

**Publisher**<http://jssidoi.org/esc/home>**METHODOLOGY FOR EVALUATING THE AGILITY LEVEL IN ENTERPRISES\*****Andrea Janáková Sujová<sup>1</sup>, Antonín Korauš<sup>2</sup>, Martin Halász<sup>3</sup>, Katarína Marcineková<sup>4</sup>,  
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**Abstract.** Agility is an important part of modern business management, enabling the company to effectively adapt to the changing external and internal demands of the market and customers. Therefore, companies must constantly implement agile methodologies and approaches that support quick decision-making, transparent communication and continuous innovation. This research aimed to create a methodology for evaluating the achieved level of agility in the company, which represents a self-assessment guide with verification of whether it is manageable and usable by managers in practice through an application in a selected company. To achieve this goal, an analysis of secondary sources was used, which provided the basis for creating a maturity model and the assessment framework. Several versions of the questionnaires for collecting input data were tested in companies to find the most accurate and applicable. The obtained results were suggested to be processed by the Scorecard method, the Euclidean distance method and the Standard Deviation. From the results, we observe that the respondents were more inclined to the possibility of using a quick but less accurate questionnaire, which enabled them to obtain the necessary data in a shorter time frame. At the same time, we managed to determine that the level of agility in the company we tested is at the level of 2.50, which speaks of achieving a medium and moving towards a high level of agility.

**Keywords:** agility; maturity model; agile elements; assessment; enterprise; scorecard

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**JEL Classifications:** L21, L25, M11, M14, O32**1. Introduction**

The current global situation affected by war and other influences is ranked among the factors that negatively affect the economy and the efficient functioning of businesses (Saputra et al., 2022). Due to the new situation, it becomes inevitable for manufacturing enterprises to gradually shift to flexible, dynamic management in conjunction with new operation models (Abdelilah, Korchi, and Balambo, 2018; Christofi et al., 2021). Elali (2021) highlights that in today's world full of uncertainty, it is more than necessary to build agile businesses that are characterised by their ability to thrive in the face of unpredictable changes in the corporate environment. Businesses that fail to spot changing situations early on and respond adequately to them may have major problems in their future operations (Troise et al., 2022). The changes induced by customers themselves in the

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context of new needs and more demanding requirements are factors that characterize the increased pressure on businesses and their need to respond in a timely and flexible manner to the constant changes that take place in the business environment (Agag et al., 2024). In the early days of agility, agility was primarily introduced in the IT sector, building it to help business processes that have been and are impacted by digitization, variability, rapidly changing technologies, and increasing uncertainty (Hidalgo, 2019; Perkin, 2020). Important insights on the application of agile principles were provided by Pope-Ruark (2017), who highlighted the importance of agility and its benefits. The importance of agility lies in creating opportunities for businesses to respond effectively to market changes, improve the quality of their products and processes, and, at the same time, be more competitive (Clauss et al., 2021).

The results of many studies have indicated that building enterprise agility has a significant impact on an organization's performance and innovation capabilities and brings it a certain competitive advantage (Salih and Alnaji, 2014; Teoh et al., 2017; Altaweel, Al-Hawary, 2021). Knowing the current state of agility in the enterprise allows maturity models to show the completeness of a given object, which is enterprise agility. The progress that the maturity model achieves can be observed and managed by defining individual levels of agility that can assess the completeness of agility in the context of the level achieved by the enterprise (Wendler, 2014). Multidimensional criteria become important, which can help an enterprise to improve and move forward in concert with its demonstrated level of agility. Authors who have addressed the issue of enterprise agility maturity models include Schweigert et al. (2013), Carvalho et al. (2019), Cimini et al. (2024), Ferdinansyah and Purwandari (2021). The need for creating validated tools to measure agility was highlighted by Grena et al. (2019), who created and tested tools to help enterprises in their journey of building agility. Authors Linkevics and Sukovskis (2015), Joiner (2019), Lee and Song (2022) also address this issue in their publications and describe it as a critical process to measure how successfully an enterprise can respond to changes. Establishing an assessment methodology for an enterprise provides valuable information on the current state of agility levels achieved, highlighting salient areas for possible improvement.

There are several models of agility maturity in the literature, but their interpretation is not uniform, and the methodologies for assessing agility levels are based on different foundations. Therefore, the paper fills this knowledge gap by creating a methodology for evaluating agility based on the maturity model. It also brings new empirical knowledge from enterprises in Slovakia, where this issue has not yet been addressed. Its thorough investigation and subsequent implementation could bring considerable benefits to enterprises, such as improving production processes, increasing product quality and strengthening competitive position in the market (Lesníková and Janáková Sujová, 2023).

The paper aims to develop a methodology for assessing the level of agility achieved in an enterprise, verifying that it will be manageable and usable by managers in practice through application in a selected enterprise. The starting point is the definition of an agile maturity model that captures the different levels of agility and their characteristics, including creating an evaluation framework. The proposed methodology applies the scorecard evaluation method, which is understandable and manageable for managers in practice.

## 2. Theoretical background

To assess the current state of agility in the enterprise, it is necessary to start from the defined agility stages in the maturity models. It is a structured framework for assessing the work and processes of an organisation in the context of agile principles, where we compare the current state of the company with the defined agility stages, thus being able to define the current level of agility and opportunities for improvement. Maturity models can be divided between descriptive, prescriptive and comparative (de Bruin et al., 2005).

A further division focuses on individual domains in the enterprise - process, object and people maturity models (Mettler and Rohner, 2009). In 2013, Pooley et al. produced an overview of available agile maturity models (Table 1).

