

**THESES OF THE DOCTORAL (PhD) DISSERTATION**  
**IMPROVEMENT OF SUPPLY CHAIN PROCUREMENT AND**  
**REQUEST FOR QUOTATION IN THE REFLECTION OF**  
**HUNGARIAN INDUSTRIAL COMPANIES**

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# **1. BACKGROUND, OBJECTIVES AND PRESENTATION OF THE RESEARCH HYPOTHESES**

The choice of the topic of the dissertation and its subsequent preparation were inspired by my experience in a multinational environment. The competition for profit in the industrial company segment is increasing day by day.

The struggle on the market is becoming more and more fierce, and it is easier for those organizations and companies that manage resources efficiently and can keep up with technological and technical development to prevail on the market. (CHIKÁN 2008).

Companies are looking for opportunities and methods to compete with the requirements of continuous renewal and development. In the corporate sphere, conditions have changed significantly in the past period, globalization, product diversification and the constantly changing environment foreshadow the need for a paradigm shift. The almost real-time flow of information and the rapid flow of people, goods and services play a decisive role in their daily lives. Thanks to digitalization and the relationships between economic actors, the increased dependence associated with the production of the product is much greater.

Traditional supply chain strategies and practices are no longer effective and are not sufficient to maintain a position and create additional added value during market competition. (HANDFIELD 2017; MONZKA et al. 2020)

As a result of these factors, the processes were accelerated. Even the smallest time delay can decide whether the process ends in success or failure. Nowadays, the focus is on speed rather than the importance of information. Obtaining the given fact with the help of the Internet is not out of the question, only the speed at which it can be achieved is an advantage for companies. While in the past, companies sent their orders to suppliers by letter, fax or e-mail, nowadays, through the online EDI, company management system, the supplier can see almost in real time the component requirements of the given customer order, to which he can react immediately. With the development of new technologies, the globalized, connected world allows us to do everything we have done so far - only much more efficiently. In the supply chain, the role of the supplier is enhanced, as the quality and traceability of the raw material and semi-finished product from the given supplier is decisive. Closer cooperation with suppliers, joint development and information flow are getting more and more attention. The metrics for the development of procurement processes

are used by the organization to measure the effectiveness and efficiency of the indicators. These indicators help identify areas for improvement and track progress over time. The level of automation of procurement shows the extent to which procurement processes have been improved, for example by using procurement software. Automation can help reduce errors, increase efficiency, and free up staff time for more strategic tasks. Nowadays, the competition for companies is increasing, it is worth seizing every opportunity in order to be able to react more quickly to market changes and to save costs, which cannot be at the expense of quality. In the case of a complex product, the processes within the supply chain include a multitude of processes that are difficult to understand. Based on my experience in the procurement field, I am planning my research focusing on the development of the procurement and request for proposals processes. It can be important for domestic economic operators to be able to keep up with the market. Thanks to innovation and technological changes, the procurement environment is constantly changing, and new raw materials, products and production processes are being formed, which require continuous development.

The knowledge and experience I gained in the field of procurement processes - after my studies at university - were based on my workplaces and my position there as Business Unit Procurement Manager. As a logistics engineer, I gained insight and experience into the processes operating at the company in question, during which I gained more specialized knowledge about the areas and sub-processes that are currently defining and in need of development. The existing information supported me in formulating the mapping of the current state and situation of Hungarian industrial companies as the primary goal of my research work, with special regard to the topic of procurement and request for proposals processes.

As a tool for efficient processes, lean is also present in procurement. By improving the procurement process, organizations can save time, reduce costs, and improve the quality of procured goods and services. (GOSHIME et al. 2019) Key steps are needed to improve the procurement process.

