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Management of Explicit and Implicit Knowledge in Industrial Regions of the Russian Federation for the Period 2000 - 2010

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Abstract The article defines the market volumes of knowledge in industrial regions of the Russian Federation for the period of 2000-2010; formulates the periodization of the knowledge market development in Russian with the indication of the volume ranges of knowledge market values; defines tendencies of development of the explicit and implicit knowledge market in industrialized federal subjects of the Russian Federation. Empirical research of knowledge market in Russian industrial regions is carried out; recommendations on the development of explicit and implicit knowledge markets are given. The analysis is based on data provided by the Russian official statistics office, ROSSTAT, methodological documents of ROSSTAT, statistical data of National research University "Higher school of Economics". The market analysis of the knowledge carried out on three levels: the macro-level, the level of the Russian industrial regions as meso-level, regional industrial enterprises as micro-level of the research. The indicator "expenses on technological innovations" is used in the study as the main indicator of the functioning of the knowledge management system in the organization.

Keywords: *explicit and implicit knowledge, knowledge management, technological innovations, knowledge market*

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1. Introduction

Explicit and implicit knowledge as constituents of the knowledge market of the economy, which is based on the development of intangible capital, are attractive for studies from perspectives of various disciplines and directions [4,5,7]. The dominance of the countries leading in the technological structure of the markets – both explicit knowledge market in the form of patents, trademarks (USA, Germany, Japan), and implicit knowledge market in the form of a modern intellectual management models in organizations, providing them with greater prosperity and longevity regardless of the type of economic activity, technology level, regional location, position on the curve of its life cycle, transnational character, popularity of trade marks (Japan) – convincingly proves the necessity to study the topic of explicit and implicit knowledge from the point of view of Economics and Management disciplines with the aim of identifying the potential markets of explicit and implicit knowledge and the dynamics of their development [11,12,14,24].

2. Overview of the Theory

The following works are basic for our research: edited by B.Z. Milner [20], B.Z. Milner, Rumyantseva Z.P., Smirnova V.G., Blinnikova A.V. [22], Makarov V.L., Kleiner G.B. [17,18], Mindeli L.E., Pipia L.K. [19], Dresvyannikov V.A. [9], Adizes I.K. [1], as well as works of other scientists [2,6,23,38].

The most important works in foreign economic literature in the area of market knowledge, the authors used in this work are the following: Lesser E.L. [15], Mandeville T. [16], Romer P.M. [31], Teece D.J. [36,37].

In the field of knowledge management at the regional level, industrialized enterprises, the authors relied on the following works: Davenport Th. [7], Patton S. [25], Weick K.E. [39], Westley F.R. [42], Welch D. [40,41], Wooldridge B., Floyd S.W. [43].

The empirical basis of the research relies on data of the Russian statistics office ROSSTAT [27,28,32,33,34], methodological documents (Decrees) of ROSSTAT [30], statistical data of National research University "Higher school of Economics" [13].

3. Methodology

Knowledge is treated as a set of explicit and implicit knowledge. «Knowledge management» in the organization refers to processes aimed at: systematization, upgrading (modernization) and implementation of knowledge in the market in the form of tangible and intangible product, narrowing the gap to upgrading (modernization) of the organization's material assets, which involves activation of processes of explicit and implicit knowledge management [2,6,9]. Components of explicit and implicit knowledge, as knowledge in general, are investigated in the work basing on the technological balance of payments. The main classifying characteristic of implicit knowledge components is its definition as «non-codified services» [12]. A more detailed information on the components of "explicit" and "implicit knowledge" is presented in the author's earlier works [12].

The indicator "expenses on technological innovations" is used in the study as the main indicator of the functioning of the knowledge management system in the regional organization on the following considerations: (a) expenses on technological innovations of industrial regional enterprises reflect the costs of product and process innovations, which are an integral part of technological innovations [34]; (b) expenses on technological innovations include nine kinds of innovation activity of industrial regional organizations, five of which, according to the authors, are connected with the knowledge management system, namely: research and development of new products, services and methods for their production (transfer), new production processes; production projecting, design and other works; acquisition of new technologies (including patents, licenses for the use of inventions, industrial designs, utility models); education and training of personnel-related innovations; marketing research (Note 1); (c) expenses on technological innovations carried out by industrial enterprises of all types of economic activity: mining and quarrying, manufacturing industries, production and distribution of electricity, gas and water, which in general testifies to the fact that the present research forms the full and reliable (at the time of the study) view about knowledge management in industrial enterprises of the Russian Federation [[27], pp. 363-367].

