

## KNOWLEDGE MANAGEMENT IN NEW PRODUCT INTRODUCTION BEFORE AND DURING THE SARS-COV-2 PANDEMIC

Natalia WILEŃSKA<sup>1\*</sup>, Paula TWARDOWSKA<sup>2</sup>

<sup>1</sup> Interdisciplinary Doctoral School of Lodz University of Technology; natalia.wilenska@dokt.p.lodz.pl, ORCID: 0000-0003-4926-638X

<sup>2</sup> Interdisciplinary Doctoral School of Lodz University of Technology; paula.twardowska@dokt.p.lodz.pl, ORCID: 0000-0003-3572-4802

\* Correspondence author

**Purpose:** The purpose of this research is to assess the importance and difficulty of particular knowledge management processes in the NPI before and during the SARS-CoV-2 pandemic. The focus of interest are the issues of knowledge flow in the organization, concerning creation and exchange of knowledge and the relationship between knowledge management practices and the creation and introduction of new knowledge in NPI.

**Design/methodology/approach:** The methodology is based on structured individual interviews that were conducted with 12 employees of companies involved in NPI processes. This format allows for better understanding and assessment of KM processes and reasons for change. The interviewees were inquired directly about the importance and difficulty of the KM processes.

**Findings:** The results have confirmed the crucial role of Knowledge Management in NPI. The processes of knowledge sharing and knowledge application are of greatest importance. The pandemic has affected knowledge flow processes; however, the perceived importance of individual KM processes during pandemic has not changed significantly, yet coding and knowledge-sharing processes require more attention.

**Research limitations/implications:** Results may not reflect the entire NPI field due to limited number of interviewed companies. It is advisable to carry out research that will take into account the division into different areas of companies' activities and analyze other processes of knowledge management.

**Practical implications:** The results are useful for adjusting by enterprises the KM processes to meet the changing conditions during NPIs, especially in the context of remote working.

**Social implications:** By adapting the KM in NPI to the presented current circumstances companies may improve not only the business outcomes, but also the well-being of employees, as a results of decreasing their stress connected with inadequacy of work processes to the real requirements.

**Originality/value:** Based on quality research, the article shows trends emerging in the KM during the NPI, which are useful for companies that run New Product Introductions, as well as for researchers by providing a starting point for further research.

**Keywords:** knowledge management (KM), new product introduction (NPI), new product development (NPD), SARS-CoV-2 pandemic, quality research.

**Category of the paper:** research paper.

## 1. Introduction

Knowledge management (KM) refers both to a business practice and to a theoretical field of study. In the last 20-30 years, a number of researchers in management field have focused on knowledge management (e.g. Nonaka, Takeuchi, 1995, Probst et al., 2002, Jemielniak, Koźmiński, 2008), many of them in the context of knowledge management in Research and Development (R&D) projects (Szczepaniak, 2016; Kerssens-Van Drongelen et al., 1996) and in the New Product Development (NPD) process (Cantamessa, Montagna, 2016; Subramaniam, 2006).

However, very few studies have focused on the knowledge management in the New Product Introduction (NPI) component of projects, despite its great importance to the success of companies bringing new products to the market (Damanpour, 1991; Subramaniam, 2006).

The aim of this study is to evaluate the importance and difficulty of particular knowledge management processes in the New Product Introduction before and during the SARS-CoV-2 pandemic. This area deserves research especially because it is often at the NPI stage of the project that the knowledge management process needs to be adjusted and different elements emphasized than during the development of the product being introduced. This issue is of particular interest in the context of pandemic changing ways of working and collaboration of teams involved in knowledge management and NPI processes, mainly in technology companies.

For this purpose, an empirical study was conducted among companies dealing with NPI, to answer the following research questions:

1. What are the assessments (in terms of importance and difficulty) of the key processes of knowledge management affecting NPI before and during the pandemic?
2. Which of these KM processes have gained in importance or difficulty, which have lost, and which have remained the same?
3. What are the reasons for the changes?

This article focuses on the issues of knowledge flow in the organization, notably on exchanging and creating the knowledge and the relationship between knowledge management practices and the creation and application of new knowledge in NPI. It is crucial to determine how persistently the company uses internal knowledge in new product launches.

The structure of the article includes a systematic review of the literature in the area of knowledge management in the NPI process, the methodology of research, its results and a discussion with recommendations for the use of its findings.

