

Management of Enterprises of High-Tech Business under the Trends of the Markets of Explicit and Implicit Knowledge: Classification, Business Model

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Received: March 10, 2015 Accepted: March 31, 2015 Online Published: April 30, 2015

doi:10.5539/ass.v11n11p277

URL: <http://dx.doi.org/10.5539/ass.v11n11p277>

Abstract

The research presents a business model of high-tech businesses management, basing on the trends of explicit and implicit knowledge market with the dominating implicit knowledge market; classification of high-tech businesses, taking into consideration the three types of economic activity; possibilities to manage high-tech business basing on its market cost, technological innovations costs and business indicators. The work uses the program documents: Strategy of innovative development of the Russian Federation up to 2020; methodological materials of the Russian and foreign agencies: ROSSTAT, OECD, statistical data of the National Research University "Higher School of Economics" (Moscow); analytical materials by Thomson Reuters (USA).

Keywords: management model, high-tech businesses, explicit and implicit knowledge market, classification of high-tech businesses, business model

1. Topicality of Research

1.1 Grounding the Research Topicality

Knowledge market as a complex of explicit and implicit knowledge markets has its own characteristics and trends of development. After stating them, it is necessary to estimate the current condition of the Russian high-tech businesses and to implement measures for strengthening their positions in these markets.

The topical international ratings of high-tech businesses, like Thomson Reuters (USA) and indexes of high-tech businesses, like Nasdaq (USA), DAX (Germany) include businesses which do not function in high- or middle-tech spheres of economy. The research of this fact will allow to reveal the notion of "high-tech businesses".

1.2 Topicality: Advanced Interpretation

The authors have elaborated the approach to research the high-tech businesses management, basing on the knowledge market analysis at macro- meso- and micro-levels, the model of knowledge management in an organization (Figure 1 A, B, C; Scheme 1, Figure 2).

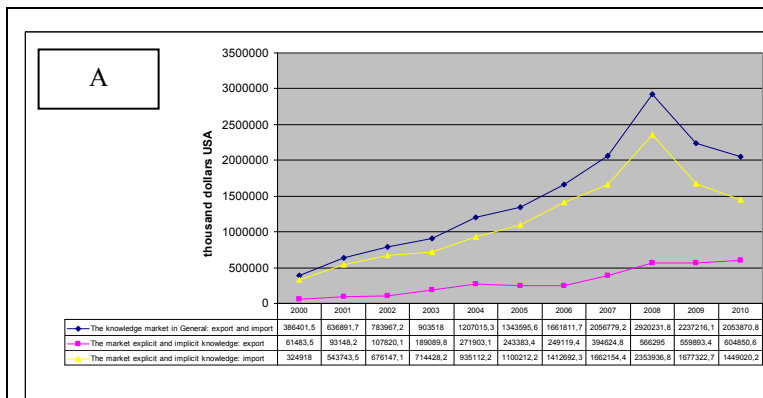
The elaborated model of knowledge management, the technique of explicit and implicit knowledge markets analysis is productive for developing and confirming the ideas represented in the works by Nonaka and Takeuchi on the significance and dominating of implicit knowledge in the knowledge market and in the organization as a whole (Borowik, 2014). Actually, the knowledge market development is ensured by the functioning of high-tech businesses, forming the bases of knowledge market, classified into explicit and implicit, the level of knowledge generation and the tools of knowledge management mechanism (Figure 2).

Basing on the authors' methodology of the analysis of explicit and implicit knowledge market, the knowledge management model in an organization as a result of knowledge market development as an integrity of explicit

and implicit knowledge markets in the Russian Federation (RF) in 2000-2010, the following conclusions are made:

