PUBLIC-PRIVATE PARTNERSHIP AS AN EFFECTIVE TOOL IN R&D ACTIVITY

Abstract. The aim of research is to develop the approach to selection the partner in public-private cooperation in R&D activity. Evaluation of the intellectual capital level can be an effective tool in option of public-private partnership in the field of product and service innovation creation. Different current approaches to intellectual capital assessment have been analyzed. The arithmetic model of intellectual capital evaluation, according to its structure, is developed by authors. Range of values of enterprise's intellectual capital integral index is determined by authors. This model allows considering and evaluating intellectual capital of a company comprehensively. The prerequisite of public-private partnership in R&D activity are revealed in the paper.

1. INTRODUCTION.

A public–private partnership in R&D should be considered as is a cooperative arrangement between two or more parties from public and private sectors (Hodge & Greve, 2007). Public-private partnerships is suggested as a promising solution for addressing challenges in product and service innovation. The selection of a business partner will be based on their level of intellectual capital of the enterprise and on a competitive basis.

Intellectual capital evaluation plays a key role in its management system and helps to define enterprise competitive positions at the market. It gives opportunity to identify intellectual assets of the enterprise, to investigate their state, degree of suitability and use in the production process, and, at the same time, to find strength and weaknesses. Activation of scientific research in the field of intellectual capital level monitoring is one of key tasks, solving of which requires creation of the intellectual capital strategic management methodology at the modern enterprise.

Analysis of the scientific research, dealing with intellectual capital management, let's to conclude that nowadays there are various methods to evaluate intellectual capital at different stages. Among famous foreign scientists, who greatly contributed to the intellectual capital theory, tried to structure, and evaluate it, there are A. Brooking (1996, 1997), K. Sveiby, H. Van den Berg (2003), Moore, L, Craig, L. (2008), K. Wiig (1997) and others. Public-Private R&D Partnerships has been investigated by S. Manrique (2018), T. Watanabe, D. Kupka, M. Cervantes, J. J. Ham, D. Oh (2014), G. A. Hodge, C. Greve (2007), Goldman (2012) and others.

Thus, depending on the fact how one evaluates the intellectual capital of the company and its elements, the following approaches are distinguished:

1. Structured approach, based on using of various measure units for every element of the intellectual capital, does not provide valuation and it is used in the non-financial models.

2. Value approach is used to define total value of the intellectual capital in the company; therefore value of its constituents is not calculated.

It is reasonable to use both mentioned approaches to evaluate the intellectual capital in the reality of modern conditions without all-purpose technique. Valuation

indicators are used for calculating the enterprise's intellectual capital value. Therefore one can use expense, income and market methods depending on peculiarities of the concrete situation. Complicated and limited possibilities to use traditional methods in the non-material assets evaluation, specific character of separate components in the intellectual capital and absence of one universal method for its evaluation justify necessity to carry out additional investigations and to form one approach to evaluate the intellectual capital.

2. METHODS.

The intellectual capital evaluation is decided to be carried out by us according to the structured approach, which includes evaluation of every separate constituent (personnel, organization, customer and informational capitals) and calculation of the enterprise's intellectual capital integral index.

Personnel capital is a combination of such characteristics of personnel as knowledge, skills, work experience in a particular industry, level of education, health, quality of life, moral values, culture of work (responsibility, conscientiousness, result oriented, mutual support, interchange), which are involved in the production and commercial activities of the enterprise in order to profit.

Information capital is defined as a collection of objects of intellectual property rights; documents certifying intellectual property rights; technical and software; scientific and methodical materials; access to special databases of scientific developments and inventions; R&D, which allows the company to create competitive products and profit.

Customer capital will be considered as a system of capital, reliable, long-term trust and mutually beneficial relations of the enterprise with its customers, buyers of goods, which developed during its work in the market.

Organizational capital is a set of the organizational capabilities of a company that must meet the needs of the market: the forms, methods and structures that make it possible to efficiently select, create and disseminate knowledge, organize them in a system accessible to all employees, which makes it possible to achieve a synergistic effect from joint activity.

Technique to evaluate the intellectual capital taking into account index of every component rate is (Shcherbachenko, 2016):

$$
\begin{cases}
X = \sqrt[4]{\prod_{a=1}^{4}(1+X_a)^{s_e}} - 1, \\[2ex]
X_1 = \sqrt[n]{\prod_{i=1}^{n}(1+I_{1i})} - 1, \\[2ex]
X_2 = \sqrt[n]{\prod_{j=1}^{n}(1+I_{2j})^{s}} - 1, \\[2ex]
X_3 = \sqrt[n]{\prod_{l=1}^{n}(1+I_{3l})} - 1, \\[2ex]
X_4 = \sqrt[n]{\prod_{d=1}^{n}(1+I_{4d})} - 1,
\end{cases}
\tag{1}
$$

