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As a manuscript

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The Impact of Customer Interactions on Innovation Activities in Knowledge-Intensive Business Services

PhD Dissertation Summary

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1. GENERAL CHARACTERISTICS OF THESIS RESEARCH

Motivation & Research Gap. Nowadays in both developed and emerging economies the lion's share of the value added and employment is contributed by the service industries[1], whose rapid growth has been fueled by the rise of knowledge-intensive business services[2]. For instance, while the share of the service industries in GDP of the USA, EU and Japan grew about 5-10% over 1996-2007, the increase of the knowledge-intensive business services' share was about 30-40% and their contribution to the growth of GDP reached 17-28%[3]. Moreover, the increase of the relevance and contribution of knowledge-intensive business services in terms of both value added[4] and service export[5] is also observed at emerging markets.

The term 'knowledge-intensive business services' or KIBS was introduced in the mid-1990s to describe private firms providing knowledge-intensive services required for business processes of other companies, non-commercial organizations and public entities[6,7]. Traditionally, the researchers[8,9] classify as KIBS those firms whose main activities are devoted to accounting, auditing, management and information technology (IT) consulting, architecture, engineering, advertising as well as legal, IT-related (including computer programming), R&D, and marketing services.

In early studies KIBS were primarily considered as innovation intermediaries, complementing or replacing universities and research centers as sources of innovation knowledge, and acting as facilitators, initiators or carriers of innovation for their clients[10,11]. Later, with the development of

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[1] Di Berardino, C. The two-way integration between manufacturing and services / C. Di Berardino, G. Onesti // The Service Industries Journal. – 2020. – Vol. 40. – N 5–6. – P. 337–357.

[2] Hidalgo, A. Innovation management and co-creation in KIBs: An approach to the ICT services sector / A. Hidalgo, R. Herrera // Technological Forecasting and Social Change. – 2020. – Vol. 161.

[3] European Competitiveness Report 2011 / European Commission. – Luxembourg: Publications Office of the European Union, 2011. – 237 p.

[4] In 2001-2016 CAGR of value added in KIBS among Silk Road countries (also taking into consideration the low base effect) was 16.6% in China, 15.7% in India, 10.1% in Russia, 13.5% in Turkey and 10.3% in Iran compared to 4.7% in the USA and 4.5% in the EU. Source: Chichkanov, N. Drivers for innovation in KIBS: evidence from Russia / N. Chichkanov, I. Miles, V. Belosusova // The Service Industries Journal. – 2021. – Vol. 41. – N 7-8. – P. 489-511.

[5] In 2000-2013 the highest levels of the average annual growth of KIBS export were observed in transitions economies (18.7%), that were significantly ahead of both developing (12.8%) and developed (10.3%) countries. Source: Wyszkowska-Kuna, J. The Growing Importance of Knowledge-Intensive Business Services in International Trade / J. Wyszkowska-Kuna // Studia Ekonomiczne. Zeszyty Naukowe. – 2016. – Vol. 266. – P. 249–260.

[6] Taking into consideration this b2b nature of KIBS in this research terms 'clients' and 'customers' are used as equivalents.

[7] Miles, I. Knowledge-Intensive Business Services: Their Role as Users, Carriers and Sources of Innovation / I. Miles, N. Kastrinos, K. Flanagan, R. Bilderbeek, P. den Hertog, W. Huntink, M. Bouman; European Innovation Monitoring System (EIMS) Reports. – URL: https://www.research.manchester.ac.uk/portal/files/32800224/FULL_TEXT.PDF (assessed at: 19.07.2021).

[8] Muller, E. What we should know about knowledge-intensive business services / E. Muller, D. Doloreux // Technology in Society. – 2009. – Vol. 31. – N 1. – P. 64–72.

[9] Schnabl, E. Statistical Classification of Knowledge-Intensive Business Services (KIBS) with NACE Rev. 2 / E. Schnabl, A. Zenker. – evoREG Research Note 25. – Karlsruhe, Fraunhofer ISI, 2013. – 10 p.

[10] Bilderbeek, R. Technology-Based Knowledge-Intensive Business Services in the Netherlands: Their Significance as a Driving Force behind Knowledge-Driven Innovation / R. Bilderbeek, P. den Hertog // Vierteljahrshefte zur Wirtschaftsforschung. – 1998. – Vol. 67. – N 2. – P. 126–138.

innovation statistics, it was revealed that KIBS companies are also highly innovative themselves and are even more innovative than most other service and manufacturing industries[12,13]. As a result, a new dualistic approach to the analysis of KIBS was developed which highlights that these companies can be simultaneously both intermediaries that promote the growth of innovative activity of their clients and innovators who create innovative products and services and introduce innovative solutions in their own business processes[14]. The main focus of the researchers has also shifted from studying the intermediary aspect of KIBS companies to the exploration of their own knowledge and innovation management practices[15,16].

One of the key features of KIBS is the application of the problem-solving project-based approach for tailoring their product and value propositions to the business problems of a particular client[17,18]. However, the development of such highly customized solutions requires active client involvement in both service co-production and value co-creation processes[19,20]. In turn, as a result of these interactions an intensive knowledge creation and sharing between KIBS and their clients emerges. Thus, the latter receive access to the professional knowledge, experience and best practices accumulated by KIBS, while the former receive an opportunity to leverage their knowledge base by the new information related to markets, products and business processes of the clients[21]. In addition, some new knowledge, i.e. not earlier possessed either by KIBS and their clients, may be jointly developed by them during the interaction[22].

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[11] den Hertog, P. Knowledge-Intensive Business Services as Co-producers of Innovation / P. den Hertog // International Journal of Innovation Management. – 2000. – Vol. 4. – N 4. – P. 491–528.

[12] Gotsch, M. Sectoral Innovation Watch – Knowledge Intensive Services Sector, Final Sector Report / M. Gotsch, C. Hipp, J. Gallego, L. Rubalcaba; Europe INNOVA Sectoral Innovation Watch. – European Commission, 2011. – 64 p.

[13] Hipp, C. Shaping innovation in European knowledge-intensive business services / C. Hipp, J. Gallego, L. Rubalcaba // Service Business. – 2015. – Vol. 9. – N 1. – P. 41–55.

[14] Shearmur, R. KIBS as both innovators and knowledge intermediaries in the innovation process: Intermediation as a contingent role / R. Shearmur, D. Doloreux // Papers in Regional Science. – 2019. – Vol. 98. – N 1. – P. 191–209.

[15] Scarso, E. What do we know about KIBS? Results of a systematic literature review / E. Scarso // Proceedings of IFKAD 2015 / Ed. J. Spender, G. Schiuma, V. Albino. – Bari, 2015. – P. 1159– 1172.

[16] J-Figueiredo, R. Knowledge Intensive Business Services (KIBS): bibliometric analysis and their different behaviors in the scientific literature / R. J-Figueiredo, J. Neto, O. Quelhas, J. Ferreira // RAI Revista de Administração e Inovação. – 2017. – Vol. 14. – N 3. – P. 216–225.

[17] Strambach, S. Knowledge-Intensive Business Services (KIBS) as drivers of multilevel knowledge dynamics / S. Strambach // International Journal of Services Technology and Management. – 2008. – Vol. 10. – N 2/3/4. – P. 152–174.

[18] Aarikka-Stenroos, L. Value co-creation in knowledge intensive business services: A dyadic perspective on the joint problem solving process / L. Aarikka-Stenroos, E. Jaakkola // Industrial Marketing Management. – 2012. – Vol. 41. – N 1. – P. 15–26.

[19] Mustak, M. Customer participation in knowledge intensive business services: Perceived value outcomes from a dyadic perspective / M. Mustak // Industrial Marketing Management. – 2019. – Vol. 78. – P. 76–87.

[20] Cainelli, G. Do knowledge-intensive business services innovate differently? / G. Cainelli, V. De Marchi, R. Grandinetti // Economics of Innovation and New Technology. – 2020. – Vol. 29. – N 1. – P. 48–65.

[21] Heikka, E.L. Constructing customer knowledge in knowledge-intensive customer relationships / E.L. Heikka // Knowledge and Process Management. – 2020. – Vol. 27. – P. 251–261.

[22] Grandinetti, R. The KIBS paradox and structural holes / R. Grandinetti // Knowledge Management Research and Practice. – 2018. – Vol. 16. – N 2. – P. 161–172.