It should be noted that some types of expenses on technological innovations of industrial regional enterprises, namely: expenses on the acquisition of machinery and equipment associated with technological innovations, other kinds of preparation for new products manufacturing, introduction of new services or methods of their production (transfer), other expenses on technological innovations (in the classification of the Rosstat), acquisition of software are – not classified by the authors in the process of knowledge management for the following reasons: these types of expenses on technological innovations can be defined as explicit and implicit knowledge due to their not-exact wording (acquisition of software must be accompanied, in our opinion, by acquisition of licenses). We should note that the specified collection lists nine types of expenses on TI in industrial enterprises by types of economic activities: [[27], p. 364].

The paper presents a study of the knowledge market in the Russian Federation (RF), based on the author's method of statistical analysis of the following data for the period 2000-2010:

1. The macro-level of research: methods and analysis of the technological balance of payments of industrial regional enterprises of the RF for the period 2000-2010.

2. The meso-level of research: methods and analysis of export and import of technologies and services of technical nature on the level of industrialized federal districts and the receipt of patent applications and issuance of protection titles in the developed meso-system of the Russian Federation for the period 2000-2010. Other meso-systems at the level of Federal districts (namely: industrially-backward regions, occupying an intermediate position, are not considered in the present work) [12].

3. Micro-level of research: methods and analysis of the explicit and implicit knowledge management on the basis of the analysis of expenses on technological innovations of industrial regional enterprises of the RF for the period 2000-2010, i.e. based on analysis of the management expenses on technological innovations in industrial regional enterprises of the Russian Federation by kinds of economic activities.

4. Results

4.1. Development of Knowledge Markets: Market Knowledge in General, Explicit Knowledge Market, Implicit Knowledge Market in the Russian Federation from 2000 till 2010

4.1.1. Volume of Knowledge Markets

Analysis of the volume of knowledge markets in the Russian Federation for the period 2000-2010 is performed by types of knowledge (explicit and implicit) and types of foreign-economic activity, implemented by the Russian industrial regional enterprises (exports and imports of technology/knowledge).

The volume of the market by type of knowledge (in the form of foreign-economic activity) is defined as follows (Figure 1):

(a) volume of knowledge market in Russia in general is defined as the sum of export of explicit and implicit knowledge and import of explicit and implicit knowledge markets;

(b) volume of knowledge export market is defined as receipts on export of explicit and implicit knowledge (Note 2);

(c) volume of knowledge import market is defined as payments for imports of explicit and implicit knowledge

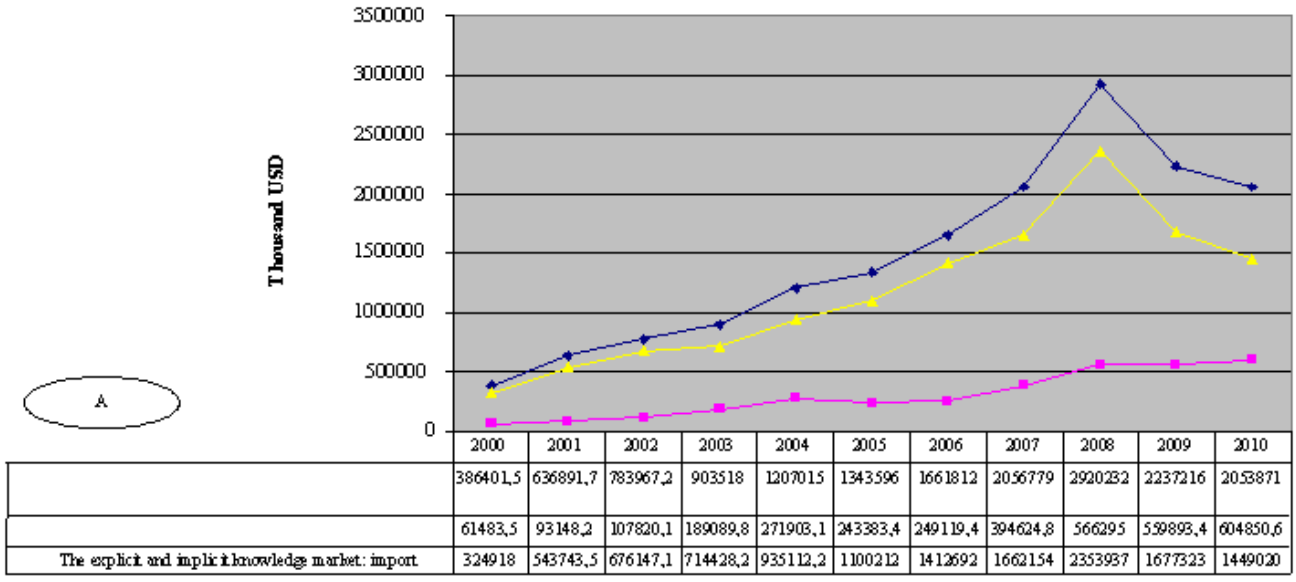
The volume of knowledge markets by types of foreign-economic activity of enterprises and organizations of the Russian Federation for the period 2000-2010 is defined for the knowledge export and import. The volume of knowledge markets in general is defined as follows (Figure 1A):

