DOI: 10.17747/2618-947X-2025-1-35-46

The interrelation between innovations and knowledge management systems: Justification and classification of knowledge-based innovations

N.V. Linder[1, 2]
P.D. Serezhin[1, 3]
[1] Financial University under the Government of the Russian Federation (Moscow, Russia)
[2] JSC Goznak (Moscow, Russia)
[3] LLC Boutique Hotel (Moscow, Russia)

Abstract

This article exexamines the role of knowledge in the innovation process, highlighting knowledge creation as a key factor in successful innovation. Current economic realities underscore the importance of knowledge as a fundamental resource for creating unique competitive advantage. The relationship between innovation and the knowledge creation process, which is often overlooked or underestimated, is explored.

The article presents different approaches to defining and classifying innovation and knowledge creation models. The authors propose a classification approach for knowledge-based innovations based on parameters such as the type of knowledge according to novelty level (completely new knowledge vs. use of existing knowledge), knowledge creation (market knowledge vs. empirical knowledge), and knowledge characteristics (explicit vs. implicit). Empirical research on knowledge-based innovation has allowed us to complement the classification approach with information on the source of knowledge acquisition for innovation creation - a critical feature for company managers.

The conclusion underlines the importance of knowledge creation and integration for the successful implementation of innovation.

Keywords: innovations, innovation classification, types of knowledge, empirical knowledge, market knowledge, knowledge management.

For citation:

Linder N.V., Serezhin P.D. (2025). The interrelation between innovations and knowledge management systems: Justification and classification of knowledge-based innovations. *Strategic Decisions and Risk Management*, 16(1): 35-46. DOI: 10.17747/2618-947X-2025-1-35-46. (In Russ.)

Acknowledgements

This article is based on the results of the research carried out at the expense of the budget on the state mission of the Financial University.

创新与知识管理的关系：基于知识的创新的原理与分类

N.V. Linder[1, 2]
P.D. Serezhin[1, 3]
[1] 俄罗斯国立财政金融大学 (俄罗斯，莫斯科)
[2] Goznak股份公司（俄罗斯，莫斯科)
[3] Boutique Hotel 有限责任公司（俄罗斯，莫斯科)

简介
文章致力于研究知识在创新过程中的作用，认为知识创造是成功创新的关键因素。现代经济条件强调了知识作为创造独特竞争优势的关键资源的重要性。 本文探讨了创新与知识创造过程之间的关系，而知识创造过程往往被忽视或低估。文中介绍了对创新和知识创造模式进行定义和分类的不同方法，包括作者基于知识创造和创新创造对创新进行分类的方法。 已形成的基于知识的创新分类包括知识的三个方面：根据新颖程度划分的知识类型（全新知识或使用现有知识）、知识创造（市场知识或经验）、知识特征（显性或隐性）。对以知识为基础的创新进行的实证研究，通过引入创新创造的知识来源信息作为公司管理者的一个重要特征，对所提出的分类方法进行了补充。结论是，创造和整合知识对于成功创新非常重要。
关键词: 创新、创新分类、知识类型。

供引用:
Linder N.V., Serezhin P.D. (2025).创新与知识管理的关系：基于知识的创新的原理与分类。战略决策和风险管理, 16(1): 35–46. DOI: 10.17747/2618-947X-2025-1-35-46.
(俄文)

致谢
这篇文章是根据俄罗斯联邦政府国立财政金融大学国家任务下的预算资金进行的研究成果撰写的。

Introduction

Modern realities illustrate the tendency of both companies and the economy as a whole to perceive knowledge as the most important economic resource and source of non-copyable competitive advantages. In this context, the importance of considering knowledge-based innovation as a separate theoretical and practical category increases.

Successful implementation of knowledge-based innovation requires a well-designed knowledge management system that enables organisations to excel in the creation of technological, market and administrative knowledge. Innovation and knowledge creation are two concepts that have a strong but complex relationship that is rarely studied in detail. This article examines both concepts and attempts to show their relationship.

In addition, qualitative and quantitative research was carried out using in-depth interviews and questionnaires. The aim of the study is to identify the real attitudes of practitioners from different fields towards the types of innovation studied.

The result of the study presented in the article is a proposal for a definition and classification of knowledge-based innovations.

1. Theoretical review of the literature

1.1. Innovation: Concepts and models

Innovation is a continuous, cumulative process of multiple organisational decisions from the moment an idea is conceived until it is fully implemented. Academic definitions of innovation include the concepts of novelty, commercialisation and implementation. That is, if an idea has not been developed and implemented as a product, process or service, or has not passed the commercialisation stage, it is not considered to be an innovation.

Definitions of innovation can be found in the works of many authors [Rogers, Williams, 1983; Utterback, 1994; Afuah, 2003; Fischer, 2001; Garcia, Calantone, 2002; McDermott, O'Connor, 2002; Pedersen, Dalum, 2004] as well as in [Frascati Manual, 2015; Oslo Manual, 2018]. 'An innovative idea arises from the identification of new customer needs or the development of new production methods. It is formed through the accumulation of knowledge and the continuous development of entrepreneurial intuition. The implementation of this idea allows the creation of a new product or process, accompanied by a reduction in costs and an increase in efficiency' [Botega, Da Silva, 2020].

In [Afuah, 2003] innovation is seen as new knowledge integrated into products, processes and services; innovations are classified as technological, marketing and administrative.