Knowledge directly shared by the client, developed by KIBS about the client, or jointly co-created by them during the co-production of service is a strategic asset for KIBS[23]. This 'client' knowledge enhances the main competitive advantage of KIBS as it helps them efficiently customize their products and services to the business needs and requirements of a particular client[24]. Moreover, some researchers[25,26] highlighted that KIBS are also characterized by the high relevance of ad-hoc innovations that are resulted not from planned R&D activities, but from the development of highly-customized solutions for business problems of the particular client. However, the impact of such daily project-related client interactions on the innovation activity of KIBS is significantly underexplored, while most of the existing studies in this field are focused only on formal cooperative client interactions (collaborations)[27]. To the best of the author's knowledge, this research is one of the first aiming at studying the impact of KIBS-client interactions during the 'routine' operational daily relationships on the innovation activities of KIBS firms.

The current thesis research is also one of the first empirical studies of the innovation activity of KIBS companies operating in Russia. The first specialized surveys of such companies in Russia were organized in 2006-2008[28,29] to study the current state and the prospects of the relevant industries[30]. Later, special attention was paid to the analysis of KIBS' crisis strategies[31], their spatial distribution[32,33] and the process of public procurement of such services[34]. The results of these studies are generally consistent with the findings of foreign researchers and confirm the positive impact of KIBS firms on the innovative activity of their clients and the high innovative potential of these

[23] Landry, R. Knowledge-exchange strategies between KIBS firms and their clients / R. Landry, N. Amara, D. Doloreux // Service Industries Journal. – 2012. – Vol. 32. – N 2. – P. 291–320.
[24] Heikka, E.L. Matching value propositions with varied customer needs: The role of service modularity / E.L. Heikka, T. Frandsen, J. Hsuan // Knowledge and Process Management. – 2018. – Vol. 25. – N 1. – P. 64–73.
[25] Toivonen, M. Emergence of innovations in services / M. Toivonen, T. Tuominen // The Service Industries Journal. – 2009. – Vol. 29. – N 7. – P. 887–902.
[26] Crevani, L. Innovation management in service firms: A research agenda. / L. Crevani, K. Palm, A. Schilling // Service Business. – 2011. – Vol. 5. – N 2. – P. 177–193.
[27] Cainelli, G. Do knowledge-intensive business services innovate differently? / G. Cainelli, V. De Marchi, R. Grandinetti // Economics of Innovation and New Technology. – 2020. – Vol. 29. – N 1. – P. 48–65.
[28] Doroshenko, M.E. Intellektual'nye uslugi segodnya i zavtra [KIBS: today and tomorrow] / M.E. Doroshenko // Foresight-Russia. – 2007. – Vol. 2. – N 2. P. 37–45 (in Russian).
[29] Doroshenko, M.E. Sektor intellektual'nykh uslug: perspektivy razvitiya i scenarnyj analiz [KIBS: future perspectives and scenarios] / M.E. Doroshenko, A.B. Suslov // Foresight-Russia. – 2008. – Vol. 2. – N 6. – P. 18–35 (in Russian).
[30] The detailed results of these studies are presented in Doroshenko. M.E. Intellektual'nye Uslugi v Rossii [KIBS in Russia] / M.E. Doroshenko, I.S. Berezin, D.V. Vinogradov, N.B. Sidorova, A.B. Suslov; – M.: Belovod'e, 2010. – 112 p. (in Russian).
[31] Doroshenko, M.E. Krizisnye strategii v sektore intellektual'nykh uslug [Crisis strategies in KIBS] / M.E. Doroshenko // Foresight-Russia. – 2010. – Vol. 4. – N 1. P. 64–73 (in Russian).
[32] Kotomina, O.V. Razvitie sektora intellektual'nykh uslug v Rossii: prostranstvennyj aspekt [KIBS development in Russia: the spatial dimension] / O.V. Kotomina // Vestnik of Saint Petersburg University. Management. – 2016. – Vol. 4. – P. 54–78 (in Russian).
[33] Ivanov, D. Human Capital and Knowledge-Intensive Industries Location: Evidence from Soviet Legacy in Russia / D. Ivanov // The Journal of Economic History. – 2016. – Vol. 76. – N 3. – P. 736–768.
[34] Vinogradov, D. KIBS for public needs / D. Vinogradov, E. Shadrina, M. Doroshenko // Economia e Politica Industriale. – 2018. – Vol. 45. – P. 443–473.

companies themselves[35]. However, there is a lack of empirical studies focusing on the exploration of the key drivers and barriers of innovation activity in Russian KIBS.

In addition, in recent years the development of Russian KIBS significantly slowed down due to the deteriorating economic and external political environment[36,37] as well as due to the COVID-19 crisis[38]. The facilitation of the innovation activity in KIBS industries is becoming an important challenge for the Russian economy as these firms may be a significant source of national economic growth[39]. Besides, the development of KIBS industries and an increase of their innovation activity will also contribute to the achievement of the goals set by the President's Executive Orders[40] and the Strategy for the Development of Services Exports until 2025[41] in terms of supporting digital transformation, boosting the competitiveness of Russian services at international markets, increasing the contribution of knowledge-based services to the total volume of Russian service exports and raising the share of Russian firms in world business services exports.

The **research object** is the innovation activity of KIBS enterprises.

The **research subject** refers to KIBS-client interactions being considered as one of the major factors of innovation activity in KIBS.

The **research goal** is to investigate whether KIBS-client interactions have an impact on the implementation of business innovations in KIBS.

To achieve this goal the following **research tasks** were established and implemented:

1. To determine the main features of KIBS companies and summarize the approaches for the identification of the industrial boundaries of KIBS;

2. To systematize the key drivers of KIBS' innovation activity;

3. To develop an approach for the empirical investigation of KIBS-client interactions represented by knowledge flows between two parties as a factor that may influence the innovation activity of KIBS;

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[35] Doroshenko, M. Knowledge Intensive Business Services: The Russian Experience / M. Doroshenko, I. Miles, D.Vinogradov // Foresight-Russia. – 2014. – Vol. 8. – N 4. P. 24–39.

[36] Berezin, I.S. Kolichestvennye i kachestvennye izmeneniya na rynke intellektual'nykh uslug v Rossii 2005-2013 [Quantitative and qualitative development of KIBS markets in Russia in 2005-2013] / I.S. Berezin, M.E. Doroshenko // Marketing in Russia 2015 / Ed. I.S. Berezin. – M., 2015. – P. 85–128 (in Russian).

[37] Belousova, V. Knowledge-intensive business services in Russia: 2014-2015 crisis aftermath / V. Belousova, N. Chichkanov // Foresight and STI Governance. – 2016. – Vol. 10. – N 4. – P. 46–58.

[38] Obshhestvo i pandemiya: opyt i uroki bor'by s COVID-19 v Rossii [The society and the pandemic: the experience and the lessons from fighting against COVID-19 in Russia] / Ed. V.A. Mau. – M.: 2020. – 744 p.

[39] Gershman, M. Bridging S&T and innovation in Russia: A historical perspective / M. Gershman, L. Gokhberg, T. Kuznetsova, V. Roud // Technological Forecasting and Social Change. – 2018. – Vol. 133. – P. 132–140.

[40] Executive Order No 204 on the National Goals and Strategic Objectives of the Russian Federation through to 2024 (07 May 2018), Executive Order No 474 on the National Development Goals of the Russian Federation through 2030 (21 July 2020).

[41] Approved by the Russian Government Resolution No1797-r of 14 August 2019.

4. To develop and empirically evaluate the model for the assessment of the relationship between KIBS' capacity to absorb knowledge[42] during client interactions and their innovation activity;

5. To suggest managerial implications for KIBS firms, aiming at boosting their innovation activity by developing client knowledge absorptive capacity;

Methodology & Methods. To fulfill the first research task, a large set of papers devoted to the development of the KIBS concept, and to the determination of the industrial boundaries of KIBS, has been carefully reviewed and systemized. In addition, two main industrial statistical classifications that are the most frequently used in KIBS studies (NACE Rev. 2 and NAICS respectively) have been compared. Finally, it has been suggested that further empirical research should take into consideration the features of the national KIBS markets (in particular, the Russian one in this study) while identifying the industrial boundaries of KIBS.