The first consideration is to identify the areas in need of development. A thorough analysis of the current procurement process must be performed, during which the areas in need of development are identified. (IMAI 2022)

## **Research questions and hypotheses**

*Q1: What requirements can be defined as criteria for full or partial automation of the procurement and request for proposals process?*

The basis of my research question was provided by the defined operational criteria (such as price, delivery time) supplemented by the strategic criteria (development potential). (DICKSON 1966, ELLRAM 1990) Procurement forms a new group among supplier selection criteria, which are either measurable or difficult to measure. (SCOTT and WESTBROOK 1991, CHOI and HARTLEY 1996) There is no unified model for supplier selection. (VERMA and PULLMAN1998, JANKER 2004) Low price is important, but it alone is not enough to choose a supplier based on this alone. (GALMOHAMMADI 2007) The comprehensive evaluation of the suppliers' performance is reflected in the establishment of criteria. (MOSMANN 2008) The selection and evaluation of suppliers is a multi-criteria problem that includes both qualitative and quantitative problems. (LIU 2010) Quality played a central role in all cases, but in addition to price and delivery time, the supplier's geographical distance and order frequency also played a prominent role. In certain cases, the procurement and request for proposals process can be handled together. If the company requests an offer from an existing supplier, or requests an offer from a completely new yet unknown supplier.

**H1: The supplier selection criteria of the procurement and request for proposals process can be specifically defined and identified.**

Companies are trying to establish closer relationships with their suppliers and partners in addition to their constantly growing expectations. One of the foundations of this is trust. It is necessary to develop a joint strategy with the supplier in order to learn about the needs and expectations of the final consumer and user. This supports the company's long-term goals of maintaining its competitiveness and making a profit. Thanks to the continuous exchange of information, some actors in the supply chain can react quickly to changes. It is reasonable to examine a sub-hypothesis related to the established hypothesis.

**H1.1: The role and hierarchy of the procurement and request for proposal process criteria varies according to the company form**

*Q2: Do domestic companies take advantage of the potential in procurement and request for proposals processes?*

The question includes an examination of the potential of procurement and request for proposals processes. It is not enough to explore the past and current performance within the framework of the supplier evaluation, but also to infer the future performance potential of the suppliers, such as the changing environmental conditions. (GLANTSCHING 1994, VONDEREMBSE and TRACEY 1999)

The role of several stakeholders and the critical success factor theory in the sustainable supplier selection process. (KANNAN 2018, OLSEN and ELLRAM 1997) Procurement and request for proposals processes can be quite simple or complex depending on the specific product to be procured and the supplier. Identification of multi-channel, alternative suppliers and unreliable suppliers is necessary. (NIU et al, 2019) During my research, the areas and sub-processes where the process steps can be quickly and easily improved must be explored. My hypothesis related to the goal is the following:

**H2: In the procurement and request for proposals process, companies make maximum use of the possibilities provided by the system**

*Q3: What methods and procedures are known for the development of processes?*

Comparison of our examination of development methods and possibilities known in the literature with the methods used by companies. LEAN tools and methods were used in the literature that provided the basis for the question. (JEFFREY 2008, MÁTRAI 2020, IMAI 2022)

A key to process improvement is communication within the supply chain. (MARTINS et al, 2020, PERUSSI et al, 2019). It is necessary to examine the process of the supplier's response. If necessary, a time window must be provided for the response. It is necessary to continuously improve the initial state. These methods are updated with the development of technology, new methods and systems are created. Restructuring of the supply chain with the help of modern technologies. (KARMAKER et al., 2023)

**H3: Hungarian companies apply the new methods and systems in practice in their procurement and request for proposals processes**

*Q4: Which indicators and areas of the companies are affected by the development of the request for proposals and procurement process of the supply chain?*

