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IT Services market as a driver for the development of the artificial intelligence market

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Abstract. The market of artificial intelligence is currently one of the most dynamically developing markets for advanced technologies of the 6th technological order due to the complexity and versatility of solutions developed within this set of technologies. The key hypothesis of the study is the assumption about the dependence of the development dynamics of artificial intelligence market on environmental factors that form the dynamics of the development of the IT services market. The key research method was the classical toolkit of multiple regression analysis. As a result, an econometric model was obtained describing the structure of the influence of environmental factors on the development of the global IT services market, and the determining influence of the IT services market on the artificial intelligence market was established and substantiated.

1. Introduction

The structure of the world economy is undergoing significant changes under conditions of formation of the 6th technological order. At the same time, the dynamic development of the markets of many innovative technologies inevitably leads to an increase in the capacity of markets complementing such technologies. The reverse trend is also true, in which the driver for increasing the market capacity of some innovative products is the dynamic development of markets for complementary and/or related products and services. One of the most obvious representatives of this trend is the artificial intelligence market (hereinafter referred to as the “AI”). According to the Gartner report (2017), AI is a key aggregate of technological solutions within the world economy. First of all, this is due to the fact that at the moment the AI elements are integrated into the vast majority of modern products and are used at every stage of the value chain.

The very concept of AI is complex and includes a significant number of technological areas [1]:

1. Machine learning;
2. Deep training;
3. Natural language processing;
4. Machine reasoning;
5. Computer vision;
6. Strong artificial intelligence.



It is established at the moment that AI can have about 215 applications, which can be divided into 3 key categories [1]:

1. Large data: raw data, such as sensor data, patient information, market indicators or a list of cyberthreats, can be analyzed in order to capture patterns, anomalies, correlations, suggest actions and outcomes;
2. Vision: applications for the collection of images or video information that perform recognition of objects, people, persons, emotions and other objects in the real world;
3. Language: artificial intelligence is used for processing and recognition of speech, texts, as well as dynamics, syntax and nuances of natural language.

The key problem is the uncertainty in the prospects of development of the world market of artificial intelligence. First of all, this is due to the uncertainty of the external environment and the lack of a uniform understanding of the drivers of development of this market. The aim of the study is to structure the directions and forces of influence of the key factors of the external environment on the market of artificial intelligence by means of a multiple regression model. This structure was determined in accordance with the key driver of the development of the market of artificial intelligence - the IT services market.

2. Literature and statistics overview

Tractica experts (2016) estimated the world market of AI as a whole of \$ 1.38 billion, and further it is expected to grow rapidly - 52% per year from 2017 to 2025. At the same time, experts emphasize that the main driving factors for the market are the growth of data generation, increased demand for solutions based on AI, increased operational efficiency and lower costs, as well as the growing need to improve the quality of customer service.

According to PwC, it is projected that the AI application market will determine the growth of global GDP by \$ 15.7 trillion by 2030.

For 2015–2017, the number of projects in the field of world AI has grown several times. If only 17 projects were announced by large companies in 2015, there were 74 of them in the first half of 2017. Totally, 162 such projects were registered in 2015–2017 in 28 countries and in 20 industries, mainly in large business (85%).

It is accepted that the main driver for the development of the AI market is the growth of scientific research in the field of artificial intelligence in the last few years in the USA (35.98% of patents), China (28.12%), Japan (8.33%), the EU (6.25%) and the Republic of Korea (6.05%). The number of protected patents in the field of artificial intelligence grew from 1,787 units in 2011 to 3,191 in 2015 in the US. The neural networks (46.81%), followed by image recognition (29.15%), machine learning (15.69%), fuzzy logic (4.63%), vectors (3.14%), deep training (0.51%) and cognitive calculations (0.07%) are the most "patented" technologies in the field of AI [2].

The authors suppose that such a dynamic development of the research process is not a driver, but a consequence of the development of the AI market due to the fact that the bulk of research funding in this area falls on large business. Consequently, the development of AI technologies has a significant economic potential. The key drivers can be markets for goods and services for which AI can act as a technological component. Such market is presented by the ICT market in general, and especially the IT services market. In many ways, this is determined by the fact that the key players in the AI market are ICT industry companies who specialize in providing IT services.

The analysis of the dynamics of various sectors of the IT services market shows that project-oriented services outstrip the services associated with outsourcing, support and training in terms of growth rates [3]. As a result of 2017, the total revenue from project-related services rose by 5% to \$ 366 billion. More than two thirds of the market for project-oriented services are occupied by services in the field of IT projects, including custom software development (Custom Application Development, CAD). It is this trend that determines the importance of the IT services market as a driver for the development of the AI market. Thus, the study of the dynamics and sources of the development of the IT services market is extremely relevant in the context of the development of the AI market [4].

3. Research methods

The IT services market is a complex one and is largely influenced by many external factors. According to the authors, the external environment of this market can be divided into 5 main sub-sectors (see figure 1) [5, 6].