## 2. Theoretical background

KM can be defined as *an effort to increase useful knowledge within the organization. Ways to do this include encouraging communication, offering opportunities to learn, and promoting the sharing of appropriate knowledge artifacts* (McInerney, 2002, p. 1014) or – in a more process-oriented perspective – as *the process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets and to develop new opportunities* (Quintas et al., 1997, p. 387).

Some of the most significant researchers in the knowledge management field (Nonaka, Takeuchi, 1995), make a distinction between tacit and explicit knowledge. Tacit knowledge is based on experience and is difficult (or even impossible) to communicate. Explicit knowledge, on the other hand, is knowledge that can be verbalized, coded, and communicated, so it can be easily shared. There is a process of transforming tacit knowledge into explicit knowledge (Nonaka, Takeuchi, 1995). In fact, the concept of knowledge management is most often viewed as a process perspective. Thus (despite the lack of a unified vocabulary), the terms "KM processes" or – usually more detailed – "KM elements" are most often used.

Classically, knowledge management processes have been defined as follows: locating, acquiring, developing, sharing and disseminating, using and keeping knowledge (Probst et al., 2002). However, Abubakar (2019) defined six knowledge management processes:

- Knowledge creation process includes an organization's ability to formulate knowledge into its services, products, and systems.
- Knowledge capture process is the process of replacing existing knowledge, with newly acquired knowledge.
- Knowledge organization process is related to the process of structuring and sharing knowledge.
- Knowledge storage process is a mechanism to store and retrieve knowledge as needed.
- Knowledge dissemination process refers to the transfer of knowledge between entities.
- Knowledge application process involves using it in action, problem solving, linking, etc.

Park & Kim (2006), based on the conducted literature review, suggest the list of major knowledge activities consisting of five elements: acquisition, organization, utilization, disposition, sharing. Relating to the activities, they propose more detailed knowledge management functions or tools: knowledge portal, document management system, information retrieval system, workflow management system, collaborative system and analysis system (Park, Kim, 2006).

It is advisable to use these different perspectives when considering the importance of individual elements of the knowledge management process. They may be developed and refined depending on the nature of the project and the characteristics of the analysis, as in Szczepaniak (2016).

The importance of all this KM processes/elements can be evaluated in the NPI stage of the project. Knowledge management methods need to be selected and evaluated depending on the purpose for which knowledge is “being managed” (Hoegl, Schulze, 2005).

It is well documented in the literature of the topic that introduction of new products and services is a critical determinant of organizational performance and survival (Damanpour, 1991). Because NPI is one of the main sources of competitive advantage for businesses, the NPI process has to be clearly described and followed by the engaged people. Models are a useful aid to communication and understanding when studying a process. Over three decades of research provide notable insights on how organizations structure and procedurally manage their new product introduction processes. There are various NPI models, the most common of which are: Departmental-stage models, Activity-stage models, and Decision-stage models (Saren, 1984).

The Departmental-stage models are the oldest and are characterised by the ‘functional’, ‘sequential’ and ‘over the wall’ approach for NPI. The focus is on the functions that are responsible to carry out each stage (Kennedy et al., 2003). The Activity-stage models of NPI offer a better view of the process since they focus on the activities that are carried out. Activity-stage models and their extension, decision-stage models, are the models that have been most rigorously investigated and used. Booz, Allen and Hamilton (Booz, Allen, Hamilton., 1982) described one of the first examples of activity-stage model. The Decision-stage models have various names in practice: Phased Project Planning, Gating System, Stage-Gate Systems or Phase-Gate Systems etc. Their characteristic is that the process consists of Stages which are always followed by Gates (Cooper, 1994). It is also made obvious that the NPI process is closely related to Project Management. The project leader drives the project from stage to stage, gate to gate (Cooper, 1994).

New product introduction, although it is a difficult process and involves high risk, is likely to turn into huge benefits such as increasing market share, improving sales of existing products to retain customers or the services the company needs to provide to increase financing and to keep its doors open.

The integration of knowledge from multiple sources, while widely regarded as fundamental to new product launches, remains unclear and presents a serious challenge for organizations. A key premise underlying this research is that the effective sourcing, sharing, and assimilation of cross-disciplinary knowledge are essential for new product capabilities. Enhanced knowledge integration exposes itself as product development or introduction opportunities as it directly affects their core attributes: consistency, frequency, simultaneous market introduction and market success (Subramaniam, 2006).

