OPTIONS FOR ASSESSING THE LEVEL OF ENTERPRISE AGILITY

Andrea Janáková Sujová*, Petra Lesníková

Technical University in Zvolen, T. G. Masaryka 24, Zvolen 960 01, Slovakia

Abstract

Flexible and agile methods are nowadays, in a volatile market environment, at the forefront of the minds of academics, researchers, professionals, managers and business owners. Efforts to become agile and to gradually increase the level of agility should be a part of the enterprise's activities, which will enable the enterprise to secure the conditions for long-term and successful operation. The aim of the paper is to present the possibilities and methods of evaluation and self-assessment of the level of agility achieved by the enterprise based on the summarization of theoretical and scientific knowledge.

Keywords: *enterprise agility, maturity model, reachability matrix, scorecard, self-assessment*

1. INTRODUCTION

Business agility is the ability of a business to adapt quickly and effectively to changing customer needs, market conditions, and competitive pressures. It is considered a key source of competitive advantage and superior performance in today's dynamic and uncertain environment. Business agility can be achieved by developing various enterprise capabilities, such as strategic agility, operational agility, workforce agility, and learning agility. Vrontis et al. (2023) conducted a mixed-method comparative analysis of firms operating in developed and emerging markets and found that strategic agility positively affects performance in both contexts. The authors also found that openness, as measured by search depth and breadth, moderates the relationship between strategic agility and performance. Similarly, Schmitt and Hörner (2021) investigated the effect of business process agility on innovation performance and found that it mediates the relationship between environmental turbulence and innovation performance.

Agility demands both fast decision-making processes and timely organizational adaptations, which can take place in the firm's different activities and business processes, such as information technology, organization, human resource management, strategy, and innovation (Brueller et al. 2014, Komodromos et al. 2019, Brannen and Doz 2012, Wilson and Doz 2011, Morton et al. 2018,). According to the resource-based view, agility is also about discovering and deploying the right resources (hard and soft) to implement the new strategy in a timely manner (Weber and Tarba 2014).

There is a growing body of literature and scientific research on enterprise agility, exploring its definition, dimensions, antecedents, outcomes, and measurement. A systematic literature review by Walter (2021) identified four categories of agility research: agility drivers, agility enablers, agility capabilities, and agility dimensions. The author also proposed a conceptual map of organizational agility and a framework for agile management. Summarizing and critically analyzing existing research on organizational agility provides a foundation for measuring and implementing agility within organizations.

It is clear that not only the principle of building agility itself becomes important, but also and above all the ability of the company to be able to assess the level of agility achieved. Ramasesh et al. (2001) argue that in assessing the level of agility achieved, the ability of the enterprise to be able to justify the investments made related to the application of agile elements, dimensions and methods is important. The need for the development of validated tools for measuring agility has also been highlighted by Grena et al. (2019), who, based on the analysis of a maturity model, have developed and tested tools to help enterprises in their journey of building and improving their agility levels. The Business Agility Institute has also been assessing agility levels since 2017. The assessment model is based on 13 domains incorporated into four key areas: relationships, leadership, processes and individuality.

An important starting point for assessing agility in the enterprise is the defined maturity model. The maturity model highlights the completeness of a given object, defining the different levels of agility that can assess the completeness of agility, in the context of its level achieved by a given enterprise (Wendler, 2014). There are a large number of agility maturity models in the literature, an overview of which can be found in the works of Pooley et al. (2013) and Schmidt et al. (2019). The most widely used is the Capability Maturity Model Integration CMMI by Shrum (2000). Each maturity model contains dimensions and elements in each agility dimension. The elements are applied within the framework of agility principles on which to build an agile enterprise and represent the fundamental foundations for agile to function properly. The core principles include adaptability and flexibility, speed and agility, high customer orientation, teamwork, innovation and learning (Wade et al., 2021). Agile principles, which are better known as the Agile Manifesto, have helped many authors over the years in creating agile frameworks and agile methodologies. The dimensions of agility form the key areas that help organizations to respond quickly and effectively to change, improve collaboration, innovation, and customer satisfaction. Defining and describing the dimensions of agility has been addressed by several authors (Gagnon, Hadaya, 2018; Baker, 2017; Kloibhofer, 2018). Conceptual frameworks of agility through dimensions and elements have also been developed by Linkevics and Sukovskis (2015), Sharifi and Zhang (2000), Cimini et al. (2024). Yu and Zheng (2006) developed an index system for measuring agility and identified three levels of agility: low, medium and high.

