

Qualitative Methods of Demand Forecasting for SMEs in Germany

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Abstract

The well-known qualitative methods for carrying out demand forecasts can also be applied well to medium-sized companies. In particular, it has been shown that expert surveys and sales estimates are very easy-to-use methods for generating demand forecasts or ensuring quality. Customer surveys also deliver good results but are somewhat more complex to carry out. The implementation of the Delphi method has proven to be quite complex and is therefore not considered a preferred method for the medium-sized company. In contrast, scenario analysis is of paramount importance. This method should also be used by medium-sized companies as a standard method that is fairly easy to use and can be used in a variety of ways.

Keywords: demand forecast; expert survey; sales estimate; Delphi method; Scenario method.

1. Forecasting Methods and Medium-Sized Companies

1.1. Demand Forecasting

Which products and services will be in demand in two years and ensure the company's sales success? What are the short-term trends in demand? What will the demand look like in the next quarter? Which product variants could be of interest to my customers in six months? These and other questions are of paramount importance for the product creation process in operational practice. Almost all operational processes and functions, such as purchasing, logistics, warehousing and all production processes and programs, depend on answering these questions. In addition, these questions are of fundamental strategic importance for the medium-sized company. If, e.g., too much capital is tied up in inventories, this could have a negative impact on a company's operating cash flow. Alternatively, if there are insufficient resources for the provision of services (e.g., in the care sector), this could have a sensitive impact on the quality of the services. The most accurate estimate of future sales or customer orders can be considered as the starting point for all planning activities for medium-sized businesses. Such forecasts also have an impact on long-term planning and thus on the strategy of a medium-sized company. Due to demographic developments in Germany, it is already foreseeable today that the number of required nursing places in retirement homes will increase by over 30% in the next 15 years (Wuest 2018), but this will also increase the need for nursing staff disproportionately. Based on these forecasts, there are significant business opportunities for medium-sized companies that are working or want to work in the nursing industry. Conversely, it also means that, from an entrepreneurial perspective, strategies must be developed to train sufficient nursing staff, to recruit them and to retain them in the long term.

Demand forecasts are of paramount importance for the entire operational service creation process and influence the company's profitability in the short, medium and long term. This article deals with the qualitative techniques for estimating the demand for goods and services in German medium-sized companies. The planning process

for small and medium-sized companies usually differs fundamentally from the corresponding processes at larger companies or companies that have well-developed planning and forecasting capacities (Doberanzke 1993, pp. 6–10).

Forecasts are used in a variety of ways in the production process. The actual process of creating a forecast is mostly uniform in a three-stage structure. After the prognosis target and the forecast horizon have been determined (e.g., planned sales for the next 12 months or the extent of the demand for a certain service in the next 6 months), the question first arises as to which forecast procedure should be used. Here you can essentially differentiate between qualitative and quantitative processes (Thonemann 2015, p. 31). Then in a second step the data are collected, and finally in the third step the forecast is created. The subsequent monitoring process is then no longer part of the actual forecasting process but usually takes place in operational controlling or, in the case of longer-term forecasts, in the strategic control department.

1.2. Structural Characteristics of Medium-Sized Companies

There are a number of qualification criteria for small and medium-sized enterprises (SMEs) in the relevant literature. If you take the official distinction criteria of the EU Commission as a basis, medium-sized companies are those that have fewer than 250 employees and either have sales of less than 50 million euros or total assets of less than 43 million euros (EU Commission 2003). Another definition developed by the Institute for Small and Medium-Sized Enterprises uses the following size classes (IfM Bonn 2020):

Type of company	Employees		Sales
Micro companies	≤10	and	≤2
Small companies	≤49		≤10
Medium-size companies	≤499		≤50

Figure 1. Quantitative characteristics of small and medium-sized enterprises (SMEs). In the following, the definition of the IfM (Figure 1) should serve as the basis for the classification of medium-sized companies. In addition to these quantitative demarcation characteristics, there are also a number of qualitative characteristics for classifying SMEs. The following table summarizes the characteristics that are important for this article (based on Dömötör 2012, p. 16).

The economic importance of medium-sized companies is enormous; in Europe, medium-sized companies are by far the largest group of companies. Approximately 99% of all companies are small and medium-sized companies, and together they employ more than 65 million people. Medium-sized companies also play an important role in Germany in particular (IfM Bonn 2020):

- In 2017, the proportion of medium-sized companies in Germany was 99.5%. This means that more than 3.5 million companies were considered to be medium-sized companies.
- Almost 58% of all employees subject to social security contributions were employed by medium-sized companies.
- The medium-sized companies contributed around 58% of the total net tower creation.