There are solid approaches to the NPI advanced in the literature, which showing the necessity of understanding the complexity of and communication linkages in the process and departments engaged in the process itself. Authors such as Bergen (1988) Langowitz (1989), Voss & Winch (1996) defined launching of new products as cross-functional coordination and collaboration between various departments pointing out marketing, NPD, and production. Further, Knudsen (Knudsen, 2007) and Ryall (Ryall, 2013) extended this definition as inter-organizational collaborative arrangements, i.e. collaboration with customers, suppliers and even competitors, as they allow companies to develop products faster and offer greater product variety. Cantamessa & Montagna (2016) provided the opinion that NPD process of a company is often described in an analytic model for an innovation process. NPD is a business process that a company performs to deliver innovation to the market.

The above definitions of introducing new products to the market have been found in the literature of product and project management. Comparing one definition with another, it can be seen that they examine interdisciplinary activities, relations between departments or even companies and close cooperation within several departments.

Knowledge integration in these kind of approaches is the cornerstone of successful new product launches (Subramaniam, 2006). In such a process, knowledge can enter from various sources. Every effort to add value is welcomed. Self-engagement and willingness to acquire exchange and re-apply knowledge is becoming crucial capability at the individual and organizational level. Creating an environment that allows a smooth transition and replacement of skilled workers is one strategy that can provide a competitive advantage to a company by creating a continuous knowledge exchange, building and strengthening the knowledge base, and reducing the risk of knowledge loss in employee turnover. The development of a knowledge management framework for an enterprise on the continuous development of both individual and enterprise knowledge is associated with the successful implementation of a new product (Pendevska, Poposka, 2020).

To identify the gap, the present study uses a systematic literature review to investigate the factors that influence knowledge management when introducing new products to the market. The systematic literature review was selected in order to conduct a higher quality, more comprehensive, extensive, and unbiased literature review. This is a clearly defined method for identifying, selecting, validating and incorporating information from the literature to be clear, transparent, recordable and reproducible. Snyder (2019) advocates that this systematic review should focus on a specific research questions and evaluate quantitative articles in terms of policy and practice. The systematic review approach is widely used by researchers (e.g., Petticrew, Roberts, 2008; Tranfield, Denyer, Smart et al., 2003).

At the initial stage, keywords and term identification are conducted to facilitate data extraction. This stage is based on key terms related to factors influencing knowledge management and new product introduction. The researchers used the following keywords to guide searches on the databases: knowledge management, new product introduction, NPI,

new product launch, new product development. The goal was to use the fewest number of concepts as possible to maintain a manageable set of results in the keyword searches. Journal articles, research studies and books were reviewed.

The review of the available literature has been performed in April 2022 in the EBSCOhost database, which includes the following databases: Academic Search Ultimate, Business Source Ultimate, Masterfile Premier, Newspaper Source, Open Dissertations, Regional Business News, Teacher Reference Center, Master FILE Reference eBook Collection. The search strategy was as follow, a table was created listing the keywords listed in each study; and as new keywords were found, the search strategy was revised using those terms. The search was rerun and documented taking into consideration only full text articles. The goal was to create an optimal search strategy to obtain useful literature citations. This process was performed for each article found based on an abstract search method. Therefore, this work represented a comprehensive systematic literature review of selected empirical studies.

Table 1 shows the combinations of keywords that were deemed of primary importance from the standpoint of this study. The first conclusion that can be drawn is that those combinations yielded a more concise list of publications related to the main research topic. Combination of two main definitions of this study, so the knowledge management and new product introduction (NPI) new product launch show that number of publications appears to be rather limited, and therefore this issue is worthy of further consideration. On the other hand, the knowledge management approach seems to be widely discussed in the literature on the subject in the area of new product development. In addition, new product development (NPD) is complex and is becoming more so. It depends on testing various new product ideas and settling on the possible best option. As a result, the problems we are dealing with in this study can be perceived in many ways as new.

**Table 1.**

*Selection criteria for literature review*

<b>Selection criteria (in abstract)</b>	<b>Number of identified articles</b>
<b>Knowledge management AND New product introduction</b>	12
<b>Knowledge management AND NPI</b>	1
<b>Knowledge management AND New product launch</b>	9
<b>Unique articles</b>	20
<b>After an abstract verification</b>	7

Source: Authors' own work based on a database search.

The results of the search performed were reviewed. The first review was based on abstract verification and the total number of articles, which are included in the further literature review, equalled 7. The criteria, for excluding the rest of the identified sources, is based on research main subject (knowledge management in new product introduction during and after pandemic (COVID-19) and research questions. The number of similar studies is limited because of the pandemic recent event.

In addition, systematic literature review shows a research gap in combining knowledge management and NPI areas, but existing articles indicate that this is a field possible to research. It is required to reference the literature from the KM and NPI areas separately and combine them into a new perspective.

