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FORESIGHT FOR SMES: HOW TO OVERCOME THE LIMITATIONS IN SMALL FIRMS?

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This paper describes an approach to foresight for SME enterprises. Foresight has become a frequently used tool for technology and innovation management generally limited large corporations. Presumably this is mainly due to the complexity of the corporate foresight concept itself and the need to invest substantial resources. To overcome this challenge and make corporate foresight also applicable for small and medium sized enterprises an adjusted methodological approach is developed taking into account the special requirements and limitations of SMEs. Based on an analysis of best practices for the development of theoretical and methodological approaches to foresight for SMEs an approach is developed taking into account the limitations of financial, human and time resources inherent to SMEs is introduced.

Keywords: corporate foresight, SMEs, roadmapping, innovation, scenarios
JEL classification: O11; O18; O32

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Introduction

The beginning of 21st century has been characterized by the increasing importance and contribution of SMEs to the innovative development of economies. In advanced economies SMEs are recognized as "locomotives" of innovation often developing disruptive technologies, creating fundamentally new products and services, and providing high-tech employment opportunities.

It can be assumed that SMEs mainly follow their intuition or possess highly sophisticated strategic planning tools and instruments which enable them to take on this locomotive role. Another distinct advantage of SMEs is a short decision making procedure within companies due to simpler management structures. Among strategic planning instruments corporate foresight has developed continuously during the last decade resulting in numerous methodological approaches (Rohrbeck et al, 2011; Gracht et al, 2010). These approaches evolved in the course of its development and implementation by mainly large companies. However these methodologies are not always suitable for application by SMEs (Stonehouse & Pemberton, 2002). Furthermore, corporate foresight methodologies for large companies have been sufficiently explored and are based on solid theoretical grounds but there remains a lack of theoretical underpinning and applications for SMEs, which shape their innovation strategies especially towards more effective interaction with the external environment. Existing studies can only be considered as pilot approaches (Battistella et al, 2015; Hideg et al, 2014; Karasev & Vishnevsky, 2010; Kindras et al, 2014; Meissner, 2012; Vishnevskiy, Egorova, 2015).

Therefore the authors conclude it reasonable to analyse the existing theoretical and methodological approaches to corporate foresight for SMEs and to examine the global practice of using these methods by SMEs in order to ultimately develop a new algorithm targeted at SMEs.

To achieve this goal a number of steps were taken. First, we compared the processes of corporate foresight for large companies and foresight for SMEs to identify major similarities and differences between these approaches. From this we found that for considerably resource-constrained SMEs the majority of existing foresight approaches are not applicable and need to be adapted. Second, an analysis of global best practice of SME foresight was carried out with a view to identify the most effective approaches. Third, we identified key application areas of SME foresight results that allow us to detect methods which can be effectively used for the long-term development of these enterprises. Finally, we formulated a methodology of SME foresight which takes into account their limited financial, human and time resources. In the future, this approach can be tested on the example of one or several SMEs to plan and implement innovation activities.

This paper is structured as follows. The first section provides a comparative analysis of foresight approaches for corporations and SMEs. The second considers the best practices of foresight implementation for SMEs. The third describes key areas of foresight use by SMEs. Finally, the fourth section contains methodological approaches to foresight studies for SMEs.

Foresight processes in large companies and SMEs

SMEs, like large companies, are facing rapidly changing environments; this increases the necessity of conducting foresight research for all business enterprises. This is determined by the real need for the formation of innovative development strategies and the optimization of future technological production plans (Vishnevskiy & Karasev, 2015; Vishnevskiy et al, 2015).

While the foresight processes for large companies are widely covered in the academic literature and thoroughly studied in practice, SME foresight has received less attention. The innovation process within SMEs is often absent or partially described and implemented, because operational activities frequently take the most time and SMEs find it hard to create strategic visions for the future (Van de Vrande et al., 2009). Although it is assumed that science-intensive SMEs, which are more open to innovation, follow a more explicit innovation strategy it appears that the innovation process even in these SMEs is limited by financial difficulties and development risks (Hewitt-Dundas, 2006).

The literature provides insight into the corporate foresight of large corporations and SMEs which both have common features and numerous differences (Major and Cordey-Hayes, 2000; Bidaurratzaga and Dell, 2012; Jun et al., 2013), which can be naturally explained by the dissimilarity between the forms of ownership, the scope of activities, and the disposable resources of large companies and SMEs (Table 1).