**Table 1.** List of Agile Maturity Models

| Creator of the model   | Model name               | Levels                         |
|------------------------|--------------------------|--------------------------------|
| Ambler                 | AMM                      | 1 - 5                          |
| Lui and Chan           | Road map                 | 1 - 4                          |
| Nawrocki et al.        | XPMM                     | 1 - 4                          |
| Packlick               | Agility maturity map     | 1 - 5                          |
| Patel and Ramachandran | AMM                      | 1 - 5                          |
| Petit                  | Agile maturity model     | -                              |
| Sidky et al.           | Agile adoption framework | 1 - 5                          |
| Qumer and Henderson    | AIIM                     | 1 - 3 (blocks), 1 - 6 (levels) |

Source: adapted from Pooley et al. (2013)

At their core, each model differs depending on the understanding of agility, with each model offering its own unique take on the different levels of agility and its understanding, allowing the business to determine the level of agility achieved. Ozcan-top and Demirörs (2013) developed evaluation criteria that are compatible with the models mentioned above and can reveal potential strengths and weaknesses of the models as well as their applicability or applicability in practice. These criteria include fitness for purpose, completeness, definition of levels of agility, objectivity, correctness, and consistency.

We include the HISMM (Hospital Information System Maturity Model) among the new maturity models. It is authored by Carvalho et al. (2019). The model contains the conventional structure of a maturity model, which means it is composed of a matrix containing different maturity levels and factors affecting maturity. Each of the factors identifies traits that are characteristic of a given maturity stage.

In practical applications, the Capability Maturity Model Integration (CMMI) is often used, which offers the basic most common division of agility levels. This model divides the different levels of agility as follows (Ferdinansyah, Purwandari, 2021):

- **Level 1: Initial** - The organization uses very limited or no agile practices that are not standardized. Low emphasis on applying agile practices prevails.
- **Level 2: Managed** - Basic agile practices are in place, and the organization is beginning to develop standardized processes. This tier involves some level of retrospection and planning.
- **Level 3: Defined** - Agile methods and practices are well-defined, documented and implemented in the enterprise. The organization has a clearly defined agile policy and standards to follow.
- **Level 4: Quantitatively managed** - The level is described by agile processes that are well-managed and measurable. The organization uses various metrics and KPIs to track performance and continuously improve agile practices.
- **Level 5: Optimising** - The organisation continuously improves and optimises its agile processes based on data and feedback. Agile is deeply embedded in the company's culture and is regularly re-evaluated and adapted to new challenges.

The distribution of each level indicates how and to what extent the business maintains a certain level of agility, while the levels applied in the maturity model reveal the critical space for moving forward (Baker, 2006; Lukasiewicz and Miler, 2012). Based on these, the enterprise can decide where and to what extent to apply particular agile approaches and principles for achieving the management's desired level of agility (Baker, 2005; Brecka and Koraus, 2016).

Cimini, Lagario and Cavalieri (2024) developed a maturity model based on the SCRUM method and the AMM maturity model by Patel and Ramachandran with 5 levels: initial, explored, defined, refined, sustained. The model also defined its own dimensions grouped into 3 groups: roles, culture and processes. Thus, each maturity model has its predetermined levels, a description of each of the levels that speak to the characteristics specific to that level, a certain number of dimensions, with the dimensions further described by certain elements or activities, and a description of each element (Fraser et al., 2002). Fundamental foundations for proper agility functionality are agile principles, which include adaptability and flexibility, speed and agility, high customer

orientation, teamwork, innovation, and learning (Conboy, 2009; Gong and Janssen, 2012; Wade et al., 2021; Mihalčová et al., 2021; Kollmann et al., 2023; Vagaská et al., 2022). They enable the application of rapid change and response in the context of business agility (Aguirre, 2023; Gombár et al., 2024). Baker (2017) argues that agility is not a technique, a fashion or a process; it is not the quantity of what an organisation does; it is primarily about how the members of the organisation think about what they do. He lists seven dimensions in the form of principles an agile enterprise should build: innovation, processing, recovery, improvement, customer responsiveness, problem-solving, and change of direction.

The principles of agility are applied within the individual elements of agility. A 2019 publication from McKinsey & Company, authored by Brosseau, Ebrahim, Handcomb, and Thaker, defines and describes eight key elements on which an agile organization should build: Decision-making and governance setup, Business planning and budgeting, Financing and decision-making, Performance management, Roles and career paths, Risk management and assurance, Workforce deployment and workspace, Technology. The dimensions of agility form key areas of the enterprise that help organizations respond quickly and effectively to change, improving collaboration, innovation and customer satisfaction (Gagnon and Hadaya, 2018). Authors Siegel and Booth (2020) state that agile planning, performance management, and talent management are considered the most important dimensions of agility. In addition to these two dimensions, according to them, four more dimensions are present, which are: organizational model, ways of working, risk and compliance, technology enablers. 3DSE, a business management consultancy, offers five dimensions that a successful organisation looking to transform into an agile organisation should apply. These dimensions are: strategy, product, process, organization, and culture (Kloibhofer, 2018). Similar to Kloibhofer (2018), Linkevics and Sukovskis (2015) and Wendler (2014) have also created a framework of agility through dimensions and elements.