(a) volume of the knowledge market of the Russian Federation in general is defined as the sum of revenues from the export and import of explicit and implicit knowledge;

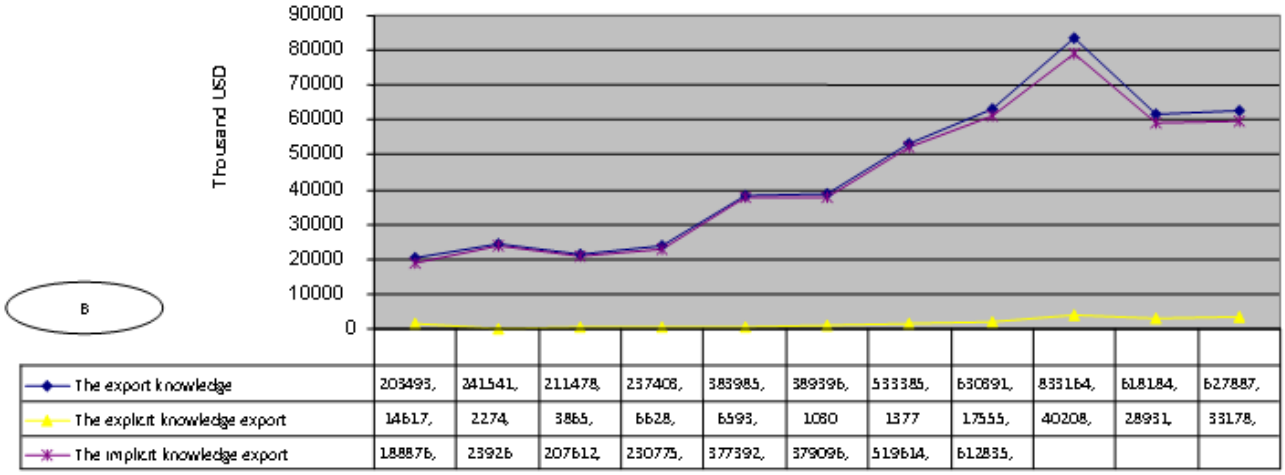
(b) volume of Russian explicit knowledge market in general is defined as receipts from exports of explicit

knowledge and import of explicit knowledge (i.e. export and import of technology/knowledge is carried out by the following seven types of explicit knowledge: patents for inventions, off-patent inventions, patent licenses, utility models, know-how, trademarks, industrial designs; and three indicators of implicit knowledge: engineering services, research and development, other);

