Neuro-technologies and fuzzy logic for intellectual capital evaluation in education and business

Nadezhda Pokrovskaia1,2*, Yakov Margulyan3, Yuri Lvin3 and Alena Bulatetskaia4
1 Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russian Federation
2 Herzen State Pedagogical University of Russia, St. Petersburg, Russian Federation
3 Saint-Petersburg State University of Economics, St. Petersburg, Russian Federation
4 Perm State National Research University, Perm, Russian Federation

*E-mail: nnp@spbstu.ru, nnp@herzen.spb.ru

Abstract. Intellectual capital as an economic concept migrated from the stock exchange financial analysis to the economics and corporate governance, and to the studies on the public regulation of innovative growth. Evaluation of intellectual capital forms the basis for making managerial decisions at the both levels of private business and of regulation of social and economic activities in a region or national State. Management at the micro and macro levels needs tools that take into account a wide variety of factors, the diversity of customers’ and partners criteria. Fuzzy sets and computing allow analysts to approach the tasks of evaluating intellectual assets and human capital both from the point of view of expert analysis, including expert machine learning, and of studying the mindsets and cognitive maps and behavioural models of participants in business processes about an actor, territory or company, and its ability to produce, transform and use an intelligent product. Neural networks and fuzzy computing are the useful intelligence tools to assess intellectual capital, customer opinion about the product, business reputation and brand. The example of the cognitive modelling presents the results of the evaluations of general business perspectives for the international cooperation given by the master students of double diploma programs, taking into account the common sense and the specific learning achievements within the course.

1. Introduction
The concept of intellectual capital relates to an organization assets and to a region or country potential. The economic analysis applied to the market value of non-tangible components of the company requires the evaluation of the income flows which is produced with formalized and informal means. The intellectual capital forms the general ground for the competitiveness of the agent in the global market system in the context of the knowledge economy. The micro- and macro-economic analysis needs to distinguish the assets representing intellectual value and the resources necessary to create additional value, the analysis within the management and governance at both, micro and macro, levels investigates the organization of the processes producing the value for consumers and for investors.

The intellectual capital relates to the both essential uncertainties of the knowledge – the anticipation for the future (basic uncertainty) and the personal character of knowledge (that exists in a concrete human being’ personality, within her / his individual conscience and acting capacity). The approaches to measure intellectual capital are based, first of all, on the purpose of such a measurement
to make a decision on merger or acquisition, or on the sale of the evaluated company; either on investing in acquiring licenses and intellectual assets or in training employees; or on carrying out a communication campaign to create a more favourable image of the company in the eyes of customers.

All three targeted approaches reflect the need to evaluate intellectual capital for making decisions about management and finances. Such decisions require an analysis of a variety of factors with diverse nature, long-term evaluation and planning, industry characteristics, cognitive maps of customers and entrepreneurs, etc. The need to take into account the diversity of factors and areas of evaluation leads to the question of applying the apparatus of modern information and mathematical tools, including fuzzy calculations, to the tasks of assessing intellectual capital.

The main purpose of the paper is to investigate the use of the traditional methodology to reveal the cognitive maps for the anticipation of business development perspectives, to discover the lacks and limitations of the mental models and to find out the ways to improve the learning tools and to develop the intellectual capital for the business development on the basis of the fuzzy logic.

1.1. Purposes for evaluation of intellectual capital. Depending on the purpose of assessment, various groups of methods for estimating intellectual capital can be applied. The intellectual capital is perceived as the difference between market value and accounted assets [1] (goodwill, including the reputation, brand and intangibles) or future income’ flow due to the investments in intellectual capital (Return on investment, ROI, or Return on assets) [2], which, theoretically, reflects an estimated income produced with the use of intellectual capital, or the difference between the income of the entity as a whole system and the income created with the physical assets.

Evaluation of intellectual capital is necessary both for the management decisions making within private business, and for improving the regulation and projects design and development at the level of local and national authorities. In both cases, the assessment of intellectual capital is aimed, in general, to seek answers to the following groups of questions: cost planning, management of the access to the intellectual performance, and resources and assets management.

1.1.1. Cost planning. The analysis and assessment of a company’ intellectual capital is necessary to define the potential additional costs that are necessary and sufficient for the long-term competitiveness of a company or of a region.