Technological innovations involve knowledge about the components, interrelationships, methods, processes and techniques used in products or services. Such innovations may or may not involve administrative changes. Technological innovations can be in products, processes or services. Products and services need to meet specific market needs. Process innovations involve changes in the operational activities of the firm, such as the supply of materials, the specification of tasks, the flow of work and information, and the use of equipment to produce goods or provide services [Afuah, 2003].

Marketing innovation refers to new knowledge embedded in distribution channels, product applications and consumer demands, preferences and needs [Afuah, 2003]. The aim of marketing innovation is to improve the marketing mix, including the product itself, price, promotion and place of sale. According to [Frascati Manual, 2015], marketing innovation includes the development and launch of new products, as well as related activities such as test launches, product adaptation for different markets, and advertising campaigns, but does not affect the formation of distribution channels.

Management innovation concerns changes in the management structure and administration of companies. It focuses on strategies, structures, systems and human resources within organisations.

The Manuals [Frascati Manual, 2015; Oslo Manual, 2018] offer different approaches to understanding innovation, but they emphasise the importance of research and development (R&D) at all stages of the innovation cycle, not only as a source of ideas, but also as a tool for commercialising innovations - an integral part of the innovation concept.

For example, [Frascati Manual, 2015] defines the following terms: fundamental research, applied research, research and development. Fundamental research ‘is experimental or theoretical work carried out primarily to obtain new knowledge about observed phenomena and facts, without having a specific practical purpose’.. Applied research is ‘original research aimed at gaining new knowledge, primarily to achieve a specific practical objective or to solve a specific problem’. Experimental development is ‘a systematic activity, based on existing scientific knowledge or practical experience, aimed at creating new or improved materials, products, devices, processes, systems or services’.

The Oslo Manual [Oslo Manual, 2018] defines innovation as the creation of a new or improved product or business process that is significantly different from the previous one. The current version of the Manual distinguishes two types of innovation:

– product innovation – improvement of existing products or creation of new ones;
– business process innovation – new approaches that improve existing business processes or create new ones for the organisation.

If we try to find common features of innovation in different approaches, we can trace the idea of the role of this or that knowledge as the basis of any innovation. This aspect was studied by P. Drucker in his study of possible sources of innovation [Drucker, 1985], of which he identified seven:

1) an unexpected event;
2) discrepancy between idea and reality;
3) the needs of the production process or the consumer;
4) the needs of the market;
5) changes in market structure;
6) changes in demographic indicators;
7) new knowledge.

Drucker’s approach shows that this source creates either radical or disruptive innovations, which implies some specificity in the process of creating such an innovation as well as its further use. But it seems fair to clarify that an innovation based on a new idea should not be radical for the market, because new ideas can improve current business processes or the company’s product range. The main sign that innovation is directly based on knowledge is the presence of such a stage in the process of creating innovation as the development of information available to the organisation, or, to put it in more practical terms, a knowledge systemIt is also important to clarify that new knowledge is not always obtained by processing information directly from the internal environment - after all, the market is very large and new knowledge appears among many of its participants from different fields, which suggests the possibility of integrating new knowledge even from completely different sectors of the market. In this case, it can be concluded that knowledge-based innovation is a commercialisable innovation that has arisen in the process of developing an organisation’s knowledge management system or by integrating new knowledge from outside.

In addition to the approaches described, there are four well-known models of innovation classification based on knowledge [Abernathy, Clark, 1985; Henderson, Clark, 1990; Tushman et al., 1997; Chandy, Tellis, 1998].

Innovation Classification Model by W. Abernethy and K. Clark

According to the authors, innovations should be classified according to their impact on the firm’s market competencies and technological knowledge. They focus on the preservation or destruction of these knowledge and competencies. For example, if technological capabilities become less important as new technologies proliferate

Table 1
Classification of innovations according to Abernathy and Clark

Types of innovation	Company knowledge and skills
Conventional innovation	Based on the company's existing technical and market knowledge and skills
Niche Innovation	Based on current technical knowledge, but accompanied by outdated market knowledge and skills
Revolutionary Innovation	Associated with outdated technical competencies, but market knowledge retained
Architectural innovation	Involves loss of both technical and market knowledge and skills

Source: compiled by the authors.

in the market, market knowledge and competencies may remain stable. Even if a firm loses its technological advantage, it can use its market knowledge to maintain its competitive position. The combination of market competencies and technological knowledge thus forms four types of innovation (Table 1).

Innovation Classification Model by R. Henderson and K. Clark

Henderson and Clark introduce the concept of two types of knowledge: (1) 'component knowledge', which is an understanding of the components that make up a product, and (2) 'architectural knowledge', which 'changes the way the components of a product are assembled while leaving the basic design concept unchanged'. According to the authors, the success of new product development depends on the presence of these two types of knowledge: knowledge of individual components and understanding of the relationships between them (architectural knowledge). The combination of these two types of knowledge results in four types of innovation (Table 2).

Table 2
Classification of innovations according to Henderson and Clark

Types of innovation	Company knowledge and skills
Incremental innovation	Aims to improve components and architecture
Radical Innovation	Aims to significantly update both components
Architectural Innovation	Improves the components of the product, but changes the architecture
Modular Innovation	Updates the architecture while keeping the components

Source: compiled by the authors.

Table 3
Classification of innovations according to Tushman, Anderson and O'Reilly

Types of innovation	Company knowledge and skills
Architectural innovations	Create new markets with minimal technological improvements (e.g. Canon photocopiers, Sony walkie-talkies)
Incremental innovations	Improving technology while remaining in a stable market
Major product/ service innovations	Lead to significant technology shifts and the creation of new markets (e.g. the transition from DOS to Windows)
Major process innovations	Accompanied by profound technological changes, but operating within the existing market

Source: compiled by the authors.