It becomes important for an enterprise to know the methods and practices that can determine the level of agility achieved and apply them effectively to various aspects of its operations. Vinodh and Aravindraj (2011) developed their unique approach to measuring agility levels called IF - THEN. Their theory builds on the principle that an agile environment should be highly interactive, and the primary concept of this approach builds on the integration of all triggers and their criteria into the creation of an agile index. The triggers include: responsibility management agility, production management agility, labor management agility, technology agility, and manufacturing strategic agility. Based on these triggers, the model can evaluate agile concepts. According to Linkevics and Sukovskis (2015), it is possible to measure an enterprise's agility level using the ODA method. The authors describe that there are two ways an enterprise can go, provided it is aware of its level of agility. Thus, an enterprise can follow the "Change" or "Improve" paths. Patel, Samuel and Sharma (2017) used a similar approach to Linkevics and Sukovskis to develop a methodology for assessing agility levels. This involved creating a model for measuring supply chain agility that consisted of 7 triggers, 25 attributes and 101 subattributes. The application of agility in the enterprise depends primarily on the right choice of a maturity model that allows the enterprise to identify its current level of agility and provides a clear roadmap for its gradual improvement. The maturity model should be tailored to the specificities and needs of the particular enterprise, considering its organisational structure, business strategy and culture.

### 3. Research objective and methodology

Establishing a methodology for evaluating the level of agility in enterprises requires a comprehensive approach that integrates different tools, methods, and procedures to provide a holistic view of the capabilities and competencies of the enterprise. The starting point for developing the agility assessment methodology is the findings from scientific publications and the results of primary research in Slovak enterprises, which show the specifics of the elements of agility, the level of knowledge of managers and their perception of agility. Proposing the methodology addresses two research questions:

1. How the achieved agility level should be found out and evaluated?
2. How should the best agility level be determined to develop actions toward its achievement?

The first step was to define an agility maturity model, i.e., agility levels and an assessment framework. Starting points from many authors were taken into consideration, using the criteria for model development according to Ozcan-top and Demirörs (2013). The constructed maturity model is a modification of existing models with

emphasis on completeness of possible agility levels, clarity for practising managers, and level of understanding of agility issues in companies. After defining the different levels of agility in the maturity model, an evaluation framework was developed by identifying the dimensions and elements of agility in each dimension while respecting the basic agile principles. This framework allows for assessing the level of agility in the different areas of the enterprise.

The second part of the study focused on determining the scope and method of collecting information and data that represent the input data for assessing agility levels. The data set corresponds to the characteristics of the agility levels in the maturity model and the agility elements in the assessment framework. An inquiry method was primarily used to create a list of defined agility elements and describe them. Based on the theoretical framework, we formulated multiple versions of the questionnaires. The first one was tested and agreed to be the most understandable. It contains a list of elements with brief descriptions without the attribute of agility level and a range of responses representing the different levels of agility. A simple scoring method was used to do so. In designing the questionnaires, care was taken to ensure that they were formulated in a clear and comprehensible manner to prevent possible misunderstandings and to ensure a high level of reliability and validity of the answers.

The required range - the frequency of responses is determined by the number of senior and middle managers in the enterprise who are relevant respondents. The reliability of the data obtained from the questionnaires is assessed through the statistical standard deviation, which measures the dispersion of the data set in relation to its mean. If the value is high, the data is scattered further away from the mean, indicating high variability in the respondents' ratings and lower data reliability. Its formula is as follows (Livingston, 2004):

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2} \quad (1)$$

Where " $\sigma$ " is the standard deviation, " $N$ " is the number of observations (respondents), " $x_i$ " is the value of each observation, " $\mu$ " is the average of all values of  $x_i$ . The level of agility of the individual elements in the dimensions can be evaluated by the arithmetic mean or median of the respondents' answers. In our application, median values were used to represent the achieved level of agility in the enterprise for a given element. The level of agility dimensions was evaluated using the Euclidean distance method. This method is primarily used to measure distances between two points in n-dimensional space. In our understanding, the method was used to determine the distance of the respondents' evaluation of a dimension from the ideal state, i.e., the highest level of agility. Lower values indicate that a given respondent perceives the dimension as closer to the ideal "agile" state, while higher values indicate a gap and more room for improvement in the domain. For the calculation, we used the following relationship (Liberti, Lavor, 2017):

$$d_i = \sqrt{\sum_{j=1}^n (x_{ij} - x_{0j})^2} \quad (2)$$

Where " $d_i$ " is the Euclidean distance of respondent i, " $x_{ij}$ " is the element value for respondent i and element j, " $x_{0j}$ " is the ideal value of element j, " $n$ " is the number of elements (dimensions).

The scorecard method was chosen as the main method for the final evaluation of the achieved level of total agility due to its reasonable difficulty and manageability when used by the managers of the enterprise. The scorecard method is a flexible tool designed to measure the performance or results achieved by organisations in specific, selected areas, which enables the setting and tracking of specific indicators and targets reflecting priority aspects of the organisation's activities and provides a framework for measuring progress. To determine the final score of the overall level of agility in the enterprise, the arithmetic mean of the median values of all the dimensions predefined by us and marked by the respondents according to the respective questionnaires was used. For the correct interpretation of the scorecard method, it is necessary to use various graphical display options in the form of dashboards, reports, heat maps or classic graphs and charts.

The result is the determination of the achieved level of agility in each dimension and its elements according to the proposed key, the discovery of reserves, and the necessary steps to move to a higher level of agility. The applicability of the proposed methodology was verified by application in a selected enterprise; in this study, it is a Slovak enterprise in the wood processing industry.

#### 4. Results and discussion

Based on a detailed review of the available agile maturity models and approaches of different authors, taking into account the already existing maturity models, we developed a modified concept of a maturity model. The maturity model was divided into 5 different levels. Each level is narrowly specified (see Table 2).