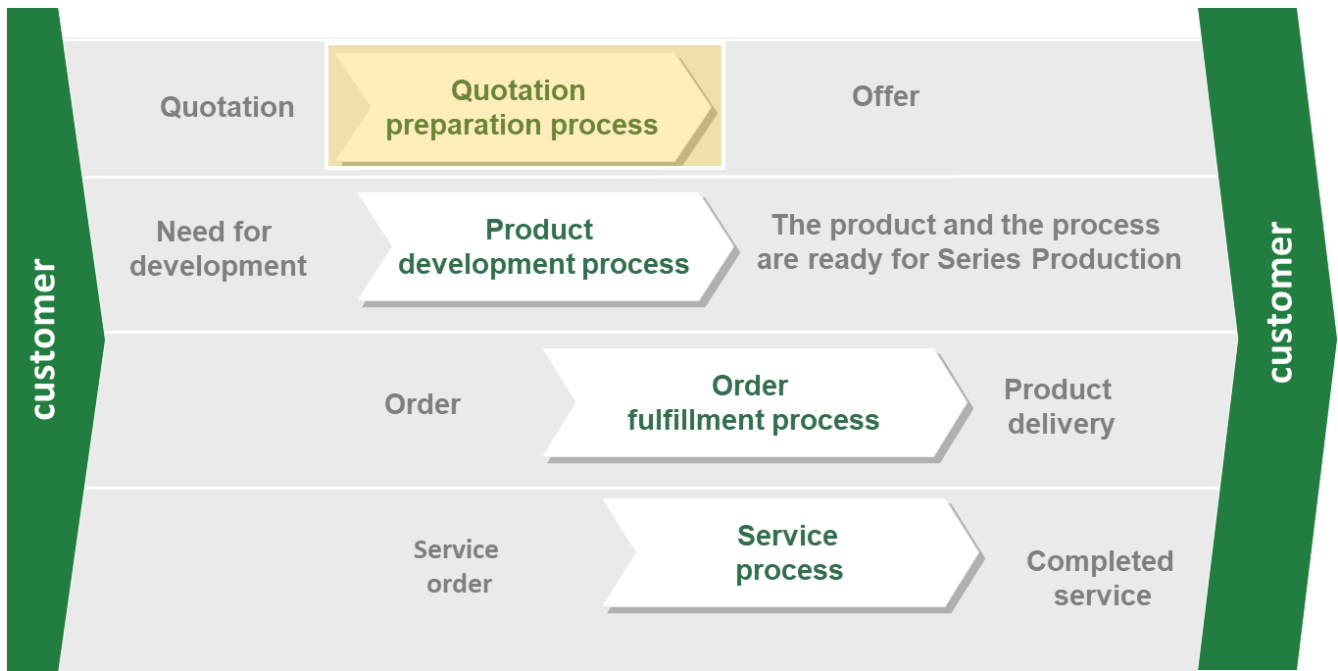
Examining the effects of procurement and request for proposals processes. The impact of changes in the procurement process of the supply chain on other areas, examining its advantages and disadvantages. (SHAH 2015, MONZKA and HANDFIELD 2020) The impact of the supply chain on innovation processes, (ZIMMERMANN et al, 2016) The impact of process change and development on the organization. (GURABI and MÁTRAI 2018)

During the development of the processes, a stable relationship and strategic cooperation can be formed between the supplier and the manufacturing company. The given development also enables the fulfillment of more precise customer needs. I formulated my hypothesis as follows:

**H4: The development of the supply chain bidding and procurement process has an impact on other areas of the company and on the company's overall indicators.**

Research can contribute to the efficient operation of industrial companies. With the help of the tool, the purchasing risk can be reduced, the goal is to increase the speed of effective information flow and reaction time.

When a company develops a new product, it must be innovative. Need to understand the market opportunity. Need to deliver a quality product and the timing needs to be right. Perhaps most importantly, you need to be cost-conscious. No matter how great your product may be, it cannot be successful without profitability. The start of requests for proposals and procurement processes is based in the vast majority of cases on meeting the customer's needs. The customer requests an offer for the new product he wants, for which the company prepares a price offer following the offer preparation process (depending on whether it affects the supplier's product or only its own internal processes). Figure 1.



*Figure 1: Model of request for offers and procurement processes – Source: own editing*