Innovation Classification Model by M. Tushman, P. Anderson and C. O'Reilly

The Tushman et al. model considers technology cycles and innovation flows and distinguishes between types of innovation based on their impact on market knowledge and technology. Market knowledge is divided into 'new' and 'existing', which is similar to the 'destroyed' and 'existing' levels in the Abernethy and Clark model. Accordingly, the model distinguishes four main types of innovation (Table 3).

Tushman and co-authors also introduce the concept of general innovation, which reflects an intermediate stage where both the market and technology are in a state of constant change.

Innovation Classification Model by R. Chandy and J. Tellis

This model again draws attention to two key axes - technologies and markets. The first axis reflects the degree of novelty of the technology in the product compared to previous versions, the second the degree of satisfaction of key customer needs compared to current offerings. Combining these axes allows us to identify four types of product innovation (Table 4).

Table 4
Classification of innovation according to Chandy and Tellis

Types of innovation	Company knowledge and skills
Incremental innovation	Low in technological novelty and need satisfaction
Market breakthrough	Low in technological novelty but significant increase in need satisfaction
Technological breakthrough	High in technological novelty but insufficient need satisfaction
Radical innovation	High in both technological novelty and need satisfaction

Source: compiled by the authors.

Thus, each of the models considered offers a unique view of the nature of innovation, emphasising the interdependence of technological and market knowledge and competencies.

A common thread running through all the models presented is the distinction between incremental and radical innovation. Let us look at this difference in more detail. Radical innovations represent fundamental changes that are radically different from existing practices and are revolutionary in nature in the field of technology [Liu et al., 2022]. The authors of [Dewar, Dutton, 1986] argue that a theoretical model of innovation should consider three key aspects:

A common thread running through all the models presented is the distinction between incremental and radical innovation. Let us look at this difference in more detail. Radical innovations represent fundamental changes that are radically different from existing practices and are revolutionary in nature in the field of technology [Liu et al., 2022]. The authors of [Dewar, Dutton, 1986] argue that a theoretical model of innovation should consider three key aspects:

In [Urabe, 1988], innovation is seen as a combination of both large and small changes. Radical innovations, according to the author, represent significant changes, especially in technological terms. In the early stages of industry development, radical product innovations dominate, but their economic impact is small because the product is not yet stable and the market is not yet defined.

The authors [Pedersen, Dalum, 2004] believe that radical innovations are fundamental changes that reflect a new technological paradigm. As a result, existing codes of communication and understanding of technologies become inadequate. Radical change introduces a high degree of uncertainty into organisations and industries, destroying much of the previous investment in technical skills, knowledge, designs, production methods, plant and equipment. Changes affect not only supply but also demand and organisational structure.

Incremental innovations are changes to products and processes that do not involve a significant degree of novelty [Oslo Manual, 2018].

Since innovation is the result of the creation and application of knowledge, we next consider the key concepts for managing the creation and application of knowledge in organisations.

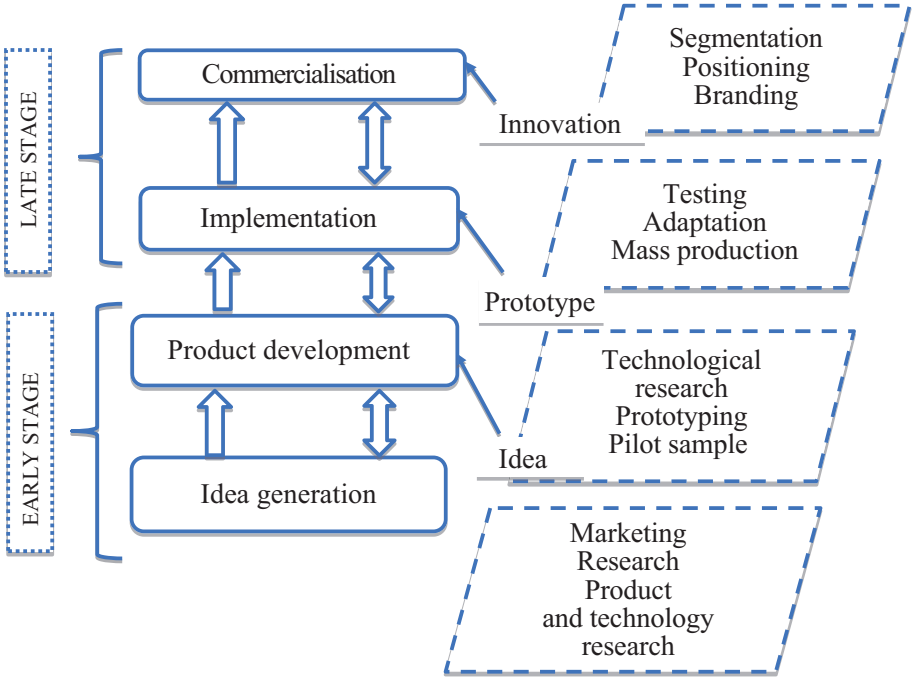
1.2. Knowledge creation in organisations: concepts and models

Knowledge is defined as a ‘justified true belief’ that enhances an organisation’s ability to act effectively [Nonaka, 1994; Nonaka, Takeushi, 1995]. Business-relevant knowledge includes facts, opinions, ideas, theories, principles, models, experiences, values, contextual information, expert judgement and intuition [Yang et al., 2022]. In [Ahlskog et al., 2017], knowledge is defined as a dynamic mix of experience, values, contextual information, and expert judgment that serves as a basis for evaluating and integrating new experiences and information.