Table 1.

Characteristics of Foresight research processes for corporations and SMEs

Comparison criteria	Corporate Foresight	Foresight for SMEs
Purpose	• Innovation strategies formation • Adaptation to changing environment conditions • Potential risks identifying • New product launches • New market development	• Make obvious strategy to find investors and appropriate partners • Adaptation to changing environment conditions • Potential risks identifying • New product launches;
General features	• Multifunctionality (involves several departments of the organization) • Consistency • Systematic character • New knowledge creation	• Situational character • Spot analysis • Existing knowledge adaptation • Low efficiency
Planning horizon	Usually 3-5 years, sometimes longer	Mainly short-term (3-6 months) but sometimes with elements of longer prediction

Own resources for Foresight implementation	• In sufficient quantity – financial and human resources • In limited quantity – time resources	Financial, human and time resources are extremely limited
Available methods	Numerous methods adapted for corporate Foresight: • quantitative, qualitative, synthetic; • market-oriented, technology-integrated; • etc.	• A small number of tools adapted for SMEs • Recommended are backcasting, bibliometrics, diffusion modeling, long wave analysis, monitoring, technological substitution, trend extrapolation, vision generation
Methods used	• 5-6 instruments of different nature during a single study • The selection depends on time and resource constraints, the availability of qualified experts, access to information • The most popular are trend analysis, publication analysis, scenarios, roadmapping, participatory methods, scanning	• The selection depends on time and resource constraints, access to information • The most popular are monitoring/ scanning, brainstorming, expert interviews, desk research
Barriers for Foresight	• Non-serious attitude of top management and stakeholders to future information application • Intraorganizational hierarchy • The existing bonus, career and control systems • Frequent personnel changes among top management • Lack of resources	• Lack of financial, human and time resources • Much of the time is spending on operational activity • Lack of incentives to the anticipation of the future • The risk of development

Source: Vishnevskiy & Egorova, 2015

The objectives of foresight implementation for both large corporations and SMEs are substantially similar: SMEs and large companies aim to anticipate future developments, prepare for changes in the environment, and identify potential risks. All companies aspire to form a development strategy for the organization and design of innovation policies, to produce new products and services that meet the needs of consumers, and to develop new markets (Slaughter, 1998; Horton, 1999; Becker, 2002; Daheim and Uerz, 2008; Gracht et al., 2010; Phillips, 2013; Battistella, 2014; Fikirkoca & Saritas, 2012). Corporate foresight of large companies is generally characterized by multifunctionality and consistency, a systematic character, and an eventual contribution to the creation of fundamentally new knowledge (Slaughter, 1999). In turn, foresight projects conducted by SMEs are likely to be decided case by case, mostly if an urgent situation arises forcing them to adapt existing knowledge to create new products (Jannek and Burmeister, 2007; Bidaurratzaga and Dell, 2012). In most cases, these efforts are characterized by low efficiency as SMEs have limited financial, time, human and informational resources. Another characteristic is that the planning horizon of such activities for SMEs is short compared to large companies, the latter can even aim at 15–20 years.

As the implementation of corporate foresight has been studied, developed and improved by numerous researchers and experts over a sufficiently long period of time, many varied

methods of foresight research are available to large companies which, in addition, posses large financial resources (Becker, 2002; Popper, 2008; Phillips, 2013).

In practice large firms are also dependent on time, so in the course of a single foresight investigation corporations apply 5–6 tools for studying potential future developments by combining qualitative, quantitative, synthetic methods and creating priority systems from which they form roadmaps and build development scenarios (Becker, 2002; Popper, 2008). Prospective product formation is most common for SMEs therefore foresight for SMEs is often confined to roadmap development for communication with investors (Holmes and Ferrill, 2005; Jun et al., 2013). In this case, at the initial stage of strategic system development external stakeholders (government, large companies, scientific community) who are interested in the innovative development of SMEs can play an important role in conducting foresight studies for SMEs having significant resource constraints. For instance, it is possible to include small business in the innovative development programs of large corporations (Major and Cordey-Hayes, 2000; Arshed et al., 2012).