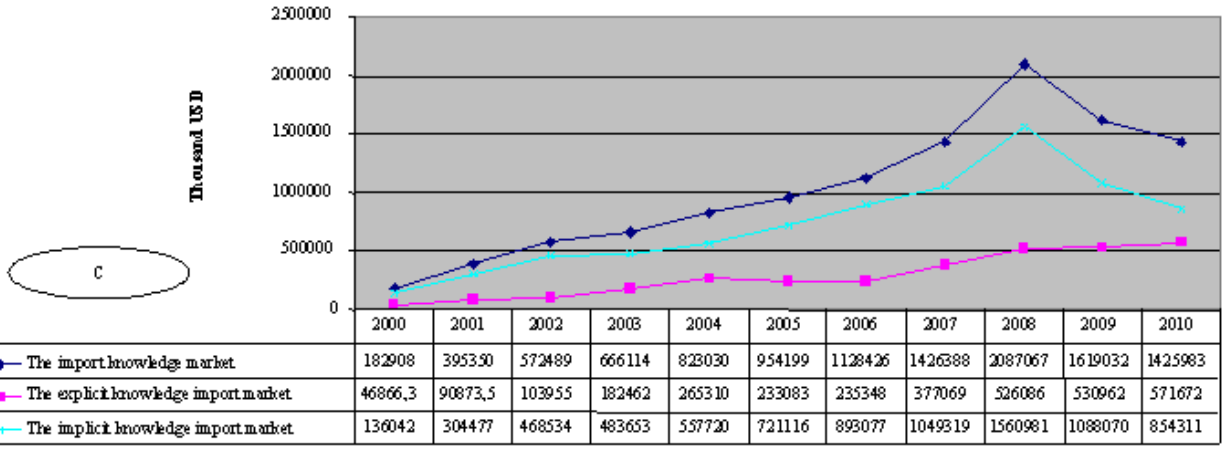
(c) volume of Russian implicit knowledge market is defined as the sum of revenues from the export of implicit knowledge and import of implicit knowledge. It should be noted that the indicators of volume of the knowledge market in general by types of knowledge and types of economic activity, presented in this paper (i.e. paragraphs (a) represent a theoretical calculation of volume of the knowledge market received as the result of this study.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	386401,5	636891,7	783967,2	903518	1207015	1343596	1661812	2056779	2920232	2237216	2053871
	61483,5	93148,2	107820,1	189089,8	271903,1	243383,4	249119,4	394624,8	566295	559893,4	604850,6
The explicit and implicit knowledge market: import	324918	543743,5	676147,1	714428,2	935112,2	1100212	1412692	1662154	2353937	1677323	1449020



The export knowledge	203493,	241541,	211478,	237408,	383985,	389396,	533385,	630891,	833164,	618184,	627887,
The explicit knowledge export	14617,	2274,	3865,	6628,	6593,	1080	1377	17555,	40208,	28931,	33178,
The implicit knowledge export	188876,	23926	207612,	230775,	377392,	379096,	519614,	612835,			



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
The import knowledge market	182908	395350	572489	666114	823030	954199	1128426	1426388	2087067	1619032	1425983
The explicit knowledge import market	46866,3	90873,5	103955	182462	265310	233083	235348	377069	526086	530962	571672
The implicit knowledge import market	136042	304477	468534	483653	557720	721116	893077	1049319	1560981	1088070	854311

Source: [based on 6]

Figure 1. Volume of knowledge markets by types of knowledge in Russian Federation, 2000-2010: knowledge market in general (A); Volume of knowledge export markets (B); Volume of knowledge import markets, in thousand USD (C)

The volume of knowledge export markets as a form of foreign-economic activity of enterprises and organizations of the Russian Federation for the period 2000-2010 is defined as follows (Figure 1B):

(a) volume of the knowledge export market in Russia in general is defined as the sum of the explicit and implicit knowledge export market;

(b) volume of the explicit knowledge export market is defined as receipts from exports of technology/knowledge on seven indicators in the field of export of explicit knowledge;

(c) volume of implicit knowledge export market is defined as payments for export of implicit knowledge, i.e. on three indicators in the field of implicit knowledge export.

The volume of knowledge import markets as a form of foreign-economic activity of enterprises and organizations of the Russian Federation for the period 2000-2010 is defined as follows (Figure 1C):

(a) volume of the knowledge import market in Russia in general is defined as the sum of the explicit knowledge import market and implicit knowledge import market;

(b) volume of the explicit knowledge import market is defined as receipts on imports of technology/knowledge by seven indicators in the field of explicit knowledge import;

(c) volume of implicit knowledge import market is defined as payments for imports of implicit knowledge, i.e. three indicators in the field of import of implicit knowledge.