Moreover, this study directly assess the influence of the COVID-19 pandemic on managing knowledge in case of new product launches. The data for the study was gathered during the pandemic period, as such, the results of this present study could offer some practical clues on how firms could achieve competitive advantage during the outbreak of pandemics.

The most important conclusions from the selected articles highlight the rate of new product and service introduction is strongly connected with the organization members' ability to combine and exchange knowledge (Smith, Collins, Clark, 2005) and there is a need for sharing various types of knowledge on different business levels (Herder, Veeneman, Buitenbuis, Schaller, 2003). The authors focus on the importance of knowledge management factors and practices to show how the companies depend on the knowledge management system in enhancing NPD performance (Inganäs, Hacklin, Plüss, Marxt, 2006).

Based on the theory of knowledge management, the authors present a conceptual framework that synthesizes various random factors. The analysis reveals that involving customers in the ideation and launch stages of NPD and KM improves product performance directly as well as indirectly through acceleration of time to market (Chang, Taylor, 2016).

Another study (Valentim, Lisboa, Franco, 2016) aims to identify and categorize knowledge management practices, which companies can adopt to develop absorptive capacity. The authors concluded that companies engage in knowledge management practices by collaborating with business partners, favoring experience-based learning processes, knowledge transfer to employees, and knowledge absorption by employees, which helps them to increase efficiency, strategically adapt and introduce new products and services, It is important to investigate how a companies' achievement of new product introduction is related to the adoption and knowledge management experience sharing within a company and with customers/suppliers (Intalar, Jeenanunta, Rittippant, Chongphaisal, Komolavanij, 2018).

In the face of challenges related to reacting to the novelties of the changing business environment (e.g. new customer requirements, changes in customer tastes and preferences, the introduction of new products or services by competitors), organizations try to build cooperation among their employees who have complementary knowledge. The integration of complementary knowledge increases the ability of employees to cope with environmental challenges and foster innovation (Acharya, 2016).

The following knowledge management processes were identified as the most important in the selected literature:

1. Knowledge absorption/acquisition.
2. Knowledge integration and coding.
3. Knowledge transfer/sharing.

4. Knowledge creation.
5. Knowledge application/usage.

### **3. Research Methodology**

Structured individual interviews were conducted with employees involved in NPI processes. An interview format was chosen to understand better assessments of KM processes and reasons for change, as well as possible connections between different aspects of the processes studied. The purpose of the interviews is to evaluate the different processes involved in knowledge management during the New Product Introduction process. Specifically, the processes of knowledge absorption/acquisition, knowledge integration and coding, knowledge transfer/sharing, knowledge creation, and knowledge application/usage during the NPI process were analyzed. The assessment focus is on how important these processes were/are and which were/are the most challenging before and during the SARS-CoV-2 pandemic. The interview also aims to identify reasons for changes.

Taking into account the issues identified in the subject literature, direct questions were asked about the importance of the aforementioned five KM processes (which were discussed in the articles identified in the systematic literature review), with a possibility of coverage of other KM processes considered important by the respondent, and additionally, about the overall significance and benefits of knowledge management during the NPI, as well as about the most challenging KM processes during the NPI.

Interviews were recorded to analyze responses accurately and avoid mistakes, as well as to use exact quotes if needed. Respondents were assured of anonymity and that their statements would not be linked to personal data; after which they consented to the recording of the interview. Respondents were also informed about the objectives of the study.

The interview included 9 questions (some of which consisted of sub-questions) and lasted approximately 25 minutes. The interviews were conducted by the authors of the paper in 2022, with 12 employees of Polish companies involved in NPI, by phone, at a time convenient for the respondent.

### **4. Research Results and Discussion**

All respondents confirmed the fundamental importance of Knowledge Management, both in the New Product Development process in general, and in particular in the New Product Introduction process:



*Knowledge management is very important in a general sense, because it allows to document and consolidate processes, but it also allows to go back to a given body of knowledge to use it, to develop it, to improve it.*

*Without knowledge management various problems come out at the NPI stage and you have to go back to earlier stages – which causes the company's loss.*

*The essence and benefit of knowledge management in the NPI process is to confirm if the product is really desirable by the market or if the producer just wants it to be.*

However, respondents varied in their ratings of the importance and difficulty of specific KM processes and the impact of the pandemic. These differences were primarily in evaluations of the integration/coding and knowledge transfer/sharing processes and were due – at least partially – to respondents' different experiences: representatives from companies that had not practiced remote working prior to the pandemic indicated a greater impact of the pandemic than representatives from companies that had already developed mechanisms for effective remote coding and knowledge sharing.