An analysis of global best practice of foresight implementation for SMEs

Research on SME foresight began only recently. Some of the work in this field is aimed at the developing foresight approaches based on a preliminary analysis or the available data of previous research (Major and Cordey-Hayes, 2000; Savioz and Blum, 2002; Pozdnakova, 2008; Paliokaite, 2010; Bidaurratzaga and Dell, 2012; Markmann et al., 2012). Other studies include both model formalization and the results of their practical use (Holmes and Ferrill, 2005; Jun et al., 2013). They find that the majority of SMEs operate in conditions that require little foresight implementation. In this regard some studies are focused on the provision of more effective foresight organization for SMEs and the promotion of a culture of future vision to these companies. In particular, Major and Cordey-Hayes (2000) describe the interaction enhancement between SMEs, the majority of which carry out entrepreneurial activity to meet the short-term needs of owners and/or managers without departing from the scope of their own horizons, and intermediary organizations within the foresight program implemented by the UK government since the 1990s and designed to reduce the qualitative gap between progressive science and practical innovation. Research studied how the transformation of the primary data into concrete actions should happen, and created a target model for SMEs, demonstrating how SMEs with different managerial attitudes should interact with certain intermediary organizations in the UK for the most effective foresight implementation (Major and Cordey-Hayes, 2000).

Foresight research for SMEs can be carried out using existing approaches, which, however, must in some way be adapted for SMEs. For example, methods such as roadmapping

have become widespread as they help SMEs to identify and select the newest technologies which will benefit businesses (Holmes and Ferrill, 2005; Jun et al., 2013). The use of corporate foresight opportunities by SMEs is also probable (Paliokaite, 2010). Roadmapping is an approach which is frequently used in foresight in different ways (Vishnevskiy et al 2015, Karasev & Vishnevskiy, 2010; Kindras et al 2014).

Holmes and Ferrill (2005) modified the T-Plan—the methodology of technology roadmap building—and applied it to Singapore companies operating in various industrial sectors. The five module process includes the initial assessment of the current position of the enterprise, market analysis, the creation of product/services concepts, the identification of key innovative technologies, and the subsequent establishment of a roadmap on the basis of this information. This process was used to build 36 operational and technology roadmaps in SMEs of different sizes (the number of employees varied from 50 to 200).

The objective of the SME Technology Roadmapping Program implemented in South Korea at the governmental level was to enhance the ability of SEMs to plan R&D activity (Jun et al., 2013). The program was carried out from 2008 to 2011, and during this period support was provided to 148 companies to create medium-term (3–5 years) technological roadmaps. Most of these firms benefited from the roadmapping process and eventually developed the strategic technologies indicated in the roadmap. To some extent, the experience of South Korea is comparable with the Singapore program in creating operational and technology roadmaps, however in the Korean case the program worked with smaller companies who required the involvement of more financial and human resources. In addition, the roadmap building processes differed significantly. Within the Singapore program various expert meetings were organized during which the roadmaps were selected by prioritizing and ranking the least costly and most efficient routes. The Korean program largely relied on more in-depth research conducted by specialists, and technology and market research provided information which could be used both for roadmap development and other future objectives.

The SME Technology Roadmapping Program stages were also divided into five modules depending on the direction of the intended analysis: environment analysis, product analysis, market analysis, technology analysis, and roadmapping. The distinction of the proposed process from the process of operational and technology roadmapping is that product analysis precedes market analysis and it allows the determination of the optimal product or service concept.

According to Paliokaite (2010) corporate foresight can be adapted for the needs of SMEs. He identified key opportunities for corporate foresight and three routes for their use by SMEs to improve strategic thinking and firms' focus on results: structure, culture and networks.

Over recent years researchers also offered essentially new concepts of foresight implementation for SMEs. These concepts combine various least-cost research practices. For instance, the concept of Opportunity Landscape created by Savioz and Blum (2002) represents an accessible system of administrative support for SMEs and is based on the Technology Intelligence method and some strategic approaches. The purpose of Opportunity Landscape is the identification and anticipation of future trends and changes in the scientific environment by means of their ongoing and systematic observation and with the help the necessary technological information for decision-making.

At the beginning of the analysis relevant strategic areas and directions of possible future development are highlighted, and then the priority of selected directions is determined with respect to three areas. The directions in the first area are under constant and intensive observation. They are described in detail to make actual strategic decisions. The second area contains the directions that are studied regularly, and the third includes those which are kept in mind but not monitored regularly. For each direction the management appoints the most competent specialist in this area, as a controller who is responsible for the continuous study of one direction. Three aspects to be examined systematically are: technologies, the market, competitor activities (fig. 1).