where X – integral index of the intellectual capital, relative units;
X_a – values of the intellectual capital constituents, relative units;
a – ordinal number of the intellectual capital constituents, $a \in [1;4]$;
X_1, X_2, X_3, X_4 – indices of the personnel, organization, customer and informational capitals evaluation; $X, X_1, X_2, X_3, X_4 \in [0;1]$, relative units;
I_{1i}, I_{2j}, I_{3l}, I_{4d} – values of some indices of personnel, organization, customer and informational capital;
i, j, l, d – ordinal numbers of personnel, organization, customer and informational capital indices;
s – indicator of *j-index* impact on the total level of organization capital: s = +1, if the impact is positive, s = −1, if the impact is negative;
S_e – synergy index, which characterizes impact of one intellectual capital constituent on another one, $S_e \in [-1;1]$ (if *Xa<0,33, Se = −1;* if *Xa≥0,33, Se = +1*).

In order to calculate indices and integral index, one defines to use modified formula of geometric value, since such an approach let's to calculate when almost one of partial coefficients is equal to zero, because in another case integral coefficient also will be zero. We emphasize three levels of the enterprise's intellectual capital: high, middle and low (table 1) (Shcherbachenko, 2016).

Table 1. Range of values of enterprise's intellectual capital integral index

Value of the index X	Level of the intellectual capital	Description
0,67≤X≤1	High	Sufficient for fast growth of the enterprise
0,33≤X<0,67	Middle	Sufficient to provide stability
0≤X<0,33	Low	Insufficient and can cause losses

One proposes to build the intellectual capital cyclogram for express-analysis of enterprise's intellectual capital level due to results of evaluation, carried out by the defined indices (fig. 1).
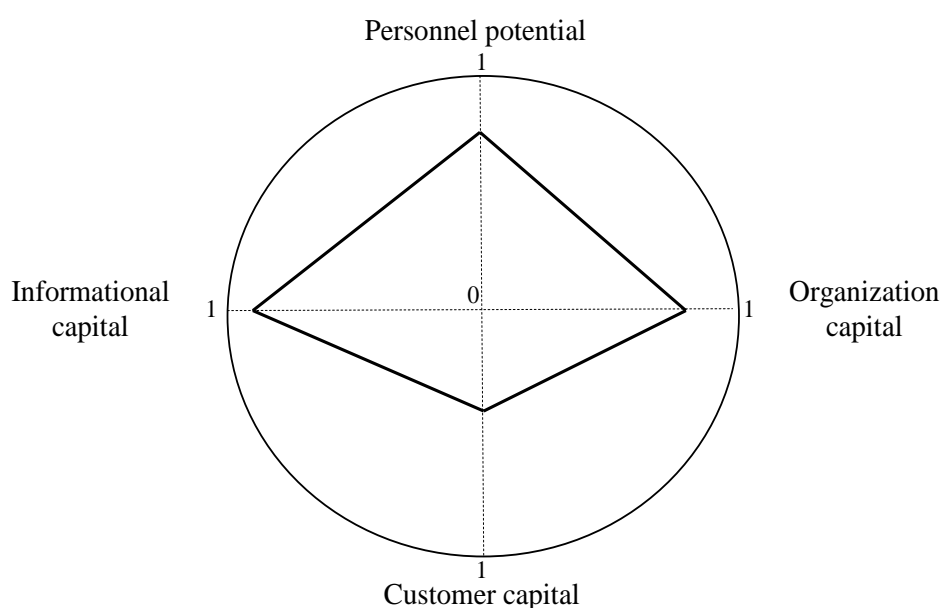

Fig. 1 Cyclorama of the intellectual capital (an illustrative example) (Shcherbachenko, 2016)

Radius of vector characterizes evaluation of the proper constituent, and angle – its weight. Since all four constituents are suggested to be observed as equal ones, tilt angel is $90°$. The shown cyclogram of the intellectual capital enables to compare it in different periods in life cycle of the analyzed enterprise, and to compare it with competitors' intellectual capital level in the branch.

Conclusions. We consider intellectual capital as a set of personnel, organizational, client and information capital, which interact with each other. Cooperation between public sector and private enterprisers with a high level of intellectual capital can be very beneficial for both. According to (Stolk, 2013), there are several reasons for establishing public-private partnerships:

- to increase scale: pooling of resources can help to address issues that cannot be addressed by a single entity;
- to share risk: by sharing risks projects can become of interest to potential partners who, without a subsidy or support, would be unwilling to get involved;
- to focus R&D priorities: by defining a strategic research agenda, in consultation with stakeholders, resources can be focused on issues of particular public interest;
- to optimize the use of available knowledge and resources: in order to make progress in many areas, there is a need to bring together data or expertise that resides with different parties. In addition, it can be used to create a research infrastructure for future work (networks, research databases etc.);
- to foster a more competitive private sector to promote economic growth: governments that support PPP research may also aim to support new R&D activities within their region or country.

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