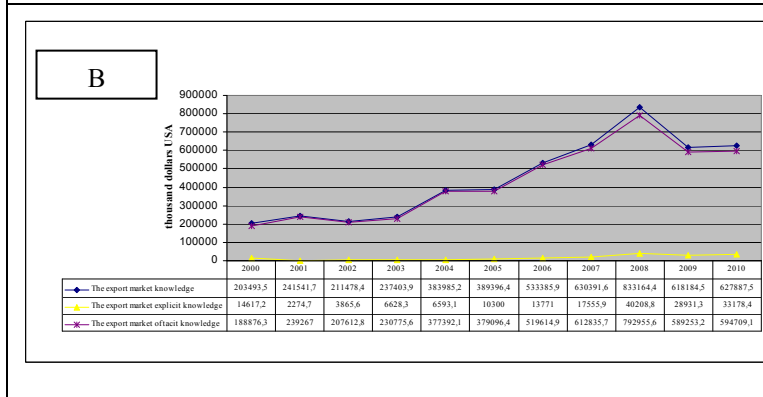
- in 2000-2010, implicit knowledge market (export and import of implicit knowledge) dominated in the development of knowledge markets in RF;
- in 2000-2010, import of knowledge, first of all, implicit knowledge, dominated in the development of knowledge markets in RF;
- maximal values in the development of knowledge markets in RF were achieved in 2008 on the basis of maximal values of export and import of implicit knowledge (Figure 1 A, B, C; Table 1);
- the worst values in the researched period were shown by the market of explicit knowledge export (in quantitative indicators by years, by the volume of growth);
- the volume of knowledge market in RF in 2000-2010 increased 7.5 times and in 2008 achieved its maximum of 2920231.8 thousand US dollars (theoretical value of the sum of export and import of explicit and implicit knowledge) and minimum of 386401.5 thousand US dollars in 2000 (Figure 1A, B, C; Table 1). Consequently, taking into consideration the maximal values (potential) of the knowledge market in RF, we can conclude that in 2000 the Russian knowledge markets dealt with about 13% of the Russian knowledge market potential; in 2010 – about 70% in all knowledge markets as a whole (export and import) (Figure 1A). The export knowledge market in 2000 dealt with 7% of knowledge of the potential of knowledge markets, in the explicit knowledge market export – 0,5%, in the implicit knowledge market export – 6,5%; in 2010 the share of knowledge in the whole knowledge export market /explicit knowledge export market / implicit knowledge export market was respectively: 21,5/1,14/20,4 % (Figure 1B). In the knowledge import market in 2000 the values of the whole knowledge market / explicit knowledge market / implicit knowledge market were respectively: 6,3/1,6/4,7 % from the whole knowledge market. In 2010 these values were respectively: 48,8/19,6/29,3.

Having revealed the trends of the Russian knowledge market in 2000-2010, we should investigate the following issues: classification of high-tech businesses; analysis of business models implemented in the knowledge markets with various groups elaborating the knowledge for high-tech businesses.



Methodology of estimating the volumes of knowledge markets by types of knowledge as a type of foreign economic activity of Russian Federation (RF) enterprises in 2000-2010.

- (a) volume of whole knowledge market in RF is defined as a sum of export and import markets of explicit and implicit knowledge;
- (b) volume of explicit knowledge market in RF is defined as income from export and import of explicit knowledge (Note 2);
- (c) volume of implicit knowledge market in RF is defined as payments for export and import of explicit and implicit knowledge (Figure 1A)



Methodology of estimating the volumes of export knowledge markets as a type of foreign economic activity of Russian Federation (RF) enterprises in 2000-2010.

- (a) volume of whole export knowledge market in RF is defined as a sum of income from explicit and implicit knowledge export;
- (b) volume of explicit knowledge export market in RF is defined as income from export of explicit knowledge by 7 indicators in the sphere of explicit knowledge export (Note 3);
- (c) volume of implicit knowledge export market in RF is defined as income from export of implicit knowledge by 3 indicators in the sphere of implicit knowledge (Note 4) (Figure 1B).

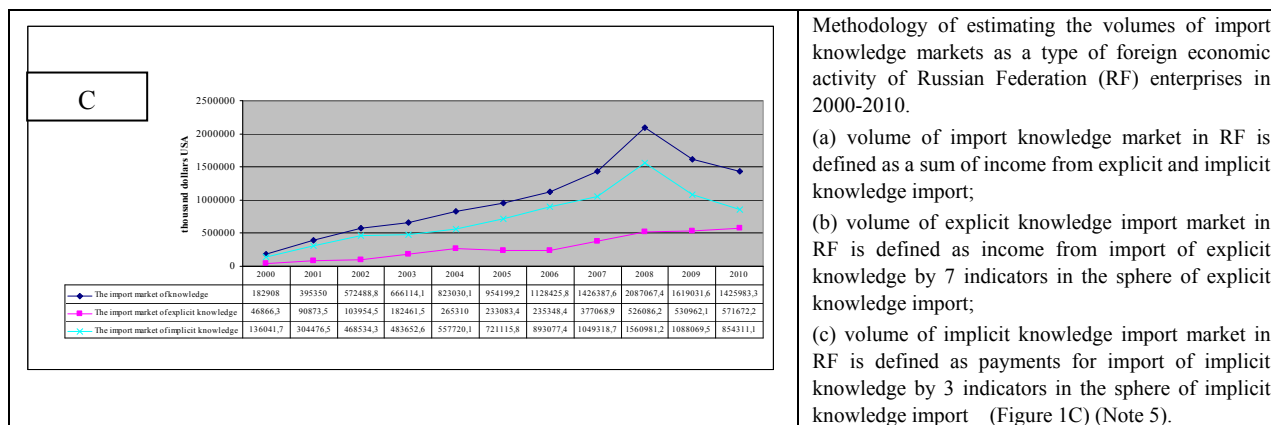


Figure 1. Volumes of knowledge markets by types of knowledge as a type of foreign economic activity of RF enterprises in 2000-2010: knowledge market as a whole (export of explicit and implicit knowledge; import of explicit and implicit knowledge), thousand US dollars (A); volume of export knowledge market (income of export), thousand US dollars (B); volume of import knowledge market (payments for import), thousand US dollars (C)

According to the rating of the world innovative companies by Thomson Reuters (Note 1) in 2013, 14 companies of 100 were classified as low-tech (Table 2). The knowledge market of the countries leading in technological patterns (USA, Japan, France) is characterized by the development of high-tech business models with high-tech businesses in all kinds of economic activity. Their dominant is managerial tools of knowledge economy (Table 2).