The authors [Nonaka, Takeushi, 1995] see knowledge as consisting of two dimensions: tacit and explicit, based on the work of [Polanyi, 1967]. The tacit dimension is based on experiences, thoughts and feelings in a specific context and includes cognitive and technical components. The cognitive component refers to the mental models, beliefs, paradigms and views of the individual. The technical component relates to specific experience and skills applicable to a particular situation. The explicit dimension of knowledge is expressed, codified and communicated using symbols [Nonaka, Takeushi, 1995]. The explicit dimension can also be classified as object-oriented or rule-oriented. Knowledge is object-based when it is codified in words, numbers, formulae, or represented tangibly in the form of equipment, documents, or models. It is rule-based when knowledge is encoded in rules, procedures, or standard operating procedures [Hagedorn et al., 2018].

The authors [Liu et al., 2025] also discuss a third type of knowledge - cultural knowledge. This refers to ‘the assumptions and beliefs that are used to describe and explain reality, as well as the conventions and expectations that are used to give meaning and significance to new information’. Cultural knowledge is not codified, but is disseminated through the links and relationships that bind a group. Although the authors [Nonaka, Takeushi, 1995] do not mention cultural knowledge, they do distinguish between individual and collective knowledge. Individual

Fig. 1. Stages of the innovation process



Source: [Linder, 2021].

knowledge is created and exists in an individual according to his or her beliefs, attitudes, opinions and factors that influence the formation of personality. Social knowledge is created and resides in the collective actions of a group. It includes norms that govern communication and coordination within the group. In a specific context, collective knowledge could be classified as cultural knowledge.

In [Zhang et al., 2023], different classifications of knowledge are proposed depending on its use or usefulness. For example, according to [Zack, 1998], knowledge can be classified as procedural (knowing how), causal (knowing why), conditional (knowing when) and relational (knowing with whom). A more pragmatic approach classifies knowledge according to its usefulness to organisations. In this case, knowledge refers to the understanding of customers, products, processes and competitors, i.e. the components of the organisation's value chain [Porter, 1985].

One of the most influential theories of organisational knowledge creation is that developed by [Nonaka, Takeushi, 1995]. In their analysis, an organisation creates new knowledge through the transformation and interaction of its tacit and explicit knowledge. Understanding the interdependent relationships between these two types of knowledge is key to understanding the process of knowledge creation. The transformation of tacit and explicit knowledge is a social process between people and is not limited to one person. Knowledge transformation occurs in four modes:

- socialisation - from implicit to explicit knowledge;
- exteriorisation - from tacit to explicit knowledge;
- combination - from explicit to explicit knowledge;
- internalisation - from explicit to tacit knowledge.

According to [Nonaka, Nishiguchi, 2001], knowledge often depends on the perception of the observer, and a person gives meaning to a concept by how he or she uses it. As a justified true belief, knowledge is a construction of reality, not something objectively true or universally correct. Knowledge is both explicit and tacit: explicit knowledge is objective, whereas tacit knowledge is more hidden or empirical. Explicit knowledge is formed through research, analysis of written documents, reports and materials, while empirical knowledge is formed through experience. We call the first type of knowledge market knowledge and the second type empirical knowledge.

2. Classification of knowledge-based innovations

Thus, innovation is an idea that has been transformed into a product or service and commercialised, creating value for the company (Figure 1).

Ideas, in turn, are formed as a result of deep interactions between people in knowledge-creating environments. Therefore, based on the theoretical literature review above, we will formulate a classification

of knowledge-based innovations that includes three aspects of knowledge:

– type of knowledge by degree of novelty - completely new knowledge or use of existing knowledge;
– creation of knowledge - market knowledge or empirical knowledge;
– characteristics of the knowledge - explicit or implicit.

The resulting classification is shown in Table 5.

Thus, the firm can create new products through research based on tacit knowledge and commercialise them using new knowledge about the market (4th column of Table 5). This scenario refers to radical innovation, where new ideas emerge unexpectedly, from new sources, usually through the intuitive knowledge of highly skilled employees.

The second option (3rd column of Table 5) is the creation of new products based on existing knowledge of the market. In this scenario, the product and its technology change, but the market remains the same. A company creates new products using existing explicit knowledge, but commercialises them using new market knowledge. Product development uses explicit knowledge about the market, product components and their combination. By redesigning product components, products can be created for new markets.

The third option (2nd column of Table 5) is when the firm creates new products using explicit existing knowledge about the market and commercialises these products using existing knowledge about the market. This means that gradual continuous improvements are created, which is a characteristic of incremental innovation.

Knowledge creation focuses on the application of knowledge to create new opportunities for the company. Innovation creation aims to transform this knowledge into products and services that have value in the markets. It is the interaction of technical and market knowledge that determines the company's ability to innovate and thus increase its competitiveness. At the same time, the conclusions drawn require empirical confirmation.

3. Methodology for research on knowledge-based innovations

To ensure maximum relevance of the research results, the sample for the qualitative and quantitative research was drawn from different market sectors.

The qualitative research was conducted through in-depth interviews with representatives from the following areas:

– banking and investment (CFO of a credit and investment organisation);
– hotel (CEO of a five-star hotel in the centre of Moscow);
– education (founder of a private school, professor at one of the country's leading universities).