**Table 2.** New concept of Agility Maturity Model

| Level: | Title:            | Description:                                                                                                                                                                                           |
|--------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.     | No Agility        | No agile principles or methods apply. There is no understanding of the benefits of enterprise agility, and processes are ad hoc and unsystematic.                                                      |
| 1.     | Low Agility       | The organization is becoming aware of agile principles, but the processes are still chaotic. Project success depends on the individual efforts of individuals, teams, and the organization as a whole. |
| 2.     | Medium Agility    | Organizations implement basic agile practices at the project level. These are basic attempts to plan, execute, monitor and control according to agile principles.                                      |
| 3.     | High Agility      | Agile methods and principles are fully integrated into the organisation's processes. There is a standardised framework of agile practices accepted by the organisation.                                |
| 4.     | Excellent Agility | Use of quantitative data for continuous improvement and optimization, proactivity in anticipating change and implementing change, and rapid implementation of changes and decisions.                   |

The proposed evaluation framework in the form of dimensions and agility elements is presented in Table 3. After studying the existing knowledge, we have chosen as dimensions the areas of the enterprise that allow us to assess the extent to which teams or enterprises are able to respond effectively to dynamic and uncertain situations within them. Within each dimension, elements (presented in Table 3.) representing specific, measurable attributes are included that allow the agility of individuals, teams or parts of enterprises to be assessed and compared.

**Table 3.** New concept of Dimensions and Elements of Agility

| Dimension                        | Elements                                                                                                                                                                                                   |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Organisation                     | Organisational structure, Decision making, Leadership, Transparency, Knowledge transfer, Communication                                                                                                     |
| Customers                        | Feedback tracking, Customer needs and requirements tracking, Customer satisfaction rate, Customer value orientation                                                                                        |
| Strategy                         | Management of continuity and change at the same time, Relationships with external actors, Commitment, Resource mobility, Responses to environmental change with objectives and strategy, Scope of planning |
| Processes, technologies, systems | Process management level, Process automation, Information system, Process digitalization, Change time and process optimization, Process adaptability                                                       |
| Products, services               | Speed of delivery, Innovation, Improvement, Portfolio management, New product and service development                                                                                                      |
| Culture of change                | Openness to change, Ability and willingness to take risks, Continuous improvement, Readiness for change                                                                                                    |
| Human Resources                  | Teamwork and autonomy, Cooperation and trust, Communication, Creativity and innovation, Learning and improvement                                                                                           |

The input data collection and subsequent assessment of the individual elements of each dimension were designed in two ways, including the same agility elements and dimensions (7 dimensions and 35 agility elements). Still, they differed in how they were implemented and how the data was collected. After pilot testing

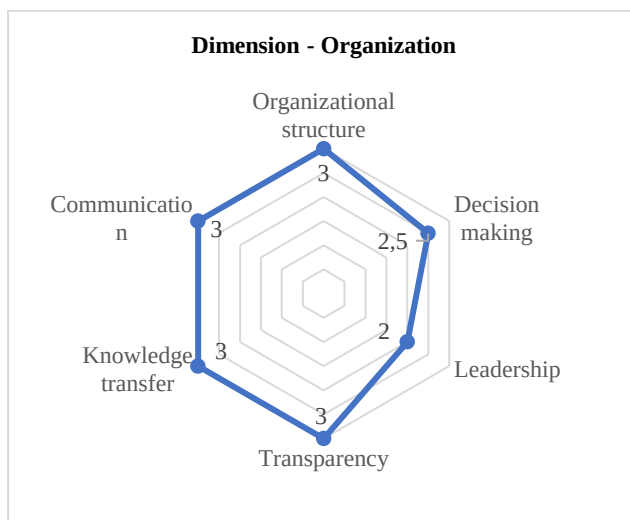
with the respondents, we selected the first way, including a list of all agility elements, a brief description, and a range of possible responses. The respondent was asked to tick the appropriate box to assign the corresponding agility level (0 to 4) to the element, according to the maturity model we developed. At the same time, the agility maturity model was presented at the beginning of the questionnaire with the characteristics of the respective agility levels. The data were collected using a simple scoring method, where individual elements are rated on a scale of 0-4, where 0 means no agility of the element and 4 means excellent, i.e. the highest level of agility. A sample of one dimension selected by Customers is presented in Table 4.

**Table 4.** Data collection questionnaire

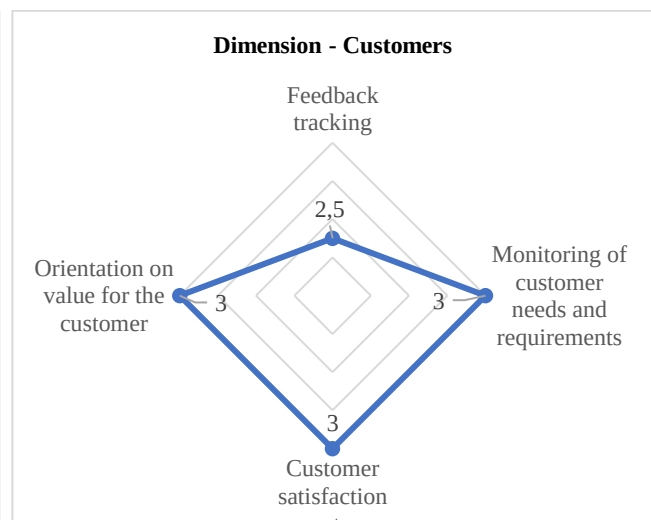
| Dimension - Customers                      |                                                                           | Agility level |    |    |    |    |
|--------------------------------------------|---------------------------------------------------------------------------|---------------|----|----|----|----|
| Element                                    | Description:                                                              | 0.            | 1. | 2. | 3. | 4. |
| Feedback monitoring                        | <i>Frequency of monitoring, customer satisfaction rating</i>              |               |    |    |    |    |
| Monitoring customer needs and requirements | <i>Response time to changed or new customer requirements</i>              |               |    |    |    |    |
| Customer satisfaction rate                 | <i>Frequency of assessment, speed and method of complaint resolution.</i> |               |    |    |    |    |
| Customer value orientation                 | <i>Business success measured against customer objectives</i>              |               |    |    |    |    |

The level of agility of individual elements, dimensions and overall enterprise agility was evaluated using the arithmetic mean, median, and Euclidean distance described in the previous chapter.