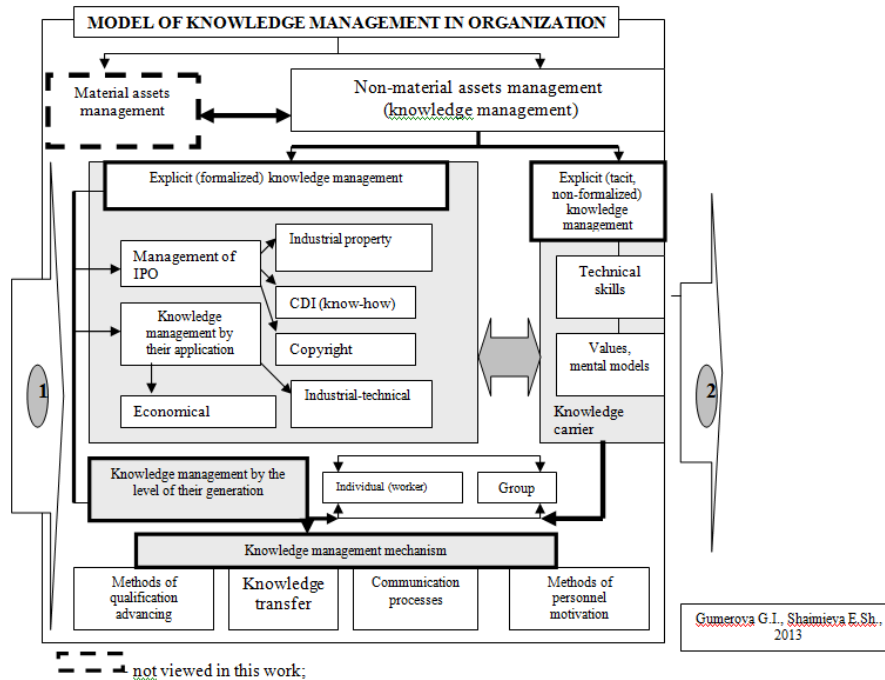
The business model, which is interpreted in the present research as a link between technology and environment of a company (Jones, 1995; Romer, 1998; Teece, 1981), implemented by the enterprises of groups 3 and 4 in the knowledge economy market, basing on the explicit and implicit knowledge management of their organizations, makes the shares of middle- and low-tech companies quote as high as the shares of companies from high-tech markets (Table 2).

The program document “Strategy of innovative development of the Russian Federation up to 2020” , and “Methodology of calculation of indicators “Share of the production of high-tech and science-intensive sectors in the gross domestic product” and “Share of the production of high-tech and science-intensive sectors in the gross regional product of a subject of the Russian Federation”, in the authors’ opinion, do not contain the sufficient criteria of development of high-tech business, science-intensive enterprises and science-intensive services. Business models of high-tech businesses have limitations for high-tech business development, forming barriers both by the age of high-tech businesses and the type of its economic activity.

METHODOLOGY OF ANALYSIS OF EXPLICIT AND IMPLICIT KNOWLEDGE MARKET

- 1. **MACROLEVEL:** methodology and analysis of technological balance of industrial enterprises’ payments
 - 1a. Explicit knowledge market: patents for inventions, patent-free inventions, patent licenses, useful models, know-how, trademarks, industrial samples (mln US dollars)
 - 1b. Implicit knowledge market: engineering services, scientific research, other (mln US dollars)
- 2. **MESOLEVEL:** methodology and analysis of export and import of technology and services of technical character at the federal districts level; patent applications and protection documents in the industrially developed mesosystems of Russia
 - 2a. Explicit knowledge market: patent applications; issue of protection documents (units)
 - 2b. Implicit knowledge market: export of technology and services of technical character (units, thousand US dollars); import of technology and services of technical character (units, thousand US dollars);
- 3. **MICROLEVEL:** methodology and analysis of explicit and implicit knowledge management basing on the analysis of expenses for technological innovations in the Russian industrial enterprises *
 - 3a. Explicit knowledge market: acquiring new technologies: rights for patents, licenses, useful models, industrial samples (mln rub.)
 - 3b. Implicit knowledge market: research and elaboration of products, services and methods of their production, new production processes (mln rub.); industrial projecting, design (mln rub.); teaching and training of personnel, connected with innovations (mln rub.); marketing research (mln rub.)