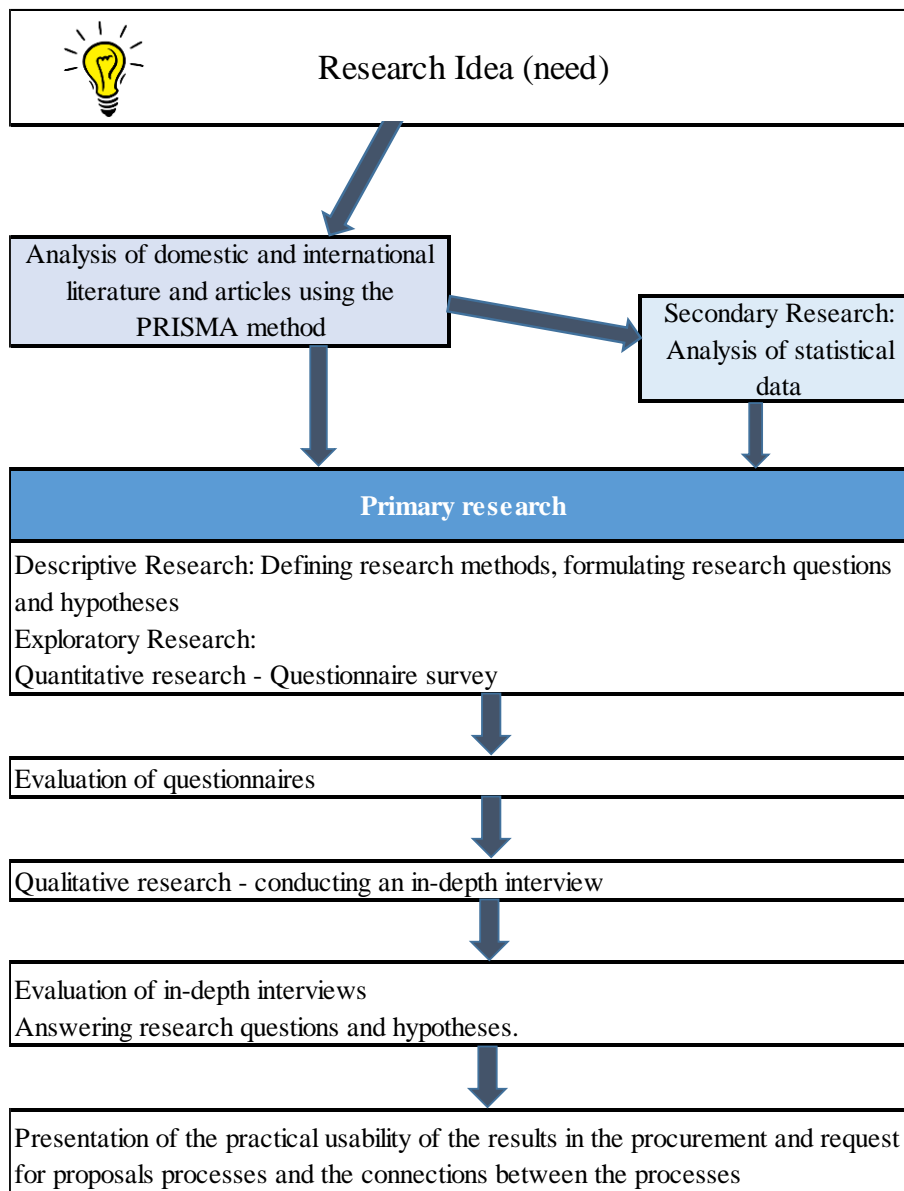
Whatever kind of process development is involved, the development of processes is also a process involving organizational development. If the processes are adequate, it is simpler, the workload is lower, there are fewer losses and the number of conflicts within the organization can be reduced. The development of processes must be in the interest of the people involved in the process. The teamwork of managers and employees. This is the driving force behind long-term efforts to create a learning organization that can adapt to environmental changes and survive productively. Without this fund, none of the investments in continuous development and learning could be realized.

Managers also have to constantly adapt to internal and external changes, this transformation has facilitating and hindering factors. (MÁTRAI, N. 2020)

## 2. DATABASE, MATERIAL AND METHODS

During my research, I used both primary and secondary research methods. I processed the most important and relevant domestic and foreign literature related to the procurement processes of the supply chain, and I also examine the request for proposals and production systems that can contribute to the automation of the process.

During my research, I followed the sequence of process steps shown in Figure 2. Secondary research is an extremely important point of the research, in this stage I obtained useful information after organizing the data. I consider this section to be decisive because it is necessary for me to get an adequate picture of the timely questions and open points of the chosen topic and where there may be development opportunities that have not yet been recorded in the literature.



**Figure 2. Research process**

Source: Own editing

## **2.1. Document analysis**

I used the PRISMA research method to examine the documents and reports found in the domestic literature. Several searchable databases (e.g. UDiscover, GoogleScholar, Science Direct, Elsevier, Ebscohost) helped me when collecting the literature. My investigation also covered doctoral theses written in previous years related to the topic. Domestic research and surveys support the openness of procurement processes to development.

## **2.2. Quantitative research - questionnaire**

The questionnaire-based survey, as a quantitative method, is a research technique that can be said to be classic, suitable for the description and interpretation of the given researched area and also for the purposes of discovering the roots of a problem. The questionnaire survey is carried out online using the Evasys system.