The methodology was verified by its application in a selected enterprise operating in the timber industry, the size of which belongs to small enterprises with up to 50 employees. In this enterprise, we involved 10 respondents in completing the questionnaires, representing the owners of the company and all top and middle managers. The results of the assessment of the level of agility of the individual elements in the dimensions based on the median values of the respondents are shown in Figures 1-7.

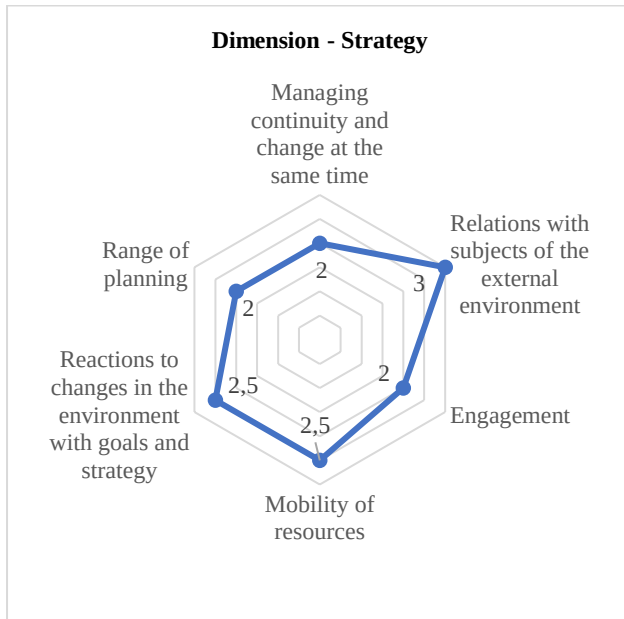


**Figure 1.** Dimension – Organization  
Source: own elaboration

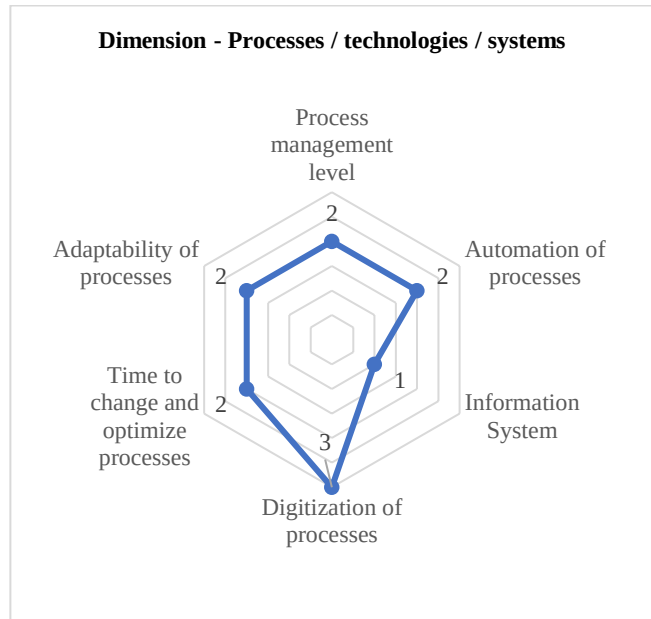


**Figure 2.** Dimension – Customers  
Source: own elaboration

In Figure 1 we can observe that the majority of respondents perceive the different elements of the Organization dimension in their enterprise as agile and at a high level, where full integration of agile principles and methods is prevalent. We see a change in the element of Decision Making, and Leadership, which is perceived as moderately agile by a portion of the respondents. Figure 2 shows us a similar situation where we see consistency across all elements except for the element of feedback monitoring, which is perceived by a portion of respondents as moderate to high agile with integration of agility across all areas of that element.