Scheme 1. Methodology of analysis of explicit and implicit knowledge markets according to the authors’ research (2013)



IPO – intellectual property objects; CDI – confidential documented information;

① - resources at the “entrance” of organization; ② products and services at the “exit” of organization
 Source: on the basis of (Thomson Reuters 2013 Top 100 global innovators; Isaksen & Karlsen, 2011)

Figure 2. Model of knowledge management in organization: theoretical aspect

Table 1. Development of knowledge markets in the Russian Federation in 2000-2010: stages and volumes

Stage	Period	Characteristic	Volume of knowledge market as a whole, thousand US dollars, в тыс. дол. США	
			Minimal value	Maximal value
1 (initial)	2000-2003	Minimal values in the explicit, implicit knowledge markets; significant gap between the explicit and implicit knowledge export market and explicit and implicit knowledge import market (Figure 1 A, B);	386401,5	903518
2 (moderate growth)	2004-2006	The knowledge market growth based on explicit and implicit knowledge export (Figure 1A, B)	1207015,3	1661811,7
3 (maximal values)	2007-2010	Maximal volumes of knowledge market in 2008, due to maximal values of implicit knowledge export, and increasing the explicit knowledge import since 2008 г. (Figure 1A, C).	2056779,2	2920231,8

Table 2. Ranking of top 100 world innovators in 2013, according to Thomson Reuters (USA)

Criterion	1 group	2 group	3 group	4 group	Authors' comment
	Companies working in high-technology sectors of economy	Companies working in middle-technology sectors of economy (of high and middle level)	Companies which can be attributed to the 1 st of 2 nd group	Companies working in low-technology sectors of economy	
Number of companies	63	25	9	3	
Type of activity	Pharmaceutics (3); semi-conductors and	Chemicals (7); industry (1);	Innovative materials (1); scientific	Oil products (2); steel	1. According to the Russian Patent Law,

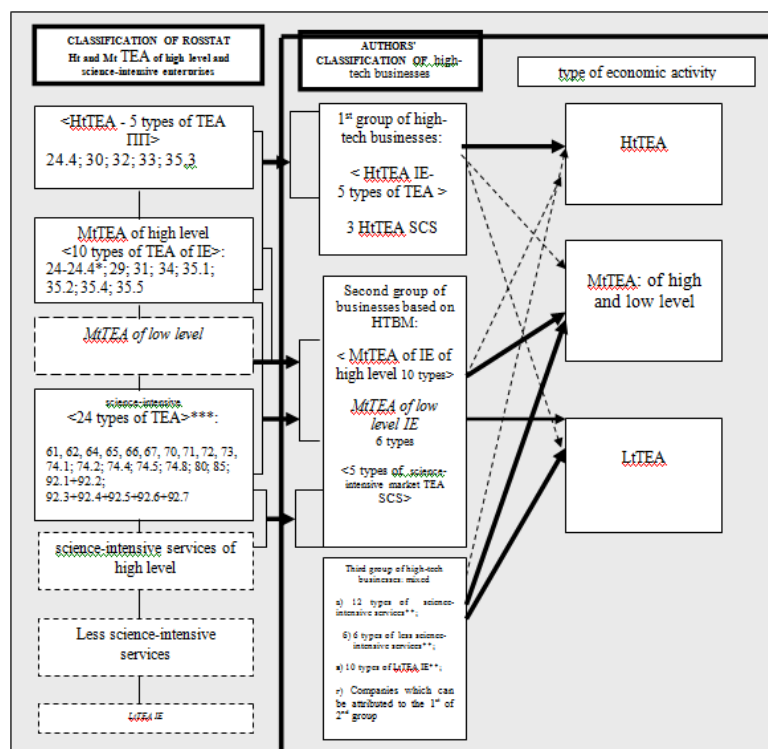
(number of companies in the type of activity)	electronic parts (23); telecommunication equipment (8); aerospace industry (2); computer parts (11); medical equipment (1); optics, photo equipment (2); software (3); electro-technical production (5); electro-technical equipment (1); electronic devices and high technology (1); household appliances (3)	automobile parts (8); power industry, machine building (2); tires production (2); transport (1); heavy industry (1); consumer goods production (1); construction materials (1); transport equipment (1)	research (4); media, internet, navigation systems (1); perfumes and cosmetics (1); sports clothes and footwear (1); finance and industry (1)	production (1);	business processes are not subject to patenting, including “planning, business development, protection of innovations within the organization”, which should be patented under DWPI (Note 6). 2. The enterprise innovation measurement is crucial: costs to income or turnover of an enterprise
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2. Elaborating Methodological Applications to High-Tech Businesses Management

2.1 Classification of Companies High-Tech Businesses

Under the companies of high-tech businesses in this research are understanding three groups of companies:

- The first group is engaged in high-tech and science-intensive type of economic activity. According to the criteria of attributing a business to high-tech sectors is a high level of technological development, defined as the ratio of scientific research costs to the gross added value. The criteria of attributing a sector to the science-intensive ones is the share of employees with a high level of professional education in the overall number of employees (Note 7).
- The second group is engaged in middle- and low-tech type of economic activity, implementing high-tech businesses management, which results in the high level of technological development of the enterprise. This is achieved by a business model (or managerial knowledge) implemented in those enterprises.
- The third group is mixed, where: (a) enterprises can have simultaneously high expenses on technological innovations, high business organization, and function in low-tech types of economic activities; (b) science-intensive businesses, whose functioning can be attributed to the 1st of 2nd group (Note 8).