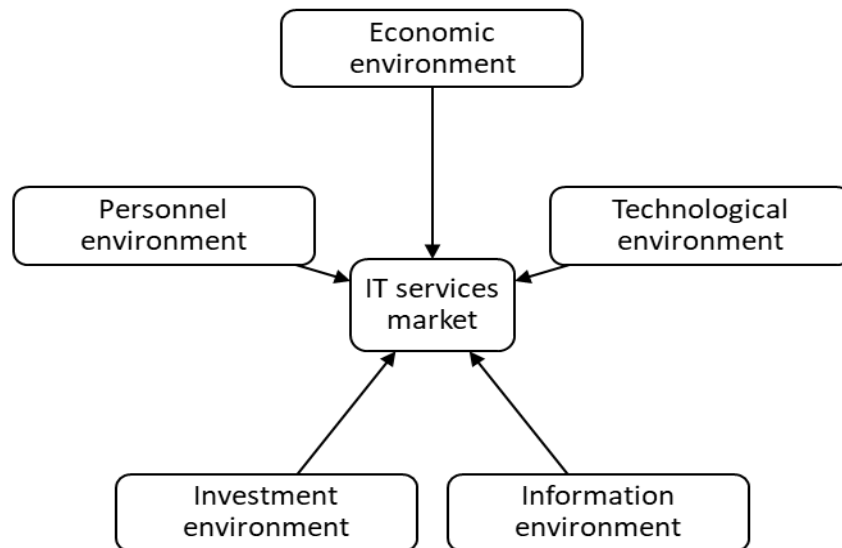


Figure 1. Structure of the external environment of the IT services market.

Each of these environments can be represented by a set of indicators. In the framework of this study, the following indicators were selected reflecting the influence of the sub-sectors of the external environment of the IT services market:

1. The economic environment - the share of IT services exports in the total export of the ICT market (%) - X_1 ;
2. Technological environment - the share of registered patents in the IT industry relative to the aggregate number of registered patents (%) - X_2 ;
3. Information environment - the proportion of Internet users relative to the world population (%) - X_3 ;
4. Investment environment - the share of cross-border M&A transactions in the ICT industry relative to the total volume of cross-border M&A transactions (%) - X_4 ;
5. Personnel environment - the share of employed in IT services relative to the total number of employed in ICT (%) - X_5 .

The resultant indicator is the volume of the IT services market (Y). The study of the influence of sub-sectors on the development of the IT services market and the identification of the directions of development of this market as the driver of the AI market is the goal of this study. The statistical array, being the basis of the study, is represented by time series of values of these indicators from 2001 to 2017 [7].

4. Research results

The study of the influence of the allocated sub-sectors on the development of the IT services market has demonstrated mixed results. This influence can be represented in the form of a multifactorial regression model:

$$Y = -872.48 + 5233 \cdot X_1 - 11715.3 \cdot X_2 + 212.03 \cdot X_3 + 581.21 \cdot X_4 + 4128.06 X_5 \quad (1)$$

The adjusted R^2 for this model is 0.88, which indicates a sufficient quality of approximation, and therefore, the high quality of the model. However, P-values of individual factors are significantly higher than the existing standard of 0.05 (see figure 2):

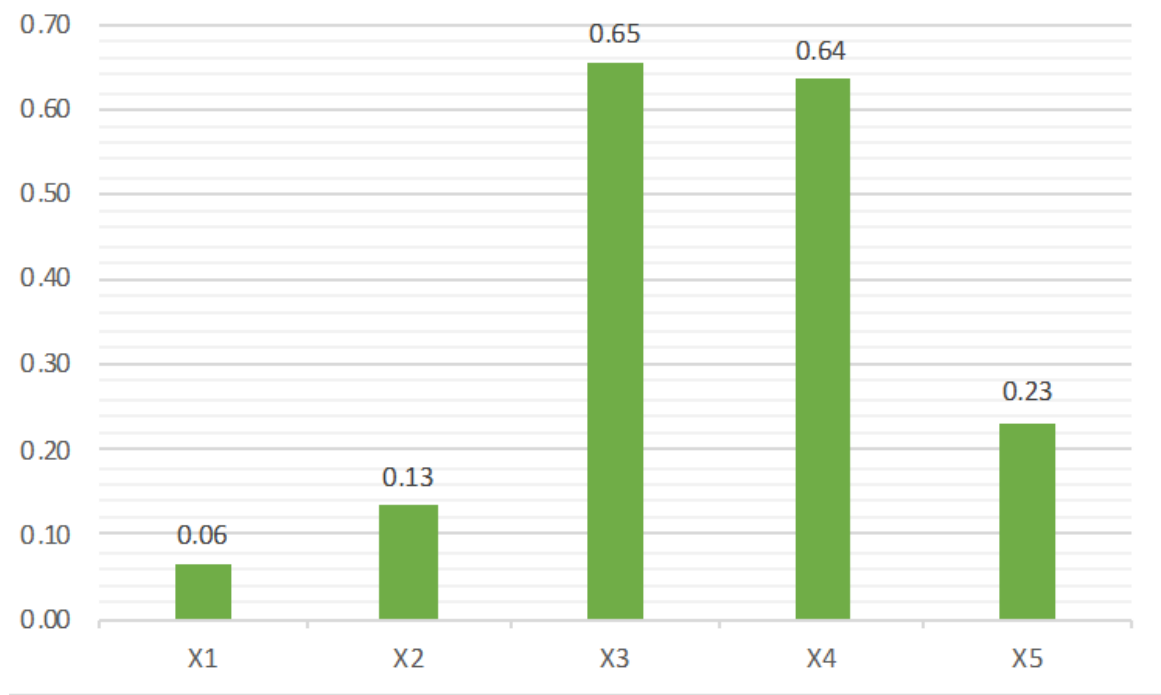


Figure 2. P-Values of model factors.

