# Determinants of Foresight Maturity in SME Enterprises of Poland

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## Abstract

The complication of the business environment, the growth of uncertainty and the dynamics of change significantly affect strategic planning in business. Foresight research used in a company serves as a link between the volatility of the surrounding environment, possible expansion prospects and an enterprise's strategy and tactics. Based on data from Poland, this article examines the main factors that determine the readiness of small and medium-sized enterprises (SMEs) to navigate a variety of paths into the future (foresight maturity). This study integrates concepts of foresight maturity, dynamic capabilities, and corporate foresight. It relies on a sample of over 500 Polish manufacturing SMEs that is representative in terms of size, type, sector and geography of activities. Using a 28-criteria assessment tool, it was found that the level of foresight maturity of a company most often depends on the size, type and geographical coverage of markets. Involving stakeholders in the development of corporate strategies, scanning the micro- and macro-environment of the enterprise using a variety of information sources, improving skills in working with foresight tools as well as fostering other dynamic capabilities enable to gain lasting competitive advantages in a changing and unpredictable business landscape.

**Keywords:** foresight; dynamic capabilities; foresight maturity; organizational foresight; exploratory factor analysis; determinants of foresight maturity

**Citation:** Kononiuk A. (2022) Determinants of Foresight Maturity in SME Enterprises of Poland. *Foresight and STI Governance*, 16(1), 69–81. DOI: 10.17323/2500-2597.2022.1.69.81

## Introduction

The dynamics involving the uncertainty and complexity of the environment and trends affecting business activity, such as the Covid-19 pandemic, widespread automation and digitization (Spencer et al., 2021), the mismatch between education and labor market needs (McGuiness et al., 2017, Cedefop, 2018), as well as the rapid pace of innovation (Parry et al., 2009), shorter production cycles, and new customer requirements, make it difficult to anticipate business growth. In Western countries, the anticipation of enterprise development is widely endorsed by organizational foresight, which has become a yearly practice for many organizations (Hodgkinson, Healey, 2008; Vecchiato, 2015).

Foresight research used at a company serves as a link between the volatility of the surrounding environment, possible expansion prospects, and an enterprise's strategy and tactics (Derkachenko, Kononiuk, 2021). From the perspective of the theory of evolutionary economics, which analyzes the development of a company in its movement (Nelson, Winter, 1982), foresight implemented in organizations is perceived as a part of the search and change strategy, i.e., as a dynamic capability (Rohrbeck, 2010). Dynamic capabilities, in turn, are learned and stable patterns of activity through which the organization systematically generates and modifies its activities and adapts to new environmental conditions (Zollo, Winter, 2002).

Although there are many foresight initiatives run worldwide, foresight research carried out by small and medium companies is still weakly documented. As Iden et al. note, this study field is still underdeveloped, poorly organized, and characterized by exploratory studies, usually involving case studies, which are used to produce arboreal models to structure and synthesize empirical findings (Iden et al. 2017)[1]. On the other hand, SME enterprises make essential contributions to economic growth and employment and constitute 99% of all enterprises in OECD countries (OECD, 2019). Therefore, the foresight research which could stimulate those companies for growth and further development should be their part of a strategic research portfolio.

This study demonstrates a quantitative approach to the concept of foresight maturity. By foresight maturity the author understands a set of highly valued, learned, repetitive organizational behaviors (capabilities) in anticipation of the future, which make the company function better on the market than its competitors. This study aims to determine, using exploratory factor analysis, the main dimensions of foresight maturity at SME companies. The survey, conducted using CATI technique, was executed on a sample of 511 SME companies of the manufacturing sector. The theoretical background of the article integrates three research themes: dynamic capabilities (Winter, 2003), corporate foresight (Rohrbeck, 2010; Rohrbeck, Gemuenden, 2011), and foresight maturity models (Grim, 2009).

## Literature Review

### *Dynamic capabilities*

Dynamic capabilities were first comprehensively described by Teece et al., who pointed out that an organization is constituted not only by resources, but also by mechanisms for the formation and use of habits and capabilities (Teece et al., 1990). Dynamic capabilities allow for internal and external skills, resources, and competencies to adapt, integrate, and reconfigure to meet the demands of the environment. Zahra et al. state that dynamic capabilities are used by organizations to build business strategies, enter new markets, acquire new competencies, commercialize new technologies, and thus increase the speed of response to changes in the organization's environment (Zahra et al., 2006). Discussing the origins of dynamic capabilities, Zahra et al. relates the concept's assumptions to evolutionary economics (Nelson, Winter, 1982), arguing that managerial decision-making under conditions of uncertainty and bounded rationality leads managers to seek satisfactory rather than optimal choices. Zollo and Winter claim that dynamic capabilities are an established collective activity as a result of organizational learning, by means of which the organization systematically generates and modifies its operational routines in the process of seeking to improve the effectiveness of its management system (Zollo, Winter, 2002). According to Wang and Ahmed, dynamic capabilities are an organization's orientation toward integrating, reconfiguring, renewing, and reconstructing the competencies of the enterprise, in particular improving and reconstructing key capabilities, directed toward responding to the changing environment and maintaining competitive advantage (Wang, Ahmed, 2007). These capabilities allow the organization to create, expand, or modify its resource base. In clarifying the concept of dynamic capabilities, it is worth pointing out their characteristic features, which include (Jashapara, 2004):

- universality – dynamic capabilities can be applied in different contexts and industries;
- specificity – organizations can use similar, in essence, dynamic capabilities, and differences at the level of detail provide opportunities for competitive advantage;
- equifinality – understood as reaching the same goal by many different ways; organizations develop similar dynamic capabilities even if they have different starting points and choose different development paths; developing similar dynamic possibilities by different companies under condi-

[1] In the Polish research on the subject, there are only fragmentary studies relating to the use of foresight in enterprises (Nazarko, 2013; Kononiuk, 2014; Kononiuk, Sacio-Szymanska, 2015).

tions of uncertainty and a multivariate future is achieved by engaging different competences by the enterprises;

- prototyping – dynamic capabilities provide the ability to verify and acquire new knowledge at relatively low cost and risk;
- real-time information – dynamic capabilities enable adaptation and adaptation to the changing context of the environment;
- multiple options – dynamic capabilities point to alternatives that provide managers with the ability to react quickly to changes in the environment.