This group of assessment’ objectives can be characterized as sustainable growth’ purpose, since the central concern is the planning of necessary investments, e.g., into the improvement of the infrastructure, education, comfortable environment and space, research, technology’ licenses purchase, etc. [3], which will allow the socio-economic agent to maintain and develop ecological policy for sustainable long-term competitive advantages in the global market.

1.1.2. Access management. The assessment of intellectual capital is helpful for governance of the further development of the intellectual activity of a company or of a region.

The restrictions, geopolitical tools as sanctions and similar legislative measures limit the access to the new technologies and innovative products in several cases. The obstacles to transfer of knowledge are multiple by nature, from the political to economic, social and cultural interests, e.g., the restrictions can stimulate the internal activity or can serve for the monopoly of the uncertainty. The access to intellectual products, such as technologies that are not available without special organizational efforts, investments stream, reputation, policies, e.g., the extensive State policy to attract foreign investment in China during the 1990-2000s was aimed not only to attract financial resources, but especially to invite the companies along with their technologies and intellectual products and processes [4].

1.1.3. Assets management. The intellectual capital produces a specific additional value that can be subject for purchase as itself. The patents, licenses and technologies can be source of the future income in the form of royalty or as a good for sale (or set of good and service to help the intellectual product’ buyer to consume it, to implement a technology, to apply a method, etc.).
The bargains of the whole R&D departments are seldom, more often the sale of a specific intellectual product permits to obtain the situational income. Exclusive rights to a particular intellectual product (an invention or newly designed model) can be sold to competitors (if the company has no sufficient resources to get profit from the invention which would become obsolete soon) or to business partners, including the technology' exchange or the transfer of knowledge and technologies between countries or regions. Such a sale can provide the necessary financing to take targeted positions in a market or in a partnership, as well in the case of the sale of fast aging technology to competitors, as in the case of a reducing activity on a market segment for the sake of switching to another one, i.e., the proceeds from the medicine formula are to be used to develop a medical nano-technology.

These three types of purposes can be arranged in a hierarchical scale: the sale or purchase of a particular patent may allow short-term growth and improvement of certain market positions, which then in the long run will create new technologies and a foundation for sustainable growth.

Depending on the purpose of assessing intellectual capital, management and regulatory solutions need to clarify not only the potential revenue (financial result), but also the prospects for the development of a specific group of technologies, as well as in the formation of demand for an intellectual product (political and social result, the concern of economic leadership for the future). The development of industries focused on the calling in high-skilled, exclusive, talented human resources (health, education, networking, transport and communications infrastructure, leisure options and activities landscape, etc.) reflects the need of territories and businesses to create an attractive environment for people, considering humans as a factor to produce knowledge and as consumers of products and services created by the economy knowledge.

1.2. Structure of intellectual capital
The estimation of an intellectual capital of the company can include measuring results of intellectual activity, of intelligent labor of its employees, but intellectual capital is not exclusively rational in its content.

The concept of intellectual capital of a firm or of a region includes: the intellectual property rights, the organizational specific value creation chain and methods of running business, the human capital and the customers loyalty based on symbolic consumption and self-identification related to the company reputation.

1.2.1. Intellectual property rights. The results of the intellectual activity are subject of the protection due to the registration of a pilot model or prototype, of a patent, trade mark, etc.

The intellectual property rights are regulated by legal mechanisms and that is owned by the company or that is fixed on (or with) local or national territory (patents, technologies, etc.), e.g., in the US there are significant tax breaks and deductions for the use of US companies’ patents registered with the US Patent bureau.

1.2.2. Methods and culture, organization business processes. The significant part of the value creation consists of the organization learning, culture and values that form the unique universe of the company.

The methods, approaches and structures, culture and philosophy of management and of relationship with business partners [5] are not protected by law, but also reflect unique features of the company. Some new methods of organization of value creation process or new approaches to service can form a ‘monopoly’ at the beginning of their applying, until other firms start to copy and to implement the created new business models and ways of solving problems, e.g., gaming, attracting users to improve the company's product (participation of customers in improving the translation in AirBnB and Google translate)
1.2.3. Human capital. The methods, values and processes are embodied by people, the human capital and the commitment and collaboration play the core role in the company functioning.