I examined the first sample questionnaire with a group of 5 experts (logistics manager, purchasing manager, strategic buyer and project manager dealing with proposal preparation), and I incorporated their comments and corrected the questionnaire. The questionnaire was finalized after 3 rounds with the expert group.

I conducted my survey using an expert sampling method. I planned to use a questionnaire to ask more than 500 companies who work in the procurement area of the given company, and deal with and participate in requests for proposals. The questions concern, among other things, the frequency of purchases, the frequency of customer modifications and offers, the turnaround time of offers, their impact on internal processes and related partner areas. The questionnaire was completed in an online format in the Evasys system. I sent the online link to the questionnaire to the company's e-mail address using a newsletter. To the procurement managers of Hungarian and international industrial companies and to the members of the Hungarian Logistics Association (of which I am also a member), MLBKT (Hungarian Logistics and Procurement and Inventory Association) to the members of the ISO forum in Hungary. I conducted the survey using an individually created link, as a result of which I have exclusive access to access the data, so I was able to guarantee the necessary anonymity required by the respondents. I processed the data of the questionnaire relying on SPSS statistical software, where I calculated basic statistics (mean, standard deviation, median,

mode) and examined the correlations of the individual variables. I used factor analysis to typify the respondents.

Questions related to the chapters and groups of the questionnaire:

*Group 1:* General questions about information about the company

*Group 2:* Questions revealing the company's internal and external relations with its products and processes

*Group 3:* Questions related to the level of digitization

*Group 4:* Questions related to organization structure

The relationship between the structure of the questionnaire and the pre-formulated research questions is contained in table 1.

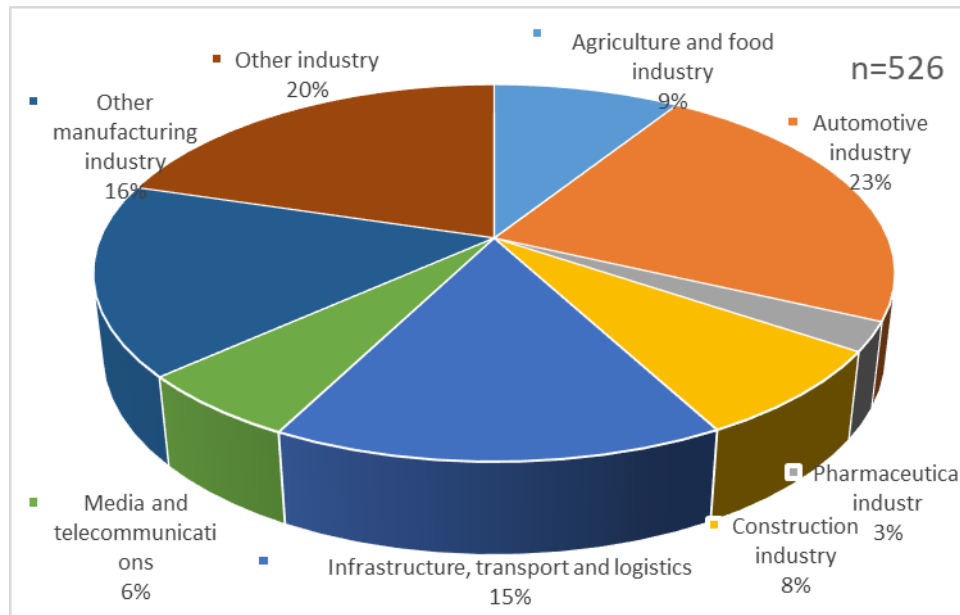
**Table 1.: Structure of the questionnaire**

QUESTIONNAIRE GROUP	QUESTIONS NUMBER	RESEARCH QUESTION
1. Group	8	Q1
2. Group	13	Q1, Q2
3. Group	9	Q1, Q2, Q3, Q4
4. Group	5	Q3, Q4

*Source: Own research*

The questionnaire content was closed questions, and a series of multiple-choice questions and statements measured with a Likert scale, and it is possible to express an individual position in detailed text form. 35 questions of the questionnaire cover the examined topic, which are meant to answer the research questions set in advance. I divided the questionnaire into four main sections in order to separate the more important areas to be investigated. Accordingly, I kept in mind that the topics are built on each other, so I started by recording the general, basic information. I also followed this processing order during the examination and evaluation of the questionnaire, so that the various questions can be reviewed in a complete structure.