1.3. Overview of Forecasting Methods

The term forecast originally comes from (ancient) Greek and means prediction (Wiktionary 2020). The forecasting techniques can essentially be broken down according to two different criteria: the information flow and the type of forecast. When differentiating according to the information flow, a distinction can be made between the top-down approaches and the bottom-up approaches. The latter include, e.g., the market share forecast and the target group share forecast. However, both forecasting techniques tend to take place on a meta-level, which is why they can only be classified to a limited extent as prognostic models. (Kühnapfel 2019, p. 16). Bottom-up techniques are used regularly to assess medium-sized companies. These techniques include all quantitative and qualitative prognostic methods.

The quantitative forecasting techniques include (Vogel 2015, p. 11; Thonemann 2015, pp. 38–60):

- One-dimensional processes, such as Trend forecast, moving averages;
- Multi-dimensional processes, such as Regression analysis, trend forecast, portfolio analysis.
- The qualitative forecasting techniques essentially include:
 - Expert survey;
 - Sales estimate and customer survey;
 - Delphi method;
 - Scenario method;
 - Relevancetreeanalysis;
 - Historical analogies.

In the following, the first four methods of qualitative forecasting are analyzed in particular. One focus is to what extent these techniques can also be used for small and medium-sized companies against the background of the specific characteristics of small and medium-sized companies.

2. The Demand Forecast as Part of the Operational and Strategic Planning Process

In the process of demand forecasting as part of the operational planning process, a number of functions of the SME are involved. First of all, this includes all functions that are directly integrated into the operational sales process. These are in particular the sales function but also the marketing function, as there is often no clear division of tasks in many areas, especially in SMEs. Furthermore, the indirectly affected functions are also included in the process of forecasting demand, e.g., the procurement or logistics functions. The controlling function takes on a central coordination function in the entire planning process: “the very essence of controllership in its highest form is coordination” (Heckert and Willson 1963, p. 93). A distinction is first made between operational and strategic planning. Both plan levels provide corporate planning, which aims to ensure that corporate goals can be achieved. In the business literature, certain characteristics are assigned to planning, such as the planning horizon, the planning object, the planning subject and the planning data (Wöhe and Döring 2013, p. 63).

The strategic planning of the medium-sized company usually includes a period of 3 to 5 years and thus forms the framework for operational planning (Schroeter 2002, pp. 309–10). The latter is the concrete, annual design of the strategic planning

and subordinate to it (Knorren 1998, pp. 108–9). The operative planning, which is sometimes also called tactical planning, typically refers to a period of 12 months. The starting point for operative planning is usually the budget process for the following business year, which usually takes place in the majority of medium-sized companies in the last quarter of the current business year. The budget process covers all operational functions, such as production planning and control, procurement planning, liquidity planning, marketing planning and personnel planning. From a SME point of view, it is critical to ensure that all sub-plans are coordinated with one another. Even if the complexity of SMEs with, e.g., only a few hundred employees is significantly less than, e.g., that of a large corporation such as Siemens AG, the entrepreneur, as the moderator of the overall process, still has the task of coordinating all sub-plans consistently. This prevents, e.g., purchasing an excessive quantity of raw materials or intermediate products that are not subsequently needed in production, based on sales planning.

The demand forecast is an essential part of sales planning and includes both aspects, the longer-term forecast of demand (e.g., 3–5 years) and the operational, annual demand forecast as part of the annual budget process. According to Gutenberg, one of the central tasks of corporate management is to determine the sales volume that should be achieved within a certain period of time (Gutenberg 1963, p. 73). In the long-term demand forecast, the entrepreneur is regularly involved, since it is about ensuring the future viability of the company and its ability to generate long-term profits. In the case of operative sales planning, which is more focused on the short time horizon (e.g., 1 year), the lead function regularly lies with the sales function, or at least the sales function plays an important role in the planning process.

Sales planning thus plays a key role in the operational planning process. It is the basis for production planning and at the same time is the determinant for purchasing and logistics (Gutenberg 2013, pp. 208–210). From a profit-oriented perspective, sales planning also plays a central role. It minimizes sales risks, ensures an optimized inventory and thus lower capital commitment costs, enables suppliers and suppliers to be integrated at an early stage and ensures that order control and production planning run in sync (Gudehaus 2005, pp. 252–53).