The working methods reflect the unique competencies of the company’s personnel or of the territory’ regional human resources. These exclusive cultural or education features and the specific competencies can be assessed both on the basis of the analysis of the education’ level (to illustrate, the development of the concept of average income trap [5] allowed econometric methods to prove the positive correlation between a country’ sustainable economic growth and the part of the population having higher education), as well as the unique abilities and competencies of the company’s personnel or people living on the territory (for example, those who come to India fall in love and smiles of Indians; or desirability rudeness and cabin attendants may be the deciding factor in the subsequent selection of airlines). A case of the global leadership and exporting power of Russian sector of cyber-security was related to the high level of technical education and physics and mathematics, so that in the beginning of the appearance of ATM and credit cards on the post-soviet territory, every young person with the middle or high school level was able to crack a banking system or a cash machine, that forced Russian banking institutions to invest into sophisticate advanced security systems.

1.2.4. Consumer capital. The reputation and the loyalty of the consumers as well as of company staff reflect the recognition and appreciation of the value created by company or by a region or country.

The perception of the company or country in the eyes of participants in business processes and the territorial brand and the establishment of stable relations with clients (brand, country-of-origin or “made in” effect), investors (attractive business environment), and tourists (infrastructure, safety, favorable socio-psychological climate and regulation landscape).

1.3. Financial and management approaches to measure the intellectual capital

A number of methodological approaches were obtained and applied to measure the intellectual capital and to assess the efficiency of its implementation [6].

The widely used model of economic analysis and measuring efficiency is based on the Value Added Intellectual Coefficient (VAIC) developed in 1996-2000 [7-9], which is similar in its fundamental basis to the methodology of EVA (Economic Value Added) [10]. Within the framework of the VAIC methodology, intellectual capital is classified on the basis of 3 criteria: capital employed efficiency, human capital efficiency and structural capital efficiency. The implementation of this approach was verified in different countries and cultures, the studies demonstrated the different results: the successful application of VAIC approach permitted to find the impact of VAIC on the ROA (Return on Investment) in USA [11], Greece [12], Austria [13], India [14], Australia [15], Japan [16], Malaysia [17,18], Saudi Arabia [19], and Pakistan [20,21], at Islamic financial institutions in 21 countries [22,23]. Nevertheless, several studies showed a lack of connection between VAIC and ROA of Turkish banking sector [24] and a lack of a significant connection between VAIC and ROA in Indian banking institutions [25].

1.4. Fuzzy sets for the communicative factors of the intellectual capital growth

The intellectual capital creates the attractiveness of a company or territory, but at the same time, it depends on the capacity of a business or area to attract talented people and customers. The intellectual capital analysis requires the evaluation of the communicative impact on the place branding as attractiveness factor for the intellectual capital growth related to the human mobility [26]. The impact of the intellectual capital on the growth is determined by the human beings who bring the additional value due to their intellectual and communicative activities.

Surveys of territorial branding have shown that the most effective tools for promoting a territory are the private records in a variety of social networks, while advertising campaigns conducted by local or national authorities have an incomparably lower effect on decision-making, on building business
relationship with the territory (investing, moving to work), as well as on a long term stay or a tourist visit.

That is why the consumer capital should be interpreted as an independent phenomenon formed by rational mechanisms in the activities of a company or a local regulator (State, local authorities) and formed under the influence of long-term accumulation of individuals’ and families’ private experiences and institutional cultivation of practices.

The participation of many actors and factors in forming the value of intellectual assets (human resources, patents and technologies, feedback of individual consumers in social networks, etc.) determines the need and efficiency of the application of mathematical apparatus and information and telecommunications technologies for assessing the intellectual capital of a company or a country. The fuzzy logics as a tool of treatment and analysis of linguistic or informal data is suitable for the evaluation of the personal knowledge, individuals’ competencies and cultural features that create a competitive advantage based on intellectual capital from the substantial point of view. Neuron technologies are appropriate to interpret and compute the uncertainties produced with the prognostics in the economic intelligence.

1.4.1. Fuzzy sets as a tool for intellectual capital evaluation. The motivation and promotion, communicative strategy and branding operate with rational as well as emotional and affective factors. The perception of a place or company is determined with the fine elements, that are sometimes difficult to catch and to measure.

The use of fuzzy sets, fuzzy logic and neural networks in macroeconomic analysis [27], investment and market decisions making [28-29], social management [30] and communications [31] is widely examined by researchers. Using the toolkit of fuzzy cognitive maps and fuzzy clustering is of interest for corporate management and organizational growth within the knowledge economy and of improving profitability of intellectual capital.