Basing on the analysis of data in Figure 1A-C, it can be stated that the development of knowledge markets in the Russian Federation for the period 2000-2010 went through three stages:

- the first (initial) stage: 2000-2003. The minimum value on the explicit and implicit knowledge markets in general; a significant gap between the value of volumes of explicit and implicit knowledge export market and of explicit and implicit knowledge import market;

- the second (phase of moderate growth): 2004-2006. The growth of knowledge market, first of all, on the basis of explicit implicit knowledge export;

- the third stage (phase of maximum values): 2007-2010. The maximum volume of the knowledge market in 2008 on the basis of the maximum values of implicit knowledge exports, and explicit knowledge import

Therefore, basing on the analysis of the knowledge markets development in the Russian Federation for the period 2000-2010, we can conclude that:

- in the development of knowledge markets in the Russian Federation for the period 2000-2010 by types of knowledge, the development of implicit knowledge market dominates;

- in the development of the knowledge market in the Russian Federation for the period 2000-2010 by types of foreign economic activity, import knowledge market development dominates;

- the volume of knowledge market in the Russian Federation for the period 2000-2010 increased numerically 7.5 times with maximum values of 2920231.8 thousand USD in 2008 (theoretical value of the sum of exports and imports of explicit and implicit knowledge) and the minimum value of 386401.5 thousand USD in 2000 (Figure 1). Consequently, in view of the maximum value (potential) of knowledge market in the Russian Federation it can be stated that in 2000 in the Russian knowledge market there were sold approximately 13% of the potential of the Russian knowledge market; in 2010 - approximately 70% of the knowledge market in general (export and import) (Figure 1). In the export knowledge market in general in 2000 there were sold 7% of the potential market knowledge; in the explicit knowledge export market - 0.5%, in the implicit knowledge export market - 6.5%; in 2010 the share of knowledge sold in the knowledge export market in general and explicit/implicit knowledge export market amounted to, respectively: 21.5/1.14/20.4 percent (Figure 1B). In the knowledge import market in 2000 in the knowledge/explicit/implicit market the following percentage was sold, respectively: 6.3/1.6/1.3 knowledge of knowledge market potential in general. In 2010, these values were respectively equal to: 48.8/19.6/29.3. Therefore, in export markets of explicit and implicit knowledge, import markets of explicit and implicit knowledge for the period 2000-2010 about minimum 70% of the potential of the corresponding knowledge market in the format of foreign economic activity were not used.

- the maximum values in the knowledge market development in the Russian Federation for the analyzed period were achieved in 2008 on the basis of the maximum values of exports and imports of explicit and implicit knowledge.

4.2. Dynamics of Knowledge Market Development at the Macro-, Meso- and Micro-levels

4.2.1. Macro-level of Research

Macro-level research of the knowledge market in the Russian Federation was carried out basing on the analysis of the technological balance of payments by contracts categories in 2000, 2005 and 2010 in the Russian industry (Table 1). Here you can highlight the following features of explicit and implicit knowledge market for the analyzed period.

I. Peculiarities of the implicit knowledge market in the Russian Federation for the period 2000-2010:

1. The dominant role in the knowledge market of the Russian Federation for the period 2000-2010 belongs to the implicit knowledge market. This situation is characteristic for both export and import operations: min. 95% of export and 60% of import transactions are carried out in the implicit knowledge market, i.e. the market of science-consuming, non-codified, unprotected (by patent or know-how), “non-bound” services (Table 1). Note that trademarks and industrial designs may become objects of trade, licensing and franchising. A trademark is an originally designed graphic image, a combination of numbers, letters, or words, etc., intended to distinguish the goods and services of one producer from similar goods and services of other producers [6].

For the period 2000-2010 the implicit knowledge market in the field of export-import operations, grew respectively: 3.1/6.3 times; the explicit knowledge market in the field of export-import operations, grew respectively 2.3/12.2 times (based on receipts/payments in the Russian economy, in thousand USD). The only component of

explicit knowledge, which ensured the growth of this market in Russia, was the import of trademarks, which, in the opinion of the authors, is the minimally science-consuming service (related to trademarks importing) (Table 1). One should not make any conclusions (assumptions) about the explicit knowledge market without additional data about where these trademarks are used (in which economic activities, enterprises of any form of ownership in dynamics in the last 5-10 years, etc.).