3. Qualitative Methods of Forecasting Demand and Their Importance for Medium-Sized Companies

3.1. Introduction

Quantitative forecasting techniques are based on statistical-mathematical models, which usually take historical time series into account and try to estimate how future demand will be structured. To eliminate special influences, the quantitative models use more or less complex smoothing methods. One of the most well-known and also widely used quantitative forecasting models is the time series analysis (Hamilton 1994). Goals of the time series analysis can include the analysis of trends and market structures. Various methods are used for smoothing, and one of the most common smoothing methods is the method of moving averages (Rinne and Specht 2002, p. 57). In contrast to quantitative forecasting methods, qualitative forecasting methods are not based on mathematical models. Rather, the qualitative methods are based on the

knowledge and experience of selected groups of people or of several individuals. This means that qualitative forecast models by definition have a higher degree of subjectivity than quantitative forecasting methods. However, this does not necessarily mean that qualitative models lead to a lower forecast quality. Rather, qualitative methods should always be preferred if for reasons of time and/or costs, quantitative models should not or cannot be used. In addition, there will also be situations in which the entrepreneur simply has no historical data available because, for example, it is a newly developed product and the market has so far not provided any information about how demand will develop. This is explained using a concrete example. As part of the COVID-19 pandemic, there has been a massive and hitherto unimaginable demand for protective masks in Germany. It has been forecast that Germany “might need billions of masks” in the end (Die Welt 2020). In a call for tenders carried out by the Federal Ministry of Health, over 100 companies, some of which were medium-sized, took part in order to start manufacturing protective masks. Since the time series available for the production and sale of protective masks in Germany so far are unusable, the sales figures accepted in the context of the tender were almost exclusively based on expert estimates (Reuters 2020).

In medium-sized companies, there is a predominant and regular combination of quantitative and qualitative forecasting methods. The entrepreneur knows “his” market well and keeps an eye on the historical time series of sales trends. In addition, techniques of qualitative forecasting are also regularly used to ensure the results of the quantitative demand forecast. Especially when it comes to strategic demand forecasts (3–5 years), the medium-sized entrepreneur tries to make extensive use of the know-how available in their company in order to avoid sales risks to the company resulting from historical trend extrapolations that could adversely impact their profit situation.

3.2. *Expert Survey*

The expert survey as a tool for collecting data is a very old method of gaining knowledge. The well-known sociologist Noelle-Neumann dates the origin of this questioning technique to the end of the 18th century (Noelle-Neumann and Petersen 1996, pp. 7ff.). Today the method of interviewing experts is used in a variety of ways in social research (Hopf 2004, p. 353). In addition, this forecasting technology has also been used extensively in political research (Kaiser 2014), but the expert survey also has a permanent place in the economic literature as a recognized method of qualitative forecasting technology (Thonemann 2015, p. 35).

As the name suggests, selected experts are interviewed during the expert survey with the aim of querying expert knowledge (Flick 2009, p. 115). On the one hand, these can belong to the SME itself. These could include the Heads of Operations (COO), Marketing (CMO), Finance (CFO) or Manufacturing and Procurement. If the group of experts is exclusively specialists from your own company, such a group of experts can also be used as a “data source” for long-term, strategic demand forecasting. To derive the greatest benefit from such a survey, the process of the survey should be prepared comprehensively and using different questioning techniques. Furthermore, the expert survey can also be embedded in the context of strategic planning. For this purpose, the already existing information about the longer-term demand trend should be processed in a targeted manner, which, e.g., could be done through the finance function. It is important

that the experts interviewed contribute their know-how as comprehensively as possible, as it is not uncommon for well-structured rounds of surveys to make new and previously unobserved aspects visible. As part of his extensive international management work, the author of this article has participated in a large number of structured, in-house expert surveys and can confirm that such surveys, provided they have been professionally and comprehensively prepared, are regularly very good and deliver usable results. Especially in the context of pronounced uncertainty about demand behavior, e.g., in the event of unforeseeable market turmoil or pronounced sales crises, the expert survey for the SME should be one of the few forecasting methods that can be used efficiently and effectively. In addition to inviting in-house experts, it can also be observed in practice that expert surveys are carried out with external experts. A possible area of application for such expert surveys is new, rapidly developing markets. One example is the market for e-bikes. The German bicycle industry association (ZIV) regularly carries out a survey of all e-bike manufacturers and e-bike dealers based in Germany in order to assess the sales market for e-bikes (ZIV 2020). These statistics regularly attract a lot of attention from the manufacturers of e-bikes, most of which are highly successful medium-sized companies based in Germany (Manager Magazin 2020).