Complementing the characteristics of dynamic capabilities, it should be noted that Augier and Teece revised their earlier definition, assuming that dynamic capabilities, which are higher-order competencies, not only provide the ability to respond to changes in the environment, but also determine these changes (Augier, Teece, 2009). Shaping pertains to an organization's capacity to deliberately shape market opportunities in order for the organization to gain a lasting competitive advantage. The act of shaping the environment is linked to the entrepreneurial attitudes of managers who, through their actions, influence changes in the organization's environment. Interesting examples of market shaping are the business models of Starbucks and Netflix. Starbucks counterbalanced its competitors' low entrance barriers by shaping the culture of coffee drinking. Its business model was not just about drinking coffee itself, which could be done more comfortably and less expensively at home, but about building the whole experience of cosy atmosphere and sharing of this experience with other customers. Another example of influencing trends in the environment is that of Netflix, which expanded its DVD by mail business model into the ability to watch movies instantly on personal computers, leading to the demise of Netflix's main competitor Blockbuster, which was unable to shape changes in the external environment at a sufficient pace (Agwunobi, Osborne, 2016). In line with Rohrbeck and Paliokate and Pacesa, who perceive foresight as a dynamic competence (Paliokate, Pacesa, 2015; Rohrbeck, 2010), in this research paper I shall argue that foresight maturity could be treated as part of a search and change strategy, i.e., as a dynamic capability.

### *Corporate foresight*

The research in this field is dominated by case studies or the use of foresight at large companies; therefore, small and medium-sized companies are still a white spot in this field. Of the many definitions of foresight, the one that best reflects the nature of its implementation in a company is Rohrbeck's definition, which treats foresight as the capacity of the enterprise to identify and evaluate discontinuous change, activating management practices to ensure the long-term survival of the business (Rohrbeck, 2010). Iden et al. complement this definition with the aspect of systematicity and building alternative visions of organizational development, treating foresight as a systematic approach to learning and understanding possible futures and building shared visions, and is aimed at guiding and enabling present-day decisions (Iden et al.,2017). Still, Hojland and Rohrbeck. conceptualize foresight carried out at companies as the combination of perceiving, prospecting, and probing acts carried out at the enterprises. Perceiving is expressed in the application of key practices that encourage the exploration of new business areas by enabling the identification of driving forces. Prospecting is about understanding the implications of driving forces at both the individual and collective level whereas probing is to undertake activities that allow for the validation of value propositions, product and service development, and market reception (Hojland and Rohrbeck, 2018).

It should be stressed that foresight at a company should be treated as a process and not just a set of techniques for anticipating the future. It is a procedure based on consultation and constant feedback (Ejdys et al., 2019). Secondly, the starting point in foresight research is the assumption that there are many alternative future states (futures) (Kononiuk et al., 2017). The type of future the company chooses depends in some part on the decisions that are made today. Hence, foresight refers to a proactive approach towards the future. Furthermore, the purpose of strategic foresight is not to predict the future, but to prepare a company to recognize future changes in its environment and to respond to them in advance (Patton, 2005). Strategic foresight supports companies in understanding the complex driving forces which are the agents of change in their environment and enables them to adapt their strategies and R&D departments to the changing conditions of the environment in which they operate. It enables anticipatory intelligence to be built: reducing uncertainty by identifying trends and weak signals (Rohrbeck, 2010). The identification of weak signals coming from the environment allows for sensitizing the company's sensors to signals coming from outside, thus the company gains new knowledge about the phenomena occurring in its environment. If it gains this knowledge earlier than its competitors, the range of uncertainty of functioning in the environment decreases, especially as weak signals become strong signals with the passage of time (van Veen, Ortt, 2021).

The main goals of foresight carried out at companies are: identification of potential business areas and new markets for business development (Daheim, Uerz, 2006), supporting and stimulating innovation processes at the company (Day, Shoemaker, 2005), and supporting decision-making processes at the company (Hines, 2006; Fink et al., 2005). Based on the implementation of a survey on a sample of 230 small, medium, and large industrial processing companies in Lithuania, Paliokate and Pacesa demonstrated that foresight has a positive impact on both exploratory and exploitative innovation (Paliokate, Pacesa, 2015).

According to an investigation of SME companies, which constitute a Russian medical technology cluster, the authors (Milshina, Vishnevskiy, 2018) concluded that foresight projects provide SMEs with an opportunity to overcome constraints to identify potential technology chains that can be translated into innovative priorities and indicators to build credible visions of the future of SMEs. Although in Polish practice it is difficult to discern a comprehensive, cyclic application of foresight research in SME enterprises, it is possible to identify practices undertaken by companies in the scope of future preparedness. The author's intention is to identify these practices at Polish small and medium industrial processing companies.

### *Foresight maturity models*

Maturity models, based on predictable patterns of development and organizational change, are represented by the theory of evolving organizational capability stage by stage (Jurczuk, 2019; Bukowski, 2019). The concept of maturity can be understood as a state of completeness, perfection, and readiness. According to Andersen and Jessen, maturity is a state of specific excellence enabling the achievement of set goals (Andersen, Jessen, 2003). This condition can be viewed through the prism of the organization's ability to manage selected areas of the business that translate into the achievement of strategic objectives (Jurczuk, 2019). Defining maturity in terms of the dimensions of its assessment, Paulk et al. note that maturity is the extent to which the activities undertaken in a company are clearly defined and measurable (Paulk et al., 1993). A transition to a higher level of maturity can be seen through the lenses of the company's acquisition of new capabilities. To date, two foresight maturity models can be identified in the literature. The first one is the Foresight Maturity Model developed by Grim (Grim, 2009). The model was developed taking into account the framework posited by Hines and Bishop (Hines and Bishop, 2006).