Accuracy and quality are of prime importance in procurement processes. For example, in the case of delayed delivery in the automotive industry, due to production line downtime, each hour started means costs exceeding HUF 30 million on the supplier side, and in the event of a complaint or product recall, these costs increase exponentially. Ensuring responsibility is of particular importance to suppliers. For this reason, in my research I basically examine the relationships of the processes according to the company form.



**Figure 3: Distribution of questionnaires by industry**  
*Source: Own research*

### 2.3. Qualitative research - in-depth interview

Based on the results of the questionnaire survey, I built the material of the in-depth interview. Interviews representative of qualitative research took place in the work environment of the subjects. The limited time availability of the interviewees made it difficult to organize a personal meeting. A total of 12 in-depth interviews were completed, with 8 top managers and 4 middle managers in the field. During the in-depth interview, I focused on the discovery of knowledge that cannot be revealed during the questionnaires, taking into account subjective factors.

The interview is divided into 6 topics, based on the foundations of the questionnaire, some parts are explored in more detail. The first topic examined general questions related to the company, in addition to the annual sales revenue, the product variety of the purchased raw materials was revealed. The second topic examined forecasting processes. How and in what form do the forecasts from the customer reach the supplier. Furthermore, does the company

follow the measurement of deviations from the forecasted quantity and the analysis of the cause of the deviation. The third topic analyzed the process of requests for proposals, between the potential supplier and the company. The fourth topic researched the procurement process, dealing separately with products with stable weight loss and solutions and in the case of products that are difficult to predict. The fifth topic examined the effects of process improvements on results. In the area of organizational behavior, the managers admitted that the company's goals are not clear for all employees, but the company has long-term goals for all employees. During the in-depth interviews, the interviewees spoke openly about the problems, and several times they realized how they could improve their own internal processes, how they could use their existing system at a higher level.

The interviews highlighted that there is currently no guideline or support for companies if they plan to improve their procurement processes. They try to transfer solutions and examples that are already working well from the parent company or other companies into their own environment. The companies are often not at the same level, so this process is hindered.

### 3. MAIN FINDINGS OF THE DISSERTATION

Companies want a predictable, stable process and system, so that they can keep up with technological and technical development in a constantly changing world. Procurement process development, where applicable, automation, using technology to automate various aspects of the procurement process, such as purchase requisitions, purchase orders, vendor selection, invoice processing and payment processing. This technology can take many forms, including procurement software, e-procurement systems, and robotic process automation (RPA). Automating procurement processes can provide many benefits, such as:

**Increased efficiency:** Automation can streamline the procurement process, reducing the time and effort required to complete tasks such as creating purchase orders and processing invoices.

**Increased accuracy:** Automated processes are less prone to human error, reducing the likelihood of errors such as duplicate payments or incorrect order quantities.

**Cost savings:** By reducing manual work and streamlining processes, automation can result in cost savings in areas such as staff time and procurement cycle time.

**Increased visibility:** Automation provides greater visibility into the procurement process, allowing stakeholders to track key metrics such as spend analytics and supplier performance.

Examples of automating the procurement process include:

**Purchase requisition automation:** This includes automating the purchase requisition creation and approval process using tools such as online forms and workflow automation.

**Purchase order automation:** This involves automating the process of creating and issuing purchase orders using tools such as procurement software and e-procurement systems.

**Automating invoice processing:** This includes automating the receipt and processing of invoices using tools such as optical character recognition (OCR) and automatic invoice reconciliation.

**Automate payment processing:** This includes automating the process of making payments to suppliers using tools such as electronic payment systems and automated payment processing.

Hungarian organizations, whether they are domestic or foreign-owned companies, are characterized by continuous development and the compulsion to keep pace with technological development due to market competition. Innovation and investment are necessary to maintain a stable market position in the supply chain within the industry. In parallel with industrial development, end users are placing ever higher expectations and demands on manufacturing companies. Manufacturing companies also demand higher quality and conditions from suppliers, from whom they also expect continuous development. At the moment, in terms of domestic industries, the development and the demand for development can be noticed among the suppliers. International companies are further enlivening this process. The first contact with suppliers, the request for proposal or the purchase order process is part of a complex system that can be determined by several factors, the available communication channels, product quality requirements, product identification system, the need for delivery frequency, financial elements, technological competences.