Table 1. Technological balance of payments by contract categories, in the Russian Federation in 2000, 2005, 2010 (in %)

Contract category	Export revenues, %			Payments for imports, %		
	2000	2005	2010	2000	2005	2010
1. Patents for inventions	0	0	0	0	1	0
2. Off-patent inventions	0	0	0	0	0	0
3. Patent licenses	0	0	0	1	2	3
4. Utility models	0	0	0	0	0	0
5. Know-how	1	0	2	6	1	4
6. Trademarks	6	1	0	17	20	30
7. Industrial designs	0	0	0	1	0	0
8. Engineering services	68	40	60	61	61	38
9. Scientific research and development	12	21	22	1	2	3
10. Other	13	38	14	13	13	19
TOTAL	100	100	100	100	100	100
including:						
EXPLICIT KNOWLEDGE	7	3	5	26	24	40
IMPLICIT KNOWLEDGE	93	97	95	74	76	60

Note: Points 1 - 7: components of the explicit knowledge; Points 8-10 - components of implicit knowledge
Source: based on: [[13] P. 252-253].

2. A significant share in the field of implicit knowledge is occupied by «engineering services» (minimum 40% in export earnings in 2005, 61% of the revenue for the import in 2010), as well as «other categories» (i.e. marketing, advertising, financial, insurance, transport and other services, which have no no-technical content, but are associated with the implementation of specific agreements on technology transfer. More detailed information is provided in: [12].) (Note 3). Thus, we can highlight that the dominant role in the development of engineering services – as the basis of implicit knowledge, i.e. non-bound science-consuming services – is played by technological innovations in the field of export and import operations of industrial enterprises of the Russian Federation in the period 2000-2010.

Because of the predominance of “other contract categories” over the category of «research and development» it is necessary, in the opinion of the authors, to further itemize this category. In the case of engineering services imports, the Russian enterprises carry out modernization of obsolete equipment to the less wasted and intangible capital. In the case of export, engineering services are provided to foreign partners without the appropriate support in the field of selling machines and equipment produced in Russia [12].

3. Significant export revenues from research and development (23% by the end of 2010) shows the development of innovative outsourcing from foreign companies, which certainly is beneficial for the development of international research networks in the Russian industry and proves the importance of intellectual (Russian) capital in the payments balance of the Russian industry (Note 4). However, the results of research and development funded by foreign companies will belong to the above foreign companies operating by the principles of open innovations. At the same time, the indicator “payments for imports of scientific research and developments” in technology balance constitutes only 6% by the end of 2010, which is another sign of the «closeness» of Russian industry concerning international research activities and lack of using the principles of open innovations, that leads, in its essence, to strengthening the position of technologically underdeveloped country [12].

II. The features of explicit knowledge market in the Russian Federation for the period 2000-2010:

4. Operations in the field of export regarding explicit knowledge market are inferior to similar transactions in the field of explicit knowledge import. For the period 2000-2010 the growth is marked in the increase of payments for explicit knowledge import (in 2010 acquisition of explicit knowledge constituted 40% of the total volume of payments for imports). Export earnings in 2010 were, in particular, only 5% of the total volume of payments in the field of foreign economic activity of Russian companies (Table 1).

5. The most vulnerable place in export-import operations in the field of knowledge management for the period 2000-2010 belongs to the export earnings in the field of explicit knowledge, i.e. to intellectual property objects (minimum of 3% in the general structure of export earnings in 2005) [12,13]. Presumably, for explicit knowledge market development it is necessary to increase export of goods to foreign countries, primarily machinery and equipment, strengthening of scientific research and development, implemented by the Russian researchers independently and in cooperation with foreign partners.