To fulfill the second research task, a set of papers devoted to the exploration of patterns of innovation behavior and innovation strategies in KIBS was collected from the interdisciplinary scientific citation databases Web of Science and Scopus, using bibliometric tools. The main drivers of innovation activity in KIBS were identified based on the analysis of the selected papers. The significance of the identified factors was empirically tested by the application of the logistic regression technique to a set of the the survey-based data collected by the HSE ISSEK in 2015 using a methodology that ensures the comparability of the results with international surveys of companies' innovation activity.

To fulfill the third research task, an approach that conceptualizes the process of KIBS-client interactions as a flow of knowledge between two parties[43,44] has been employed. The concept of absorptive capacity has been used to study the impact of KIBS-client interactions on the innovative activity of KIBS companies. In addition, a special questionnaire has been proposed to assess the key dimensions of the client knowledge absorptive capacity in KIBS – i.e. their abilities to acquire knowledge during client interactions, to assimilate this knowledge, and to apply it for further usage.

To fulfill the fourth research task, a Research Model has been developed for the assessment of the relationship between the three dimensions of the KIBS' client knowledge absorptive capacity as well as other innovation drivers and innovation activity of KIBS. The process of data collection was supported by HSE ISSEK in 2019 as a part of the long-term project 'Monitoring of Knowledge-

[42] The term 'absorptive capacity' was introduced by Cohen & Levinthal (1990) and refers to 'the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends' (p.128). Source: Cohen, W.M. Absorptive Capacity: A New Perspective on Learning and Innovation / W.M. Cohen, D.A. Levinthal // Administrative Science Quaterly. – 1990. – Vol. 35. – N 1. – P. 128–152.p. 128.

[43] Miles, I. KIBS and knowledge dynamics in client-supplier interaction / I. Miles // Exploring Knowledge-Intensive Business Services / Ed. E. Di Maria, R. Grandinetti, B. Di Bernardo. – London: Palgrave Macmillan, 2012. – P. 13–34.

[44] Zieba, M. Knowledge Exchange Between KIBS Firms and Their Clients: Case Study Analysis / M. Zieba, E. Bolisani, E. Scarso // Proceedings of the 20th European Conference on Knowledge Management / Ed. E. Tome, F. Cesario, R.R. Soares. – Reading: 2019. – P. 1152–1159.

Intensive Business Services in Russia' and the author of the thesis research fully participated in the processes of the development of the survey methodology and tools. The logistic regression technique has been used to test the model in terms of both product and business process innovations.

To fulfill the fifth research task, the obtained results have been summarized and their implications discussed, and a set of practical recommendations aimed at stimulating KIBS' innovative activity by developing their ability to absorb knowledge during operational 'routine' client interactions have been suggested.

The author obtained the following **main findings to be defended**:

1. The KIBS sector can be fruitfully seen as consisting of three sub-segments representing companies specializing in technological, professional and creative activities and drawing on specific types of knowledge and thus possessing specific features;

2. Access to external knowledge is one of the key drivers of the development and implementation of innovation in Russian KIBS;

3. KIBS' capacity to absorb client knowledge can be understood in terms of the three main dimensions: *acquisition* of the client knowledge through the client interactions during the project execution; *assimilation* of the client knowledge with the support of knowledge management and customer relationship management systems; and *application* of the client knowledge in different functional areas;

4. The likelihood of KIBS innovation (i.e. that KIBS will introduce an innovative product or service on the market, or will implement a business process innovation related to the service development, service delivery, administration or marketing) tend to be higher for firms with a higher client knowledge absorptive capacity;

5. An implication of the empirical results is that KIBS firms aiming at boosting their innovation activity should develop more tight relationships with their clients during project executions by extending the process of interaction to the digital channels; should implement deliberate (formal) approaches to the management of client knowledge enhanced by IT-enabled solutions; and should increase the availability of this knowledge across the whole organization.

Thesis research contains the following elements of **scientific novelty**:

1. The approaches for the identification of the industrial boundaries of KIBS were systematized taking into consideration both international experience and the specific features of the Russian KIBS market;

2. For the first time, the relevance of the main innovation drivers was empirically assessed for Russian KIBS implementing different types of innovation;

3. An original questionnaire was developed for the measurement of KIBS' client knowledge absorptive capacity, and a model for the empirical assessment of the relationship between the client knowledge absorptive capacity and innovation activity in KIBS was outlined;

4. The empirical assessment of the Research Model using a unique dataset of KIBS firms operating in Russia allows the first confirmation of the significance of the client knowledge absorptive capacity for innovation activity in KIBS;

5. KIBS' abilities to acquire, assimilate, and apply client knowledge were found to have positive impacts on both the development of product innovations (including digital knowledge-capturing products) and the implementation of various types of business process innovations in KIBS.

The theoretical significance of the thesis research involves its contribution to:

1. Systematization of the approaches to the identification of the industrial boundaries of KIBS and the key innovation drivers of these companies;

2. Application of the 'absorptive capacity' concept, for the analysis of KIBS-client relationships as an important factor of KIBS' innovation activity;

3. Development of a Research Model enabling the assessment of the relationships between three main dimensions of KIBS' client knowledge absorptive capacity (i.e. acquisition, assimilation and application of client knowledge) and their innovation activity.

The practical significance of the thesis research refers to:

1. Empirical assessment of the significance of the main innovation drivers for Russian KIBS;

2. Development of the questionnaire for the measurement of the key dimensions of KIBS firms' client knowledge absorptive capacity;

3. Empirical confirmation of the relationship between client knowledge absorptive capacity in Russian KIBS and their innovation activity in terms of both product and business process innovations.

Approbation of the Thesis Research Results. The results of the thesis research were presented by the author and discussed at **six international conferences and one scientific workshop**[45]:

1. 30th International RESER Congress (21-22 January 2021, University of Alcalá, Alcalá de Henares, Madrid, Spain). Presentation: 'The Role of KIBS-Client Interactions and Related Knowledge for Innovation in KIBS';

2. Trapeznikov Institute of Control Sciences of Russian Academy of Sciences (ISC RAS) Moscow Seminar 'Expert Assessments and Data Analysis' (10 June 2020, ISC RAS, Moscow, Russia). Presentation: 'Client Knowledge as a Factor of KIBS innovation activity' (in Russian);

[45] The 2020-2021 scientific events were held in online format due to the worldwide pandemic of COVID-19.

3. 29th International RESER Conference (12-14 September 2019, University of Granada, Ceuta, Spain)[46]. Presentation: ‘Coproduction as an Innovation Driver in Knowledge-intensive Business Services’;

4. 14th International Forum on Knowledge Asset Dynamic (IFKAD-2019) (05-07 June 2019, University of Basilicata, Matera, Italy). Presentation: ‘Coproduction and Innovation in Knowledge-Intensive Business Services’;

5. Symposium 'Foresight and Science, Technology and Innovation Policy' (an associated event held within the XX April International Academic Conference on Economic and Social Development, 10-12 April 2019, HSE University, Moscow, Russia). Presentation: ‘Drivers for Innovation in KIBS: Evidence from Russia’;

6. III International Scientific and Practical Conference 'Innovative Economics and Management: Methods and Technologies' (16-17 May 2018, Lomonosov Moscow State University, Moscow, Russia). Presentation: ‘Innovation activity of KIBS in Russia’ (in Russian);

7. XIX April International Academic Conference on Economic and Social Development (10-13 April 2018, HSE University, Moscow, Russia). Presentation: ‘Innovation activity of KIBS in Russia’ (in Russian);

The results of the thesis research were also applied in 2017-2020 during the author’s participation in the execution of the five relevant research projects funded by the HSE Program of Fundamental Studies and devoted to the analysis of the activities of the innovation process actors including KIBS as well as during the execution of the fundamental scientific research project funded by the Russian Foundation’s for Basic Research (RFBR’s Grant for PhD Students, 2019-2021). Finally, the results of the thesis research were used for educational purposes during the Research Seminars for the bachelor and master students of the Faculty of Economic Sciences.

The following **limitations** should be taken into account while generalizing and summarizing the results:

1. The concept of ‘innovation’ has been considered in a broad sense at the level of the individual company. This approach is fully consistent with the international practices of analyzing the innovative activity of companies[47] and ensures the comparability of the results with foreign studies, but it does not allow taking into account the level of strategic importance and/or the commercial effectiveness of the corresponding innovative solutions when developing practical recommendations;

[46] Rewarded as the best PhD paper presented at the conference (RESER Founders’ PhD Award 2019).
[47] OECD/Eurostat. Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation. – 4th ed. – Luxembourg: OECD Publishing, Paris/Eurostat, 2018. – 254 p.