However, there are also some gaps and challenges in the literature and scientific research on enterprise agility. For instance, there is no consensus on the definition and measurement of business agility among different scholars and practitioners. Moreover, there is a lack of empirical evidence on how to implement and manage business agility in different contexts and industries. Furthermore, there is a need to explore the potential trade-offs and risks associated with business agility, such as increased complexity, uncertainty, and vulnerability. Therefore, more research is needed to advance the theory and practice of agility in enterprises.

In this paper, the attempt was made to make an overview of the existing frameworks for maturity models of agility and methods for measuring and assessing the level of the agility in a company. Thus, the development of an assessment methodology for an enterprise provides valuable information on the current state of the achieved level of agility, while highlighting areas for possible improvement.

2. MATERIALS AND METHODS

2.1. Materials

Solving the problem of the article required an extensive literature search of existing knowledge. The input information was publications of foreign authors, which we drew from scientific articles registered in various databases, book publications available online, official reports of the Business Agility Institute. The selection of publications included theoretical, review articles and also empirical studies with application in enterprises.

2.2. Methods

The first step was to conduct a literature search in the field of enterprise agility regarding maturity models, principles, elements, dimensions, concepts (frameworks) and also ways and methods of measuring and evaluating agility in the enterprise. The search included more than 100 publications.

Based on the knowledge gained from the literature search, we proposed a procedure for assessing the level of agility in the enterprise and a baseline maturity model with identification of levels of agility. Subsequently, the options of methods for collecting input data for the assessment and methods for evaluating agility levels were summarized.

In the conclusion, the advantages and disadvantages of each method were evaluated from several perspectives and their suitability for self-assessment by managers themselves in enterprises.

The methods of analysis, deduction, comparison, description and summarization were used in the preparation of the article.

3. RESULTS

By summarizing the existing knowledge, we obtained an up-to-date picture of the process of assessing agility in the enterprise. Based on this, we have compiled a methodological procedure, depicted in figure 1.