The advantages of expert surveys are obvious: If the experts are employees of the company, then the necessary resources are already available. If the expert survey is initiated by the entrepreneur, it can be assumed that the willingness of the selected managers to participate in such a survey is high. Finally, participation in the expert survey can be seen as the core task of the corresponding function. However, this is offset by the costs for such a survey and in particular the limiting time factor. It is all the more important, as already mentioned above, that such surveys are very well prepared. If not only in-house experts are included in the survey, the unwillingness of the selected experts can also be a limiting factor. In addition, the result of the demand forecast can be unclear, and further analyses could be necessary. Finally, it must be considered that the result depends on the good selection of experts. Plausibility analyses and plausibility tests must be carried out regularly in the context of the sales planning of the medium-sized company in order to further validate the collected statements.

3.3. Sales Estimate and Customer Survey

In addition to the expert survey as an instrument for forecasting demand, the technique of sales estimation in SMEs is likely to be widely used. The author of this article, in his many years as an international executive, did not experience one occasion in the annual budget process where the assessment of the sales function was not included in the demand forecast. In many companies, sales management is even the function that is ultimately responsible for forecasting annual demand. The main idea is to use the extensive market knowledge resulting from the diverse customer contacts as a forecast basis for the demand. In this context, the sales function often pursues a combined strategy: On the one hand, the quantitative time series of historical demand trends are used as the starting point for the demand forecast (Kiener et al. 2012, p. 170). These are adjusted for special effects using simple smoothing techniques. As soon as the sales figures are determined and normalized, the demand forecast will be developed through the extensive involvement of the sales staff of the SME. In most

cases, this is done in a multi-staged, iterative process that is initially bottom-up. The individual sales employee develops a “raw” forecast based on the historical sales figures (e.g., for the past three years) and enriches these data with the information from market events to form a demand forecast. All individual forecasts are then consolidated into one overall forecast. As soon as the consolidation has taken place, usually at a company-level, a comparison with the demand forecasts is obtained from the strategic planning. Any adjustments from senior management are then communicated top-down. This is then again followed by an iterative bottom-up coordination process. This process can take several weeks and, in rare cases, months. In day-to-day business, the demand forecasts for the sales function are regularly checked by a neutral body. This is done for reasons of caution and sales risk minimization. One place that could perform such validation is the financial function in which neutrality can be assumed as given. In addition, the manager responsible for operations management (e.g., the Chief Operating Officer) will have a valid interest in the resilience of such forecasts. Such validation can be carried out using historical probabilities of occurrence depending on the corresponding project status. Figure 3 shows an example of the situation for a medium-sized company that builds software solutions for e-commerce applications (E-Software AG).

Company A contacted E-Software AG for the first time and requested the creation of a customerapp; a “pitch” has already taken place. Based on historical time series, the sales staff know that the probability of a deal after a first customer contact (pitch) is around 30%. Accordingly, the project value (EUR 1.5 million) is multiplied by the probability and results in a forecast value of EUR 0.45 million. The contract with company B has already been legally signed and can therefore be fully incorporated into the demand forecast (EUR 5.00 million). In the project to optimize customer logins, there were two further specification meetings with company C after the initial meeting. Based on the sales database, the likelihood of a deal is set at 60%, so the forecast value is EUR 1.20 million. The maintenance contract with company D is a long-term contract, i.e., the value can be set at 100% (EUR 3.00 million). By summing up all individual forecasts, E-Software AG receives the demand forecast for the entire company.

In practice, such sales estimates are regularly checked neutrally. This is important insofar as there is a tendency in many sales functions to estimate sales figures as conservatively as possible. The over-fulfilment of plan specifications then regularly flows into the overall assessment of the sales function but also of the individual employee. From the point of view of the entrepreneur, a neutral assessment of the demand forecast would be desirable. If it is a new product (in this case a software product), it will also be difficult for experienced sales staff to predict a reliable estimate of the likelihood of closing.

The customer survey is closely linked to the sales estimate. Sales estimates and customer surveys often go hand in hand. The sales representative will regularly obtain feedback from large and important customers of the company to generate an estimate of the demand forecast that is as accurate as possible in the course of the last quarter of the current year. In addition to these ad-hoc customer surveys on the part of the sales department, the SME can also conduct the customer survey on

potential future demand as a structured process. In this case, the implementation is more likely to be carried out by a “neutral” body, e.g., the marketing function. The customer survey as a method is attributable to the research discipline of market research and plays an outstanding role here (Meffert et al. 2008, p. 146). Professional preparation and implementation is decisive for the quality of the survey results (Schneider and Kornmeier 2006, p. 97). Customer surveys usually deliver good results and can easily be combined with the existing know-how of the sales force and with the historical time series that may be available.