The FMM model assumes the assessment of the processes run in the enterprise in accordance with the best managerial practices identified on the basis of external benchmarks. The model is evolutionary, which means that a higher degree of maturity could be obtained after a lower degree of maturity has been reached. The FMM model developed by Grim takes into account such dimensions (referred to by Grim as disciplines) of the company's functioning as: leadership, framing, scanning, forecasting, visioning, and planning. The characteristics of these disciplines are represented in Table 1.

Each of the disciplines mentioned in the FMM models is measured against the scale of activity, which allows one to achieve the preferred outcome. The disciplines could be treated as the areas of foresight activities within companies. The author of the FMM model developed a specific matrix that provides foresight maturity indices for each level of maturity in the identified area. The higher the outcome of the practice, the greater the level of foresight maturity (Grim, 2009).

The second model of foresight maturity (the Corporate Foresight Maturity Model) was developed by Rohrbeck (Rohrbeck, 2010). The model consists of three main parts – context, capabilities, and impact. The context is compiled in terms of six criteria: size of company, nature of strategy, corporate culture, source of competitive advantage, complexity of environment, and industry clock speed. The capabilities are deployed to assess the foresight system in terms of its power in identifying, interpreting, and replying to discontinuous changes. In this context, the maturity level in each dimension of the capability can be used to lead improvement projects. The capabilities are divided into five different dimensions (Rohrbeck, 2010):

- information usage – definition of the type of information entered into the corporate foresight system;
- method sophistication – description of methods employed to interpret information;
- people and networks – description of individual employee characteristics and the networks the company uses to communicate information and foresight;
- organization – illustration of how information is gathered, interpreted, and used within the organization;
- culture – illustration of the importance of corporate culture in supporting or hindering forecasting activities.

The impact is applied to evaluate the type of outcome or added value achieved by corporate foresight activities. The impact is segmented into four categories: reduction of uncertainty, triggering internal actions, influencing others to act, and secondary benefits such as, for example, organizational learning. Reduction of uncertainty measures the extent to which uncertainty in the environment has been made manageable. Triggering internal actions assesses the number of actions that have been initiated in the enterprise as the opposite to influencing others which describes the number and value of actions that have been generated outside the enterprise, whereas secondary benefits measures effects that are not primary goals of the company's activity but constitute extra value for the enterprise. (Rohrbeck, 2010).

In each dimension, there are three to five criteria against which the maturity of the foresight system can be assessed. The conclusions from the practical use of FMM by the author of this article for the assessment of the foresight maturity of enterprises posed some difficulties for interpretation. For example, the forecasting dimension of the FMM model is based on the assumption that there is more vision for the development of an organization, whereas traditional foresight assumes trend extrapolation which refers to a single point in

Table 1. **Disciplines of the Foresight Maturity Model**

| Discipline | Characteristics |
|---|---|
| Leadership | Expressed in the involvement of many employees in the creation of a vision of the development of the organization. A collection of good practices conducive to the implementation of foresight research capability. |
| Framing | Creating a framework within the company that enables the creation of alternative future states. Establishment of boundaries and scope of activities. |
| Planning | Positioning and using organizational resources to implement desired visions of the company's development. Providing plans, people and skills to support the implementation of the organizational vision. |
| Scanning | Gathering and analysing relevant data that contribute to the growth of the organisation. |
| Forecasting | It is expressed in the assumption that there is more than one vision for the development of the organization. Each development alternative creates unique implications for the existing state of the organization. |
| Visioning | It is expressed in creating the desired vision of the future and related ideals and values. |

*Source*: (Grim, 2009).

time that can be determined by methods that forecast linear and non-linear trends (Paliokate et al., 2014). Furthermore, some of the disciplines seem to overlap in meaning, e.g., leadership, which is expressed in the involvement of many employees in the creation of a vision of the development of the organization, and the visioning dimension.

In turn, the dimensions of the model proposed by Rohrbeck (Rohrbeck, 2010) were developed on the basis of qualitative research conducted at large companies and refer to corporate foresight. Hence, the author of this article intends to develop dimensions of foresight maturity dedicated to small and medium-sized enterprises which are based on variables validated in a quantitative study.

## Research Methodology

The implementation of the actual study was preceded by the construction of a questionnaire, which contained 36 statements relating to foresight capabilities of the company (assessed on a seven-point Likert scale, where 1 – meant that a respondent strongly disagreed with the statement, and 7 – that the respondent strongly agreed with the statement) relating to future-oriented activities run in enterprises. Detailed statements were prepared on the basis of the literature review referring to different and dispersed activities of organizational foresight. The representativeness of the sample and reliability of the results gathered were ensured by commissioning the execution of a nationwide survey to a professional research institution – IPC Research Institute Sp. z o.o. The research activity and elaboration of the results were carried out in the period July 2019-April 2021. The measuring scale finally included 36 variables (Table 2). The criteria of factor selection involved their popularity and significance for organizational foresight in the existing published works.

The actual survey was preceded by a pilot survey, that assumed success in obtaining a representative sample allowing for the generalization of the results for the entire general population

The study covered a total of 511 SME industrial processing enterprises operating in Poland, which included 5% of the enterprises of the surveyed population. At the time of designing the survey, the number of manufacturing enterprises in Poland was 203,521.[2] Assuming a confidence level of 0.95 and a maximum permissible error of 5%, the minimum sample size determined for the overall population was 383. Owing to the involvement of an external research institution, 511 SMEs were recruited for the survey.