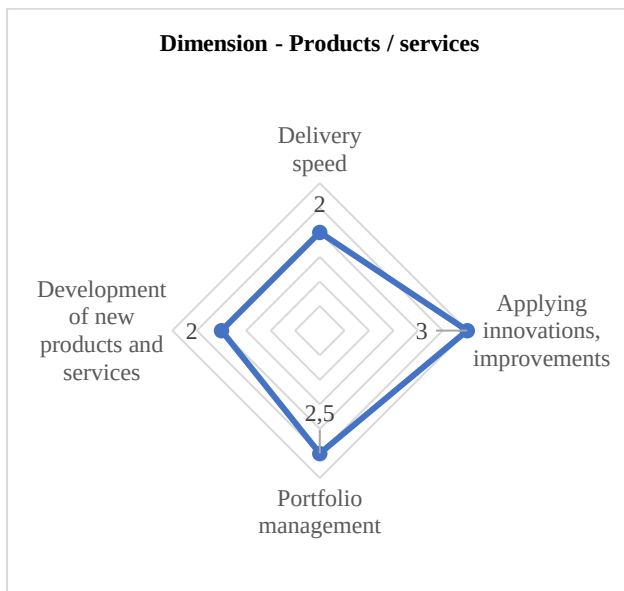


**Figure 3.** Dimension – Strategy  
Source: own elaboration

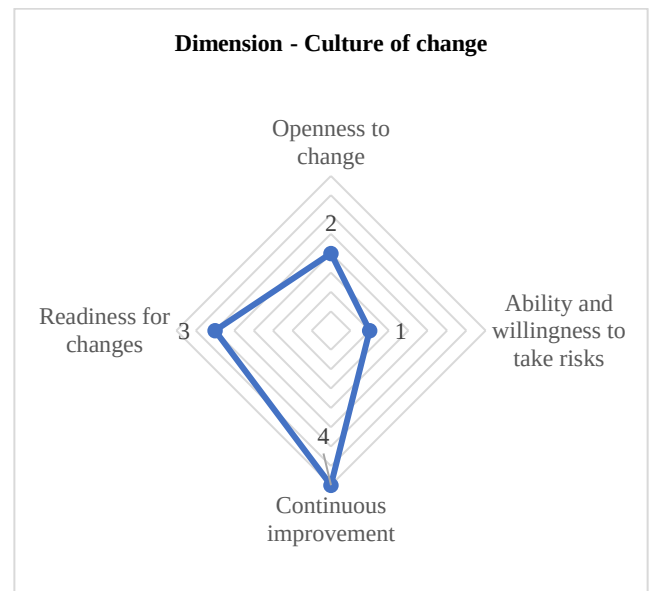


**Figure 4.** Dimension – Processes / technologies / systems  
Source: own elaboration

Figure 3 shows in the Strategy dimension that respondents were mainly inclined to define the elements according to a medium level of agility to a high level for the element of relationships with external environment actors. Figure 4, characterizing the Processes / Technologies / Systems (PTS) dimension, shows high volatility in the median data of the individual questionnaires. The elements are predominantly skewed towards the median level of agility, where basic agile practices and methods are applied. The only change occurs in the information system case, where respondents indicated that it achieves low agility, and thus, only awareness of agile practices and principles is prevalent. In the digitization of processes, respondents indicated high levels of agility.



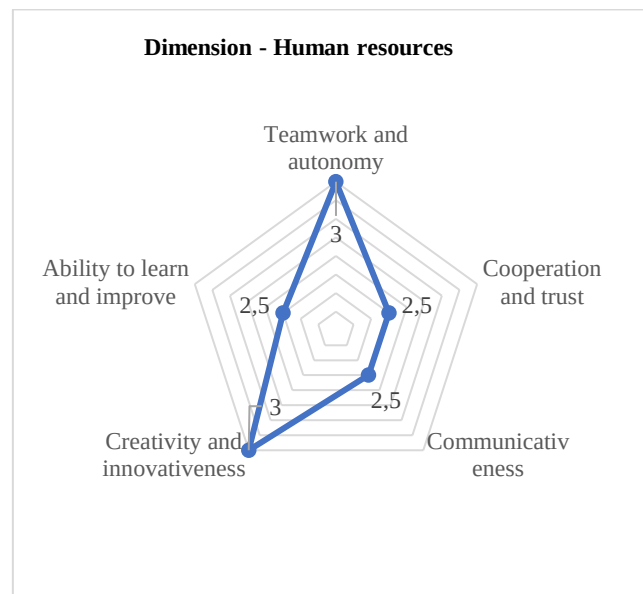
**Figure 5.** Dimension – Products/services  
Source: own elaboration



**Figure 6.** Dimension – Culture of change  
Source: own elaboration

Figure 5 shows that the elements of the Products and Services dimension are perceived mostly towards medium to high agility in applying innovation and improvement. In Chart 6, we observe a greater variation in the values, where we see ratings at almost all levels for each element, ranging from a low level of agility for the Capability and Willingness to Take Risks element to an excellent level of agility for the Continuous Improvement element.

Figure 7 shows us the values of the individual elements of the last dimension Human Resources. The most common levels that respondents assigned to the elements are medium to high levels of agility.



**Figure 7.** Dimension – Human Resources

Source: own elaboration

The assessment of the level of agility for the defined dimensions is presented in Table 5. This assessment was performed using the Euclidean distance method.

**Table 5.** Euclidean distances of agility dimensions

| Dimension                        | R1   | R2   | R3   | R4   | R5   | R6   | R7   | R8   | R9   | R10  |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|
| Organisation                     | 4.47 | 4.16 | 4.32 | 4.58 | 4.68 | 4.57 | 4.31 | 4.42 | 4.53 | 4.37 |
| Customers                        | 2.24 | 2.05 | 2.42 | 2.19 | 2.46 | 2.33 | 2.11 | 2.27 | 2.30 | 2.50 |
| Strategy                         | 5.10 | 4.81 | 5.55 | 4.91 | 5.25 | 5.14 | 4.85 | 5.40 | 5.18 | 5.34 |
| Processes, technologies, systems | 6.16 | 5.68 | 6.40 | 5.76 | 6.22 | 5.99 | 5.72 | 6.35 | 6.20 | 6.12 |
| Products, services               | 4.00 | 3.86 | 4.12 | 4.04 | 3.97 | 4.06 | 4.10 | 3.94 | 4.03 | 4.07 |
| Culture of change                | 3.46 | 3.60 | 3.31 | 3.55 | 3.72 | 3.59 | 3.50 | 3.42 | 3.65 | 3.48 |
| Human Resources                  | 3.46 | 3.61 | 3.29 | 3.57 | 3.50 | 3.49 | 3.40 | 3.38 | 3.55 | 3.52 |