- not included into classification; <text> - classification of the Russian Agency on Statistics

—————▶ - dominating type of economic activity; - - - - -▶ - secondary type of economic activity

* - 24.4. – pharmaceutical production, excluding 24.4; ** - high cost of the company; *** - both subsectors and constituents as separate type of economic activity; [30] – subsector from the Russian classifier of types of economic activity; 24.2. – constituent of a subsector

HTB – high-tech businesses

IE – industrial enterprises

HTA - high-tech activity

SCS – science-intensive services

TEA – type of economic activity

LtTEA – low-tech type of economic activity

HTBM – high-tech business management

MtTEA – middle-tech type of economic activity

Figure 3. Classification of high-tech businesses (author's know-how)

According to the authors', the common criteria of high-tech businesses are: (1) high market value of the company, based on the knowledge economy objects management: enterprise brand, explicit and implicit knowledge, personnel; (2) life span of the company. Thus, high-tech businesses are enterprises obtaining profit from the company cost management regardless of their type of economic activity (low-, middle- or high-technological).

The characteristic of the 1st group of enterprises is the expenses on technical innovations and scientific research not less than 5% of the enterprise turnover. The main task of development strategy for the 1st group of high-tech businesses is technological leadership. The structural elements of high-tech businesses management is management system. The main task of development strategy for the 2nd group of high-tech businesses is business indicators: market share, cost of production, profit, etc. The enterprises of the 3rd group can have simultaneously high expenses on technological innovations, high business organization, and function in low-tech types of economic activities (Note 9) (Figure3).

When elaborating the classification of high-tech businesses, based on the methodology of Russian Statistical Agency (2014) and OECD (2008, recommended by NACE 1,1), the authors have concluded that:

1. The cited documents do not state sufficient differences in coding the type of economic activity in industrial production and science-intensive services (Note 10);
2. The following two types of industrial enterprises are mentioned in the cited documents: the high-tech and middle-tech type of economic activity of high level in industrial production;
3. The analysis has not revealed any reasons for not using the classification of science-intensive services based by OECD methodology.

The methodology of the classification of high-tech businesses in industrial production and science-intensive services, used by the authors, is shown in Scheme 2.

THE METHODOLOGY OF THE CLASSIFICATION OF HIGH-TECH BUSINESSES IN INDUSTRIAL PRODUCTION AND SCIENCE-INTENSIVE SERVICES
0. Comparative analysis of codes of types of economic activity in industrial production and science-intensive services by OECD and Rosstat; INDUSTRIAL PRODUCTION:
1. Analysis of types of industrial production according to OECD
2. Analysis of types of industrial production according to Rosstat
3. Formulating the criteria for classifying the types of industrial production
4. Formulating the classification of the types of industrial production based on OECD methodology, on Rosstat classification
SCIENCE-INTENSIVE SERVICES:
1. Analysis of types of science-intensive services according to OECD;
1a. Formulating the criteria for classifying the science-intensive services
2. Analysis of types of science-intensive services according to Rosstat;
2a. Analysis of the evolution of science-intensive services classification in 2011-2014;
2б. Forming: (a) a block of types of science-intensive services, which are mentioned in the documents on high-tech business development; (b) a block of types of science-intensive services, which are not mentioned in such documents
3. Formulating the classification of knowledge-based services based on OECD methodology, on Rosstat classification

Scheme 2. Methodology of classification of industrial production and science-intensive services based on OECD methodology

Table 3 shows the types of economic activity according to Rosstat.

Table 3. Types of economic activity of high-tech businesses according to the List of Types of economic activity of Rosstat²⁾: industrial production and science-intensive services