The companies participated in the survey voluntarily and their responses were anonymous. The survey questionnaire addressed at innovation department managers and business owners included general information on future-oriented activities undertaken by companies, an assessment of the company's foresight maturity factors, and a metric. Table 3 represents the distribution of surveyed enterprises by size, type and area of activity, while the Figure 1 demonstrates the structure of enterprises by the area of activity.

Quantitative research was carried out using the CATI technique supported by the CAWI technique. The choice of the CATI technique was dictated by the need for personalized contact with innovation department managers or business owners. The CAWI technique was chosen because of its advantages which include: the ability to survey a relatively large group of respondents, a relatively short time needed to conduct the survey, the anonymity of the survey, and the low cost of the survey (Gulc, 2020).

### *Exploratory Factor Analysis*

Exploratory Factor Analysis (EFA) was used to analyze the collected data, allowing one to detect the structure of relationships between observable variables and extract a small number of hidden variables – factors (dimensions) that cannot be directly measured. Before

[2] https://stat.gov.pl/en/, accessed 16.10.2022.

Table 2. **Capabilities of a Company that Characterize Foresight Maturity**

| No. | Code | Description | Sources |
|---|---|---|---|
| 1 | (var_1) | Identifying trends in the microenvironment | (Ruff, 2015) |
| 2 | (var_2) | Identifying trends in the macroenvironment | (Vecchiato, 2015) |
| 3 | (var_3) | Identifying signs of technological breakthrough | (Rohrbeck et al., 2007) |
| 4 | (var_4) | Identifying subtle signs of change (weak signals) | (Hiltunen, 2013) |
| 5 | (var_5) | Identifying wild cards (low probability and high impact events) | (Mendonca et al., 2009). |
| 6 | (var_6) | Thinking out of the box about the products | (Sarpong, Maclean, 2011) |
| 7 | (var_7) | Thinking out of the box about the services | (von der Gracht et al., 2010) |
| 8 | (var_8) | Thinking about business activity in a reflexive way | (Sarpong, Maclean, 2016) |
| 9 | (var_9) | Managing change effectively | (Merzlikina, Kozhanova, 2019) |
| 10 | (var_10) | Recovering from turbulence in the organizational environment | (Edgeman, 2015) |
| 11 | (var_11) | Thinking about the company in a systemic way | (Weissenberger-Eibl, 2019) |
| 12 | (var_12) | Building networks within the organization | (Wolff, 1992) |
| 13 | (var_13) | Building networks outside the organization | (Rohrbeck, 2010) |
| 14 | (var_14) | Building alternative scenarios | (Bradfield et al., 2005; Wack, 1985) |
| 15 | (var_15) | Matching scenarios them with organizational strategy | (Grim, 2009) |
| 16-20 | (var_16) – (var_20) | Involving employees or external stakeholders in setting the vision or mission of the company's development, as well as involving them in product development | (Kononiuk, Glinska, 2015; Inayatullah et al., 2013; Calof et al., 2017; Ruff, 2015; Wind, Mahajan, 1997) |
| 21 | (var_21) | Using roadmapping | (Strauss, Radnor, 2004), |
| 22 | (var_22) | Using mathematical models | (Chung, 2004) |
| 23 | (var_23) | Using Delphi method | (Rowe et al., 2005) |
| 24 | (var_24) | Identifying future customer expectations | (Rohrbeck et al., 2007) |
| 25 | (var_25) | Having a holistic view of the industry | (Saprong, Maclean, 2016) |
| 26 | (var_26) | Creating long-term objectives consistent with the vision and mission of the company | (Grim, 2009) |
| 27 | (var_27) | Developing a system of indicators for goal achievement | (Grim, 2009) |
| 28 | (var_28) | Valuing teamwork | (Ruff, 2015) |
| 29 | (var_29) | Creating a climate conducive to innovation | (Grim, 2009) |
| 30 | (var_30) | Promoting the free and transparent flow of information | (Rohrbeck, 2010) |
| 31 | (var_31) | Participating in the activities of professional trade associations | (Ansoff, 1975; Hansen, 2006) |
| 32 | (var_32) | Participating in prestigious scientific conferences | |
| 33 | (var_33) | Collecting information about patents | |
| 34 | (var_34) | Reading specialist scientific journals to keep abreast of the latest trends affecting the development of the industry | |
| 35 | (var_35) | Searching the Internet and other media constantly for trends shaping the development of the industry | |
| 36 | (var_36) | Conducting expert research in the form of surveys, focus groups, individual interviews in order to identify trends affecting the development of the industry | |

*Source*: author.

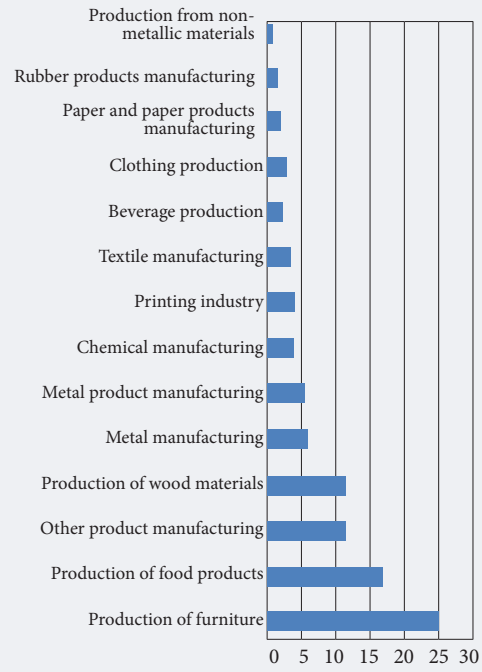
starting the exploratory factor analysis, the basic conditions of its use were checked. Maiser-Mayer-Olkin and Bartlett tests were carried out, which confirmed the good properties of the data (Bedyńska, Cypryańska, 2013)[3].