2. The study of client knowledge absorptive capacity remains rather exploratory in nature. Even though researchers [48, 49] have already justified the necessity of differentiating different types of absorptive capacity, depending on specific sources of knowledge, the number of empirical studies in this field remains extremely restricted. In this regard, this paper focuses on the development of tools for the assessment of the main dimensions of KIBS' client knowledge absorptive capacity. However, the developed measures represent one of the first attempts for the empirical evaluation of the client knowledge absorptive capacity in KIBS and should be considered with some caution due to their limitations. Moreover, the further development of these measures may also help to extend the research boundaries by assessing the drivers and the barriers of the absorption process as well as by the analysis of other types of KIBS' absorptive capacities (for example, to absorb scientific knowledge during interactions with universities and research centers), and the possible relationships between them, currently remaining outside of the scope of this research;

3. The empirical part of the study is conducted using survey-based data about a sample of companies from a single market. First, such data rely on the subjective assessments of the responding companies and is biased in nature, even despite the several measures (e.g. preliminary piloting of the questionnaire, the use of control questions, etc) being taken to minimize this shortcoming. Second, the dataset employed includes only KIBS located in large cities (with a population of over one million), so the generalization of the results is limited only to such companies. The characteristics and strategies of innovative behaviour of those KIBS located in small cities with a smaller population would require a separate study. Third, the use of cross-sectional data allows one to conclude that there is a relationship between the phenomena under consideration but limits the possibility of establishing causal relationships between them. For a more detailed analysis of the identified dependencies, it is necessary to conduct an additional longitudinal study and employ a sample of panel data on KIBS.

[48] Schmidt, T. Absorptive Capacity - One Size Fits All? A Firm-level Analysis of Absorptive Capacity for Different Kinds of Knowledge / T. Schmidt // Managerial and Decision Economics. – 2010. – Vol. 31. – P. 1–18.

[49] Dell'Anno, D. Absorptive and desorptive capacity of actors within university-industry relations: does technology transfer matter? / D. Dell'Anno, M. del Giudice // Journal of Innovation and Entrepreneurship. – 2015. – Vol. 4. – N 13. – P. 1–20.

2. MAIN FINDINGS TO BE DEFENDED

1. The KIBS sector can be fruitfully seen as consisting of three sub-segments representing companies specializing in technological, professional and creative activities and drawing on specific types of knowledge and thus possessing specific features.

Based on the results of the analysis of the literature devoted to the development of the KIBS concept the following key characteristics of the respective companies were determined:

- intangible nature of production;
- strong orientation on b2b markets and the provision of services for other companies, public entities and non-profit organizations, rather than for end-users;
- dual role of knowledge, which is both a key production factor (in the form of human capital and other elements of intellectual capital) and the main result of business activities;
- highly relational nature of activities in terms of the client involvement in the joint production of services and the high degree of their customization;
- high probability of creating ad-hoc innovations resulted from daily project-related activities rather than from specific research and development activities.

For further empirical analysis, the approaches to the determination of the sectoral boundaries of KIBS were systemized and generalized. It was revealed that the best statistical representation of KIBS sector is presented in the North American Industry Classification System (NAICS), where all the main activities traditionally related to KIBS are concentrated in a specialized section 'Professional, Scientific and Technical Services'. In turn, in the Russian Classification of Economic Activities (OKVED 2) which is also harmonized with the Statistical Classification of Economic Activities in the European Community (NACE Rev. 2), those KIBS specializing in business services in the fields of computer programming and information technology, are allocated in separate classes J62 and J63.

Due to the high level of heterogeneity of KIBS industries, for an additional control of the relevant industry effects, it is proposed to use a three-segment classification[50], based on the differences in the set of types of knowledge and skills they use. The technological sub-segment (T-KIBS) includes companies whose main activities are related to the provision of services in the field of information technology (including software development), architecture, engineering, research and development. Professional KIBS (P-KIBS) are represented by companies providing legal, accounting, audit and management consulting services. In turn, due to the higher creative component of their activities, which involves knowledge about aesthetic and cultural issues, creative KIBS (C-KIBS) like advertising and marketing agencies are distinguished separately from P-KIBS.

[50] Miles, I. KIBS and knowledge dynamics in client-supplier interaction / I. Miles // Exploring Knowledge-Intensive Business Services / Ed. E. Di Maria, R. Grandinetti, B. Di Bernardo. – London : Palgrave Macmillan, 2012. – P. 13–34.

To ensure international comparability, but taking into account the features of the Russian KIBS market, in this study those companies specializing in R&D services (OKVED 72) are excluded from further consideration. In Russia, state funds currently remain the main source of financing for internal expenditures on R&D, and most of the relevant organizations are characterized by state ownership[51].

2. Access to external knowledge is one of the key drivers of the development and implementation of innovation in Russian KIBS.

Based on the results of the extensive literature review four major types of factors that may significantly influence the innovation activity of KIBS were identified. These factors are related to the creation of knowledge inside the companies, access to external knowledge sources, market and financial conditions. To empirically test the significance of these factors for Russian companies, four main hypotheses were developed:

H1.1: KIBS companies with a higher level of expenditures on human capital development are characterized by a higher level of innovation activity;

H1.2: The probability of creating and implementing innovative solutions is higher for KIBS companies with a wide regional network;

H1.3: The relationship between the level of standardization and innovation activity of KIBS companies is characterized by an inverse U-shaped relationship;

H1.4: Higher advertising and marketing expenditures are associated with higher innovation activity in KIBS.

To empirically test the hypotheses H1.1-H1.4, the following Research Model was developed:

$$\log\left(\frac{P_i}{1-P_i}\right) = \alpha_0 + \lambda_1 * Human\ Capital_i + \lambda_2 * Branches_i + \lambda_3 * Standardization_i +$$
$$+ \lambda_4 * Standardization_i^2 + \lambda_5 * Marketing\ Expenses_i + \lambda_6 * Market\ Size_i + \gamma_1 * Strategy_i +$$
$$+ \gamma_2 * T\_KIBS_i + \gamma_3 * C\_KIBS_i + \gamma_4 * Size_i + \gamma_5 * Age_i + + \varepsilon_i \quad (1)$$

where $(\frac{P_i}{1-P_i})$ reflects the probability that the firm i has implemented the particular type of innovation; $Human\ Capital_i$, $Branches_i$, $Standardization_i$, $Standardization_i^2$, $Marketing\ Expenses_i$, and $Market\ Size_i$ reflect factors that can have a significant impact on the innovative activity of the company i; $Strategy_i$, T_KIBS_i, C_KIBS_i, $Size_i$, and Age_i are control variables, λ_1 ... λ_6 и γ_1 ... γ_5 – regression coefficients; α_0 is a constant; ε_i is an error term. Detailed descriptions of all of these variables as well as their descriptive statistics are presented in Table 1.

[51] Science. Technology. Innovation. Pocket Data Book / K. Ditkovskiy, L. Gokhberg, E. Evnevich, et al.; National Research University Higher School of Economics. – Moscow. HSE, 2021. – 92 p.

Table 1 – Definitions and descriptive statistics of variables used for the empirical assessment of the Research Model (1)

Variable	Description	Min.	Max.	Mean	St.dev.
Dependent variables					
Technological Innovation	1, if the company implemented technological innovation (including innovative products and services) in the 1st half of 2015, 0 otherwise	0	1	0.64	0.48
Marketing Innovation	1, if the company implemented marketing innovation in the 1st half of 2015, 0 otherwise	0	1	0.25	0.44
Organisational Innovation	1, if the company implemented organisational innovation in the 1st half of 2015, 0 otherwise	0	1	0.26	0.49
Innovation enablers					
Human Capital	Share of expenditures on recruiting and training in total expenditures of the company in the 1st half of 2015	0	25	5.10	5.71
Branches	1, if the company had branches or representative offices in other cities, 0 otherwise	0	1	0.29	0.45
Standardisation	Seven categories from 1 means that the share of standardised services in the total amount of orders in 2014 was less than 10% to 7 means that the share of standardised services in the total amount of orders in 2014 was higher than 90%	1	7	5.39	1.52
Marketing Expenses	Share of expenditures on advertising in total expenditures of the company in the 1st half of 2015	0	40	7.15	6.03
Market Size	Natural logarithm of the number (in thousands) of companies registered in the city in 2014[52]	3.61	7.04	5.18	1.34
Controls					
Strategy	1, if in the 1st half of 2015 the company continued the strategy had developed in 2012-2014 with minor changes or already introduced a new strategy for 2015, 0 otherwise	0	1	0.45	0.50
T-KIBS	1, if the company operates in information technology or engineering industries, 0 otherwise	0	1	0.20	0.40
C-KIBS	1, if the company operates in advertising, information-communication consulting or web, design and digital services industries, 0 otherwise	0	1	0.31	0.46
Size	Three categories where 1 for small enterprises (from 7 to 50 employees in the 1st half of 2015), 2 for medium-sized enterprises (from 51 to 250 employees in the 1st half of 2015) and 3 for large enterprises (more than 250 employees in the 1st half of 2015)	1	3	1.38	0.58
Age	Natural logarithm of the age of the company in the 1st half of 2015	0	4.17	2.13	0.69

Source: developed by the author.