The knowledge acquisition process was typically rated as less important in the NPI stage. Although the process is not insignificant (e.g., gathering information from customers is still important), it was pointed out that the importance of this process is much greater in the initial stages of New Product Development, than in the NPI stage (which is the final element of the broader NPD process). However, some respondents claim that this is a key process in NPI, yet it was understood by these individuals as a process of acquiring knowledge only about customer requirements for the final product design (so it involved a limited range of knowledge):

*[Knowledge acquisition in NPI] is very important because it allows us to both gather and confront knowledge – to come to a situation where our understanding of the product and the customer is better, so it allows us to eliminate problems in product introduction.*

The pandemic did not affect the perceived importance of the process, although made it more difficult:

*Knowledge acquisition is equally important (...). [The pandemic] forced us to rebuild different working models (...) and to intensify the search for knowledge.*

During the pandemic, it was possible to notice a variety of activities supporting effective knowledge management, carried out with the use of modern forms of communication:

*Knowledge transfer became particularly important during the pandemic, when employees operate in a dispersed position. Under these conditions, traditional methods of knowledge management have lost their purpose. The tools used to obtain knowledge have changed. In a situation where everyone worked remotely, people initially encountered difficulties with the exchange of information. quick and efficient adaptation of the process of acquiring knowledge to new conditions and limitations during a pandemic.*

It was typical for people with the experience of NPI process in pre-pandemic times to assess the impact of the pandemic on the effectiveness of communication and knowledge transfer in the process:

*The importance of awareness and knowledge to the NPI process has increased over the course of the pandemic. This was due to the possibility of longer conversations, faster contact with the co-worker (teleconferences) as well as recognition by all team members and sub-teams that understanding the other party and obtaining this knowledge may result in improved communication and avoiding errors and misalignments during the NPI process.*

Knowledge integration and coding was not rated as particularly important in NPI. This process is generally treated subordinately to other KM processes, and in small teams the flow of knowledge is often so smooth and easy that knowledge integration and coding procedures are not necessary. Nevertheless, this process is not considered completely unimportant, because:

*If we encode knowledge, we can go back to it, use it, improve it.*

It was also pointed out that during the pandemic the encoding of knowledge became more important:

*The process advanced (...) [due to] the readiness that at any time our colleague can get affected by Covid and 'fall out of loop', hence the importance of integration and coding of knowledge increased,*

and also because of its more difficult flow:

*Contacts have loosened up, there are no personal meetings, thus knowledge needs to be transmitted in a more structured way – in coded form indeed.*

In this case, the evaluation of the importance of the process was linked to the evaluation of its difficulty.

It is extremely important to develop knowledge in the company based on experience and successful implementations in a past. If the process of knowledge coding advances along with the development of technology, the method of obtaining information will be easily digestible and accessible to users:

*When applying the codification strategy, the enterprise relies on explicit knowledge. Therefore, employees use the knowledge previously developed in the company and are encouraged to supplement it with their own observations and experiences gained during the implementation of projects. Assuming above, the pandemic and remote work did not have a negative impact on the process of integrating and coding knowledge.*

The use of modern technologies makes it possible to reach a wider group of people involved in the process, including participating in virtual space, e.g. conducting remote meetings or using platforms that enable tracking the current implementation status. NPI's virtual space has become much more popular, mainly during the pandemic, when companies started using online platforms to share data with customers:

*During the pandemic, this process was carried out online, remotely and developed in this direction to a greater extent. It is just as important as before and after the pandemic, only in an altered form.*

*Knowledge transfer is largely virtual, but the pandemic had a certain impact on the process, mainly due to communication difficulties, i.e. the inability to conduct a "quick" meeting in the office to discuss current topics related to the NPI project. The process of sharing knowledge is very important in NPI processes. Incorrect information provided in the initial phase of implementation may cause a snowball effect and have a very large impact on the success of the entire project.*

Knowledge transfer/sharing is a process that is important at every stage of a project, including NPI. The pandemic made the process more difficult, due to limited opportunities for in-person meetings among team members and impeded communication:

*With in-person meetings, you could immediately deduct whether someone has or hasn't understood; and with online meetings: whether with cameras or even without cameras, you aren't really even sure if anyone was listening.*

*The risk of misunderstandings and errors in this process increased.*

Nevertheless, its importance in the assessment of almost all respondents has not changed: it is perceived as very important both before and during the pandemic.