Fig. 1. **Interaction between Opportunity Landscape and business strategy**
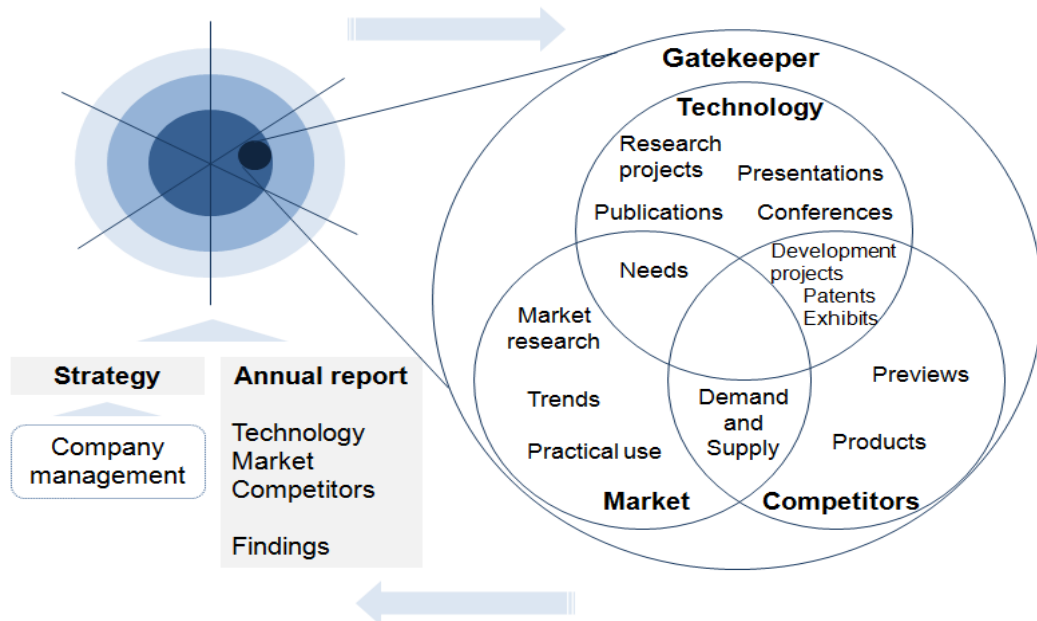
Source: Savioz and Blum, 2002

Pozdnakova (2008) paid closer attention to Knowledge Management, which is the process of the systematic creation, preservation, distribution and application of the elements of organizational intellectual capital. Knowledge Management, which involving such aspects as

strategy, technology, enterprise resources, organizational culture, business processes, and the processes of knowledge processing, contributes to the efficiency and competitiveness of SMEs. In the study, it was suggested to combine the elements of foresight and Knowledge Management. The final model contains common elements of the SME environment, Knowledge Management and foresight, and takes into consideration five aspects, namely strategy, external conditions, knowledge, processes, technologies and methods.

Bidaurratzaga and Dell (2012) proposed the Future Garage Process which represents a specially designed foresight process for SMEs and based on an analysis of the literature, expert pools and case studies. The Future Garage Process contains the elements of open innovation. Moreover, it brings weak signals, leading indicators and long-term impact factors in SME innovative strategies and helps to overcome some common barriers for SMEs.

Markmann and colleagues offered a collaborative foresight approach as a key tool for company survival under conditions of external environment instability. This method enables the identification of assessing and managing future changes with the help of an innovative web-based foresight platform—Competitiveness Monitor (Markmann et al., 2012). The platform provides an opportunity to implement cooperative risk management and joint foresight studies by SMEs, scientific research institutes and universities, and has four interlinked scopes of application which aim at creating conditions for the cogeneration, discussion, evaluation and development of advanced knowledge. Wherein special attention is paid to the relevance and the timeliness of the information.

The above approaches to foresight implementation for SMEs have both similarities and significant differences emanating from their focus and scope.

Table 2.