The interview consisted of several logical blocks in which innovation activities, the knowledge management

Table 5
Classification of knowledge-based innovations

The knowledge creation process / The process of creating innovations	Market knowledge	Combination of market and empirical knowledge	Empirical knowledge
Idea	Marketing research, strategic analysis - product refinement based on consumer demand	Marketing research, strategic analysis - creating a new product based on existing knowledge	Product and technology research is a completely new idea based on new knowledge.
Product development	Prototyping	Prototyping / Technological Research	Technology research - new product features
Commercialisation	Exploitation of an existing product	Commercialisation of a new product using existing market knowledge	Commercialisation of a new product using new market knowledge
Types of innovations by degree of novelty	Incremental innovation - commercialisation through existing market knowledge	Creation of products based on existing knowledge, commercialisation of the product based on new knowledge of the market	Radical innovation - a completely new product

Source: compiled by the authors.

system and the interrelationship between these phenomena were discussed, leading to an argument about knowledge-based innovation.

The quantitative study was carried out using a questionnaire with a Likert scale, where 7 points means absolute agreement and 1 point means absolute disagreement, which allowed us to systematise the results obtained and identify the respondents' perception of the theses proposed in the questionnaire. 225 representatives of SMEs and larger companies took part in the survey.

4. Analysis of research results

4.1. Qualitative research

The results of an interview with a representative of a credit and investment organisation showed that in this sector the innovation process is an integral part, without which no company could continue to exist. It was also noted that participants in the financial industry consistently create up to five innovations per year, which may include product, marketing, technological and organisational (but if we rely on the modern categorisation according to [Oslo Manual, 2018], then process and product). As an example, the period of active digital transformation of the industry was cited, when all products and services of this market began to be offered to users through various IT products. As the interviewee noted, all the major players of this period began to develop their IT technologies in order to remain competitive, but this required not only large monetary investments in developments, but also a large knowledge base with high qualifications of both developers and managers of various levels, so that the process was equipped both from the technical side and from the organisational side, which is no less important. Thus, the discussion led to the justification of the need for a well-developed knowledge management system to facilitate fundamental innovation processes of this kind. As the interviewee noted, it was the knowledge management system with a large base of accumulated knowledge of the organisation that allowed a major step forward in the issue of development and technological innovation. In this context, the question of knowledge-based innovations and how exactly they are generated was considered. The respondent gave a clear answer in favour of the relationship between the knowledge management system and the innovation process, agreeing that they are complementary. And the end product of their complementarity is innovation, the core of which is knowledge, which in turn is knowledge-based innovation.

The interview with the representative of the Gnostic sphere was structured in the same way, so that the question of the innovation process was considered first. The interviewee emphasised that the sphere is not high-tech, so technological innovations are extremely rare, but the situation with product, organisational and marketing innovations looks the same. This is due to the fact that hotel services have to be constantly improved, not only by correcting mistakes but also by introducing new ones, as well as their promotion, which has to constantly adapt and improve in terms of marketing strategies and the tools used. All these improvements and innovations often lead to the need to improve the organisational process, which entails organisational innovations. As for the knowledge management system, this is not a common practice for this market, but the respondent shared that their organisation has it, and it was also emphasised that it is necessary for quality work - after all, it is a set of rules as well as a base where all the experience of the activity is stored. Therefore, the formed knowledge base is often a source of improvement of the above-mentioned innovations. Thus, the relationship between the knowledge management system and the hotel market has been highlighted, leading to the creation of knowledge-based innovations.

A representative of the education sector pointed out the importance of the innovation process in activities, since continuous improvement of the educational process increases customer satisfaction, which leads to their loyalty and commitment, and also popularises the school. The innovation process mostly concerns the product itself, since it is the main value in this market, and it allows not only to increase the indicators of overall competitiveness, but also to create non-copiable competitive advantages in the form of different methods and approaches. As for the knowledge management system, the respondent highlighted it as the main component of successful activity - after all, the main product of the analysed organisation's activity is knowledge. For this reason, it is necessary to create a knowledge base with various approaches to the educational process, methods, as well as the experience accumulated by employees during the entire period of their activity. In addition, the knowledge base focuses on the acquisition of external knowledge accumulated by other market participants rather than internal knowledge accumulated by the organisation itself. This is due to the fact that the respondent's educational organisation seeks to study new practices and integrate them into its activities with its own interpretation. This specificity is also due to the fact that staff are a very important source of new knowledge, as they are literally the bearers of the knowledge that they share with their students, and they receive this knowledge mainly from outside a single organisation. Thus, there is an emphasis on the acquisition of external knowledge, which leads to the creation of knowledge-based innovations.

4.2. Quantitative research

The quantitative study was conducted using a 7-point Likert scale questionnaire. The main objective

of the quantitative study was to determine the actual perception of categories such as innovation process, knowledge management system and their relationship leading to knowledge-based innovation. Due to the specific nature of the questionnaire, it does not contain questions, but rather propositions that respondents can agree or disagree with.