Next, correlation analysis was conducted between the studied variables and it was noticed that each variable correlates significantly with several other variables, which is also confirmed by the determinant of the correlation matrix, which is 0.000000000004266. The very low value of the determinant of the correlation matrix means that there are many significant correlations between the analyzed variables and there are probably factors that bind the given variables. Bartlett's sphericity test also confirms that the correlation matrix contains significant correlation coefficients, and the high value of the Kaiser-Mayer-Olkin measure (close to 1) provides a rationale for undertaking the factor analysis (Table 4).

In the first stage of the exploratory factor analysis, the number of dimensions (factors) formed by strongly related questions of the questionnaire was determined.

[3] In the literature, it is recommended that one suggest at least three to four variables for each potential factor and that the sample should consist of at least 200 observations (Rószkiewicz et al., 2013). Some authors believe that the number of observations should be even four or five times greater than the number of variables (Wieczorkowska, Wierzbiński, 2010). Both conditions in this study were met: eight factors were expected to be extracted with thirty-six variables, and the sample size of 511 companies far exceeded the recommended minimum.

Figure 1. **The Structure of Enterprises by the Area of Activity**




*Source*: author.

Table 3. **The Structure of Enterprises by Size, Type, and Area of Activity**

| Indicator | Share (%) |
|---|---|
| ***Size*** | |
| Small enterprises | 60.5 |
| Medium enterprises | 39.5 |
| ***Type*** | |
| Manufacturing enterprises | 34.6 |
| Service enterprises | 24.1 |
| Enterprises combining manufacture and services | 41.3 |
| ***Area of activity*** | |
| Local market | 35.6 |
| National market | 34.6 |
| International market | 29.7 |

*Source*: author.

Table 4. **Determinant of the Correlation Matrix, KMO and Bartlett's Test**

| Indicator | Value |
|---|---|
| Determinant of the correlation matrix | 4.266E-012 |
| KMO measure of sampling adequacy | 0.958 |
| Bartlett's sphericity test, Approximate Chi-Square | 13097.637 |
| df | 378 |
| Sig | 0.000 |

*Source*: author.

To extract the number of factors, the principal component as an extraction method allowing one to obtain such factors that explain the maximum percentage of variance of the initial variables was used. Apart from the maximum likelihood method, it is one of the most frequently recommended methods, which maximizes the connections between factors and variables and does not require that the analyzed data have a normal distribution (Brown, 2015). In order to further improve the fit of the factor structure to the output variables, Oblimin[4] with Kaiser Normalization rotation was used with a delta parameter equal to zero. In the case of the research problem presented in this paper, this would appear to be justified in view of the fact that factors are expected to be correlated as they relate to the measurement of the construct of foresight maturity. Using a factor loading matrix, ambiguous and insignificant variables were removed, namely variables that did not have factor loading with an absolute value greater than 0.4 (Lo, 2016). The variables that did not meet this criterion were variables number 9, 10, 12, 14, 15, 24, 25, and 36 (see Table 2). Using the exploratory factor analysis, eight factors were identified that influence the foresight maturity of SME enterprises as a set of highly valued, learned, repetitive organizational capabilities in anticipation of the future (Table 5). Given that these factors explain over 82.127% of the variance in the baseline variables (see Table 6), they enabled the grouping of observable variables. The correlation matrix confirms the assumption that the extracted dimensions are correlated with each other (Table 7). The interpretation of some of these correlations is represented at Table 8. Reliability analysis of the developed foresight maturity measurement scale (28 variables grouped into eight dimensions) was carried out using Cronbach's alpha values, which were counted separately for the subscales extracted in the factor analysis (Table 9).

## Discussion of the Results

The foresight maturity level was calculated by averaging the respondents' results in individual survey questions. The level of indicators can take values from 1 to 7, according to the used Likert scale. Hence, the level of foresight maturity reaching values in the range <1.0-3.0) can be regarded as low, in the range <3.0-5.0) as medium, while in the range <5.0-7.0> as high (Leończuk, 2019; Ryciuk, 2016). In the case of the analyzed enterprises, the average level of foresight maturity of the analyzed SMEs is x=3.29 (with standard deviation SD=1.21), which, taking into account the seven-grade evaluation scale, can be considered as an average level. The median Me=3.28 (the middle line in Figure 6) also reaches a similar value.

[4] This rotation allows for the identification of correlations between factors and does not assume the zero correlation of the factors (Leończuk, 2019).

Table 5. **Capabilities in Anticipation of Future Gained by Companies**

| Dimension (factor) | Description |
|---|---|
| F1: Involving stakeholders and building networks | Concerns the ability of the enterprise to involve employees in creating a vision and mission for the company. It also concerns the capability of the organization to involve external stakeholders (customers, representatives of industry organizations, and suppliers) in creating a vision of the company and product development |
| F2: Building supportive organizational culture | Refers to the recognition of the value of teamwork at the enterprise, to the creation of a climate conducive to innovation and the free and transparent flow of information at the company |
| F3: Scanning the micro- and macroenvironment of the company | Concerns the capabilities of the company to identify trends in the micro- and macroenvironment of the company affecting its development. It also comprises the capability of the company to identify signs of technological breakthrough in the sector as well as the ability to identify subtle signals of change that can influence the development of the industry in the future |
| F4: Using strong tie sources | Refers to the participation of the company in professional trade associations and prestigious scientific conferences as well as to the collection of information about patents by the enterprise |
| F5: Using weak tie sources | Refers to the activities undertaken by the company, such as reading specialist scientific journals to keep abreast of the latest trends affecting the development of the company's industry and searching the Internet and other media for trends shaping the development of the industry |
| F6: Creating aims for the company's development | Concerns the ability of the enterprise to create long-term objectives for the development of the organization that are consistent with the mission and vision for the development of the organization |
| F7: Thinking outside the box, reflectively and systemically | Refers to thinking about the products and services the company offers in an out-of-the-box way, concerns reflective and systemic thinking about the business activity |
| F8: Using foresight methods | Refers to the capability of the company to use roadmapping, mathematical methods of forecasting the future as well as the Delphi method to determine the vision of the company's development |

*Source*: author.