As can be seen, the factors X_3 , X_4 and X_5 are not significant, and, therefore, the change thereof does not have a significant impact on the dynamics of the IT services market [8-10]. Thus, the influence of the external environment on the market under study can be artificially limited to research exclusively on its economic and technological sub-environment. This two-factor model takes the following form:

$$Y = -1153.82 + 7346.13 \cdot X_1 - 12488.53 \cdot X_2 \quad (2)$$

Adjusted R^2 for this model is 0.87, which confirms the previously formulated conclusion of the absence of significance of sub-sectors excluded from analysis. It can be concluded that the economic and technological sub-environment has the most significant impact on the IT services market. Figure 3 shows the dynamics of the development of the IT services market.

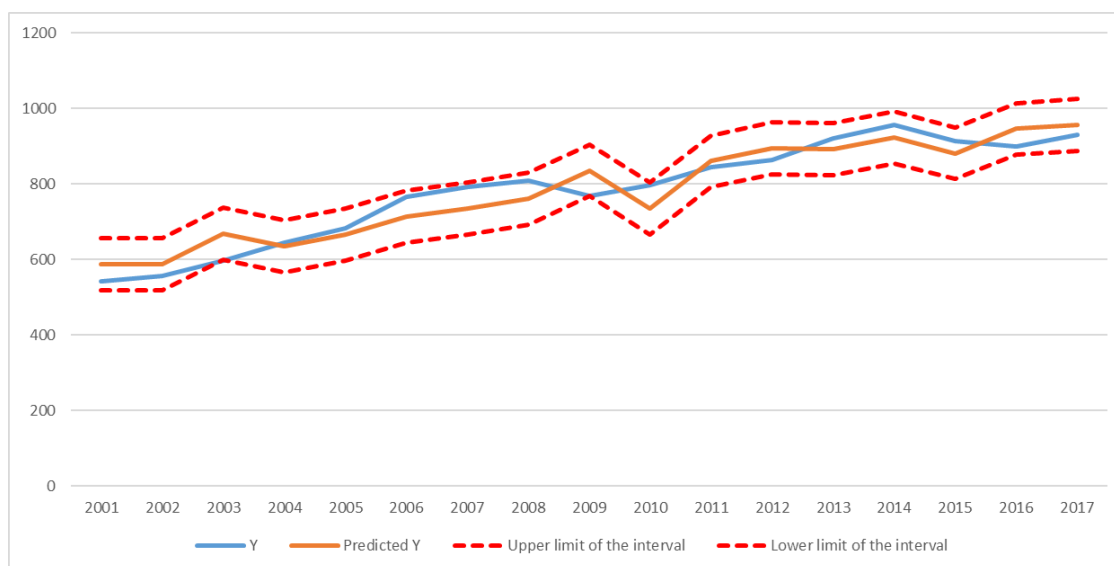


Figure 3. Dynamics of the development of the IT services market.

The development of the IT services market is unstable as can be seen in Fig.3. The most significant crises in this market were observed in 2010 and 2015. One of the main directions of market stabilization and its sustainable development is the improvement of international legislation in the field of IT services trade as well as investments in establishing sustainable distribution channels within the framework of international cooperation. Therefore, the vector of development of trade relations between countries with a dynamically developing economy (China, South Korea, India, etc.) becomes especially important, since they are able to form a significant part of the demand for IT services in the upcoming years.

5. Directions for future research

The IT services market is one of the key drivers of the AI industry development worldwide. At the same time it was found that, despite of the complex and multifaceted structure of the external environment of the IT services market, the economic and technological sub environments exert a significant influence on its dynamics. The vector of influence of these sub-sectors is primarily determined by the direction of development of international trade legislation and investments in research and development. Thus, it can be established that the dynamics of the development of the AI market will largely depend on the development of trade relations between countries with a dynamically developing economy. High concentration of this market is determined by high importance of the developed technological basis that key market representatives possess. The place of Russia is insignificant in this market at the moment. The absence of a necessary technological basis does not allow predicting a significant increase in the share of Russia in the global IT services market. Therefore, the program of international cooperation should become the primary step in the development of this sector at the national level. The authors' subsequent research will be devoted to the issues of constructing such programs, as well as evaluating the effectiveness thereof.

The key direction of future research is the search and specification of complex drivers for the development of the artificial intelligence market, the refinement of the resulting model of multiple regression and the forecasting of development of the studied markets as a whole.

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