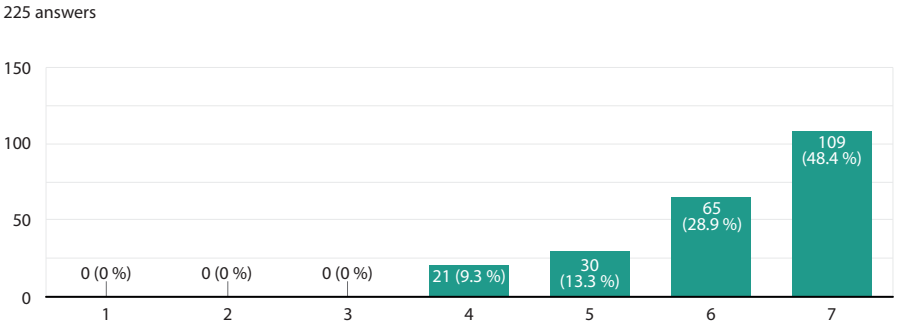
The first thesis concerned the role of the KM system in the management and operational activities of the organisation: 'The presence of a knowledge management system improves the organisation of both the management and operational components of the company' (Fig. 2).

As can be seen from the results, respondents were extremely consistent in their answers, as indicated by their clear tendency towards absolute agreement. It is also important to note that there was no disagreement among the 225 respondents, which is a positive sign.

The second thesis was as follows: To be successful, a company must invest its resources in the innovation processэ (Fig. 3).

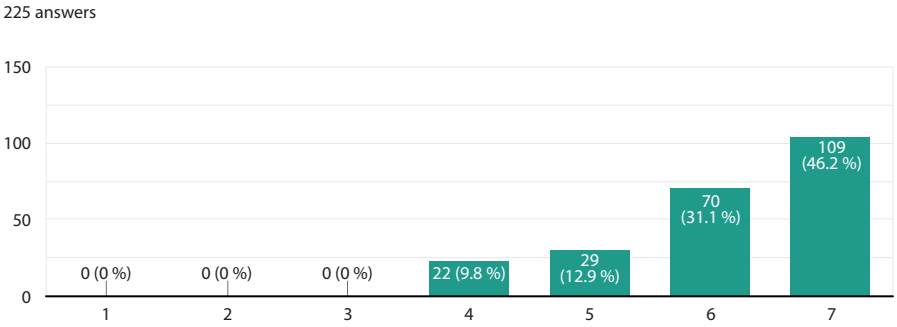
The result also deserves special attention because of its positive trend for the study towards absolute agreement with the statement regarding the importance of the innovation process for successful activity. It should also be emphasised that there were no negative reactions to the thesis.

Fig. 2. Respondents' answers on the availability of a knowledge management system



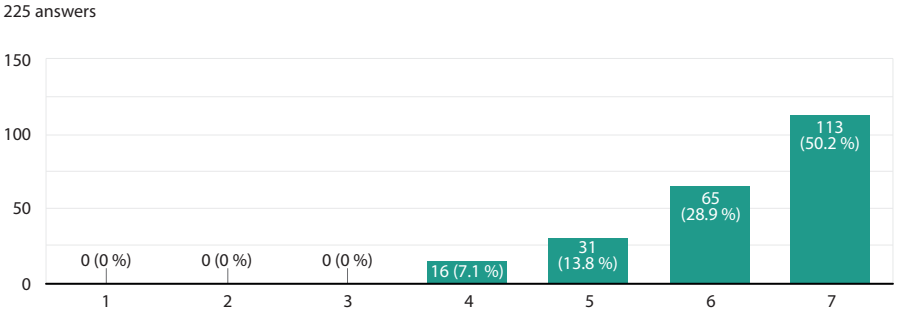
Source: compiled by the authors.

Fig. 3. Respondents' answers on investment in the innovation process



Source: compiled by the authors.

Fig. 4. Respondents' answers on the impact of the knowledge management system on the innovation process



Source: compiled by the authors.

The next question was the key one in the questionnaire, as the results would either confirm or refute the need to identify knowledge-based innovations: 'The knowledge management system stimulates the innovation process of the organisation and creates knowledge-based innovations' (Fig. 4):

As can be seen from the results in Fig. 4, the respondents agreed that knowledge-based innovation occurs in their practice as a separate type of innovation, which justifies the research question and also emphasises the need to study this topic.

Summarising the qualitative and quantitative research, we can conclude that:

- Respondents from different business sectors and sizes emphasise the importance of the innovation process for the success of their activities.
- Respondents highlight the importance of the knowledge management system as an important element in the life of the organisation.
- Respondents noted the relationship between the knowledge management system, where the knowledge management system stimulates the innovation process. It was also said that they can complement each other.
- The final outcome of the relationship between the knowledge management system and the innovation process is knowledge-based innovation.