5 types of high technological level		10 types of middle technological types of activity of high level		24 science-intensive types of activity	
I		II		III	
A	Sector	A	Sector	A	Sector
24.4	Pharmaceutical production	[24]-24.1	Chemical production, excluding pharmaceutical production	[61]	Water transport
		-24.2-24.3		[62]	Air and space transport
[30]	Production of office equipment and computing appliances	[29]	Production of machines and equipment	[64]	Communication
		[31]	Production of electric machines and equipment	[65]	Financial agency
				[66]	Insurance
[32]	Production of electronic components, equipment for radio, television and communication	[34]	Production of automobiles and trailers	[67]	Auxiliary activity in the sphere of financial agency and insurance
				[70]	Real estate operations
				[71]	Renting of machines and equipment without operators; renting household appliances and personal belongings
				[72]	Using computer equipment and informational technologies
				[73]	Scientific research and development
[33]	Production of medical devices; measuring and controlling equipment, equipment for managing and testing; optical devices, photo- and video-equipment; watches	35.2 + 35.4 + 35.5	Production of railway vehicles (locomotives, tram cars, etc.); Production of motorcycles and bicycles; Production of other transportation vehicles outside other groups	74.1	Activity in the sphere of law, accounting, and audit; consulting in commercial activity and business management
				74.2	Activity in the sphere of architecture; engineering-technical projecting; geological and geophysical works;
				74.2	Geodesic and cartographic activity; activity in the sphere of standardization and metrology; activity in the sphere of hydrometrology and adjacent spheres; activity in the sphere of technical tasks, not included in other groups
				74.4	Advertising activity
				74.5	Employment and selecting of personnel
				74.8	Rendering various services
				[80]	Education
				[85]	Health care and rendering of social services
				92.1 +92.2	Activity in the sphere of production and demonstration of films, activity in the sphere of radio and television broadcasting
				92.3 +92.4+92.5+92.6 +92.7	Other entertainment activity; activity of information agencies; other activity in the sphere of culture; activity in the sphere of sport; other activity in the sphere of rest and entertainment

[30] – subsector from the Russian classifier of types of economic activity; 24.2. – component of a subsector

The authors' classification of high-tech businesses has the following advantages (Figure3):

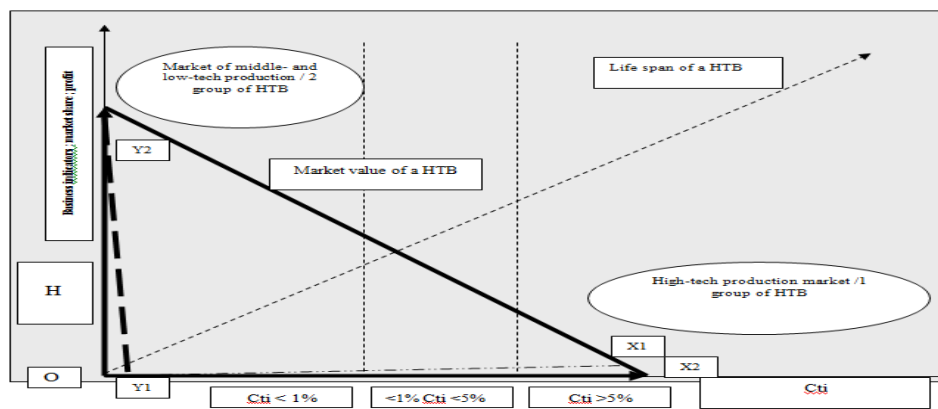
1. Inclusion of enterprises of middle-tech types of economic activity of low level (Note 11);

2. Grouping of enterprises to define the particular long-term strategic goals of development in the international and internal markets: 1st group – achieving technological leadership, development of the company’s intellectual portfolio with patents, like in the Chinese Patent Office, the Japanese Patent Office (Note 12); 2nd group – achieving high business indicators (share in the market, profit, business diversification);

3. Defining the particular development tools for each group: the 1st – on the basis of high expenses for technical and scientific research, demanding sufficient state and other support; 2nd – on the basis of modern tools of high-tech businesses management system, demanding the development of multi-level and multi-factor management system without large state support (except socially-significant type of economic activity).

2.2 Business-Model, High-Tech Business Index

Researchers (Jones, 1995) list the features of business for building business models of science-intensive enterprises. They are: network structures of value creation; open innovation models; modular technology development; technological standards and platforms (Note 13); subversive innovations; functioning of know-how markets.



HTB – high-tech businesses; TI – technological innovations;
 H – business indicators depending on type of economic activity
 Cti – expenses for innovations to the turnover (%)
 scheme [O, Y1, Y2] – critical position for enterprises of 2 group of HTB;
 scheme [O, X1, X2] – critical position for enterprises of 1 group of HTB
Diagram 1. Business model of high-tech businesses: expenses for innovations, business indicators (based on [33, 34])

The authors’ business model of high-tech businesses is based on regulating the high-tech businesses’ functioning on the markets of high-, middle- and low-tech production by managing the business indicators and expenses on technological innovations. The critical positions are [O, Y1, Y2], [O, X1, X2]. In the first case the life span of a high-tech business is ensured by the efficient management system, which is bound to fail short-term without expenses on technological innovations (Note 14). In the second case, the massive expenses on (technological) innovations lead to bankruptcy, though there are patents and the brand, but there is no appropriate management system, business model and knowledge management in the organization (Note 16). The space optimal for high-tech businesses functioning is [Y1, Y2, X1] (Diagram 1): cost management of a high-tech business is carried out long-term with expanding expenses on technological innovations and strengthening business indicators (Note 16). An additional tool for analyzing the high-tech businesses management is an index of high-technology of high-tech businesses, which is a complex of three equations in the sphere of high-tech businesses management (scheme 3):