The importance of this process in NPI was rated differently by various respondents. This indicates differences in the perception of the importance of this process in NPI. Some respondents assessed it as crucial for NPI, while others indicated that, as in the case of the knowledge acquisition process, at the NPI stage it is "too late" to create new knowledge, as this process should mainly take place at earlier NPD stages:

*[in NPI] we already have a product and we only refine it, while we do not create new functionalities anymore,*

whereas NPI is a project stage where it is much more important to use the created knowledge effectively. Knowledge creation, however, has become somewhat more important in a pandemic:

*Before the pandemic we had processes already working, and during the pandemic some became obsolete and new ones had to be created, so the importance of knowledge creation increased.*

The perceived difficulty of the process did not change.

Due to the imposed communication restrictions, team representatives could continue their activities in the area of NPI, bearing in mind the proper allocation of knowledge about the risks and threats caused by the pandemic:

*During the pandemic, when we usually deal with new threats, it is very important to conduct rapid and thorough research in order to build knowledge about the threat and eliminate it as quickly as possible or at least reduce the risk of the threat.*

However, in terms of the creation knowledge during NPI process, it was always very crucial to document and save all of details required for the successful execution of the process. The same approach is applied for all of the changes appeared during the NPI process. It is a very complex and dynamic process, where each change can be significant for a successful implementation. Therefore, it is necessary to track the changes on a regular basis and make sure they are documented and well known to the team:

*Knowledge creation in the NPI process is particularly important in the initial phase of a project. It is the basis for further stages of the implementation process. Correct data allows for the timely and, above all, effective introduction of products to production. The pandemic did not affect the relevance of this process.*

All respondents agree that this is a crucial process in NPI:

*It is one of those key processes that can determine the success or failure of the product being implemented.*

*The application of knowledge in the context of new product introductions is critical and this has not changed at the time of the pandemic,*

and all of the discussed processes are used to ensure that knowledge is applied effectively in the NPI stage:

*That's what all those previous processes were for: to use that knowledge – that's what we did those activities and actions for: to implement the knowledge.*

As in the case of the knowledge creation process – the pandemic is unlikely to have had a significant impact on the difficulty of this process, but the knowledge application/usage is generally seen as the most important in the NPI, as well as being a significant challenge.

It can also be pointed out that the pandemic has further emphasized the importance of using knowledge that is passed on from reliable sources:

*It seems to me an obvious statement that building supporting processes or improving the existing ones is connected with skillful use of knowledge gathered from previous implementations and experiences. Without using knowledge, there is no point in building or acquiring knowledge / information if they are only to be archived.*

*The use of knowledge is a positive value in the process, which allows the implementation process to run smoothly and for all users to know exactly the requirements, expectations and the implementation process.*

Respondents' answers confirm and expand on the findings of previous research on the subject. Respondents did not indicate that any other KM processes were of particular importance in NPI, although the general need to evaluate knowledge and to treat knowledge management in an iterative manner was noted. KM cannot be performed in a waterfall way because the knowledge required for new product development and introduction changes dynamically, so its acquisition, integration, etc., should be performed continuously with special attention to its quality and completeness:

*For example, people's expectations, their routines, some habits before the pandemic were different than after, so iteration helps to verify whether a product is still desirable in the market, whether some things happened that made people no longer need it or would like to use it differently.*

As indicated above: during the pandemic increased especially the difficulty of knowledge sharing and the process is perceived as one of the most difficult now. The second is creating new knowledge. In most cases, it concerns the early phase of the implementation process. This is the first stage on which further processes are built. Without it, they cannot work properly.

*These are the most difficult processes, because the research needed to create knowledge, it is very complicated and takes time, often the results of research are ambiguous, which further complicates the creation of knowledge. In acquiring both new and existing knowledge, there is always a risk that the knowledge is not entirely true or has been gathered from unconfirmed sources. A perfect example is the internet, where virtually anyone can post information.*

Concerning the processes that were perceived to be the most difficult before the pandemic, most respondents had difficulty identifying the processes that were previously the most challenging. One respondent provided the following explanation, which seems to accurately explain this fact:

*Before the pandemic we had already developed and tested procedures for everything; we were already used to a certain way of working and the methods were known.*

## **5. Conclusions**

KM is an extremely important aspect of NPI, as well as – more broadly – NPD. Effective knowledge management enables effective introduction of new products that truly address customers' needs.