Based on the hierarchy established on the basis of the research, process improvements can be standardized depending on the company form, so faster development can be achieved in the purchasing area. A standard system can be created, which can highlight in which area it is possible to apply it routinely in practice.

Assessment and optimization of the process in order to make full use of the possibilities provided by the system. After examining the conditions, developing a new process and, if necessary, further training. The development option can significantly improve the company's indicators with almost minimal investment.

With the hypotheses defined in the first stage of the dissertation, I tried to fully explore the topic of the research, however, due to the differences between companies and industries, the request for proposal and procurement process development needs to be defined individually (tailored to the company's characteristics). I am convinced that the results of my study can be applied both in theory and in practice. The company-tailored solution and design of the procurement process development system can serve as a starting point for further research. Among the results of the developments, there are those that can be demonstrated in the short term, for example, changes in stock levels, compliance with order deadlines. However, the results of the indicators determined in process development only have their effect in the long

term, for example changes in corporate communication, knowledge of joint corporate strategy, level of employee motivation, the values and effects of these indicators require further background work and research.

#### 4. NEW AND NOVEL RESULTS OF THE DISSERTATION

I used both quantitative and qualitative approaches to test the hypotheses set at the beginning of the study, and as a result, I was able to present some decisive scientific results. Table 2 presents a summary of the results.

**Table 2: New and novel results of the research**

RESEARCH QUESTIONS	HYPOTHESES	NEW AND NOVELTY ACHIEVEMENTS
Question1: What requirements can be defined as criteria for full or partial automation of the procurement and request for proposals process?	H1: The criteria of the procurement and request for proposals process can be specifically defined and identified.	A ranking according to aspects, which represent the criteria that determine the supplier selection of procurement processes.
	H1.1: The role and hierarchy of the procurement and request for proposal process criteria varies according to the company form	Depending on the company form and industry, the importance of the criteria varies.
Question2: Do domestic companies take advantage of the potential inherent in procurement and request for proposals processes?	H2: In the procurement and request for proposals process, companies make maximum use of the opportunities provided by the system	Introducing a new process to effectively utilize the opportunities provided by the system.
Question3: What methods and procedures are known for developing processes?	H3: Domestic companies apply the new methods and systems in practice in their procurement and request for proposals processes	Introduction of a procurement process development indicator that supports continuous development and can provide guidance on which areas and in which direction development is necessary. Its effect also increases efficiency in other areas of the company.
Question4: Which indicators and areas of the companies are affected by the development of the supply chain request for proposals and procurement process?	H4: The development of the supply chain bidding and procurement process has an impact on other areas of the company and on the overall indicators of the company	

Source: Own research

1) Ranking according to aspects, which represent the criteria determining the supplier selection of procurement processes.

Based on the results of the questionnaires, I examined the pre-determined hypotheses using several methods, and also arranged the criteria in order of priority. When developing the procurement and request for proposals process, the first step is to find and select potential partners. The selection of possible suppliers is based on different criteria. After defining the aspects, I examined the criteria using different statistical methods and arranged them according to a ranking. The ranking according to the selection criteria is as follows: reliability, product price and product quality and production capacity.

2) Depending on the company form and industry, the importance of the criteria changes.

I analyzed the ranking according to the criteria at the organizational form and industry level, based on which I verified with my research that the priorities change according to the company form and the industry. Other values are more important at the level of limited partnerships than limited companies. and at the level of joint stock companies. At the industry level, there are significant differences in the order of importance in the construction industry, the automotive industry, and the pharmaceutical industry. The primary aspect of limited partnerships' supplier selection processes is determined by the price of the product. In the case of other corporate forms, reliability comes to the fore.

3) Introduction of a new process to effectively utilize the opportunities provided by the system

During the questionnaire research, I started the investigation with the object of the purchase, the properties and requirements that can be linked to the product determine the complexity of the purchase. Based on the questionnaires, it can be clearly demonstrated that the companies do not make adequate use of the limitations of their corporate governance system. During the in-depth interviews, this statement was also supported by the interviewees. Greater or maximum utilization of potentials is possible with low investment. Process steps can be partially or fully automated by exploiting the opportunity.