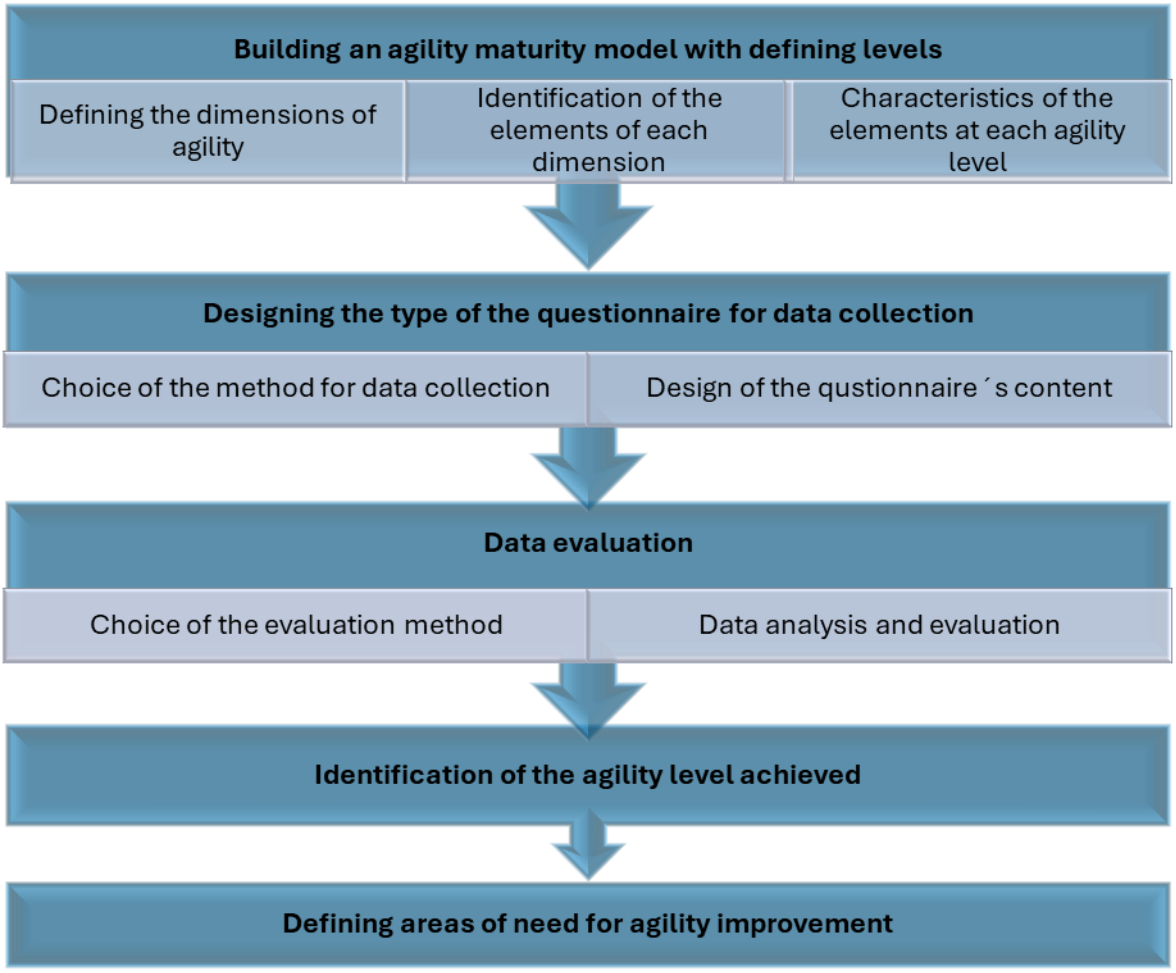

Fig. 1. Methodological procedure for assessing the level of agility in an enterprise

3.1. Agility maturity model

For the purpose of assessing the current state of agility in the enterprise, it is necessary to start from the defined agility stages, which are the content of the maturity models. Maturity models can be divided between descriptive, prescriptive and comparative (de Bruin et al., 2005). Another division focuses on the individual domains in the enterprise - process, object and people maturity models (Mettler, Rohner, 2009). Other observed levels are for example organisational, team or personality. Each of these models has, in most cases, its predetermined levels, a description of each of the levels that speaks to the characteristics specific to that level.

Based on a detailed review of the available agile maturity models and the approaches taken by each author, a cross-sectional, exemplary model can be constructed, as described in Table 1.Solving the problem of the article required an extensive literature search of existing knowledge. The input information was publications of foreign authors, which we drew from scientific articles registered in various databases, book publications available online, official reports of the Business Agility Institute. The selection of publications included theoretical, review articles and also empirical studies with application in enterprises.

Level	Name	Description
0.	**No agility** (score: 0%)	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 (reactivity)** (score: 1 - 20%)	The organization is becoming aware of agile principles, but the processes are still reactive. It is able to respond to changes in the environment, but is slow to react to change, has long decision-making processes and rigid processes.
2.	**Medium agility (adaptability)** (score: 21 - 45%)	Organizations implement basic agile practices at the process level. These are basic attempts to plan, execute, monitor and control according to agile principles. The ability to adapt and respond to change is present. Decision making is relatively faster, and there is some level of multidisciplinary collaboration
3.	**Higher agility (flexibility)** (score: 46-60%)	Agile methods and principles are fully integrated into the organisation's processes. There is a standardised framework of agile practices accepted by the organisation. The organization is able to adapt and make changes at any time, in anything and in any way.
4.	**High agility (full agility)** (score: 61-89%)	The organization measures and analyzes its agile processes using quantitative data, develops a culture of adaptability and continuous improvement, and encourages experimentation and innovation. It is able to implement change and adapt quickly and in a timely manner.
5.	**Excellence in agility (proactivity)** (score: 90 - 100%)	The organization continuously improves through innovation and optimization based on a deep understanding of agile methods and their effective adaptation, leveraging artificial intelligence to anticipate and shape market trends

Table 1. Agility maturity model

Source: own processing.