The pandemic has affected many aspects of work, changing knowledge flow processes in many companies. Industries such as IT that had previously adjusted to remote working were less affected by these changes, but every company had to adapt to the new conditions, including increased emphasis on knowledge security in general (Wisniewska, Wisniewski, 2019). In particular, coding and knowledge-sharing processes require more attention. However, the perceived importance of individual KM processes has not changed significantly. In NPI the processes of knowledge sharing and knowledge application are of greatest importance, so that an introduced product meets the customers' needs. Knowledge management, on the other hand, should be continuous and the various processes systematically iterated, as this helps to ensure high product quality and adapt to dynamic changes.

This article would be helpful for researchers in the field of knowledge management and the NPI process, as well as for companies whose activities include New Product Introductions – especially if the process involves a complex team collaborating remotely. However, the limitations of the study should be mentioned. Research was conducted on a sample of 12 employees from Polish companies, so the results may not reflect the entire NPI area. In particular, it is advisable to carry out research that will take into account the division into different areas of companies' activities, as the described assessments by representatives of different industries differed from each other. It would also be advisable to analyze other processes of knowledge management, such as knowledge protection, as this study focused only on the processes most frequently discussed in the existing literature on the subject; however, given the dynamics of change in recent years and the increasingly rapid development of areas related to innovation, it is possible that processes that were of marginal importance before (and therefore not addressed in this analysis) are becoming more important over time and worthy of more detailed examination.

## Acknowledgements

This article has been completed while the authors were the Doctoral Candidates in the Interdisciplinary Doctoral School at the Lodz University of Technology, Poland.

## References

1. Abubakar, A.M., Elrehail, H., Alatailat, M.A., Elçi, A. (2019). Knowledge management, decision-making style and organizational performance. *Journal of Innovation and Knowledge*, 4(2), 104-114. <https://doi.org/10.1016/J.JIK.2017.07.003>
2. Acharya, C. (2016). *Cooperative Strategy and Sources of Knowledge Integration Capability and Innovation: A Relational View*. Toulouse Graduate School.
3. Bergen, S.A., McLaughlin, C.P. (1988). The R&D/Production Interface: A Four-country Comparison. *International Journal of Operations & Production Management*, 8(7), 5-13. <https://doi.org/10.1108/EB054844>
4. Booz, Allen, Hamilton (1982). *New products management for the 1980s*. Booz, Allen & Hamilton.
5. Cantamessa, M., Montagna, F. (2016). Technological Knowledge and Organizational Learning. *Management of Innovation and Product Development*, 17-29. [https://doi.org/10.1007/978-1-4471-6723-5\\_2](https://doi.org/10.1007/978-1-4471-6723-5_2)

6. Chang, W., Taylor, S.A. (2016). The Effectiveness of Customer Participation in New Product Development: A Meta-Analysis: *Journal of Marketing*, 80(1), 47-64. <https://doi.org/10.1509/JM.14.0057>
7. Cooper, R.G. (1994). Third-Generation New Product Processes. *Journal of Product Innovation Management*, 11(1), 3-14. <https://doi.org/10.1111/1540-5885.1110003>
8. Damanpour, F. (1991). Organizational Innovation: A Meta-Analysis Of Effects Of Determinants and Moderators. *Academy of Management Journal*, 34(3), 555-590. <https://doi.org/10.5465/256406>
9. Herder, P.M., Veeneman, W.W., Buitenbuis, M.D.J., Schaller, A. (2003). Follow the rainbow: A knowledge management framework for new product introduction. *Journal of Knowledge Management*, 7(3), 105-115.
10. Hoegl, M., Schulze, A. (2005). How to support knowledge creation in new product development: An investigation of knowledge management methods. *European Management Journal*, 23(3), 263-273. <https://doi.org/10.1016/j.emj.2005.04.004>
11. Inganäs, M., Hacklin, F., Plüss, A., & Marxt, C. (2006). Knowledge management with focus on the innovation process in collaborative networking companies. *International Journal of Networking and Virtual Organisations*, 3(3), 283-298. <https://doi.org/10.1504/IJNVO.2006.010952>
12. Intalar, N., Jeenanunta, C., Rittippant, N., Chongphaisal, P., Komolavanij, S. (2018). The role of quality control circles on new product development: A case study of Thailand. *Quality Management Journal*, 25(3), 129-141. <https://doi.org/10.1080/10686967.2018.1474676>
13. Jemielniak, D., Koźmiński, A.K. (Eds.) (2008). *Zarządzanie wiedzą*. Wydawnictwa Akademickie i Profesjonalne.
14. Kennedy, K.N., Goolsby, J.R., Arnould, E.J. (2003). Implementing a Customer Orientation: Extension of Theory and Application. *Journal of Marketing*, 67, 67-81.
15. Kerssens-Van Drongelen, I. C., de Weerd-Nederhof, P. C., & Fisscher, O. A. M. (1996). Describing the issues of knowledge management in R&D: towards a communication and analysis tool. *R&D Management*, 26(3), 213-230. <https://doi.org/10.1111/J.1467-9310.1996.TB00957.X>
16. Knudsen, M.P. (2007). The Relative Importance of Interfirm Relationships and Knowledge Transfer for New Product Development Success. *Journal of Product Innovation Management*, 24(2), 117-138. <https://doi.org/10.1111/J.1540-5885.2007.00238.X>
17. Langowitz, N.S. (1989). Managing new product design and factory fit. *Business Horizons*, 32(3), 76-79. [https://doi.org/10.1016/0007-6813\(89\)90013-X](https://doi.org/10.1016/0007-6813(89)90013-X)
18. McInerney, C. (2002). Knowledge Management and the Dynamic Nature of Knowledge. *Journal of the American Society for Information Science and Technology*, 53(12), 1009-1018. <https://doi.org/10.1002/asi.10109>