4.2.2. Industrial Regions as the Meso-level of Research

Basing on the analysis of data on receipt of patent applications and protection documents issuing in industrialized federal districts of the Russian Federation for the period 2000-2010, the following trend in the explicit knowledge market is obvious: (a) the leading position in the field of explicit knowledge management for the period 2000-2010 is occupied by the Central Federal District (CFD), which has about 40% of the total shares of patents for inventions and utility models; (b) the Ural Federal District (UFD) lags behind the CFD, showing, in

particular, eight-fold lagging-behind in obtaining patents on inventions and five-fold - in obtaining useful inventions (2010), which corresponds to 45% and 34% lagging-behind (in percent to the total, 2010, Table 2); (c) the Privolshsky Federal District (PFD) occupies stable middle position in the analyzed period (Table 2). It should be noted that the total expenses on technological Innovations in Russian industrial enterprises include min. 20% of expenses in the industrialized Federal districts (the Central Federal District (CFD), the Privolshsky Federal District (PFD), the Ural Federal District (UFD)) [28,32].

Analysis of export and import of technologies and services of a technical nature, considered as components of implicit knowledge, gives us an idea of the following trend for the period 2000-2010: the situation in the implicit knowledge market is similar to the situation in the explicit knowledge market. The Central Federal District occupies the leading position in the field of export and import of technologies and services of a technical nature. According to the ratio of the number of agreements on export/number to the number of agreements on imports in total (in % to the total) in 2000, 2005 and 2010, the most significant indicators can be observed in the position of the export of technologies and services simultaneously: the Central Federal District (CFD): 43/34, 26/17, 51/51; the Privolshsky Federal District (PFD): 8/9, 10/9, 14/15 (Table 2). In the case of low export operations in the number of the export of technologies and services, we have revealed a low number of transactions in the field of import in the Ural Federal District (UFD): 5/15, 5/9, 4/6. Monetary indicators of the agreements do not demonstrate such tendency (CFD 81/26, 71/13, 42/42; PFD: 7/6, 8/7, 21/22; UFD: 0/26, 4/22, 8/8, respectively, in 2000, 2005 and 2010) (Table 2 and Table 3).

Table 2. Receipt of patent applications and protection documents issuing in Russia in the industrially developed mesosystems at the level of federal districts of the Russian Federation for the period 2000-2010 (in % to the total)

Level of research: Russian Federation, industry Federal district	2000				2005				2010			
	patent applications filed		patents issued		patent applications filed		patents issued		patent applications filed		patents issued	
	Inventions	utility models	Inventions	utility models	Inventions	utility models	Inventions	utility models	Inventions	utility models	Inventions	utility models
Russian Federation	100	100	100	100	100	100	100	100	100	100	100	100
Central Federal District	42	43	46	46	44	39	46	39	51	42	51	42
PrivolshskyFederal District	19	21	18	20	19	24	17	24	14	21	15	22
Ural Federal District	7	9	6	9	6	10	6	10	4	8	6	8
Other	32	27	30	25	31	27	31	27	31	29	28	28

Source: based on: [32,33].

Table 3. Analysis of the explicit and implicit knowledge management in industrialized Federal districts of the Russian Federation for the period 2000-2010

Level of research: Russian Federation, industry, Federal district	2000		2005		2010	
	Explicit knowledge	Implicit knowledge	Explicit knowledge	Implicit knowledge	Explicit knowledge	Implicit knowledge
	Granted patents for inventions and utility models (units)	Number of export-import agreements for technologies and services of a technical nature (units)	Granted patents for inventions and utility models (units)	Number of export-import agreements for technologies and services of a technical nature (units)	Granted patents for inventions and utility models (units)	Number of export-import agreements for technologies and services of a technical nature (units)
RF	18453	1660	26405	3108	31814	50349
CFD	8423	659	11654	671	15296	25612
PFD	3418	141	5067	292	5574	7472
UFD	1257	141	1714	215	1995	2347

Note: CFD - the Central Federal district; RF - the Russian Federation; PFD – the Privolshsky Federal district; UFD - Ural Federal District
Source: based on: [23 C. 819-820; 22 S. 807-810; 21, S. 989].

Table 3 shows the analysis of the explicit and implicit knowledge management in industrialized Federal districts for the period 2000-2010. For the explicit knowledge analysis, the positions of granted patents for inventions and utility models were united; for implicit knowledge analysis, the numbers of export and import agreements for technologies and services of a technical nature were united (Table 3).