3.2. Dimensions and elements of agility

Once the levels of agility have been defined, it is necessary to determine the dimensions along which agility will be assessed. These dimensions help to shape a flexible and dynamic work culture that is able to effectively face challenges and seize opportunities in an ever-changing business environment. The are different opinions and characteristics of dimensions in scientific works. Sometimes they are considered as agility kinds or fields, sometimes are defined as agile principles. We understand the dimension of agility as a quantitative or qualitative measurable area that makes it possible to assess the extent to which individuals, teams or organisations are able to respond effectively to dynamic and uncertain situations. The elements of agility comprise the individual attributes of each dimension that are assessed and their characteristics are different for each level of agility. We suggest 4-6 elements for each dimension to be evaluated.

A summary of the dimensions and their elements found in existing publications is presented in Table 2.

Dimension	Elements
Organisation	Communication, Experience, Size, Learning, Team building, Goals
Quality	Guidelines, Agreements, Standards, Tools, Roles, Change Management
Value	Release Management, Product Management, Portfolio Management, Metrics
Productivity	Communication, Knowledge Management, Learning, Environment, Collaboration, Motivation, Teams, Experience
Process	Time boxed activities, roles, artifacts
Management and leadership	Communication, risk, style
Innovation	Flexibility, proactivity, speed
Strategies	Engagement, industry awareness, planning
Culture	Accountability, trust, values and principles, openness to change, continuous improvement, willingness to take risks
Learning and change	Organisational learning, skills development, workforce skills, adaptability
Structure	Collaboration, cooperation
Product	creating the best possible product, customer service, portfolio management, speed of delivery, speed of new product development
Customers	Monitoring customer feedback, needs and requirements, customer satisfaction
People	Teamwork, team autonomy, communicative, creative/innovative, collaborative, learning and improvement

Table 2. Dimensions and elements of agility

Source: own processing.

The Business Agility Institute conducts agility assessments in 5 dimensions and each dimension contains 4 elements. The elements in this model represent the capabilities of the business. The dimensions are as follows: engaged culture, responsive customer-centricity, people-first leadership, flexible operations, value-based delivery.

The second way to define the parameters to be evaluated is to create a list of agility principles and their characteristics. The agile principles are known as the Agile Manifesto and can be summarized as follows:

1. Flexibility and adaptability: an agile enterprise can respond quickly and effectively to changes in the environment and changing customer needs. The principle of flexibility and adaptability means that the enterprise is able to adapt to new conditions and change its processes and strategies quickly.

2. Customer focus. The principle of customer-centricity means that the business can adapt to changes in customer preferences and provide them with the value they expect.

3. Iterative and Incremental Approach: Agile enterprise works with an iterative and incremental approach to develop and deliver products and services. The principle of the iterative and incremental approach means that the enterprise focuses on delivering functional and usable parts of the product quickly, with each iteration adding additional value.

4. Self-organization and teamwork. The principle of self-organisation and teamwork means that teams have more responsibility and freedom in decision making and work planning.

5. Transparency and communication. The principle of transparency and communication means that information is freely available and shared, enabling better collaboration and decision-making.

6. Continuous improvement and learning: An agile enterprise focuses on continuous improvement of its processes and results and fosters a culture of learning. The principle of continuous improvement and learning means that the enterprise is not satisfied with the status quo but is always looking for ways to improve and innovate.

3.3. Data collection methods

The method of obtaining input data is by means of a questionnaire. However, there are several options for the formulation of questions and answers and corresponding and usable methods for the evaluation of the results.

The first option is to list the principles of agility with a brief description of them and use a rating scale for the answers, either a 5-point Likert scale (strongly disagree to strongly agree), or a 3-point scale: yes, partly, no, or just 2 options: yes and no. The result will be an indication of which principles the company applies, which it applies only partially and which it does not apply at all. In this option it is not possible to assess individual dimensions, but only the level of overall agility.

The second option is to use a diagnostic test of agility elements: creating a pair of options with characterization of agility elements in each dimension at the highest level of agility and at zero level according to the maturity model. The result will be to find out how many elements of the whole set are agile and what is the percentage of agility - both overall and in each dimension. This can also be applied when introducing the principles of agility.