5. Clarification of the classification of knowledge-based innovations based on the results of the empirical analysis

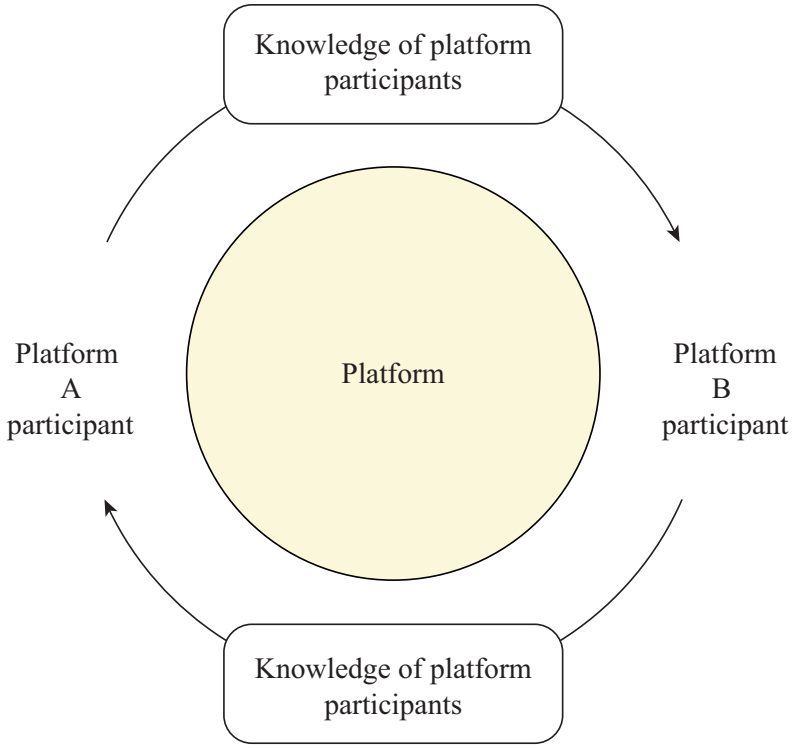
The empirical analysis carried out has allowed us to complete the developed classification of innovations based on knowledge by introducing information about the source of knowledge for creating innovations as an important characteristic for company managers. Knowledge can be:

- created on the basis of the knowledge of the organisation itself - this type of knowledge-based innovation consists in the fact that the enterprise creates process or product innovations on the basis of the knowledge it has accumulated and created within its organisational structure, without going beyond its boundaries. The main tool for creating this type of innovation is modern digital technologies, which help to store and replenish the relevant database, which can be used as the main source of obtaining innovations;
- the second type implies that the innovation is the result of knowledge sharing and management within networked organisations that may be in the same value chain or operating on the same platform. The supporting tool is modern cloud technologies, which enable the fast and secure transfer of knowledge between participants.
- a favourable factor for the creation of innovations based on this type of knowledge is the platform business model, in which each of its participants complements the others, and consumer value is increased by the increasing interconnection between the elements of the platform. This is because knowledge begins to circulate throughout the platform system, accumulating new knowledge and stimulating innovation. A kind of synergy is created. This process is shown schematically in Fig. 5;
- created on the basis of external knowledge - the last type is innovations whose source is knowledge created outside the structure of the organisation, and even outside the platform if it is located on one. This type of innovation based on knowledge can be one of the most important, since the amount of knowledge in the world is extremely large and a relatively large part of it can be integrated into one or another organisation, even if the "creator" of the knowledge is located in an extremely distant sector of the market.

Conclusion

The study demonstrated the importance and necessity of studying knowledge-based innovations due to their practical benefits for participants in different market sectors.

Fig. 5. Circulation of knowledge between the participants of the platform



Source: compiled by the authors.

Participants in the qualitative and quantitative research concluded that:

1. Innovative activity is important for the successful operation of an organisation because the presence of innovation implies the creation of competitive advantages.
2. The knowledge management system serves as a good tool for improving the quality of processes in the organisation, and also often has a positive effect on the innovation process due to its tendency to create new knowledge.
3. The relationship between the knowledge management system and the innovation process involves the creation of innovations based on new knowledge - knowledge-based innovations.

In the final part of the thesis, a classification of knowledge-based innovations was proposed in terms of the source of obtaining new knowledge that formed the basis of the created innovation. This classification is one of the possible approaches that can be proposed in the process of studying the issue.

Further research should concern a complete study of the process of creating knowledge-based innovations: their success may require both certain skills and technological support from the organisation. At the end of the study of this theoretical and practical category, it would be appropriate to propose a methodology for implementing knowledge-based innovations, which will be proposed by one of the authors as a dissertation study.

References

Linder N.V. (2021). *Transformation of the innovative behavior of Russian industrial enterprises in the context of the Fourth Industrial Revolution:* dissertation, dr. sci. (econ.), Moscow, Financial University under the Government of the Russian Federation. (In Russ.)

Abernathy W.J., Clark K.B. (1985). Innovation: Mapping the winds of creative destruction. *Research Policy*, 14(1): 3-22.

Afuah A. (2023). Redefining firm boundaries in the face of the internet: Are firms really shrinking? *Academy of Management Review*, 28(1): 34-53.

Ahlskog M., Bruch J., Jackson M. (2017). Knowledge integration in manufacturing technology development. *Journal of Manufacturing Technology Management*, 28(8): 1035-1054.

Botega L.F.D.C., Da Silva J.C. (2020). An artificial intelligence approach to support knowledge management on the selection of creativity and innovation techniques. *Journal of Knowledge Management*, 24(5): 1107-1130.

Chandy R.K., Tellis G.J. (1998). Organizing for radical product innovation: The overlooked role of willingness to cannibalize. *Journal of Marketing Research*, 35(4): 474-487.

Dewar R.D., Dutton J.E. (1986). The adoption of radical and incremental innovations: An empirical analysis. *Management Science*, 32(11): 1422-1433.

Drucker P.F. (1985). *Innovation and entrepreneurship*. New York, Harper & Row Publishers.

Fischer G. (2001). Communities of interest: Learning through the interaction of multiple knowledge systems. In: Proceedings *of the 24th IRIS Conference*. Bergen, Department of Information Science, 1: 1-13.

Frascati Manual (2015). A summary of the Frascati manual. Main definitions and conventions for the measurement of research and experimental development (R&D). OCDE/GD(94)84. http://www.oecd.org/document/6/0,2340,en_2649_34451_33828550_1_1_1_1,00.html.

Garcia R., Calantone R. (2002). A critical look at technological innovation typology and innovativeness terminology: A literature review. *Journal of Product Innovation Management*: 19(2): 110-132.