Correlation VE/ life span of an enterprise =	$\frac{\text{market value of company}}{\text{life span of an enterprise}}$	(1).
Correlation VIPO/ life span of an enterprise =	$\frac{\text{value of intellectual property of the company}}{\text{life span of an enterprise}}$	(2).
Correlation VMA/ life span of an enterprise =	$\frac{\text{value of material assets of the company}}{\text{life span of an enterprise}}$	(3)

where: life span of an enterprise – from the date of its creation till the moment of HTB Index evaluation (Note 17); HTB – high-tech business; E – enterprise; MA – material assets; IPO – intellectual property objects; V - value

Scheme 3. High-tech business index: correlation of the company value; intellectual property objects; material assets to the life span of the company

Interpretation of the analysis of high-tech business index is as follows:

I. at the level of three indicators of high-tech business index: analysis of data and revealing the causes of the company value at the expense of intellectual property objects or material assets during the life span of an enterprise;

II. At the level of indicators of correlation between company value, intellectual property objects value and the life span of an enterprise:

(a) if the life spans of the analyzed companies are equal, more efficient is the company with the larger index of high-tech business; (b) if the spans of the analyzed companies are not equal, it is necessary to find the mean value, making groups with closest values.

2.2.1 Analysis of Using the High-Tech Business Index on the Example of Football Clubs

The scientific-practical application of the authors' theoretical provisions is the analysis of the management of intellectual property objects in football clubs as high-tech businesses (Isaksen & Karlsen, 2011). This activity – code 92.6 by the Russian classifier of types of economic activity – is researched only for the extended indicator “Share of the production of high-tech and science-intensive sectors in the gross domestic product compared with the indicator recommended for OECD members”. The research shows how knowledge economy tools are used for enterprise management (in foreign football clubs) and the lack or absence of such tools (Russian football clubs).

The analysis of high-tech business index according to the authors' technique showed that in 2012 there were two groups of clubs: with life span from 100 to 150 years and from 50 to 100 years. The first group of clubs includes mainly foreign football clubs: Manchester United, Bavaria, Real, Barcelona. The second group includes Russian football clubs: Zenit, Spartak, Shakhter (Table 4, Figure 4).

Table 4. HTB index for football clubs (by 2012)

FC	Date of creation	Life span	Value	Value of OIP	HTB index 1: correlation of IV to III	HTB index 2: correlation of V to III	Average value for the group of correlations of HTB index 1 and HTB index 2	
I	II	III	IV	V	VI	VI	HTB index 1	HTB index 2
First group of FCs with life span from 100 to 150 years								
1. Manchester United	1878	134	2903	853	21,7	6,4	19,4	4,5
2. Bavaria	1900	112	2042	786	18,2	7		
3. Real	1902	110	3013	600	27,3	5,5		
4. Barcelona	1899	113	2995	580	26,5	5,1		
5. TsSKA	1911	101	321	32	3,2	0,3		
First group of FCs with life span from 50 to 100 years								
6. Zenit	1930	82	524	56	6,4	0,7	4,4	0,35
7. Spartak	1922	90	227	30	2,5	0,33		
8. Shakhter	1936	76	385	23	5,1	0,3		
9. Rubin	1958	54	201	17	3,7	0,06		

HTB – high-tech businesses; IPO – intellectual property object; FC – football club; correlation HTB index 1 – football club value to the life span; correlation HTB index 2 – IPO value to the life span

Basing on Table 4, Figure 5, we see that the value of the Russian football clubs during the whole period of their functioning is the value of their material assets, i.e. the material-technical base without the knowledge-intensive component of knowledge economy. When managing a football club as a material asset only, there is no business

model of company management as a complex of material and non-material assets management, which is the constituent part of the science-intensive service – activity in the sphere of sports by the authors' classification of high-tech businesses, the trends of explicit and implicit knowledge market are not taken into account. The high-tech businesses management on the basis of trends of explicit and implicit knowledge market allows to introduce the parameter “life span of the company”. If the company value increases, this parameter is an obligatory indicator of its business model, reflecting the constructive activity of the highly qualified personnel creating and implementing the explicit and implicit knowledge in the market, within the knowledge management system in the organization. That promotes the company value growth in the knowledge market long-term.