Table 6. **The Results of Exploratory Factor Analysis**

| Factor | Variable | Factor load |
|---|---|---|
| F1: Involving stakeholders and build networks | variable_20 | 0.763 |
| | variable_17 | 0.719 |
| | variable_19 | 0.714 |
| | variable_18 | 0.687 |
| | variable_16 | 0.675 |
| | variable_13 | 0.536 |
| F2: Building supportive organizational culture | variable_28 | 0.774 |
| | variable_30 | 0.737 |
| | variable_29 | 0.709 |
| F3: Scanning the micro- and macroenvironment of the company | variable_1 | 0.802 |
| | variable_3 | 0.774 |
| | variable_4 | 0.734 |
| | variable_2 | 0.622 |
| | variable_5 | 0.573 |
| F4: Using strong tie sources | variable_31 | 0.859 |
| | variable_32 | 0.842 |
| | variable_33 | 0.618 |
| F5: Using weak tie sources | variable_34 | 0.870 |
| | variable_35 | 0.833 |
| F6: Creating aims for the company's development | variable_26 | 0.664 |
| | variable_27 | 0.626 |
| F7: Thinking outside the box, reflectively and systemically | variable_7 | 0.757 |
| | variable_6 | 0.659 |
| | variable_8 | 0.530 |
| | variable_11 | 0.478 |
| F8: Using foresight methods | variable_22 | 0.910 |
| | variable_23 | 0.707 |
| | variable_21 | 0.575 |

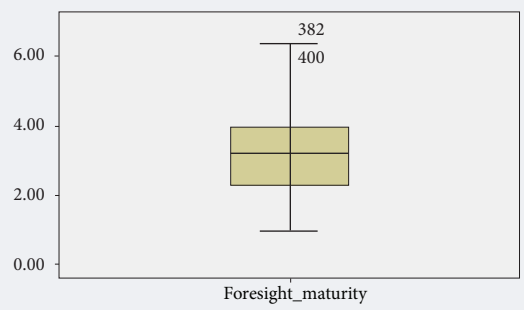
*Note*: Extraction method: Rotation method: Oblimin with Kaiser Normalization. Rotation converged in 12 iterations.

*Source*: author.

The values of the first and third quartile (upper and lower borders of the box) indicate that in the case of 50% of the surveyed companies, the level of the variable describing the average level of foresight maturity of small and medium-sized enterprises was between the values Q1=2.35 and Q3=4.00. Two outliers characterized by a high degree of maturity were also marked on the box plot with numbers 382 and 400. Both cases relate to medium, manufacturing, and international enterprises, one of which belongs to metal product manufacturing. In order to determine whether the level of foresight maturity differs between small and large companies, the Mann-Whitney test was conducted. The results of the test are presented in Table 10.

The significant value of the test statistic (p=0.0000) allows for concluding that the level of foresight maturity is statistically significant and different depending on the size of the enterprise (mean of 2.55 in small enterprises as compared to mean 4.24 in medium companies). In both groups, there is similar variation in

Figure 2. **Foresight Maturity Level of Polish SME Enterprises – Box Diagram**




*Source*: author.

Table 7. **Component Correlation Matrix**

| Component | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | 0.310 | 0.439 | 0.397 | 0.417 | 0.422 | -0.354 | **0.501** |
| 2 | 0.310 | 1.000 | 0.332 | 0.269 | 0.323 | 0.224 | **-0.508** | 0.248 |
| 3 | 0.439 | 0.332 | 1.000 | **0.494** | 0.267 | 0.371 | -0.360 | **0.594** |
| 4 | 0.397 | 0.269 | **0.494** | 1.000 | 0.279 | 0.271 | -0.239 | 0.341 |
| 5 | 0.417 | 0.323 | 0.267 | 0.279 | 1.000 | 0.239 | -0.279 | 0.304 |
| 6 | 0.422 | 0.224 | 0.371 | 0.271 | 0.239 | 1.000 | -0.328 | 0.375 |
| 7 | -0.354 | **-0.508** | -0.360 | -0.239 | -0.279 | -0.328 | 1.000 | -0.280 |
| 8 | **0.501** | 0.248 | **0.594** | 0.341 | 0.304 | 0.375 | -0.280 | 1.000 |

*Source*: author.

Table 8. **Interpretation of the Strongest Correlations between Dimensions**

| Linked factors (codes) | Correlation coefficient | Explanation |
|---|---|---|
| F3 – F8 | 0.594 | Selected foresight methods are widely used to scan the company's environment |
| F2 – F7 | 0.508 | Supportive organizational culture allows one to think out of the box about products and services, positively influences the ability of the company to think in a reflective way as well as stimulates the capability to think about the company in a systemic way |
| F1 – F8 | 0.501 | Capability to use foresight and forecasting methods as a result of socializing the process of building the enterprise vision requires the capability to use foresight and forecasting methods |
| F3 – F4 | 0.494 | The dimension F3 refers to the general capabilities of companies in scanning the micro- and macroenvironment, while the dimension F4 refers to specific scanning activities (participation in the activities of industry associations, prestigious scientific conferences, collecting information on patents) |

*Note:* See Tables 5 and 6 for the description of dimension codes.
*Source*: author.

