

Mathematical Approach to Calculating the Intellectual Rent of an Industrial Enterprise for Achieving Innovative Leadership

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Abstract Economic development trends lead to a significant expansion of the boundaries of scientific ideas about such economic category as rental relations. Globalization and international integration of labour have a direct impact on the transformation of national economies, forcing them to follow the innovative path. The study considers intellectual rent, which now represents one of the main sources of income for the most developed countries and contributes to the achievement of innovative leadership in a market-based economy. The digital transformation of the economy and transition to a new qualitative level of production relations development are impossible without building up intellectual capital. However, calculating intellectual rent at various levels is fraught with serious difficulties. The rental approach will allow calculating the super-profits of an industrial enterprise obtained using the intangible elements, that is, an intellectual capital.

This paper suggests developing mathematical methods for intellectual rent calculation purposes. The resulting assessment can reflect both the intellectual income from a unit of output and quantitatively in monetary terms measure the intellectual rent of an entire industrial enterprise with due regard for industry average profitability indicators.

Keywords: *mathematical approach, intellectual rent, industrial enterprise, innovative leadership*

1 Introduction

The modern market economy is in constant dynamics, which is manifested not only in increased competition among market participants but also in its improving quality. Specific advantages obtained through capitalizing intangible assets make it possible to increase the performance of an economic entity and achieve leadership positions (Tkachenko et al. 2019). There is a worldwide positive trend towards the use of patents, industrial designs, trademarks, licenses for exclusive rights in production activities the commercialization of which not only increases profitability, but also allows obtaining additional competitive advantages in the market environment, for example, due to brand recognition or Goodwill growth (Tikhomirov and Komshilova 2019). Intellectual rent is a surplus profit of the company gained in this way.

The main economic prerequisite to the formation of intellectual rent for an industrial enterprise is a gap between the utility of the proposed intellectual property and traditional production. Moreover, intellectual rent is generated because the entity holds exclusive rights to some unique intellectual capital asset.

Current mechanisms for generating and distributing rental income could, with a certain adjustment, ensure economic development, however, insufficient concern for existing rental factors in regulating income

generation at various levels (production/industrial enterprise/territorial association levels) creates “institutional traps” in state management (Zaytsev et al. 2019).

The relevance of exploring issues related to the generation and the mathematical calculation of the intellectual rental value of industrial enterprises in the emerging innovative economy lies in the importance of intellectual transformation for the development and creation of products in the field of information technology, dissemination of innovative elements in all economic spheres and, also, in the lack of research on the essence of intellectual rent and its generating factors.

The use of intellectual property and numerical assessment of its value suggest that there is potential for improving business performance, providing additional competitive advantages and increasing the market value of the enterprise. The essence of the intellectual activity of industrial enterprises warrants the development of new and improvement of the already existing methodological support.

2. Theoretical foundations of the rental approach to intellectual capital

The formation of an innovative economy is not conceivable without the use of intellectual capital, which becomes the key resource for digital transformation. At the industrial enterprise level, the essence of intellectual capital is constituted by a collective knowledge of all employees and managerial personnel that ensure long-term competitiveness. Given that, intellectual material must be formalized, documented and utilized to produce a more asset. Intellectual capital is generated as a result of the interaction of the human, structural and consumer related (Tkachenko et al. 2019; Zhilenkova et al. 2019).

The aspects of building an intellectual economy, that is, an area of human activity engaged in creating intellectual life's comforts through the use of reproducible factors of production, primarily intellectual capital, are considered in the monograph by Salikhov (2018). With accelerated technological development and the digital transformation of the economy, the impact of intellectual property on economic growth is to increase, as discussed in the articles by Senchenia (2019), Shipunova et al. (2018), Nikolova et al. (2017), Zhilenkova et al. (2019). Globalization leads to the acceleration of scientific and technological progress and complicates production relations. The economy of any state should promptly adjust to the dynamics of these conditions, which is indicated in Dmitriev (2019).

Thus, to intellectualize the economy, it is not production volume and gross indicators that have to be increased, but the level of innovative development and the speed of innovation. The importance of establishing a favorable investment and innovation environment for the development of an innovative economy was studied in the works of the following authors: Rudskaia (2017) examined the essence of innovation at the regional level; Rodionov et al. (2017) evaluated the existing innovative systems operating in Russia; Degtereva and Goncharova (2018) identified the main contradictions in the field of innovative development at the regional level and drew up recommendations on how to overcome them; Rudskaya and Rodionov (2017) used econometric modeling to evaluate innovation systems of individual territorial associations.

The work of Mamrayeva et al. (2018) explored the essence of innovative capital at the global level and revealed the intellectual component that exerts the most influence on the formation of the innovative economy of individual states.

Despite an entire history of studying rents, a unified approach to considering the essence of this phenomenon is yet to be developed. Rental problems, especially those related to land rents, have lost their relevance in an industrial society, even though “the rent began to be found everywhere” by the modern scientific community as confirmed by Fishman and Davydov (2015). Rental relations occur at the intersection of economy and politics, progress incessantly and have an impact on a significant number of economic categories and phenomena (Syorensen 2016).