1.4.2. Application of fuzzy sets as a tool for multicriteria evaluation. The evaluation of the intellectual capital can help to get the holistic evaluation of the sophisticated phenomena, it is more efficient to get the aggregated assessment instead of going in depth in details.

T. Samsonova has shown in her study [32], that the evaluation of the prospects and significance of the intellectual activity product (engineers, developers, programmers, etc.) relies, up to beginning of the 3rd millennium, primarily on the experts’ intuition. The example of Xerox, which did not use the inventions of the computer mouse and color screen for computers made by the Palo Alto Research Center (PARC), clearly demonstrates that the issue of evaluating intellectual capital is complicated.

Despite a significant number of approaches to assessing the prospects for investing in research, inventions and innovations, evaluating the anticipated value for the created intellectual product (which can be fixed as intangible assets of a company or a country) is based on two poorly formalized instruments: the intuition of the most experienced developers and the entrepreneurship flair which reflects the needs, meanings and values that are most important for a solvent market. In addition, intellectual capital is evaluated on the basis of its future use within a changing universe of meanings and dynamic change of values, including the socio-cultural evolution of the society’ predominant values scale.

These two tackles – intuitive expertise and entrepreneurial appraisal – take into account the three essential influencing factors: the personal involvement of motivated and charismatic people, the symbolic space of meanings and rational and emotional judgements, the grid of economy of knowledge. In this landscape, the intellectual capital should be analysed from the following points of view:

- as an affective, emotional capital, passion energy and motivating component which is embodied, firstly, in the competence of the human resources of the company or region, their capacities to change the reality, and secondly, in the ideas of the effectiveness and competitive advantages of the company or territory formed by external stakeholders (customers, investors,
partners), who are able to change (improve or spoil) the results of the implementation of a potentially fruitful knowledge;
- as a knowledge capital, based on the economic analysis of the fixed and variable costs and sharing consumption models, on the internal and external actors of the business processes who are taking their part in the value creation chain from the point of view of production, transformation, transfer and consumption of knowledge;
- as a representative capital of sense and values enrooted in culture and reflecting the culture’ evolution.

The subject of assessment of intellectual capital includes a significant area of uncertainty in the assessing methods. Earlier, decision-making was intuitive, and the implementation of decisions was based on the energy and charisma of the entrepreneur. Today, business intelligence and digital tools support making decisions based on data and implementation through data processing. That means the methodological shift from the traditional processes and factors analysis towards a new environment to be taken into account and into calculation.

The complex character of assessing the prospects for a particular innovation determines the implementation of fuzzy sets for evaluations, and the assessments themselves can be collected from experts or from social networks and the Internet information space (articles, publications, reviews, etc.), which can be the subject for the use of fuzzy logic tools to obtain the final characteristics, and neural technologies can be used for data analysis to extract regularities.

1.4.3. Multi-criteria evaluation tools in business. The multicriteria evaluations are subject for the investigation in analytical practice and scientific research since the post-industrial economy expansion due to the increase of the complicated processes in the economy and management.

The analytical hierarchical procedure of T.L. Saati [33] is used efficiently and often (by virtue of its comparative simplicity) to make a choice on the basis of collating variants by a set of criteria, using paired comparisons of options and determining the significance of the criteria. These two procedures of collations and weights within the framework of the hierarchy analysis method can successfully rely on the both expert estimates and fuzzy-set analysis using neural networks [34], or neural processors forming artificial intelligence.

To apply fuzzy clustering and neural networks algorithms, large data processing procedures can be used for a given search, e.g., with company name, region, technology, idea. The neural network is capable of extracting the basic parameters and calculating the frequency of certain concepts used in the information space with respect to the selected object. In this case, fuzzy sets can be used to clarify the belonging of a company or technology to different groups with different degrees of each feature' expression, e.g., the same company can be fully traditional and in significant part innovational, such as a classical hotel chain with digital technologies of booking and modernized methods of work. Thus, a neural network can be used to extract parameters and, if necessary, to find or weight criteria. The mechanisms of fuzzy computing allow the clustering of a number of objects, despite their belonging to some extent to each cluster.

2. Methods
Fuzzy sets help to aggregate the probabilities of as a reflection of the semantic environment, especially in the cases when the assessment is presented in the linguistic form, such as “good” or “brilliant” perspectives and “obvious” or “clear” advantages. The generalized opinions given by respondents are subject to the deeper treatment through the scale (semantic differential [35]).