Table 9. **Cronbach's Alpha Values for Foresight Maturity in SME Dimensions**

| Factor | Variable numbers | Cronbach's alpha |
|---|---|---|
| F1 | 13, 16, 17, 18, 19, 20 | 0.943 |
| F2 | 28, 29, 30 | 0.922 |
| F3 | 1, 2, 3, 4, 5 | 0.927 |
| F4 | 31, 32, 33 | 0.885 |
| F5 | 34, 35 | 0.831 |
| F6 | 26, 27 | 0.859 |
| F7 | 6, 7, 8, 11 | 0.883 |
| F8 | 21, 22, 23 | 0.881 |

*Note:* See Tables 5 and 6 for the description of dimension codes.
*Source*: author.

values, as evidenced by the standard deviation values at the level of 0.9 for small enterprises and 0.97 for medium enterprises. The median value is similar in small and medium enterprises, yet the difference between the median values is statistically significant.

It was also verified whether the mean values of all eight identified dimensions of foresight maturity differed in a statistically significant way depending on the size of the enterprise. The differences in assessments are presented in Figure 3. Based on the analysis of the graph, it can be noted that the highest average scores in medium companies were obtained for *The capability to think outside the box, reflectively and systematically* and for *The capability to create aims of the company's development*. Slightly lower, but still highly rated are the dimensions: *The capability to involve stakeholders and build networks and the capability to scan the micro- and macroenvironment of the company*. These results are not surprising as the capabilities mentioned above are fundamental for foresight activities run at the enterprises (Sarpong, Maclean, 2011; von der Gracht et al., 2010, Saprong, Maclean, 2016; Weissenberger-Eibl 2019; Ruff, 2015; Vecchiato, 2015). The lowest rating among medium-sized enterprises was given to *The capability to use strong tie sources* which might indicate that the medium-sized companies either are unlikely to have the necessary human and financial resources or do not pay enough attention to the participation in professional trade associations and in prestigious scientific conferences nor do they pay enough attention to the collection of information about patents. Among small enterprises, *The capability to think outside the box, reflectively and systematically* was also rated highest, in turn, the lowest rated was *The ability to build a supportive organizational culture*. This may stem from the fact that small businesses, mainly due to their involvement in day-to-day and limited resources, pay little attention to building supportive organizational culture, i.e., to the recognition of the value of teamwork at the enterprise, to the creation of a climate conducive to innovation, and the free and transparent flow of information at the enterprise. The significant value of the test statistic (p=0.0000) for each of the identi-

Table 10. **Mann-Whitney Test and Basic Statistics**

| Dependent variable — foresight maturity | Independent variable (grouping): size of the company | |
|---|---|---|
| | Small enterprises (0-49) | Medium enterprises (50-249) |
| Number of enterprises N (total = 511) | 309 | 202 |
| Mean rank | 178.82 | 374.06 |
| Sum of ranks | 55255.50 | 75560.50 |
| Mean | 2.66 | 4.25 |
| Standard deviation | 0.9 | 0.97 |
| Median | 2.59 | 2.58 |

| | |
|---|---|
| Mann-Whitney U | 7360.500 |
| Wilcoxon W | 55255.500 |
| Z | -14.617 |
| Significance (2-tailed) | 0.0000 |

*Source*: author.

fied foresight dimensions makes it possible to state that the mean values of foresight dimension are statistically significant and different (Table 11).

Furthermore, when analyzing the means and medians for the presented dimensions, it can be seen that these values do not differ much from each other, which means that a mean is an appropriate measure for assessing the average level of foresight maturity dimensions at companies (Table 12). Still, when analyzing the coefficient of variation, one can notice higher values for particular dimensions at small enterprises. This means that the respondents here were less unanimous in their assessments. On the one hand, this may be due to the fact that small enterprises do not have sufficient resources to implement future-oriented activities, on the other, it could be that within this group of enterprises, however, there are companies that rate their foresight capabilities highly.

Table 11. **Mann-Whitney Test for Each Foresight Dimension (grouping variable: size of the company)**

| Dimension code | Mann-Whitney U | Wilcoxon W | Z | Significance (2-tailed) |
|---|---|---|---|---|
| F1 | 10770.500 | 58665.500 | -12.535 | **0.000** |
| F2 | 8913.500 | 56808.500 | -13.971 | **0.000** |
| F3 | 6634.000 | 54529.000 | -15.078 | **0.000** |
| F4 | 12535.000 | 60430.00 | -11.512 | **0.000** |
| F5 | 19270.500 | 67165.500 | -7.347 | **0.000** |
| F6 | 14186.500 | 62081.500 | -10.486 | **0.000** |
| F7 | 13981.000 | 61876.000 | - 10.574 | **0.000** |
| F8 | 11885.000 | 59780.00 | -11.881 | **0.000** |

*Source*: author.

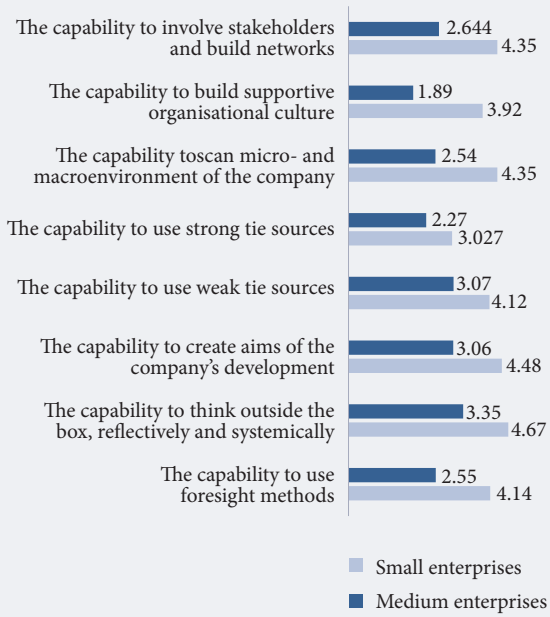
Table 12. **Foresight Dimensions – Basic Statistics**