Such researchers as Nazarycheva (2013), Gaisin (2017), Vorchester (2000) explored rent from the modern point of view, that is, taking into consideration its multidimensionality and polysemy. Osipov (2003) noted that the main source of social wealth in the modern world is economic rent, one of the contributing factors of which is the growth of aggregate demand necessitating the exploitation of resources with poor performance. The work of Zaytsev et al. (2019) exemplifies a rent analysis of the innovative component in resource productivity, which allows for evaluating a specific rent with due account for the innovative component of excess profits.

The essence of economic rent in industrial development was studied in the works of Schwab and Werker (2018), Latkov (2006) and Abdulahi et al. (2019). The excess profit that owners of intellectual and other non-natural resources receive is called a quasi-rent. This rent is temporary in nature and represents compensation for the generation, accumulation and utilization of human capital, entrepreneurial talent and significant innovation risks.

Intellectual rent was considered in the work of Susha and Lutsevich (2009) where intellectual rent is referred to as the excess profit received by entities from the use of intellectual resources, primarily intellectual capital. This excess profit is the main incentive for innovative processes.

Figure 1 shows the position of intellectual capital in relation to market capital as well as its individual constituents. Note that intellectual rent unites all the constituents of intellectual capital, not only human, as is commonly believed, but structural ones as well.

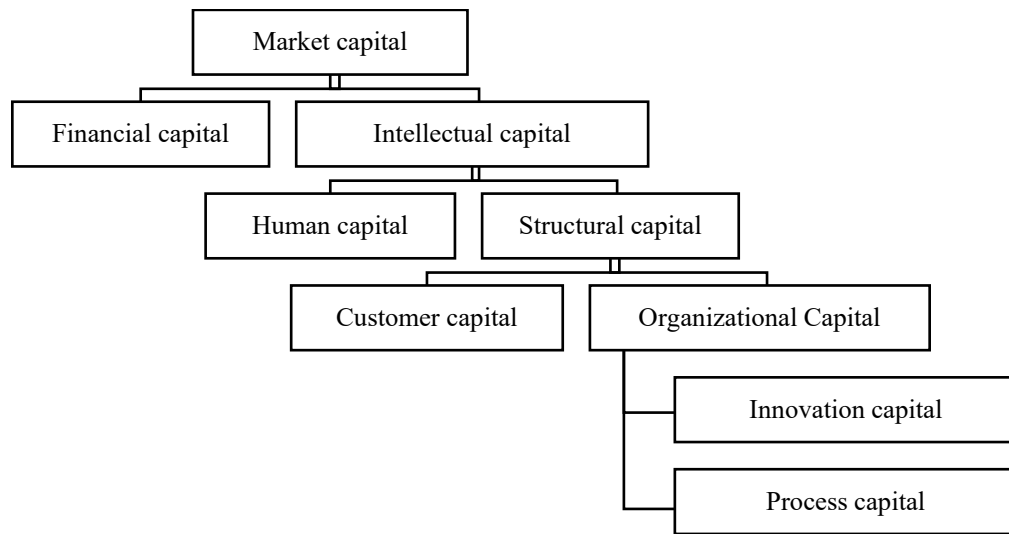


Fig.1. Market capital constituents
Source: Nazarycheva (2013)

Thus, in order to create an innovative economy, it is necessary to ensure the intellectual development of individual business entities, primarily in the industrial sphere, which is related to the country's production and position on the world stage. Optimization of innovation process management in a manufacturing enterprise is discussed in Demidenko et al. (2018).

The development of modern economic relations has resulted in a significant weakening of the impact that tangible assets exert on the market value of the organization; it is intangible assets that determine now the intellectual capital of an economic entity. The issues that arise in quantifying individual constituents of intellectual capital are associated with the impossibility of assigning a specific intangible asset to specific capital (Tkachenko et al. 2019; Dmitriev 2018). In general, the following innovative solutions contributing to the growth of rental income can be distinguished:

- application of new technologies to existing production processes;
- development of new production processes based on existing technologies;
- search for and application of new sources of raw materials for production needs;
- search for new manufactured products markets;
- development of new management mechanisms to improve efficiency.

These innovative solutions have a qualitative impact on the intellectual capital of the enterprise, its reproduction. As a result, it is thanks to this process that innovation and intellectual rent is obtained. That is, in general, the extension of rental theory to modelling the development and use of intellectual capital can be considered justified. In addition, investment in a person, in developing their specific abilities will prove more advantageous than investment in developing natural resources.

3. Mathematical apparatus for calculating the intellectual rent

Intellectual rent is generated by adding a premium to the average sale price of intellectual property, sale of patents and licenses, goodwill of innovatively active enterprises (Nazarycheva 2013). The mechanism of intellectual rent generation is considered in Table 1.