2.1. Qualitative research construction
The questions were asked in the form of open questions, two questions were asked and discussed during a lecture at the international programs of double diploma with German, French and Italian universities:
- What are the sectors for the international cooperation between Russia and Europe with the highest potential?
- If you open a new business in each of these mentioned sectors, how you could evaluate the potential success of such a company?

The meaningful environment forms semantic landscape and cognitive maps, a set of stereotypes, a company or territory has difficulties to break them out of in order to develop more promising activities in the graduates’ future career.

2.2. Sample description
To examine the industrial content of these cognitive maps, an evaluating study was carried out in July-August 2017 (N = 37 interviewed), March 2018 (N = 54) and April 2019 (N = 41).

The opinions were collected of Russian students of international economic programs, including Russian-Italian double diploma Master, Russian-German double diploma Master and French Master diploma proposed in Russia in the form of remote learning with Russian university assistance in the form of additional lectures and practical works, seminars, colloquiums, etc.

The perspective work for Russian-European businesses is the core purpose for these students to work on their Master research and papers that means that they are the key specialists and motivated persons to be experts in the field of the asked questions.

3. Results and Discussion
The research demonstrated the significant differences between the evaluations of students generations and cohorts [36]. The study was oriented to the understanding of the applicability of the methodologies, the given opinions are not to be treated and representative for the Russian business.

The questions concerned the potential collaboration in the competitive industries of Europe as an industrial and innovative leader in the global economy. The study showed a marked influence of stereotyped ideas (cognitive maps) on judgments about the prospects of joint business: the respondents chosen are aware and informed deeper and involved in international business to a greater extent than the average population of Russia. The surveyed future Russian economists and specialists in corporate management and international business have an extremely narrow idea of the competitive advantages of the European economy and perspectives for the cooperative businesses with Russia (Table 1).

Table 1. Which industry represents the highest competitiveness for the Russian-European cooperation – evaluation of potential degree of success

| European Union’ activity sector | 2017   | 2018   | 2019   | Average 2017-2019 |
|--------------------------------|--------|--------|--------|-------------------|
| Finance                        | 97.3%  | 98.1%  | 97.6%  | 97.7%             |
| Manufacturing, equipment, machinery | 94.6%  | 98.1%  | 95.1%  | 96.0%             |
| Chemicals, pharmaceuticals     | 86.5%  | 74.1%  | 92.7%  | 84.4%             |
| Education, scientific research, technology transfer | 83.8%  | 68.5%  | 100.0% | 84.1%             |
| Restaurants                    | 94.6%  | 100.0% | 56.1%  | 83.6%             |
| Agriculture                    | 86.5%  | 13.5%  | 95.1%  | 65.0%             |
| Food producing                 | 81.1%  | 67.6%  | 36.6%  | 61.7%             |
| Fashion industry, clothes      | 78.4%  | 64.9%  | 41.5%  | 61.6%             |
| Tourism                        | 83.8%  | 70.3%  | 29.3%  | 61.1%             |
| Ceramics                       | 13.5%  | 10.8%  | 22.0%  | 15.4%             |
| Energy sector                  | 10.8%  | 8.1%   | 19.5%  | 12.8%             |
| House equipment                | 5.4%   | 5.4%   | 17.1%  | 9.3%              |
| Building industry              | 2.7%   | 0.0%   | 7.3%   | 3.7%              |
The undergraduates are sure that it is possible to do business with European banking sector and industrial manufacturing (absolute majority, more 94% during the 3 periods of the survey), chemicals, research and science and education (more than two third of respondents mentioned these sectors). Restaurants were mentioned as a specific activity for cooperation (with high volatility – from 56 to 100%), at the same time, agriculture (probably, opinions were influenced by the Russian government’s anti-sanctions), tourism and fashion got lower evaluations (about 60-65%).

The data shows that it is possible to draw up a dividing line in the cognitive maps of future Russian managers, cutting off a part of the potential cooperation areas between Europe and Russia (Fig. 1).

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**Fig. 1.** The most perspective industries for the Russian-European cooperation, according international Master students’ opinion, 2017-2019.
Thus, answering an open question of the most competitive sectors of the European economy and of the sectors promising fruitful cooperation between Russian and European business, the Master students indicated the finance (97.7% on average for 3 years) and the machinery and manufacturing (96.0% as the average evaluation for 2017-2019). These two sectors represent in the common sense the successful industries, if finance is specific to the Europe, the industrial development and scientific research were typical to the former Soviet Union, these two fields are declining several times since the 1990s, but the in mind of the young economists manufacturing takes the similar place for the cooperation between Russia and Europe.