Basing on the analysis of the data in Table 3 and Figure 1, the following trends of explicit and implicit knowledge market at the level of industrialized Federal districts of Russia become apparent: over the period 2000-2010 the knowledge market at the level of industrialized federal districts underwent quantitative changes towards the substantial increase in the number of transactions in the implicit knowledge market; while in 2000 in the CFD, PFD, and UFD the explicit knowledge market dominated, in 2010 there was a considerable growth of the implicit knowledge market (the maximum value of agreements on services export-import was reached in 2010 in the CFD, the increase amounts to more than 38 times in comparison with 2000); the leading position in the analyzed region over the period 2000-2010 is occupied by CFD, significantly outperforming the next one, PFD both in explicit and implicit knowledge management.

4.2.3. Regional Industrial Enterprises as Micro-level Studies

Basing on costs of TI industrial regional enterprises of the Russian Federation for the period 2000-2010, the following can be stated: notably, a significant reduction of costs in the field of explicit knowledge management which in 2010 reached the minimum value of 1.3% of the total expenses on TI; costs in the field of implicit knowledge management are stable and constitute min. 27% of the total expenses on industrial enterprises TI; a

significant proportion of the costs of implicit knowledge is occupied by «research and development of new products, services and methods for their production (transfer), new production processes», that is min. 14% of total costs. Here arises the question about the inconsistency of statistical data in the field of trademarks expenses, comprising 30% of payments for imports in 2010 in the technological balance of payments in the Russian Federation, i.e. the data on the macro-level with statistical data at the micro-level, when an increase of expenses for "explicit knowledge" for the period 2000-2010 is not observed [12].

5. Conclusion

On completion of the study, the following conclusions can be made:

1. The knowledge market in the Russian Federation for the period 2000-2010 is formed mainly by development of implicit knowledge market. Explicit knowledge market development in Russia is substantially lower than implicit knowledge market development for the analyzed period. Unrealized knowledge market in Russia is about 70% of the potential export, import, explicit, implicit knowledge market.

2. Findings: significant correlation between engineering services as constituents of implicit knowledge and technological innovation; dominance of technological innovation in the development of implicit knowledge market as a component of “non-bound services” economic activity; tendency of domination of implicit knowledge market development in the Russian Federation for the period 2000-2010.

3. Development of «explicit knowledge» market in the field of export operations lies in the area of development of scientific researches, which are accompanied by development of patents, off-patent inventions, patent licenses on the basis of cooperation with foreign partners with the consolidation of the research activity results in the Russian organizations.

4. To increase the volume of implicit knowledge possessed by an organization at micro-level, it is necessary: to increase expenses on engineering services (as components of the expenses on technological innovations); to implement organizational and managerial tools at the level of knowledge generation in the organization; to use specific tools of knowledge management (methods of personnel qualification improvement and others).

Note

Note 1: The specified collection lists nine types of expenses on TI in industrial enterprises by types of economic activities: (1) research and development of new products, services and methods for their production (transfer), new production processes; (2) production engineering, design and other works...; (3) acquisition of machinery and equipment associated with technological innovation; (4) purchase of new technologies (including ... the right to the patents, licenses for the use of inventions, industrial designs, utility models); (5) procurement of software; (6) other types of production preparation for manufacturing of new products, introducing new services or methods of their production (transfer); (7) education and training of personnel-related innovations; (8) marketing research; (9) other TI expenses [27, P. 364].

Note 2: Here we imply: exports and imports of technology/knowledge on the following seven types of explicit knowledge: patents for inventions, off-patent inventions, patent licenses, utility models, know-how, trademarks, industrial designs; export and import of technology/knowledge in the following three kinds of implicit knowledge: engineering services, research and development, other.

Note 3: It is known that, in the case of imports, engineering services are accompanied by the acquisition of machinery and equipment by Russian industrial enterprises (in the structure of expenses on technological innovation this expenses item is 55-60% of total expenses on technological innovations; in the import structure the acquisition of machinery and equipment was 44.5% in 2010). In the case of exports, the situation is different (in the structure of exports to foreign countries, the export of machines and equipment in 2010 amounted to 5.7% in the commodity structure of the Russian Federation export).

Note 4: By "research and development" we imply development (for export) - research carried out by Russian specialists and foreign-financed (the export of technology); for import - research conducted by foreign experts and financed from Russian sources [12].

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