Table 1. Intellectual rent generation

Intellectual rent		
Rent from selling innovative products (premium over the average price)	Rent from selling patents and licenses	Rent derived from positive goodwill of innovatively active enterprises

Source: Own results

The widespread dissemination of intelligent production methods through the introduction of information and knowledge-intensive technologies leads to the dynamics of intellectual rent, which begins to decline per enterprise under the influence of these trends and to increase under the influence of investments. Thus, to maintain competitive production, industrial enterprises need to ensure a sufficient level of investment in intellectual capital so as to prevent a decrease in intellectual rent.

Developing a rental approach to assessing the intellectual effect requires identifying the patterns of distribution and use of intellectual rent. The agents of intellectual rent distribution are industrial enterprises with intellectual property rights and innovators that hold intellectual knowledge. The mechanism of intellectual rent distribution allows for the efficient use of intellectual property whereas intellectual rent will cover costs of innovative development.

According to the authors, the use of intellectual property in production processes allows for creating a model for determining the respective rent. There are the following types of situations associated with eliciting the intellectual rent of an industrial enterprise:

1. Intellectual rent is the excess that the industrial enterprise receives over the normative profit due to the increased price of products developed through innovative methods;
2. Intellectual rent is not generated if the industrial enterprise receives only normative profit and intellectual production does not yield positive results;
3. Intellectual rent is not generated if the income of an industrial enterprise does not cover costs, which leads to losses.

Intelligent rent enables industrial enterprises to receive additional profit through the use of intellectual resources. It is suggested that the generation of intellectual rent is considered on the basis of multifactor model:

$$IR = \{x_1; x_2; x_3; x_4; x_5\}, \quad (1)$$

where IR (intellectual rent) - intellectual rent;

x1 – a value expression of an individual intellectual property object;

x2 – a quantitative expression of intellectual property objects;

x3 – a value expression of products manufactured through the use of intellectual property objects;

x4 - income received from selling patents and transferring rights under license agreements;

x5 – the amount of goodwill as the difference between the market and book values of an industrial enterprise.

It is suggested that the following formula is used to calculate the intellectual rent from a single product:

$$IR = v - c - Pn, \quad (2)$$

where IR (intellectual rent) - intellectual rent;

v (value) – the price of products manufactured through the use of intellectual property objects;

c (cost price) – the cost of production through the use of intellectual property objects;

Pn (normative profit) – the normative profit of products manufactured through the use of intellectual property.

$$Pn = c * Knr, \quad (3)$$

$$Knr = Pf / Cf \quad (4)$$

where:

c (cost price) – the cost of production utilizing intellectual property objects;

Knr (normative rate of return) – the normative coefficient of profitability;

Pf (fact profit) - the actual profit received from selling manufactured products of an industrial enterprise over the previous year;

Cf (fact cost) - the actual cost of sales over the previous year.

A similar calculation can be applied to the calculation of intellectual rent at the level of an industrial enterprise with regard to industry average profitability indicators:

$$IRie = I - C - \Pi_n, \quad (5)$$

$$Npie = E * Knri, \quad (6)$$

where:

IRie (intellectual rent of an industrial enterprise) - intellectual rent at the level of an industrial enterprise;

I (income) - income of an industrial enterprise from all types of activities (revenue from product sales, operating and non-operating income);

C (costs) - expenses of an industrial enterprise on all types of activities (cost of production, operating and non-operating expenses);

Npie (normative profit of an industrial enterprise) – the normative profit of an industrial enterprise over the year;

E (equity) – the equity of an industrial enterprise at the end of the year;

Knri (normative rate of industry return) – the normative coefficient of profitability of the industry.

The proposed methodology allows for the calculation of intellectual rent at the product level and at the level of an industrial enterprise with regard to industry average indicators of profitability and intellectualization of the enterprise.

4. Conclusions

To sum it all up, the study of intellectual rent highlights the following peculiarity: the costs of developing and implementing intellectual resources are different and it is impossible to predict the future value of a development outcome, which indicates a significant risk of using intellectual capital for industrial enterprises.

However, it is intellectual rent that is an indicator of the wealth and maturity of the modern economy since it provides the opportunity to manufacture a product under a patent, to introduce this or that innovation. The authors distinguish the following distinctive features of intellectual rent:

1. Intellectual rent emerges in the innovative, informational and social spheres of economic relations and depends on the innovation infrastructure;
2. Intellectual rent appropriators in the economic sphere are the owners of intellectual capital;
3. Intellectual rent is generated from profits and excess profits derived from a monopoly position and relative savings in costs from the use of high-quality intellectual capital;
4. Intellectual rent is a specific phenomenon tied with owning legally protected property rights to intellectual property.

Our research proposes methods for the mathematical calculation of intellectual rent at the level of production and at the level of an industrial enterprise. These mathematical methods will allow for calculating the cost of intellectual rent and determine the level of the enterprise's intellectualization with regard to industry average indicators.

The proposed algorithm can be used for enterprises of various sectors and allows comparing companies in terms of their intellectual resources as well as elaborating guidelines for more rational use of intellectual resources.

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