The third option is to create a list of elements without the agility grade flag. For the answers, a scale will be created representing each level of agility: rigid, reactive, adaptive, flexible, agile, proactive. In order to indicate the correct answer, a description of each level according to the maturity model must also be provided. This will result in the identification of what level each element is at.

The fourth option is to formulate a characterization of the agility elements of each dimension for each level of agility according to the maturity model. In the generated checklist, the assessor ticks (marks) the appropriate option - the element characteristics that best describes the state of their enterprise. As a result, the level at which each element is at will be identified and the level of agility for each dimension and overall agility can be evaluated.

3.4. Data evaluation methods

Several methods can be used to evaluate the answers obtained, the basis of which are statistical methods:

- Frequency of responses, primarily relative, reflecting the percentage of agile principles, elements, and dimensions present.
- Median of the degree of the principles and elements and the mean of the dimension for the scaling response options.
- Euclidean distance method: evaluation and analysis of agile elements of organizations using fuzzy logic. Once the agile factors are identified and evaluated, fuzzy calculations are used to aggregate the evaluations and create an overall agility index. Here, Euclidean distance plays a key role in comparing the obtained fuzzy values with the predefined linguistic levels, which allows assigning a comprehensible linguistic rating to the overall agility of the organization. The Euclidean distance will represent the distance between the achieved level and the highest level of agility.

For the final evaluation of the achieved agility of the enterprise we recommend 2 methods:

Scorecard: a map capturing the results of scoring individual agility dimensions as well as individual elements within the agility dimensions. The scoring is the resulting relative frequency of the elements or principles of agility, or the median grade of the individual elements and principles followed by the

average of the entire dimension, or Euclidean distance. For visualization, there is the possibility of using a radar chart, which will also show in which dimensions there are the largest margins. An example of the result of the evaluation is shown in Figure 2.

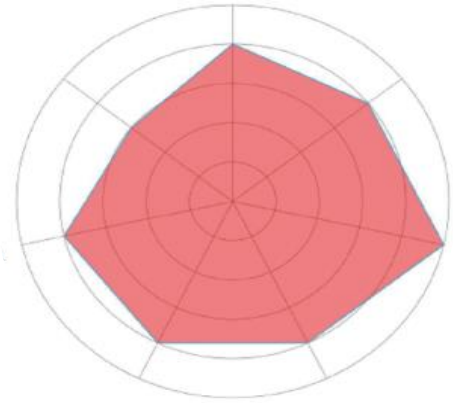

Fig. 2. Scorecard radar chart

Source: own processing

Reachability matrix based on Interpretive structural modelling (ISM) that is an interactive learning process in which a set of different and directly related elements is structured into a comprehensive systemic model. ISM helps in identifying the inter-relationships among variables. It is a suitable modelling technique for analysing the influence of one variable on other variables. Having decided on the element set and the contextual relation, a structural self-interaction matrix (SSIM) is developed based on pair-wise comparison of variables. In the next step, the SSIM is converted into a reachability matrix and its transitivity is checked. The SSIM format is transformed into a reachability matrix format by transforming the information in each entry of the SSIM into 1s and 0s in the reachability matrix. Once transitivity embedding is complete a matrix model is obtained. Then, the partitioning of the elements and an extraction of the structural model. The matrix is partitioned, by assessing the reachability and antecedent sets for each variable. See figure 3.

	1	2	3	4	5	6	7
1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1
3	0	0	1	0	1	1	1
4	0	0	1	1	1	1	1
5	0	0	1	0	1	1	1
6	0	0	0	0	0	1	1
7	0	0	0	0	0	0	1

Dimension	Reachability set	Antecedent set	Intersection set	Level
7	7	1, 2, 3, 4, 5, 6, 7	7	I
6	6	1, 2, 3, 4, 5, 6	6	II
3	3, 5	1, 2, 3, 4, 5	3, 5	III
5	3, 5	1, 2, 3, 4, 5	3, 5	III
4	4	1, 2, 4	4	IV
1	1, 2	1, 2	1, 2	V
2	1, 2	1, 2	1, 2	V

Fig. 3. Reachability matrix and its interaction

Source: Sushil and Chroust (2015)

4. DISCUSSION

Maturity models help organizations assess their achieved agility levels, identify areas for improvement and plan steps to achieve higher levels of agility. At their core, we are talking about tools that provide a structured framework to assess an organization's work and processes in the context of agile methodologies. Thus, in themselves they represent different levels of effectiveness and adoption of agile practices in an organisation. By using them, we compare the current state of the company with the

defined levels of agility, thus being able to define the current level of agility and the possibilities for improvement. The proposed model is detailed, capturing 5 levels of agility, as well as the most widely used CMMI model used by several authors, but the characteristics of the levels have been modified by summarizing the findings.