To empirically assess Research Model (1), a set of retrospective data on KIBS companies collected by HSE ISSEK in 2015 within the framework of the project 'Monitoring of Knowledge-Intensive Business Services in Russia' was used. This dataset was collected via a survey of a stratified[53] sample of KIBS companies[54] located in the administrative centers of 14 regions of Russia

[52] Collected from Rosstat.
[53] Special quotas for the location, industry and size of the firm were established.

(those regions with the largest number of operating enterprises and volume of gross regional product). After excluding those companies that did not provide any information on their innovation activity, the final sample employed for the analysis includes 519 companies. The findings of the empirical assessment of Research Model (1) are presented in Table 2.

Table 2 – The results of evaluating the Research Model (1) in the context of technological, marketing and organizational innovations (marginal effects)

Variables	Technological innovation	Marketing innovation	Organizational innovation
1	2	3	4
Innovation drivers			
Human Capital	0.019*** (0.004)	-0.001 (0.003)	0.004 (0.003)
Branches	0.263*** (0.051)	0.102** (0.042)	0.130*** (0.044)
Standardization	0.141** (0.061)	0.092 (0.063)	-0.010 (0.066)
Standardization^2	-0.020*** (0.006)	-0.012* (0.007)	-0.001 (0.007)
Marketing Expenses	0.010*** (0.004)	0.013*** (0.003)	0.003 (0.003)
Market Size	-0.018 (0.014)	-0.035** (0.015)	0.035** (0.015)
Controls			
Strategy	0.012 (0.038)	0.052 (0.036)	0.021 (0.038)
T_KIBS	0.179*** (0.050)	-0.148*** (0.054)	-0.135*** (0.053)
C_KIBS	0.111*** (0.043)	0.030 (0.041)	-0.093** (0.044)
Size	-0.021 (0.039)	-0.011 (0.034)	0.038 (0.035)
Age	-0.022 (0.029)	0.011 (0.028)	-0.039 (0.030)
Nagelkerke R^2	0.323	0.178	0.093
Share of correct predictions, %	72.8	76.1	75.0
*** p<0.01, ** p<0.05, * p<0.1			

Source: developed by the author.

These findings generally confirm the hypotheses H1.1-H1.4, which indicates the significance of the innovation enablers identified by the foreign studies for the innovative activity of Russian KIBS. Access to external knowledge was found to be the only factor to have a significant impact on all three types of innovations considered. Those KIBS companies with a more extensive regional network (the variable ‘Branches’ in Table 2; this implies higher ability to interact with partners and customers from

[54] The target respondents were the owners and/or top managers of KIBS companies.

other regions) are characterized by a higher level of innovation activity in terms of both technological (column 2) and non-technological - marketing (column 3) and organizational (column 4) - innovations.

3. KIBS' capacity to absorb client knowledge can be understood in terms of the three main dimensions: *acquisition* of the client knowledge through the client interactions during the project execution; *assimilation* of the client knowledge with the support of knowledge management and customer relationship management systems; and *application* of the client knowledge in different functional areas.

A review and systematization of the relevant studies show that when assessing the importance of factors of KIBS' innovation activity, most attention is paid to both their ability to create knowledge within companies and the importance of knowledge obtained from external sources. The focus of the dissertation research is to assess the impact of daily 'routine' interactions with clients (i.e. interactions in the process of carrying out project activities by KIBS aimed at solving the business problems of these clients) on the innovative activity of KIBS firms themselves. The analysis is based on the conceptualization of the KIBS-client interaction process as a helix of knowledge flows[55,56]. To denote the knowledge that can be absorbed by KIBS during such client interactions, the concept of 'client knowledge' is introduced. This client knowledge refers to the knowledge directly shared by the clients (for example, about their business needs that require a solution, industry specifics), knowledge developed by KIBS companies about these clients (for example, about the organization of their business processes, behaviour patterns), and knowledge jointly created during the process of service co-production.

Based on the synthesis of the best-known frameworks of the process of knowledge absorption from external sources[57,58,59,60], three key dimensions of client knowledge absorptive capacity were identified – the acquisition, assimilation, and application of client knowledge:

- The main mechanism for *the acquisition of* client knowledge by KIBS is direct face-to-face interaction during business meetings[61]. However, with the development of digital

[55] Miles, I. KIBS and knowledge dynamics in client-supplier interaction / I. Miles // Exploring Knowledge-Intensive Business Services / Ed. E. Di Maria, R. Grandinetti, B. Di Bernardo. – London : Palgrave Macmillan, 2012. – P. 13–34.
[56] Bolisani, E. Knowledge management in client-supplier relationship: Emergent vs deliberate approach in small KIBS / E. Bolisani, E. Scarso, L. Giuman // Knowledge Management Research and Practice. – 2016. – Vol. 14. – N 2. – P. 178–185.
[57] Cohen, W.M. Absorptive Capacity: A New Perspective on Learning and Innovation / W.M. Cohen, D.A. Levinthal // Administrative Science Quaterly. – 1990. – Vol. 35. – N 1. – P. 128–152.
[58] Zahra, S.A. Absorptive Capacity: a review, reconceptualization, and extension / S.A. Zahra, G. George / The Academy of Management Review. – 2002. – Vol. 27. – N 2. – P. 185–203.
[59] Lane, P.J. The reification of absorptive capacity: a critical review and rejuvenation of the construct / P.J. Lane, B.R. Koka, S. Pathak // Academy of Management Review. – 2006. – Vol. 31. – N 4. – P. 833–863.
[60] Todorova, G. Absorptive Capacity: Valuing A Reconceptualization / G. Todorova, B. Durisin // Academy of Management Review. – 2007. – Vol. 32. – N 3. – P. 774–786.
[61] Growe, A. Developing trust in face-to-face interaction of knowledge-intensive business services (KIBS) / A. Growe // Regional Studies. – 2019. – Vol. 53. – N 5. – P. 720–730.

technologies, face-to-face interaction is now increasingly complemented by interaction through digital channels. On the one hand, such interaction allows the faster exchange of codified knowledge and also contributes to the further externalization of tacit knowledge[62]. On the other hand, the use of digital channels can make it harder to develop trust between the KIBS firm and the client, which indirectly indicates also a higher ability of KIBS to acquire client knowledge during traditional face-to-face interactions;

- *Assimilation* of client knowledge allows KIBS to accumulate and store this knowledge for future use. The key mechanism for assimilation (including transformation) of client knowledge in these companies is the process of codification of tacit knowledge. This process, which is an example of a formalized approach to knowledge management[63], has become widespread in KIBS companies due to the rapid development of digital technologies for the storage and use of knowledge[64];
- The *application* of client knowledge can affect various aspects of KIBS' businesses. Most often, client knowledge is considered in the context of tailoring services to customer requirements, including the development of new services[65]. However, this knowledge can also influence the changes in the processes of promoting services, interacting with clients, and in other organizational practices of companies in the sector.

To assess the impact of these three dimensions of KIBS' client knowledge absorptive capacity on their innovation activity, three main hypotheses were developed:

H2.1: Acquisition of client knowledge during project-related client interactions increases KIBS' innovation propensity;

H2.2: Assimilation of client knowledge by using a digital CRM system increases KIBS' innovation propensity;

H2.3: Application of client knowledge in different functional areas increases KIBS' innovation propensity.