Characteristics of approaches to SME Foresight studies

Comparison criteria	Roadmaps	CF for SMEs	Opportunity Landscape	Knowledge Management	Future Garage Process	Collaborative Foresight
Purposes	Identifying and selecting technologies for business development, company activity planning	Use of corporate Foresight opportunities for the needs of SMEs	Identifying future trends and changes, providing information for decision-making	Shaping the future development of SMEs, making strategic decisions	Managing the innovation process in the organization	Identifying, evaluating and managing future changes
General characteristics	Focus on technology development Include 3-4 stages	Structural, cultural and network approaches to the use of corporate Foresight opportunities	Based on Technology Intelligence and strategic approaches Build on the work of controllers	Stores, distributes and applies knowledge; Supports Foresight process	Includes three stages Based on the trust	Implies the creation of web-based Foresight Platform

Coordinators	Government agencies, research institutes, universities	SME Management	SME Management	SME Management	Government agencies, NGOs	Government agencies, research institutes, universities
Methods used	Expert pools, brainstorming, market analysis, technology research, expert studies	Activities to introduce corporate Foresight	The top-down/ bottom-up approaches, expert analysis methods, market analysis, technology research	Brainstorming, meetings, competitor analysis, knowledge audit, teamwork	Analysis of literary sources, expert pools and case studies	Prediction markets, analysis of literary sources, future seminars
Planning horizon	Medium-term/ short-term	Medium-term	Short-term	Medium-term	Short-term	Long-term
Financial and human resources	External	Internal	Internal and external	Internal	Internal and external	External

Source: authors

Due to the fact that both the objectives and the organisation of these approaches are significantly different and the majority of these methods have not yet been studied in practice, it is quite difficult to distinguish the most appropriate for SME foresight implementation. The specific choice must be based on the objectives of the proposed research, the available resources, and the readiness of SMEs to implement such approaches.

Identifying the key areas of using foresight results by SMEs

Foresight research, aimed at studying potential future developments through a variety of approaches, is able to serve as an important tool for more efficient innovation in the short and long term. SMEs can use the results of these studies in a variety of ways.

The greater the company's willingness to change, the stronger is its dependence on the knowledge that foresight, which also ensures the reliability of future investment decisions, can provide. The need to act and to build a strategy in accordance with an uncertain future can result from competitive pressure and a dynamic development of environment. For instance, European SMEs generally used foresight results in order to support strategic planning and innovation management (Jannek and Burmeister, 2007).

Although most approaches to foresight by SMEs, including those considered in detail in the previous section, are waiting for practical application, there are results from the practical application of some methods by SMEs. For example, the results and the directions of the technological roadmaps are covered in the literature in detail. They are usually R&D activity,

specific actions in such areas as manufacturing, marketing, sales, warranty service, and the discovery of new development directions.

Notably, South Korean SMEs applied technology roadmaps to create or improve R&D strategies (Lee et al., 2007; Jun, et al. 2013). In addition during the roadmapping it became possible to increase the capacity of human resources involved in the process, to develop technologies, and to strengthen their chances of commercial success.

The practical use of Opportunity Landscape was realized by a Swiss medium-sized company (500 employees) engaged in medical technologies in the field of dental implantology. The study was intended to identify future development directions and the subsequent creation of R&D strategies (Savioz and Blum, 2002). The application of this management tool also made the development of an internal knowledge base possible and contributed to organizational learning and knowledge management.

In turn, foresight research realized by means of the open innovation method allows SMEs to access market information and the necessary technologies for the creation of customer value. Foresight studies also helped to expand the absorptive capacity of SMEs through a positive interaction with the company's environment (Igartua et al., 2010).

The results of most SME foresight studies organized in different ways are primarily used for innovation activity planning, for the implementation of specific measures to develop new products and services, and for the establishment and improvement of intellectual capital. In addition, in the course of foresight SMEs can get additional benefits that go beyond the original purpose, e.g. in terms of relations with external environment.

Methodological approaches to foresight for SMEs

By studying the best development practices of the theoretical and methodological approaches to SME foresight and by analysing the best world practices of such methods we formulate methodological approaches to SME foresight research.

The whole set of foresight methods used at the corporate level was evaluated with respect to their cost and effectiveness. For this purpose a criteria system was formulated (Table 3).

Table 3.