4) Procurement Process Development Maturity Index

As a result of the research, I created the Procurement Process Development Maturity Index, with the help of which companies can assess how prepared they are for the development of

their procurement process. It provides a support for what level of maturity they are. Based on the 16 different indicators, we can get a comprehensive, comprehensive picture of the preparedness level. The metric shows the area or sub-unit where development can significantly improve processes. With the help of the indicator, companies can increase their competitiveness.

As a result of the research, I created the Procurement Process Development Maturity Index, (Sipos Improvement Process Of Sourcing) named after the author, with the help of which companies can assess how prepared they are for the development of their procurement process. It provides support based on their graduation level. Based on the 16 different indicators, we can get a comprehensive, comprehensive picture of the preparedness level. The metric shows the area or sub-unit where development can significantly improve processes. I named the indicator Procurement Process Development Maturity Indicator. The index was compiled based on the weighted values of 16 factors. The maturity index provides companies with insight into the level of development of the real procurement process.

The formula for the Procurement Process Development Maturity Index (SIPOS) is as follows:

$$BFEM = \frac{(A1 \times 0,12) + (A2 \times 0,1) + (A3 \times 0,1) + (A4 \times 0,14) + (A5 \times 0,11) + (A6 \times 0,15)}{B1 \times 0,1 + B2 \times 0,08 + (B3 + B4) \times 0,03 + B5 \times 0,05 + C1 \times 0,03 + C2 \times 0,05 + C3 \times 0,03 + C4 \times 0,02 + C5 \times 0,05}$$

The elements of the indicator:

- Annual net sales - A1
- Number of annual requests for proposals managed by the company - A2
- Number of annual orders sent to suppliers - A3
- Use of a company management system - A4
- Management of requests for proposals, communication – A5
- Management of purchase orders, communication – A6
- Number of supplier sources for key products - B1
- Product identification systems at the company – B2
- Stocks of strategically important products at the company - B3
- Delivery frequency of strategically important products – B4
- Are there opportunities for employees to receive continuous training and update their knowledge - B5
- Complexity of purchased products – C1

- Quality requirements for purchased products – C2
- Frequency of evaluation of suppliers – C3
- Feedback to the employee regarding the tasks performed in the given period – C4
- Does the company have clear long-term strategic goals for all employees - C5

During my research, one of the defining events was when, based on the results, it became apparent that the companies have a high-quality corporate governance system that is not being used properly. During the in-depth interviews, this finding was confirmed, the vast majority of the interviewees recognized the opportunity inherent in this during the interview. In order to utilize processes at a higher level, I felt that gap filling could be an indicator that supports companies in giving guidance on what level of maturity they are in for the development of procurement processes. In addition to the main findings, I consider the creation of the index as part of the new and innovative results.

## **5. PRACTICAL APPLICABILITY OF THE RESULTS**

1) The developed process development indicator can be a suitable tool for the management to determine the long-term strategic goals of the purchasing area. It can give guidance on which area needs to be emphasized more.

2) Periodic evaluation of the indicator can help the company in the field of development and innovation. Continuous monitoring of the designated development directions supports continuous development, with the help of which the company can remain competitive and can build and maintain a joint and lasting partnership with the actors of the supply chain.

3) Depending on the organizational form and industry, supplier selection criteria can be useful information for companies and suppliers. Based on the criteria defined in the research, the selection process can be faster and more effective. For companies, knowing the main aspects of the selection, the range of suppliers can be narrowed and simplified. From the perspective of suppliers, it can facilitate targeted compliance with customer considerations.

4) In my study, the solutions used by the respondents (RFID, QR, VMI) are based on information obtained in the framework of a benchmarking. For organizations that are still on the verge of such an introduction, the sharing of specific experiences in a knowledge base can serve as a reference.

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## LIST OF PUBLICATIONS RELATED TO THE DISSERTATION

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1. Ghouse, A., Sipos, C. (2022): RPA progression throughout years and futuristic aspects of RPA. *Pollack Periodica*. 17 (1), 30-35, ISSN: 1788-1994. DOI: <http://dx.doi.org/10.1556/606.2021.00344>
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