To empirically test the hypotheses H2.1-H2.3, an original questionnaire[66] was developed aimed at assessing the three main dimensions of KIBS' client knowledge absorptive capacity:

- An indicator that characterizes the extent to which KIBS use digital channels of interaction

[62] According to SECI model by Nonaka & Takeuchi (1995), the process of externalization refers the transformation of knowledge from tacit to codified form. Source: Nonaka, I. The knowledge-creating company: How Japanese companies create the dynamics of innovation / I. Nonaka, H. Takeuchi. – New York, Oxford: Oxford University Press, 1995. – 284 p.
[63] Bolisani, E. Knowledge management in client-supplier relationship: Emergent vs deliberate approach in small KIBS / E. Bolisani, E. Scarso, L. Giuman // Knowledge Management Research and Practice. – 2016. – Vol. 14. – N 2. – P. 178–185.
[64] Cabigiosu, A. Innovation in Knowledge Intensive Business Services: The Digital Era / A. Cabigiosu. – Abingdon, Oxon: Routledge; New York, NY: Routledge, 2020. – 160 p.
[65] Cabigiosu, A. Innovation and growth in KIBS: the role of clients' collaboration and service customisation / A. Cabigiosu, D. Campagnolo // Industry and Innovation. – 2019. – Vol. 26. – N 5. – P. 592–618.
[66] To validate the questionnaire, a series of interviews with both industry experts and innovation researchers were conducted.

and communication with clients is used to assess their ability to acquire client knowledge. An index-based variable equals the amount of the particular digital channels used by KIBS. The full list of such channels includes seven digital communication tools[67];

- An indicator that reflects the presence and the use of a digital customer relationship management (CRM) system by KIBS is used to assess their ability to assimilate client knowledge. Such digital CRM systems enhance the opportunities for knowledge codification and by doing so facilitate its further storage and analysis;
- An index-based variable is used as a proxy for KIBS' ability to apply client knowledge. The respondents were asked to choose in which of the five suggested functional areas their firms use client knowledge the most frequently. The list of the potential areas for the usage of client knowledge was developed taking into account the potential benefits of KIBS-client interactions identified in the research literature and include five key areas[68].

4. The likelihood of KIBS innovation (i.e. that KIBS will introduce an innovative product or service on the market, or will implement a business process innovation related to the service development, service delivery, administration or marketing) tend to be higher for firms with a higher client knowledge absorptive capacity.

For the empirical testing of the hypotheses H2.1-H2.3, the following Research Model was developed:

$$\log\left(\frac{P_i}{1-P_i}\right) = \alpha_0 + \beta_1 * CK_{Acquisition_i} + \beta_2 * CK_{Assimilation_i} + \beta_3 * CK_{Application_i} + \lambda_1 * R\&D_i + \\ + \lambda_2 * P - KIBS\ Purchases_i + \lambda_3 * T - KIBS\ Purchases_i + \lambda_4 * C - KIBS\ Purchases_i + \\ + \lambda_5 * Standardization_i + \lambda_6 * Standardization_i^2 + \gamma_1 * Size_i + \gamma_2 * T\_KIBS_i + \\ + \gamma_3 * C\_KIBS_i + \gamma_4 * Location_i + \gamma_5 * Age_i + \varepsilon_i \quad (2)$$

where $(\frac{P_i}{1-P_i})$ reflects the probability that the firm i has implemented the particular type of innovation; $CK_{Acquisition_i}$, $CK_{Assimilation_i}$ and $CK_{Application_i}$ are proxies for the abilities of the company i to acquire, assimilate and apply client knowledge; $R\&D_i$, $P - KIBS\ Purchases_i$, $T - KIBS\ Purchases_i$, $C - KIBS\ Purchases_i$, $Standardization_i$, $Standardization_i^2$ reflect factors that can have a significant impact on the innovative activity of the company i; $Size_i$, T_KIBS_i, C_KIBS_i, $Location_i$ and Age_i, are control variables, $\beta_1 \dots \beta_3, \lambda_1 \dots \lambda_6$ and $\gamma_1 \dots \gamma_5$ – regression coefficients; α_0 is a constant; ε_i is an error term. Detailed descriptions of all of these variables as well as their descriptive statistics are presented in Table 3.

[67] E-mails, video conferences, messaging apps, corporate messaging apps, professional project management software, client own-developed digital platforms, joint usage of file sharing systems and cloud knowledge repositories.

[68] The promotion of the already existing products and services at current markets, modification of this existing products and services, entering new markets, development of new products and services, significant changes in business processes.

Table 3 – Definitions and descriptive statistics of variables used for the empirical assessment of the Research Model (2)

Variable	Description	Min.	Max.	Mean	St.dev.
Dependent variables					
Product Innovation	Equals 1, if KIBS introduced on the market a non-digital innovative product and service, a digital innovative knowledge-capturing product or service, or both in 2016-2018, 0 otherwise.	0	1	0.52	0.50
Digital Product Innovation	Equals 1, if KIBS introduced on the market a digital innovative knowledge-capturing product or service in 2016-2018, 0 otherwise.	0	1	0.36	0.48
Service Development Innovation	Equals 1, if KIBS brought into use innovation in service production & development in 2016-2018, 0 otherwise.	0	1	0.37	0.48
Service Delivery Innovation	Equals 1, if KIBS brought into use an innovation either in service delivery, ordering or both in 2016-2018, 0 otherwise.	0	1	0.49	0.50
Administrative Innovation	Equals 1, if KIBS brought into use at least one type of innovation in administration and management (innovations in strategic, operational, knowledge or HR management, finance, supplier interactions, development of external partnerships) in 2016-2018, 0 otherwise.	0	1	0.64	0.48
Innovation in ICT	Equals 1, if KIBS brought into use innovation in the data storage systems in 2016-2018, 0 otherwise.	0	1	0.32	0.47
Marketing Innovation	Equals 1, if KIBS brought into use at least one type of innovation in marketing and sales (innovative ways of marketing, pricing, post-sale support and innovation in sales channels) in 2016-2018, 0 otherwise.	0	1	0.49	0.50
Client knowledge absorptive capacity dimensions					
$CK_{Acquisition}$	The index calculated as a sum of 7 dummy variables each of which equals 1 if KIBS used the particular digital channel for client communications, 0 otherwise. The following digital channels were considered: e-mail (1), video calls (2), messaging apps (3), corporate messaging apps (4), project management software (5), client own-developed digital platforms (6), joint usage of file sharing systems (7).	1	7	3.46	1.43
$CK_{Assimilation}$	Equals 1, if KIBS used a digital CRM system, 0 otherwise.	0	1	0.40	0.49
$CK_{Application}$	The index calculated as a sum of 5 dummy variables each of which equals 1 if KIBS applied client knowledge in a particular functional area, 0 otherwise. The following functional areas were considered: promotion of already existent products and services at current markets (1), entering new markets (2), modification of existent products and services (3), development of new products and services (4), changes in the business processes (5).	0	5	2.23	1.02
Innovation enablers					
R&D	Equals 1, if KIBS has a specific department responsible for R&D or innovation activity, 0 otherwise.	0	1	0.12	0.33
P-KIBS Purchases	Equals 1, if KIBS purchased at least one type of professional business services (legal, accounting and auditing, management consulting) in 2016-2018 in a systematical manner, 0 otherwise.	0	1	0.58	0.49

Continue of Table 3

Variable	Description	Min.	Max.	Mean	St.dev.
T-KIBS Purchases	Equals 1, if KIBS purchased at least one type of technological business services (IT, engineering, and architecture) in 2016-2018 in a systematic manner.	0	1	0.67	0.47
C-KIBS Purchases	Equals 1, if KIBS purchased at least one type of creative business services (advertising, marketing and business research) in 2016-2018 in a systematic manner, 0 otherwise.	0	1	0.42	0.49
Standardization	Share of standard and modular services in total KIBS revenues (%).	0	100	53.72	38.03
Controls					
Size	Natural logarithm of the number of company employees	0.7	8.6	3.25	1.54
T-KIBS	Equals 1, if KIBS belongs to IT, engineering or architecture industry, 0 otherwise.	0	1	0.67	0.47
C-KIBS	Equals 1, if KIBS belongs to advertising or market research industry, 0 otherwise.	0	1	0.13	0.33
Location	Equals 1, if KIBS is located in Moscow, 0 otherwise.	0	1	0.43	0.50
Age	The difference between 2019 (the year of the survey) and the year the company was established (full years)	1	28	12.75	7.05

Source: developed by the author.