Table 5 presents us the individual values of the Euclidean distances for the given dimensions calculated based on the elements belonging to these dimensions. In the Organization dimension, we observe that the respondents' ratings show medium variability. Respondent 2 perceives this dimension most positively (closest to the ideal "agile" state) with an Euclidean distance value of 4.16, while respondent 10 perceives the most room for improvement. The Customer's dimension is perceived as highly agile by respondents, observing consistent responses with Euclidean distance values ranging from 2.27 for respondent 8 to 2.50 for respondent 10. The Strategy dimension is perceived most positively by respondent 2 with a value of 4.81 and least positively by respondent 7 with a value of 4.85. In the Processes, Technology and Systems dimension, the most positive perception was measured for respondent 2 with a Euclidean distance value of 5.68 and the most room for

improvement was perceived by respondent 7 with a Euclidean distance value of 5.72. Respondents 2 and 8 perceive the Products and Services dimension as the most positive with values of 3.86 and 3.94 respectively, while respondent 7 perceives it as suitable for improvement, however, where the Euclidean distance value does not differ much and is at 4.10. In the Culture of Change dimension, we observe that the closest to the ideal state would be compared by respondents 3 and 8 with values of 3.31 and 3.42 respectively, while respondent 5 perceives it as an area for improvement with a value of 3.72. The last dimension which is the human resource dimension is seen most positively by respondent 3 where a Euclidean distance value of 3.29 was recorded. In contrast, respondent 2 sees it as the most suitable for improvement with a value of 3.61. Overall, we observe a very low level of variation in the individual Euclidean distances, which underlines the fact that respondents agree on the different areas that are suitable for improvement in the enterprise.

**Table 6.** Standard deviation of Euclidean distances

| Dimension                        | Standard deviation |
|----------------------------------|--------------------|
| Organisation                     | 0.27               |
| Customers                        | 0.22               |
| Strategy                         | 0.31               |
| Processes, technologies, systems | 0.40               |
| Products, services               | 0.17               |
| Culture of change                | 0.24               |
| Human Resources                  | 0.20               |

In Table 6 we can observe that the Processes, Technologies and Systems dimension shows the greatest variability in the individual Euclidean distance values. Thus, from the results we can conclude that managers in the enterprise are not similar in their opinions on processes, applied technology and the overall level of technology in the enterprise and the systems that are in place (level of process management, process automation, information system, digitalization of processes, time of change and optimization of processes, adaptability of processes), where the standard deviation reaches a visibly higher value of 0.40 compared to the other dimensions. A similarly higher value is achieved by the Strategy dimension (management of continuity and change at the same time, relations with external actors, commitment, mobility of resources, reactions to environmental changes by objectives and strategy, scope of planning), where the standard deviation value is 0.31. On the other hand, the least variability is shown by the Products, services dimension with a standard deviation value of 0.17.

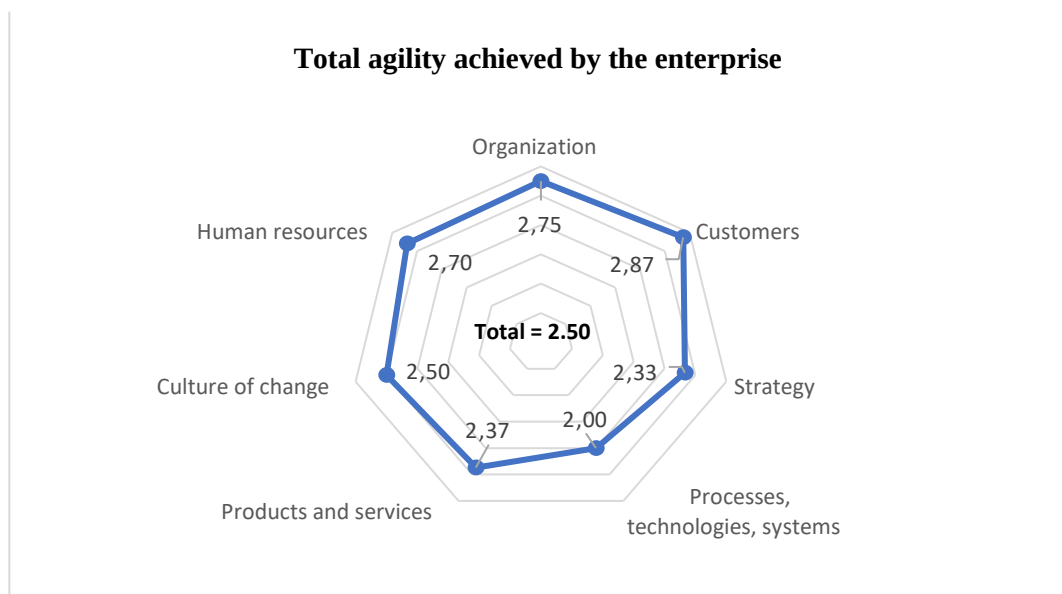
Table 7 below summarizes the median Euclidean distance values for each dimension, and we also constructed the arithmetic mean of the median values for each dimension according to the specific responses of the respondents for each item.

**Table 7.** Resulting dimension scores

| Dimension:                       | Euclidean distance (Median) | Assessment by the median values of the elements |
|----------------------------------|-----------------------------|-------------------------------------------------|
| Organisation                     | 4.44                        | 2.75                                            |
| Customers                        | 2.31                        | 2.87                                            |
| Strategy                         | 5.16                        | 2.33                                            |
| Processes, technologies, systems | 6.14                        | 2.00                                            |
| Products, services               | 4.11                        | 2.37                                            |
| Culture of change                | 3.52                        | 2.5                                             |
| Human Resources                  | 3.49                        | 2.7                                             |

From Table 7, we observe that in terms of Euclidean distance, the Customers dimension is closest to the ideal state, the Organization, Products and Services, Culture of Change and Human Resources dimensions have a high homogeneity in responses and a medium distance from the ideal. Conversely, slightly higher variability was noted for the Strategy and Processes, Technology, Systems dimensions, indicating a diversity of opinion in these areas, and the highest values represent a large room for improvement for these dimensions and their elements. In order to determine the overall level of enterprise agility in our study enterprise, we used the measured median values of the individual agility elements and created an average value for each dimension. For each dimension, respondents were most likely to lean towards medium (Strategy; Processes, Technology, Systems; Products and Services) to high levels of agility (Organization, Customers).