19. Nonaka, I., Takeuchi, H. (1995). The knowledge-creating company: How Japanese companies create the dynamics of innovation. *Harvard Business Review, Issue November-December*. Oxford University Press.
20. Park, Y., Kim, S. (2006). Knowledge management system for fourth generation R&D: Knowvation. *Technovation, 26*(5-6), 595-602. <https://doi.org/10.1016/J.TECHNOVATION.2004.10.008>
21. Pendevska, M., Poposka, K. (2020). Selected Knowledge Management Practices and Result in Innovation Activities Cycle in Enterprises. *Economic Development, 1-2*, 105-118.
22. Petticrew, M., Roberts, H. (2008). Systematic Reviews in the Social Sciences: A Practical Guide. *Systematic Reviews in the Social Sciences: A Practical Guide*, 1-336. <https://doi.org/10.1002/9780470754887>
23. Probst, G., Raub, S., Romhardt, K. (2002). *Zarządzanie wiedzą w organizacji*. Oficyna Ekonomiczna.
24. Quintas, P., Lefrere, P., Jones, G. (1997). Knowledge management: A strategic agenda. *Long Range Planning, 30*(3), 385-391. [https://doi.org/10.1016/S0024-6301\(97\)90252-1](https://doi.org/10.1016/S0024-6301(97)90252-1)
25. Ryall, M.D. (2013). The New Dynamics of Competition. *Harvard Business Review, 91*(6), 80-87.
26. Saren, M.A. (1984). A classification and review of models of the intra-firm innovation process. *R&D Management, 14*(1), 11-24. <https://doi.org/10.1111/J.1467-9310.1984.TB00504.X>
27. Smith, K.G., Collins, C.J., Clark, K.D. (2005). Existing knowledge, knowledge creation capability, and the rate of new product introduction in high-technology firms. *Academy of Management Journal, 48*(2), 346-357.
28. Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333-339. <https://doi.org/10.1016/J.JBUSRES.2019.07.039>
29. Subramaniam, M. (2006). Integrating cross-border knowledge for transnational new product development. *Journal of Product Innovation Management, 23*(6), 541-555. <https://doi.org/10.1111/J.1540-5885.2006.00223.X>
30. Szczepaniak, P. (2016). Procesy zarządzania wiedzą w projektach badawczo rozwojowych. *Studia Ekonomiczne, 278*, 30-41.
31. Tranfield, D., Denyer, D., Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management, 14*(3), 207-222. <https://doi.org/10.1111/1467-8551.00375>
32. Valentim, L., Lisboa, J.V., Franco, M. (2016). Knowledge management practices and absorptive capacity in small and medium-sized enterprises: is there really a linkage? *R&D Management, 46*(4), 711-725. <https://doi.org/10.1111/RADM.12108>



33. Wisniewska, M., Wisniewski, Z. (2019). *The relationship between knowledge security and the propagation of innovation. Advances in Human Factors, Business Management and Society*. Proceedings of the AHFE 2018 International Conference on Human Factors, Business Management and Society, July 21-25, 2018 (pp. 176-184). Loews Sapphire Falls Resort at Universal Studios, Orlando, Florida, USA: Springer International Publishing.
34. Voss, C.A., Winch, G.M. (1996). Including engineering in operations strategy. *Production and Operations Management*, 5(1), 78-90. <https://doi.org/10.1111/J.1937-5956.1996.TB00386.X>.