Hagedorn T.J., Krishnamurty S., Grosse I.R. (2018). A knowledge-based method for innovative design for additive manufacturing supported by modular ontologies. *Journal of Computing and Information Science in Engineering*, 18(2): 021009.

Henderson R.M., Clark K.B. (1990). Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35(1): 9-30.

Liu Q., Wang K., Li Y., Chen C., Li W. (2022). A novel function-structure concept network construction and analysis method for a smart product design system. *Advanced Engineering Informatics*, 51: 101502.

Liu Q., Zhang J., Fang P., Shi Q., Liu X., Li D. (2025). Knowledge management for product innovation design based on dual-layer concept network. *International Journal of Modern Physics*, C: 2442010.

McDermott C.M., O'Connor G.C. (2002). Managing radical innovation: An overview of emergent strategy issues. *Journal of Product Innovation Management*: 19(6): 424-438.

Nonaka I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1): 14-37.

Nonaka I., Nishiguchi T. (2001). *Knowledge emergence: Social, technical, and evolutionary dimensions of knowledge creation*. Oxford, Oxford University Press.

Nonaka I., Takeuchi H. (1995).*The knowledge-creating company*. Oxford, Oxford University Press.

Oslo Manual (2018). The measurement of scientific and technological activities. Proposed guidelines for collecting and interpreting technological innovation data. European Commission. http://www.oecd.org/ dataoecd/35/61/2367580.pdf.

Pedersen C.Ø., Dalum B. (2004). *Incremental versus radical change - The case of the digital North Denmark program*. Paper presented at 10th International Schumpeter Society Conference 2004, 9-12 Juni. Milano, Bocconi University.

Polanyi M. (1967). Sense-giving and sense-reading. *Philosophy*, 42(162): 301-325.

Porter, M. E. (1985). Technology and competitive advantage. *Journal of Business Strategy*, 5(3) 60-78.

Rogers E.M., Williams D. (1983). *Diffusion of innovations*. Glencoe, IL, The Free Press.

Tushman M.L., Anderson, P., & O'Reilly, C. (1997). Technology cycles innovation streams and ambidextrous organisations. In: *Managing strategic innovation and change: A collection of readings*. New York, Oxford University Press.

Urabe K. (1988). Innovation and the Japanese management system. In: Urabe K., Child J., Kagono T. (eds.). *Innovation and management international comparisons*. Berlin, Walter de Gruyter.

Utterback J.M. (1994). One point of view: Radical innovation and corporate regeneration. *Research-Technology Management*, 37(4): 10.

Yang J., Quan H., Zeng Y. (2022). Knowledge: The good, the bad, and the ways for designer creativity. *Journal of Engineering Design*, 33(12): 945-968.

Zack M. (1998). *What knowledge-problems can information technology help to solve?* AMCIS 1998 Proceedings, 216.

Zhang C., Kordestani H., Shadabfar M. (2023). A combined review of vibration control strategies for high-speed trains and railway infrastructures: Challenges and solutions. *Journal of Low Frequency Noise, Vibration and Active Control*, 42(1): 272-291.

About the authors

Natalia V. Linder
Doctor of economic sciences, professor, professor of the Department of Strategic and Innovative Development, Faculty of Higher School of Management, Financial University under the Government of the Russian Federation (Moscow, Russia); head of the Marketing Department of Goznak JSC (Moscow, Russia). ORCID: 0000-0002-4724-2344.
Research interests: strategy and development management companies, formation of development strategy of industrial companies in the context of the fourth industrial revolution, innovation transformation of business models, dynamics and development of e-business development strategies of companies in the energy sector in the fourth industrial revolution, exit strategies of Russian companies on international markets.
NVLinder@fa.ru

Pavel D. Serezhin
Scientific assistant, Financial University under the Government of the Russian Federation (Moscow, Russia); general director, 'Boutique Hotel' LLC (Moscow, Russia).
Research interests: the introduction of innovations and their impact on the efficiency of companies, the activities of small and medium-sized businesses, knowledge-based innovations, their typology, knowledge management in organisations.
pserezhin@mail.ru

作者信息

Natalia V. Linder
经济学博士、教授、战略与创新发展系教授, 高等管理学院, 俄罗斯联邦政府国立财政金融大学(俄罗斯，莫斯科); 'Goznak' 有限公司的营销部负责人(俄罗斯，莫斯科). ORCID: 0000-0002-4724-2344.
科学兴趣领域: 公司发展战略与管理、第四次工业革命条件下工业公司发展战略的制定、商业模式的创新与转型、电子商务的动态与发展、第四次工业革命条件下能源行业公司的发展战略、俄罗斯公司进入国际市场的战略。
NVLinder@fa.ru

Pavel D. Serezhin
研究实习生, 俄罗斯联邦政府国立财政金融大学 (俄罗斯，莫斯科); 'Boutique Hotel' 有限公司的总经理(俄罗斯，莫斯科)。
科学兴趣领域: 创新的引入及其对公司业绩的影响、中小型企业的活动、以知识为基础的创新、创新类型、组织中的知识管理。
pserezhin@mail.ru

The article was submitted on 10.01.2025; revised on 11.02.2025 and accepted for publication on 20.02.2025. The authors read and approved the final version of the manuscript.
文章于 10.01.2025 提交给编辑。文章于 11.02.2025 已审稿。之后于 20.02.2025 接受发表。作者已经阅读并批准了手稿的最终版本。