine 2017: maibutnie robotiv ta mashyn [Electronic source]. - Electronic source: <https://www.softserveinc.com/uk-ua/news/itw-ukraine-2017/> .
4. SoftServe otrymav nagorodu «Premii HR-Brend» [Electronic source]. - Electronic source: <https://itcluster.lviv.ua/softserve-otrymav-nagorodu-premiyi-hr-brend-2017/> .
5. Otvety IBS na «novuyu normalnost»: seria [Electronic source]. - Electronic source: <https://www.ibs.ru/media/news/otvet-ibs-na-novuyu-normalnost-seriya-spetsializirovannykh-programmno-apparatnykh> .
6. Mnykh O. B. (2016) Marketyng u formuvanni rynkovoï vartosti mashynobudivnogo pidpriemstva. Monography/ [in Ukrainian] .
7. Mnykh O. B. (2015) Marketyngovyï analiz kapitalizatsiinykh protsesiv i rozvytok informatsiinykh tekhnologii modeliuvannya rynkovoï vartosti pidpriemstva na osnovi metodu nechitkykh mnozhyn [in Ukrainian] ] / O.B. Mnykh, R.M. Brytskyi (2015)// Integratsii ekonomichnykh ta informatsiinykh protsesiv: suchasnyi stan i perspektyvy rozvytku [collective monography] .
8. Richna finansova zvitnist emitenta [Electronic source]. - Electronic source: [smida.gov.ua/db/emitent/year/xml/showform/88418/165/templ](http://smida.gov.ua/db/emitent/year/xml/showform/88418/165/templ)
9. L'viv prydbaye u Berlini 30 tramvayiv: <https://www.epravda.com.ua/news/2018/02/12/634009/> .
10. Aprusheva N. N. (1986) Try algoritma iestestvinnoi klasterizatsii ob'ektov .
11. Geml Pol P., Tapp Alan, Marsella Entoni, Stoun Merlin (2007). Marketyngovaïa revoliutsiïa: radikalno novyi podkhod k preobrazovaniiu biznesa, togovyi marki i polucheniïa prakticheskikh rezultatov .
12. Olejnychuk-Merta A. (2006) Udział klientów w tworzeniu wartości firmy // Marketingowe strategie budowania wartości przedsiębiorstwa / red. Nauk. Anna Chubała, Wyd. Ekonomiczna w Krakowie, Kraków, 547s., s.320-326 .