The average value provided us with a final view of the individual dimensions regarding the level of agility achieved. Also, it allowed us to determine the overall level of enterprise agility achieved in the enterprise we studied. Based on the data in Table 7, the resulting value of overall enterprise agility is 2.5, representing a degree between medium and high levels of agility. The resulting scores can be displayed using the scorecard method presented in the graph in Figure 8.



**Figure 8.** Overall level of agility achieved by the enterprise

Figure 8 shows that all values are between medium to high agility levels, with an overall agility level of 2.50. Thus, we can conclude that the enterprise has at least the basics of agile practices in place in all its dimensions, with the ability to adapt and respond to change being present, with full integration of agile methods and principles prevalent in most areas where agile processes are being measured. The enterprise can adapt at any time, in any way and in anything, as evidenced by the overall level of agility, which we also call high flexibility.

From the results obtained, whether it is the business owners or individual managers (respondents), their answers are similar to the questions of the different dimensions and elements. The prevailing high homogeneity of the answers could be due to the uniform understanding of the agile concept within the enterprise, similar experiences and equally similar perceptions of the different business processes based on internal communication and information-sharing culture.

By evaluation, we observe that the most significant reserves where the process of amplification of individual dimensions and, consequently, their elements can be realized are mainly in the dimensions of Strategy, Processes, Technologies and Systems and Products/Services. The dimensions in question can be seen as some of the most important components of the enterprise, forming the core from which all other areas are derived.

Therefore, the enterprise should focus more on the elements of these dimensions and look for opportunities in the form of different agile principles and techniques that would help it increase the level of agility in these areas. Increased application of agile principles is needed, especially in process management, information systems, product delivery and development, and product portfolio innovation. In the area of strategy, the main focus needs to be on increasing motivation and commitment to implementing change. Respondents agreed fairly accurately on the other dimensions that achieve a higher level of agility, namely Organization, Customers, and Human Resources. From the above, we can conclude that despite the three dimensions that fall far short of the "perfect, ideal state", all dimensions are very close to high agility, creating a prerequisite for creating the appropriate agile awareness in the enterprise and its further growth. At the same time, we argue that by combining the individual dimensions into a whole, which can be called the enterprise itself, the enterprise achieves a medium to high level of agility, characterized by the application of basic agile practices but also by the full integration of agile principles and methods in most cases.

At the end of the research, we found that the final score of the overall agility level of the enterprise is 2.50, which is the upper middle level of agility that the enterprise achieves. Therefore, the enterprise knows agility well, is flexible, measures its agile processes, and can adapt quickly and effectively to different aspects. The most significant area identified where it would be necessary to start improving the level of agility achieved is the Processes/Technology/Systems dimension, which, throughout the research, was characterised by its lower level of agility compared to the other dimensions. For this dimension, it would be appropriate to strengthen and then apply agile techniques and methods such as Agile Modeling (use of iterative techniques for documentation and systems design), Value Stream Mapping (analysis and visualization of value stream in processes), DevOps (integration of development and operations teams).

It should be added that the dimensions and elements of agility proposed and assessed by us are fully flexible, and the enterprise should be able to adapt them according to its needs and capabilities to identify its level of agility as accurately as possible. The Scorecard approach to assessing enterprise agility is simpler and more manageable for managers than the Reachability Matrix, which provides a formal and systematic analysis of the relationships and interactions between different system elements but is complex and time-consuming in its execution yet requires advanced knowledge and specialized tools. The scorecard approach has the disadvantage of the subjectivity of individual views, and the results can also be influenced by the current understanding of the enterprise as a whole, along with the understanding and interpretation of the agile concept. However, it is a flexible, adaptable solution that allows changes to be implemented quickly and their impact on the agility of the enterprise to be tracked, making it an ideal approach for managers seeking effective solutions.

## **Conclusions**

The ability to build and maintain a certain level of agility in the enterprise is becoming an essential part of a competitive enterprise today. Building this capability requires the application of the right methodology to enable the business to take these steps. Our proposed methodology provides a structured and comprehensive approach to identify and assess key areas of agility specific to manufacturing and industrial enterprises. The application of the agility assessment methodology offers an opportunity for enterprises to identify their agility strengths and weaknesses, focus on targeted improvement of agility-enabling elements, measure their progress, and be better prepared for the future. Based on the presented application of the methodology for assessing the level of agility achieved, we conclude that the overall agility in the enterprise is at a high level. The enterprise is thus applying agile principles and methods that it can measure and work with to adapt to change effectively. We have also identified the Processes/Technologies/Systems dimension as the most important dimension most needed for further improvement in agility and developing the ability to respond quickly and effectively to change, thereby ensuring the long-term competitiveness and success of the enterprise.

We consider the presented approach original and workable in manufacturing companies as it fills a gap in this area and offers a new, unique solution to the agile problem. The results of this research can help small and medium-sized industrial enterprises, especially, to be prepared for unexpected changes from the external and internal corporate environment, which we consider to be a key factor for their long-term sustainability and improvement of their position in the market.

A limitation of this research is the focus on manufacturing enterprises only, which is a limiting factor that could be eliminated in the future by modifying or generalizing the individual dimensions and barriers. Further direction of the research will be carried out in terms of creating a management model for building agility, which will serve as a concept of agility at the strategic level, allowing to acquire or improve the ability to respond to any changes in the company's environment or to make the necessary changes in a timely manner.

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