Data collection for the empirical testing of the Research Model (2) was carried out as part of the field stage of the HSE ISSEK long-term project 'Monitoring of Knowledge-Intensive Business Services in Russia' in 2019. The survey methodology was harmonized with the methodological issues identified during the previous waves of Monitoring, the results of the foreign surveys of companies' innovation activity (e.g. Community Innovation Survey), as well as updated methodological recommendations for the collection and analysis of innovation data presented in the new edition of the Oslo Manual[69].

The SPARK-Interfax database was used to develop a stratified sample by establishing quotas for the corresponding types of activity (based on the Russian Classification of Economic Activities OKVED 2)[70] and for the size of companies located in the largest cities of Russia[71]. The target respondents were the owners and/or top managers of KIBS companies. Their answers to the survey were supplemented with financial indicators and employment data obtained directly from the SPARK-

[69] OECD/Eurostat. Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation. – 4th ed. – Luxembourg: OECD Publishing, Paris/Eurostat, 2018. – 254 p.

[70] The sample covers KIBS firms with different size operating in the following industries: computer programming, consultancy and related activities (J62), information service activities (J63), legal and accounting activities (M69), management consultancy activities (M70.2), architectural and engineering activities; technical testing and analysis (M71), and advertising and market research (M73).

[71] In order to cope with the low response rate (which is typical for such surveys in Russia – see, for example, Andreeva, T. Knowledge processes, knowledge-intensity and innovation: A moderated mediation analysis / T. Andreeva, A. Kianto // Journal of Knowledge Management. – 2011. – Vol. 15. – N 6. – P. 1016–1034), the 'snowball approach' method was additionally used for data collection. In this regard, despite the general control of the adequacy of the geographical distribution of companies, the resulting sample is not geographically representative.

Interfax database. The final sample used for empirical testing of Research Model (2), in the context of various types of innovations, included 417 observations[72].

The results of the empirical assessment of Research Model (2) for the case of product innovations, presented in Table 4, generally confirmed hypotheses H2.1-H2.3 about the importance of KIBS' client knowledge absorptive capacity for this type of innovation. It shows that the implementation of innovative products and services in KIBS is significantly influenced by their ability to assimilate and apply client knowledge (column 2). A significant impact of all of the three dimensions of the client knowledge absorptive capacity measured by the acquisition of such knowledge through the digital channels, its assimilation using a digital CRM system, and application in different functional areas, was also confirmed for the case of digital knowledge-capturing product innovations (column 3).

Table 4 – The results of the Research Model (2) evaluation for the case of product innovations in KIBS (marginal effects)

Variables	Product innovations	Digital knowledge-capturing product innovations
1	2	3
Client knowledge absorptive capacity		
$CK_{Acquisition}$	-0.00509 (0.0165)	0.0327** (0.0152)
$CK_{Assimilation}$	0.124*** (0.0454)	0.177*** (0.0420)
$CK_{Application}$	0.0953*** (0.0216)	0.0702*** (0.0231)
Innovation enablers		
R&D	0.312*** (0.0868)	0.126** (0.0623)
P-KIBS Purchases	-0.0672 (0.0425)	-0.0495 (0.0429)
T-KIBS Purchases	-0.0150 (0.0456)	-0.0383 (0.0449)
C-KIBS Purchases	0.111** (0.0439)	0.0609 (0.0428)
Standardization	0.00521** (0.00211)	0.00329 (0.00213)
$Standardization^2$	-6.91e-05*** (2.06e-05)	-4.38e-05** (2.06e-05)
Controls		
Size	-0.00419 (0.0161)	-0.00528 (0.0147)
T-KIBS	0.134** (0.0532)	0.180*** (0.0535)

[72] Those companies that are only formally KIBS since they are serving mostly individual clients (for example, legal firms whose work is mainly dealing with divorce, inheritance, criminal cases, etc), and those companies that decided not to disclose innovation-related aspects of their businesses due to confidentiality reasons were excluded. The final sample was controlled for the non-response bias and the common method bias.

Continue of Table 4

Variables	Product innovations	Digital knowledge-capturing product innovations
1	2	3
C-KIBS	-0.158** (0.0786)	-0.180** (0.0901)
Location	0.0727 (0.0444)	-0.00331 (0.0436)
Age	0.00274 (0.00311)	-0.000432 (0.00314)
Nagelkerke R^2	0.377	0.351
Share of correct predictions, %	72.9	73.6
*** p<0.01, ** p<0.05, * p<0.1		

Source: developed by the author.

The results of the empirical evaluation of the Research Model (2) for the case of business process innovations in KIBS are presented in Table 5.

Table 5 – The results of the Research Model (2) evaluation for the case of business process innovations in KIBS (marginal effects)

Variables	Service development innovations	Service delivery innovation	Organizational innovations	Innovations in ICT	Marketing innovations
1	2	3	4	5	6
Client knowledge absorptive capacity					
$CK_{Acquisition}$	0.0421** (0.0166)	0.0242 (0.0190)	0.0536*** (0.0168)	0.0318* (0.0167)	0.0357** (0.0172)
$CK_{Assimilation}$	0.0661 (0.0521)	0.0985* (0.0524)	0.0860* (0.0483)	0.0664 (0.0511)	0.0827* (0.0485)
$CK_{Application}$	0.0710*** (0.0253)	0.0577** (0.0255)	0.0929*** (0.0222)	0.0181 (0.0237)	0.111*** (0.0225)
Innovation enablers					
R&D	0.0195 (0.0678)	0.0280 (0.0743)	0.0309 (0.0713)	0.0147 (0.0720)	0.0703 (0.0735)
P-KIBS Purchases	-0.00989 (0.0461)	0.0279 (0.0479)	-0.0102 (0.0429)	-0.0759* (0.0455)	0.0219 (0.0450)
T-KIBS Purchases	-0.0635 (0.0491)	0.189*** (0.0479)	0.0484 (0.0454)	0.0891* (0.0493)	0.0198 (0.0482)
C-KIBS Purchases	0.0313 (0.0484)	0.00669 (0.0506)	0.0535 (0.0450)	-0.00543 (0.0480)	0.127*** (0.0447)
Standardization	0.00420* (0.00228)	0.00345 (0.00240)	0.00506** (0.00214)	0.00611*** (0.00235)	0.00419* (0.00227)
$Standardization^2$	-4.88e-05** (2.23e-05)	-3.10e-05 (2.38e-05)	-4.92e-05** (2.12e-05)	-5.40e-05** (2.24e-05)	-3.29e-05 (2.24e-05)
Controls					
Size	-0.00768 (0.0183)	-0.0302* (0.0182)	0.0300* (0.0160)	0.00159 (0.0168)	0.0283* (0.0169)
T-KIBS	0.146** (0.0600)	-0.0891 (0.0600)	-0.0350 (0.0572)	-0.0493 (0.0589)	0.0598 (0.0578)

Continue of Table 5

Variables	Service development innovations	Service delivery innovation	Organizational innovations	Innovations in ICT	Marketing innovations
1	2	3	4	5	6
C-KIBS	-0.0370 (0.0887)	0.0194 (0.0855)	0.125 (0.0789)	-0.0114 (0.0821)	0.0696 (0.0785)
Location	0.0550 (0.0476)	-0.0988** (0.0492)	0.0403 (0.0460)	0.0333 (0.0476)	-0.00780 (0.0474)
Age	0.000143 (0.00346)	0.00203 (0.00354)	-0.000374 (0.00327)	0.00117 (0.00343)	-0.00593* (0.00335)
Nagelkerke R^2	0.176	0.151	0.293	0.098	0.278
Share of correct predictions, %	68.1	66.9	73.1	69.3	70.5
*** p<0.01, ** p<0.05, * p<0.1					

Source: developed by the author.

In most cases, the hypotheses H2.1-H2.3 about the existence of a positive relationship between each of the dimensions of the KIBS' client knowledge absorptive capacity and the innovative activity of these companies were confirmed. The results indicate that all of the three dimensions of the client knowledge absorptive capacity are significantly related to the implementation of organizational (column 4) and marketing (column 6) innovations in KIBS. For the other two types of business process innovation (service development and service delivery innovations respectively) at least two of the three client knowledge absorptive capacity dimensions were found to be significant. Thus, significant relationships were found to exist between both acquisition and application of client knowledge and the implementation of service development innovations in KIBS (column 2). Besides, the relationship between both the assimilation and application of client knowledge and innovation activity of KIBS was also confirmed for the case of service delivery innovations (column 3). The only type of business process innovation that has very limited and weak relationships with different dimensions of the client knowledge absorptive capacity is innovations in information and communication technologies (column 5).