| Foresight maturity dimension | Mean | Median | Standard deviation | Coefficient of variation |
|---|---|---|---|---|
| F1 (small) | 2.644 | 2.5 | 1.28 | **48** |
| F1 (medium) | 4.35 | 4.5 | 1.2 | 28 |
| F2 (small) | 1.89 | 1 | 1.18 | **62** |
| F2 (medium) | 3.92 | 4 | 1.38 | 35 |
| F3 (small) | 2.54 | 2.4 | 1 | **39** |
| F3 (medium) | 4.35 | 4.4 | 1 | 23 |
| F4 (small) | 2.27 | 2 | 1.21 | **53** |
| F4 (medium) | 3.93 | 3.83 | 1.52 | 39 |
| F5 (small) | 3.027 | 3 | 1.6 | **53** |
| F5 (medium) | 4.12 | 4 | 1.61 | 39 |
| F6 (small) | 3.06 | 3 | 1.42 | **46** |
| F6 (medium) | 4.48 | 4.5 | 1.23 | 27 |
| F7 (small) | 3.35 | 3.25 | 1.29 | **39** |
| F7 (medium) | 4.67 | 4.75 | 1.08 | 23 |
| F8 (small) | 2.55 | 2.33 | 1.09 | **43** |
| F8 (medium) | 4.14 | 4 | 1.38 | 33 |

*Note:* small = small enterprises, medium = medium enterprises. See Tables 5 and 6 for the description of dimension codes.

*Source*: author.

Figure 3. **Differences in Assessments of the Dimensions of Foresight Maturity at Small and Medium-Sized Enterprises**




*Source*: author.

Table 13. **Differences in the Level of Foresight Maturity by Type and Area of Company Activity**

| Dependent variable: foresight maturity | N | Mean | Standard deviation | Median | Mean rank | Kruskal-Wallis test results |
|---|---|---|---|---|---|---|
| **Independent grouping variable: type of company** | | | | | | |
| production | 177 | 3.8 | 1.41 | 3.86 | 311.05 | Chi^2=39.039, df=2, p=0.000 |
| services | 123 | 3.07 | 0.98 | 3.2 | 214.32 | |
| production and services | 211 | 2.95 | 0.98 | 2.96 | 234.12 | |
| **Independent grouping variable: area of activity** | | | | | | |
| local | 182 | 2.56 | 0.9 | 3.33 | 165.57 | Chi^2=134.897 df=2 p=0.000 |
| national | 177 | 3.36 | 1.09 | 3.32 | 265.49 | |
| international | 152 | 4.1 | 1.12 | 4.01 | 353.22 | |

*Source*: author.

Differences in the level of foresight maturity depending on the type of company and its area of activity were also examined. For this purpose, the Kruskal-Wallis test[5] was used, which is a non-parametric equivalent of the one-way analysis of variance that assesses whether independent samples come from the same population or from a population with the same median (Stanisz, 2006). The results of the Kruskal-Wallis test (test probability level not exceeding 0.05) indicate that the level of the foresight maturity of small and medium enterprises depends on the type and area of activity of the enterprise. Analyzing the data in Table 13, it may be noticed that the lowest level of foresight maturity is characteristic of production and service enterprises (mean=2.95) and those operating on the local market (mean=2.56), whereas the highest level is characteristic of production enterprises (mean=3.8) and those operating on the international market (mean=4.1). There is also a rational justification for this situation. Manufacturing companies experience frequent changes in the technological environment, hence undertaking activities in the area of future-preparedness is justified. Similarly, companies operating on the international market, due to the unpredictability of the global environment, must undertake more actions in the area of foresight than companies operating on the local and domestic markets.

## Conclusions

The presented quantitative analysis of the foresight maturity of enterprises complements the qualitative research carried out by Grim and Rohrbeck in the field of identifying the factors that create the dimensions of foresight maturity for enterprises. The exploratory factor analysis carried out allowed the author to further refine the definition of the foresight maturity at small and medium-sized enterprises. The analyses made it possible to identify 28 factors of the foresight maturity at small and medium enterprises grouped into eight dimensions. SME companies that are interested in increasing their foresight maturity should implement in their daily practice the capabilities related to involving stakeholders in creating the vision and mission of the company, building a supportive organizational culture, scanning the micro- and macroenvironment of the enterprise. The equally valuable components are the capabilities to work with weak tie sources of information, to set realistic goals, and to think outside the box, reflectively and systemically.

In general, the level of foresight maturity of Polish manufacturing SMEs is assessed as medium, but the results of non-parametric tests indicate its dependence on the size, type, and geography of companies' activities. The most mature are medium-sized manufacturing enterprises operating on the international market. In addition, maturity indicators differ significantly between small and medium-sized entities. The impact of these factors on corporate innovation activity is assessed. Measures are proposed to develop appropriate potential to increase competitiveness in an unpredictable and multidimensional environment.

The main limitations of the present research are related to the use of a Likert scale questionnaire, which involves the risk of subjective answers from respondents due to insufficient familiarity with such basic corporate foresight terms as weak signals or wild cards, or their incorrect interpretation. Further directions of the research are to cover countries with other levels of economic development and to compare levels of foresight maturity. The author also envisages extending the research with qualitative research in the form of individual interviews carried out at small and medium-sized enterprises, which will allow for more generalized conclusions and increase the reliability of the research process.

*The publication of the article for 11th International Conference on Engineering, Project, and Production Management—EPPM2021 was financed in the framework of the contract no. DNK/SN/ 465770/2020 by the Ministry of Science and Higher Education within the "Excellent Science" programme.*

[5] The Kruskal-Wallis test is a non-parametric equivalent of the one-way analysis of variance that assesses whether independent samples come from the same population or from a population with the same median (Stanisz, 2006).

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