Parametric system for evaluating the effectiveness of Foresight methods application

Costs	
Number of experts involved	1 – single specialists, 4 – a large number of experts
Specific requirements for the analyst	1 – general qualification is enough, 4 – deep expertise is necessary
Complexity of an event organization	1 – special organizational activities are not required, 4 – complex organizational activities are needed
Complexity of the tool preparation	1 – special tool is not required, 4 – the development of special tool is necessary
Complexity of the searching and processing the primary intentional data, the need to purchase expensive databases	1 – specific data are not required, 4 – very expensive purchases
Complexity of result analysis	1 – it is relatively easy to process data, 4 – sophisticated analysis algorithms are required
Need to involve costly subcontractors	1 – the work is done on their own, 4 – costly outsourcing is required
Results	
Possibility of direct use of the results in decision-making	1 – to use the data during the process of management their special treatment is needed, 4 – the data can be used directly
Opportunity to discuss results with experts and stakeholders	1 – the results of the individual method cannot be discussed with experts and stakeholders, 4 – the results can be used directly to discuss with experts and stakeholders
Usefulness of results for the analysis of technology	1 – the object is difficult to study by this method, 4 – very high utility
Usefulness for market analysis	1 – the object is difficult to study by this method, 4 – very high utility
Accuracy and objectivity of data	1 – the accuracy and objectivity of the data cannot be guaranteed, 4 – the accuracy of the data can be provided
Data completeness	1 – completeness of coverage is not guaranteed, 4 – complete coverage can be guaranteed
Possibility of generating new knowledge	1 – method only organizes the existing knowledge, 4 – method can generate new knowledge

Source: authors

With the use of these parameters the survey was conducted amongst more than 20 experts who participated in the implementation of foresight projects. This made it possible to obtain integral estimates of the most used foresight methods cost and effectiveness (Fig. 2).

Fig. 2. **The results and cost assessment of Foresight methods**
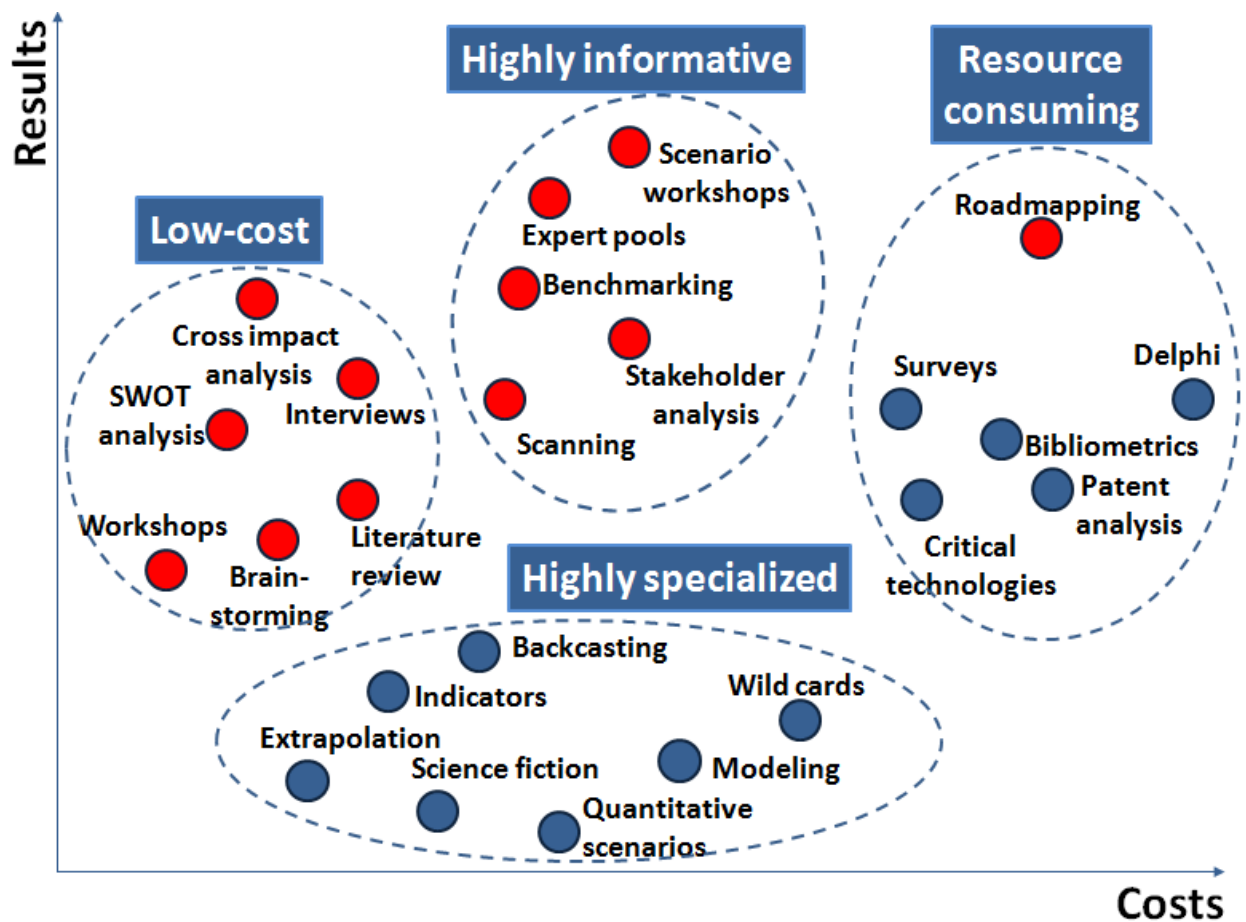
Source: Vishnevskiy & Egorova, 2015