5. An implication of the empirical results is that KIBS firms aiming at boosting their innovation activity should develop more tight relationships with their clients during project executions by extending the process of interaction to the digital channels; should implement deliberate (formal) approaches to the management of client knowledge enhanced by IT-enabled solutions; and should increase the availability of this knowledge across the whole organization.

The results of the thesis research confirm the idea that not only formal cooperation with clients for the joint development of innovative solutions, but also KIBS' ability to absorb client knowledge during the 'routine' operational client interactions is an important driver of KIBS' innovation activity.

This means that KIBS firms need to take into account that client knowledge can be useful not only to meet customer requirements and develop customized solutions but can also be helpful for the development of innovative products and services, as well as can facilitate the implementation of innovative solutions in KIBS' business processes.

Client knowledge absorptive capacity is the main tool that allows KIBS to successfully apply client knowledge for its internal purposes. Thus, the development of such capacity should become one of the crucial goals of knowledge and innovation management in KIBS. To improve their client knowledge absorptive capacity, KIBS firms should focus on its three main dimensions associated with acquisition, assimilation and application of client knowledge:

- To enhance their ability to acquire customer knowledge, KIBS companies need to complement face-to-face customer interactions with interactions in digital channels. Digitalization of the client communication process will allow enhancing the spatial proximity between KIBS and their clients by additionally establishing a 'virtual proximity' between two parties. This will increase KIBS' capacity to acquire client knowledge and by doing so stimulate their innovative activities;
- The development of the ability to assimilate client knowledge will also increase KIBS' propensity to develop both product and business process innovations. Assimilation of client knowledge need to be enhanced by the implementation of more formal deliberate approaches to customer relationship and knowledge management supported by modern digital solutions like e-CRM systems which facilitate client knowledge accumulation and storage;
- It should also be taken into account that client knowledge is a significant factor of the innovation activity in KIBS in terms of both product and business process innovations. Accordingly, KIBS need to ensure that all potentially interested business units can access client knowledge and encourage its use in different functional areas.

3. CONCLUSIONS

The current thesis research develops the idea about the high relevance of client interactions as one of the factors that increase the KIBS company's innovation activities. The research is based on the idea of studying the KIBS-client interactions as a helix of knowledge exchanges between them and on adapting the absorptive capacity concept to the corresponding type of knowledge, labeled as 'client knowledge'. To implement the empirical part of the study, a special questionnaire was developed to assess three key elements of KIBS capacity to absorb client knowledge (its acquisition, assimilation and application respectively), as well as a Research Model which links these elements with the innovative activity of KIBS is suggested. This Research Model was tested using a unique data set on Russian KIBS companies in terms of the introduction of innovative products and services to the market, as well as of the implementation of innovative solutions in various business processes.

The implemented set of research tasks makes it possible to draw the following conclusions:

- KIBS firms, constituting one of the most dynamic and innovative sectors of the service industry, are represented by companies specializing in technological, professional and creative activities;
- The main drivers of innovation activity of KIBS companies identified in the foreign scientific literature are significant for the Russian market as well, and the most significant factor influencing the creation and implementation of all major types of innovations was access to external sources of knowledge;
- The high importance of external knowledge for KIBS companies requires a deeper study of the absorptive capacity of these companies in the context of various types and sources of this knowledge;
- The relationship between the ability of KIBS companies to absorb client knowledge and their innovative activity is observed both when analyzing the introduction of innovative products and services (including digital services) by these companies to the market, and when analyzing the introduction of innovative solutions into their own business processes (excluding innovations in information and communication technologies, which were considered separately);
- The development of client knowledge absorptive capacity in KIBS companies may be facilitated by the establishment of closer relationships with customers through the introduction of digital communication channels, by the formalization of approaches to managing this knowledge using IT solutions, as well as by the development of approaches to their use in solving internal business tasks.

4. LIST OF AUTHOR'S PUBLICATIONS

The main results of the thesis research are presented in the three articles published in the international peer-review journals indexed in multidisciplinary citation databases Scopus and Web of Science (WoS):

1. Chichkanov, N. Knowledge intensive business services: ambiguities and continuities / I.D. Miles, V. Belousova, N. Chichkanov // Foresight. – 2018. – Vol. 20. – N 1. – P. 1–26. (Scopus Q3 Management of Technology and Innovation[73]).

The author of the thesis research was responsible for the empirical part of the article including the process of data collection, cleaning, statistical analysis and visualization. He also supported the development of the theoretical framework by selecting and reviewing the literature on the topics suggested by co-authors as well as searching for the theoretical and empirical evidence confirming the research hypothesis. The results of this article contribute to the *first research task* of the thesis;

2. Chichkanov N. Drivers for innovation in KIBS: evidence from Russia / N. Chichkanov, I. Miles, V. Belousova // The Service Industries Journal. – 2021. – Vol. 41. – N 7-8. – P. 489-511. (Scopus Q1 Management of Technology and Innovation[74]; WoS Q1 Management[75]).

The author of the thesis research is a corresponding author who had the main responsibility for both developing hypotheses and providing empirical results of the study. He made an extensive literature review identifying critical research gaps, develop and empirically explore the model as well as check the robustness of the received results. The results of this article contribute to the *second research task* of the thesis.

3. Chichkanov, N. The role of client knowledge absorptive capacity for innovation in KIBS / N. Chichkanov // Journal of Knowledge Management. – 2021. – Vol. 25. – N 5. – P. 1194-1218. (Scopus Q1 Management of Technology and Innovation[76]; WoS Q1 Management[77]).

The author of the thesis research is the only author of the paper and was fully responsible for the whole research process and results presented in this paper. The results of this article contribute to the *third, fourth and fifth research tasks* of the thesis.

Other publications containing the results of the thesis research include:

- Chichkanov, N. Yu. Innovacionnaya aktivnost' kompanij sektora intellektual'nyx uslug v

[73] URL: https://www.scimagojr.com/journalsearch.php?q=16106&tip=sid (assessed at: 26.07.2021).
[74] URL: https://www.scimagojr.com/journalsearch.php?q=24928&tip=sid (assessed at: 26.07.2021).
[75] URL: https://journalprofile.clarivate.com/jif/home/?journal=SERV%20IND%20J&year=2020&editions=SSCI&pssid=H1-8R5CLsS2vIYTHu8YTUC2bn4wjYq5hx2Bko-18x2dYVRtC2x2BfWgsPrQKQ8eH2vwx3Dx3DHPZAs39S0SZFWVfarop8iAx3Dx3D-qBgNuLRjcgZrPm66fhjx2Fmwx3Dx3D-h9tQNJ9Nv4eh45yLvkdX3gx3Dx3D (assessed at: 26.07.2021).
[76] URL: https://www.scimagojr.com/journalsearch.php?q=144668&tip=sid (assessed at: 26.07.2021).
[77] URL: https://journalprofile.clarivate.com/jif/home/?journal=J%20KNOWL%20MANAG&year=2020&editions=SSCI&pssid=H1-8R5CLsS2vIYTHu8YTUC2bn4wjYq5hx2Bko-18x2dYVRtC2x2BfWgsPrQKQ8eH2vwx3Dx3DHPZAs39S0SZFWVfarop8iAx3Dx3D-qBgNuLRjcgZrPm66fhjx2Fmwx3Dx3D-h9tQNJ9Nv4eh45yLvkdX3gx3Dx3D (assessed at: 26.07.2021).

Rossii [Innovation activity of KIBS companies in Russia] / N.Yu. Chichkanov, I.D. Miles, V.Yu. Belousova // Proceedings of the III International Scientific and Practical Conference ‘Innovative Economics and Management: Methods and Technology’ 16-17 May 2018. – Moscow, 2020. – P. 294-299 (in Russian).

- Chichkanov, N. Coproduction and Innovation in Knowledge-Intensive Business Services / N. Chichkanov // Proceedings of International Forum on Knowledge Asset Dynamics (IFKAD 2019) ‘Knowledge Ecosystems and Growth’, 5-7 June, Matera, Italy. – 2019. – P. 2349-2360.
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- Chichkanov, N. Conditions for Innovation in KIBS: Evidence from Russia / N. Chichkanov, I. Miles, V. Belousova // NRU Higher School of Economics. Series WP BRP "Science, Technology and Innovation". – 2019. – N 92;