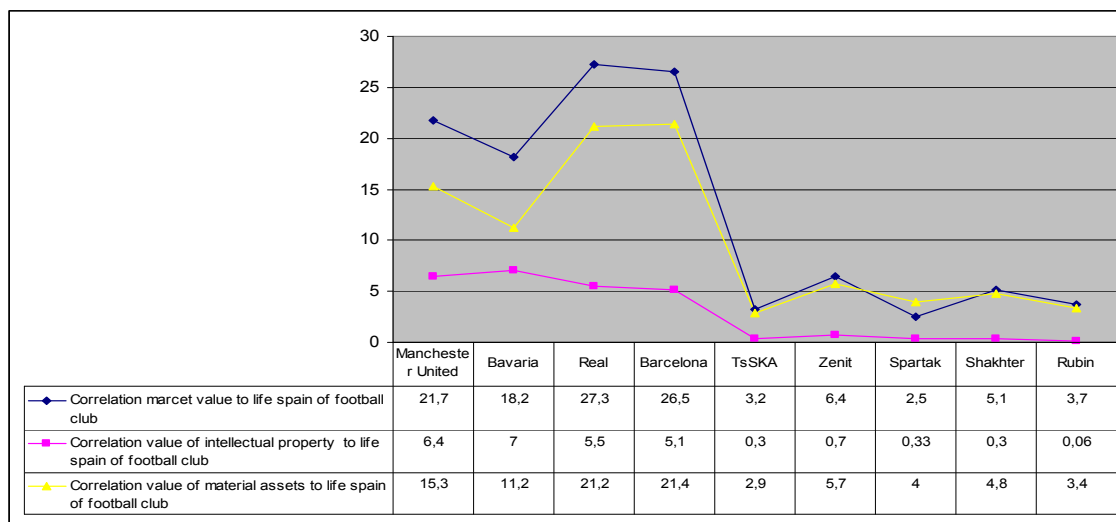


Figure 4. High-tech businesses indexes of foreign and Russian football clubs (2012)

3. Conclusions

The following scientific-theoretical and scientific-practical conclusions are made:

1. The work differentiates the notion “a high-tech business”, distinguishing three groups of enterprises.
2. Classification of high-tech businesses is proposed, taking into account the three types of economic activity, which allows to include high-tech businesses with high market value.
3. The proposed business model of the interaction between enterprises functioning in the high-, middle- and low-tech markets implies the possibility to manage the life span of the company basing on its value, expenses on technological innovations and business indicators.
4. The following issues are considered to be disputable (or requiring further research): (a) minimal market value of enterprises of the second and third groups by the authors' classification of high-tech businesses, which would allow the low- or middle-tech business to be included into the group of high-tech businesses; (b) the “high-tech index” is disputable due to its novelty, thus, it requires further research.

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Notes

- Note 1. Thomson Reuters is a supplier of analytical information, informational decisions and databases for businesses and professionals, with headquarters in New-York
- Note 2. Export and import of technology/knowledge is carried out by the following seven types of explicit knowledge: patents for inventions, patent-free inventions, patent licenses, useful models, know-how, trademarks, industrial samples; Export and import of technology/knowledge is carried out by the following three types of implicit knowledge: engineering services, scientific research, other (Figure 1A).
- Note 3. The following seven indicators of technology/knowledge export by the seven types of explicit knowledge: patents for inventions, patent-free inventions, patent licenses, useful models, know-how, trademarks, industrial samples (Figure 1B).
- Note 4. The following three indicators of technology/knowledge export by the three types of implicit knowledge: engineering services, scientific research, other (Figure 1C).
- Note 5. It should be noted, that the volumes of knowledge markets as a whole by types of knowledge and types of foreign economic activity, are a theoretical calculation obtained in this research.
- Note 6. DWPI - Derwent World Patents Index® is a database of improved patent documents formed by Thomson Reuters' experts in the following spheres: technical content, planning, business development, innovation protection within the organization. DWPI database contains more than 21.85 mln of related patents and more than 45.2 mln patent documents, comprising 47 patent agencies worldwide.
- Note 7. Examples of 1 group companies are: hardware manufacturers, software developers; access & content providers; e-commerce), etc.
- Note 8. Depending on the sphere of research and patents in proper types of economic activity. Besides, it should be noted that this group can be divided into two subgroups.
- Note 9. The examples of 3rd group of enterprises are well-known foreign fast-food companies, tobacco companies. About business models of Mac-Donalds and others.
- Note 10. When forming the high-tech businesses classification, we use the Russian classifier of types of economic activity.
- Note 11. The middle-tech sectors of low level are: coke and oil production, resin and plastic goods production, other non-metal mineral products production, metallurgic production and production of metal goods.
- Note 12. The global scale of enterprises' innovative character by Thomson Reuters (USA) is assessed by the presence of four-parties patents in the company portfolio, which include patenting in the following international agencies: the Chinese Patent Office, the European Patent Office, the Japanese Patent Office, the United States Patent & Trademark Office.
- Note 13. On implementation of cooperation in the sphere of research and development in Europe within the frameworks of technology and research policy in 1970-2000.

Note 14. An example of reducing a life span of a high-tech business is Ford's company, which was for a long time producing a standard T-model, which resulted – with high management system and low expenses on innovations – in the loss of competitiveness.

Note 15. Examples of enterprises in 2000-2014 are a number of Tatarstan enterprises: “Tasma” Public Corporation (production of photo-, video- and roentgen film); “Zarya” Public Corporation (confectionary); “Khiton” Public Corporation (production of aerosols and dyes); “Ildan” Public Corporation (clothes).

Note 16. Issues of cost management are researched by.

Note 17. It should be noted that forming the company brand usually takes place later than the creation of a company. However, the authors consider the date of company creation to be more important.

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