Based on the analysis, four main classes of methods can be distinguished:

1. **Low-cost.** These methods, among which are literature review, interviews and brainstorming, are expedient for any foresight processes since they do not require considerable expenses, but achieve results which ensure the reliability of research.

2. **Highly informative.** Despite the more significant costs in comparison with the first category, the performance of these methods is the best among the rest of the approaches. Primarily they include benchmarking, stakeholder analysis and scenario workshops.

3. **Highly specialized.** These methods (eg, wild cards and modeling) achieve specific positive effects. However, their use is justified only when there are sufficient time and financial resources, so in the general case their application to SMEs is inappropriate.

4. **Resource consuming.** These methods are important for large businesses, but their implementation requires significant financial, organizational and other resources (a typical example is efficient but resource consuming Delphi). Given the limited

capabilities of SMEs from this group it is expedient to use roadmapping which provides an integral foresight document.

Given the limited financial, human and time resources of SMEs it is advisable to combine low-cost and highly informative methods to eventual develop a roadmap. Accordingly the range of methodologies for SME foresight is smaller than for large companies.

Conclusion

This paper analyses the suitability and appropriateness of different foresight methods taking into account the special features of SMEs. Table 4 shows a comprehensive list of foresight methods and their potential application for corporate foresight and foresight for SMEs.

Table 4.

Parametric system for evaluating the effectiveness of Foresight methods application

Methodology class	Methods for corporate foresight	Methods for SMEs foresight
Low cost	• Literature review • Interviews • Cross-impact analysis • SWOT analysis • Workshops • Brainstorming • etc.	• Literature review • Interviews • Cross-impact analysis • SWOT analysis • Workshops • Brainstorming • etc.
Highly informative	• Benchmarking • Stakeholder analysis • Scanning • Expert panels • Scenario workshops • etc.	• Benchmarking • Stakeholder analysis • Scanning • Expert panels • Scenario workshops •
Highly specialized	• Wild cards • Extrapolation • Science fiction • Quantative scenarios • Indicators • backcasting and modeling • etc.	—
Resource consuming	• Delphi • Surveys • Key technologies • Patent analysis • Bibliometrics • etc.	• Roadmapping

Source: authors

It shows that although the results of some corporate foresight methods have a reasonable potential output-wise they cannot be applied for SMEs. The reasons are mainly found in the need to allocate significant resources which are often scarce in SMEs. Also SMEs often have a

different time horizon for planning their activities. Large companies serve different markets and applications which is not the case for typical SMEs who are usually more focused. Accordingly the scope and complexity of foresight is different for SMEs compared to large companies.

The study of theoretical and methodological approaches and the investigation of the practical implementation experience distinguishes the key features of foresight conducted for SMEs. Proceeding from the limitations of financial, human and time resources, it was concluded that the standard methods of corporate foresight cannot be completely taken for long-term forecasting in the interests of SMEs. Some aspects of corporate foresight methodology can be adapted for SME needs, however there are a number of approaches designed specifically for SME strategic planning.

This paper fills a gap in the literature—a lack of comprehensive methodology for foresight for SMEs. Most of the existing approaches have been developed for a specific project aimed at the development of the SME. We developed a two-step foresight methodology for SMEs based on cost-benefit analysis of each foresight method. This creates a system of priorities for the development of SMEs, and offers an action plan for their implementation.

Such an approach allows foresight studies to be conducted in resource-limited settings and can be used by small companies and in regional foresight, long-term future studies for industrial clusters and technology platforms, and all other areas where quick and cost-efficient foresight is in a great demand.

The methodology can be developed further in terms of the set of criteria, the portfolio of foresight methods, fields for application, the groups of beneficiaries, and linkages with STI policy and funding.

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