The “borders” between more or less perspective industries are at the following levels
- near 100% (the lowest estimation for manufacturing was achieved in 2017 – 94.6%)
- at the level of 85% - the chemicals, education and research and restaurants took the places in the heads of big part of the future economists and managers
- at 60%, where the agriculture and food production, fashion industry and tourism took their places on the students’ mental map ;
- the last industries mentioned by students were ceramics and energy sector (between 8 and 22% during the survey periods), and several students were thinking about their home (house equipment, ) and building industry, especially, for the new materials and industrial constructions (1-3 persons by year).

It is interesting to mention, that during the first survey, in 2017, only 1 person remembered the great Romans builders of roads and aqueducts (2.7%), and, even in spite of the suggestive question of the interviewer (N.N. Pokrovskaja) about the construction industry in Italy and the famous architecture chef d’oeuvres in France, Italy, the famous high roads in Germany and the architects from Great Britain, in 2018 no student did give a positive answer. The influence of the interviewer (the lecturer in the course of International corporate organization and Competitive Strategies of international business) did non change the cognitive framework of students as their planning for the future potential successful business with European partners.

The study of the cognitive practices of self-regulation and self-control among students studying technical specialties [37] demonstrates the flexibility of students individuals’ mind when the decisions and actions in a wide degree depend on the social and educational order: the students prefer to follow the external stereotyped ways instead of autonomous search for information to justify an opinion.

The stereotypes are widely used by students for the theoretical opinions and judgements, but they overcome the cognitive rigidity when studying the practical elements of the courses [38], which require the specific attention to be paid to the treatment of concrete data within the learning process.

The attempt to evaluate the ways to react with different levels of involvement and correlation with the psychological features of students [39] demonstrates the deeper analysis of the different cognitive processes that have impact on the students’ results and that are helpful to develop the learning organization in the field of the adaptation of the teaching tools to the different psychological types of students to facilitate the acquisition of the new information.

The neuron networks could help students, giving them the concrete examples, statistics and new ideas about the potential development of their activity. The fuzzy tools could be helpful to understand the reasons of this distribution of the opinions, the reality of sense and meanings for the cognitive practices of students would be promising for the further development of the business planning as well as the educational practices.

4. Conclusions
In the information society, the space of meanings, the neural-fuzzy analysis of social networks’ content can be opposite to the analysis of statistics, to conclude to the more justified choice of European competitive sectors and the prospects for joint business projects of Russian and foreign enterprises. Thus, the assessment of consumer market capital as part of the intellectual capital of a country or a company can be effectively carried out using neural-fuzzy tools.
The mental maps and cognitive practices and paths existing in the human mind have a significant inertia. The management decisions within the innovative economy of knowledge are based on this analysis and should be oriented both to search for undervalued assets (for example, the brand of Germany for the road construction, the competences of France in the nuclear energy field, the history of the Italian innovations in the building of gas pipelines), and the need to take into account the complexity and cost of overcoming patterns and stereotypes in the mind of collaborators, partners and customers.

The intellectual capital includes the elements of the cognitive maps in the form of the consumers’ loyalty and company reputation in the market niche [40]. But the cognitive practices’ impact is wider and deeper, they determine the initial steps of innovative business in the fields that are, in several cases, closed due to the mental map’ borders. This effect could be overcome with the neuro-fuzzy tools implemented in the business as well as in the management.

The development of non-classical logic, including the use of fuzzy systems, is primarily due to the new filling of the external environment for the organization. Earlier the business was aimed to satisfy the existing needs in the unsaturated market with the help of production of goods and services. Now the enterprise has to act within a cultural, emotional and socially oriented semantic space, creating new values and senses, impressions, feelings and perceived intangible forms.

The use of fuzzy sets, neural technologies for data analysis, mathematical and intelligent systems for processing large amounts of data helps to identify and estimate undervalued intellectual assets. In the conditions of the knowledge economy and innovative growth, the adoption of managerial decisions in a semantic environment requires justification based on research not only on the actual situation (for example, macroeconomic sector indicators) but also on cognitive maps emerging from potential customers and partners. These areas determine the prospects for using neuro-fuzzy approaches to evaluate intellectual capital, including the structural, competence and communication-market capital of the business entity.

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