Regarding the dimensions and elements of agility, there is confusion and inconsistent understanding in existing publications as to what are dimensions and what are elements. It is only in works dealing with the concept of agility for the purpose of its evaluation that this understanding is unified, but there is again a conflation of elements with the principles of agility. Therefore, in this paper we have organized the knowledge and presented a summary of all dimensions and elements, recommending to select a maximum of 6 dimensions and within each dimension 4-5 elements. The Business Agility Institute conducts an assessment in roughly the same scope.

Within the data collection methods for the assessment model, the fourth option of creating a checklist of items is the most accurate, with the only disadvantages being longer preparation and a large range of items for assessment. The third option, on the other hand, has a simpler preparation but the highest risk of incorrectly capturing responses, as knowledge of the different levels of agility of the rater is required. The second option is also clearer and easier for the assessor to understand, but on the other hand does not allow as much accuracy in detecting the level of agility. The first option is the simplest, but does not allow to evaluate the level of agility of each dimension.

The scorecard method for assessing agility levels is a flexible tool designed to measure the performance of organisations in specific, selected areas, allowing specific indicators and targets to be set and tracked. It is mostly used in the evaluation of start-ups; we have chosen to use it for the evaluation of enterprise agility. The advantage of this method is its low complexity and manageability by business managers for self-assessment of agility, which can be performed periodically as part of monitoring improvements in agility.

The reachability matrix is more difficult to process, but it includes not only an assessment of the level of agility, but also the identification of the relationships between the elements of agility, which allows to evaluate their mutual influence and more effectively set the steps for improving agility.

5. CONCLUSIONS

The current global crisis is among the factors of the globalised world that have negatively affected the functioning and economic performance of businesses. The data provided by the Business Agility Report shows that the need to create and build business agility is clearer and more important than ever, taking into account the events of recent years. The results of many studies have shown that building business agility has a significant impact on an organisation's performance, its innovation capabilities and gives it a definite competitive advantage.

Knowing your current state is a necessity when a business wants and is interested in building agility. The starting activity is therefore to assess the level of agility in the enterprise. This paper has discussed the methodological procedure and methods to collect and evaluate the data. The methods that are suitable for this activity and manageable by practicing managers are the Scorecard and the Achievability Matrix. The result is the determination of the level of agility achieved in each dimension according to the proposed key and the discovery of the reserves as well as the necessary steps to move to a higher level of agility.

ACKNOWLEDGMENTS

The paper is a partial result of the grant scientific project VEGA 1/0333/22 Business agility - the ability to effectively adapt to unpredictable changes in the environment in the context of corona crisis during the COVID-19 pandemic.

REFERENCES

1. Baker, T. 2017. Performance management for agile organizations: Overthrowing the eight management myths that hold businesses back. Springer.
2. Brannen MY, Doz YL (2012) Corporate languages and strategic agility: trapped in your jargon or lost in translation? *Calif Manag Rev* 54(3):77-97. https://doi.org/10.1525/cmr.2012.54.3.77
3. Brueller NN, Carmeli A, Drori I. 2014. How do different types of mergers and acquisitions facilitate strategic agility? *Calif Manag Rev* 56(3):39-57. https://doi.org/10.1525/cmr.2014.56.3.39
4. Cimini, C., Lagorio, A., & Cavalieri, S. 2024. Development and application of a maturity model for Industrial Agile Working. *Computers & Industrial Engineering*, 188, 109877.
5. Gagnon, B., Hadaya, P. 2018. The four dimensions of Business Agility. Semantic scholar. Online: https://www.semanticscholar.org/paper/The-Four-Dimensions-of-Business-Agility-Gagnon-Hadaya/9763e3845da2d446cf54e4c8e681166dde01355f
6. Grena, L., Torkara, R., Feldtb, R. 2019. Towards a Quantitative Measurement of Agility: A Validation Study on an Agile Maturity Model. arXiv preprint arXiv:1904.02444.
7. Kloibhofer, P. 2018. Five dimensions for a successful scaled agile transformation. 3DSE. Retrieved from https://clone.3dse.de/insights/wp-content/uploads/2018/10/3DSE-Insights-Article-Dimensions-of-agile-transformation_final_interactive.pdf
8. Komodromos M, Halkias D, Harkiolakis N. 2019. Managers' perceptions of trust in the workplace in times of strategic change: the cases of Cyprus. *Greece Romania Euromed J Bus* 14(1):2-20. https://doi.org/10.1108/EMJB-03-2018-0018
9. Linkevics, G., Sukovskis, U. 2015. Evaluation of the Agility Level of the Organization. *Applied Computer Systems*, 18(1), 21-26.
10. Morton J, Stacey P, Mohn M. 2018 Building and maintaining strategic agility: an agenda and framework for executive IT leaders. *Calif Manag Rev* 61(1):94-113. https://doi.org/10.1177/0008125618790245
11. Pooley, R., Coady, J., Schneider, C., Linger, H., Barry, C., Lang, M. 2013. Information Systems Development: Reflections, Challenges and New Directions. Springer Science & Business Media.
12. Ramasesh, R., Kulkarni, S., Jayakumar, M. 2001. Agility in manufacturing systems: an exploratory modeling framework and simulation. *Integrated manufacturing systems*, 12(7), 534-548.
13. Sharifi, H., Zhang, Z. 2000. A methodology for achieving agility in manufacturing organizations, Int. J. Operations and Production Management, Vol. 20, pp. 496-512.
14. Shrum, S. 2000. Choosing a CMMI model representation. CrossTalk, 13(7), 6-7.
15. Schmitt, A., Theobald, S., Diebold, P. 2019. Comparison of Agile Maturity Models. In: Franch, X., Männistö, T., Martínez-Fernández, S. 2019. Product-Focused Software Process Improvement. PROFES 2019. Lecture Notes in Computer Science, vol. 11915. Springer, Cham. https://doi.org/10.1007/978-3-030-35333-9_52
16. Schmitt, A. and Hörner, S. 2021, Systematic literature review - improving business processes by implementing agile. *Business Process Management Journal*, Vol. 27 No. 3, pp. 868-882. https://doi.org/10.1108/BPMJ-10-2019-0422
17. Vrontis, D., Belas, J., Thrassou, A. *et al.* 2023. Strategic agility, openness and performance: a mixed method comparative analysis of firms operating in developed and emerging markets. *Rev Manag Sci* 17, 1365-139. https://doi.org/10.1007/s11846-022-00562-4
18. Wade, M., Teracino, E., 2021. reprint HBR 6 Principles to Build Your Company's Strategic Agility. Harward Business Review. Available at: https://hbr.org/2021/09/6-principles-to-build-your-companys-strategic-agility

19. Walter, AT. 2021. Organizational agility: ill-defined and somewhat confusing? A systematic literature review and conceptualization. *Manag Rev Q* 71, 343-391 (2021). https://doi.org/10.1007/s11301-020-00186-6

20. Weber Y, Tarba S.Y. 2014. Strategic agility: a state of the art introduction to the special section on strategic agility. *Calif Manag Rev* 56(3):5-12. https:// doi. org/ 10. 1525/ cmr. 2014. 56.3.5

21. Wendler, R. 2014. Development of the organizational agility maturity model, 2014 Federated Conference on Computer Science and Information Systems (FedCSIS), IEEE, Warsaw, Poland, pp. 1197-1206.

22. Wilson K, Doz Y.L. 2011. Agile innovation: a footprint balancing distance and immersion. *Calif Manag Rev* 53(2):6-26. https://doi.org/10.1525/cmr.2011.53.2.6

23. Yu, L., Heng, Z. 2006. Measuring Agility of Enterprise Using Analytic Hierarchy Process and Bayesian Belief Networks. International Conference on Management Science and Engineering, 551-556.