3.4. Delphi Method

Similar to the expert survey, the Delphi method is a survey concept. The difference, however, is that the Delphi method uses an iterative feedback approach that tries to optimize the result of the estimate over several feedback cycles. The Delphi method was developed in the United States at the beginning of the 1960s (Hüttner 1982, p. 29) and has since been used extensively in trend estimation, in making forecasts and in the long-term assessment of the effects of new technologies.

A well-known example of the application of the Delphi method is the “Delphi ‘98 survey”, which was carried out by the German Fraunhofer Institute on behalf of the German Federal Ministry of Education, Science, Research and Technology (BMBF) (Fraunhofer Institute 1998). The subject of the survey was the “Study on the Global Development of Science and Technology”. The course of the study follows a multi-stage structure. First, the basic theses were developed by a steering committee, which included nine selected scientists and business people. These included questions such as: What are the areas of innovation in which significant progress can be made over the next 30 years? Which events in research and development will expand human knowledge the most? Which social “mega-trends” have to be related to the development of science and technology?

After the steering committee was formed, over 100 experts from industry, universities and other institutions were invited to answer the key technical and scientific questions. Subsequently, theses about future developments were worked out in several workshops. The core of this Delphi process consisted of two “rounds” of surveys. In a first round, 2400 “experts” commented and evaluated the thesis paper by asking questions. The answers were then evaluated and sent to the same group of people again for comments. In the second round, the experts should rethink their answers under the influence of their peers’ assessments and have the opportunity to change their minds.

The Delphi method is now used in many different disciplines. Examples of Delphi studies carried out in Germany include technology assessments for the health sector, studies on the future of bibliography and scenario analyses for the logistics industry (von der Gracht 2010). In the practice of the Delphi method, most surveys are now carried out electronically, so that feedback to the participants can be given quickly (Niederberger and Renn 2019, p. 54).

Figure 2 shows the basic concept of the Delphi method. Basically, it is a five-stage, iterative process. The first stage begins with the preparation of the study. Here it is determined what the subject of the Delphi survey should be. In the context of the demand forecast for medium-sized companies, this could be, for example, the sales forecast for a particular product. In addition, other attributes are also queried, e.g.,

quality, price, certain product characteristics, etc. Furthermore, it must be determined who is included in the survey, i.e., the identification of experts. These can be existing customers of the SME or potential new customers that were determined in the context of market research. In addition, relevant experts from industry associations or professional organizations can also be considered. It is crucial for the entrepreneur that the identified persons are experts who can make a real value contribution in the form of the requested sales forecast based on their experience and their know-how. As soon as the questions are determined (e.g., sales forecasts) and the addressees are determined, the thesis and question catalogue will be presented to the experts. In practice, this is now done almost exclusively in electronic form. Step 2 then represents the assessment of the participating experts. As soon as the answers from this first round are available, step 3 systematically evaluates the existing interim results.

Chances	Challenges
Increased flexibility - Flat hierarchies - Short and quick decision making - Low communication complexity - Little bureaucracy Proximity and access to the market - Is usually faster and reacts more flexibly to market fluctuations - Market knowledge is usually very high	Resource deficit - Limited access to debt and equity - Limited human resources and thus dependency on key personnel Strategy deficit - Not fully formulated corporate strategy - Conditional method know-how Control systems - Strategic control mostly underdeveloped - Conditional know-how for quantitative forecasting processes

Figure 2. Qualitative characteristics of SMEs.

Subsequently, the consolidated interim result in step 4 is reflected back to the participating experts in an anonymized form. The aim is for the experts to rethink, refine, expand or modify their own answers in the context of the answers of other experts. This structured process of opinion formation usually takes place over two or three iterations, which means that steps 2-4 shown in the figure can be repeated several times in the basic model. In a final step 5 there is the final result, a prepared group opinion, which ideally provides the medium-sized company with an indication of the expected demand for a product.

The Delphi method has a few weaknesses that should also be considered when used in the context of demand forecasts (Häder 1998, pp. 12–13):

- The Delphi method tries to reduce misjudgments using an iterative procedure. Experience shows, however, that despite the involvement of various experts, some of the results of the Delphi method can diverge to a considerable extent.
- It is fundamentally questionable whether, in the context of forecasting the demand of medium-sized companies, the experts surveyed have knowledge that goes well beyond the know-how of the medium-sized company.
- For the actual selection of experts, there are basically no predetermined selection criteria; In this respect, the term “expert” is subjective and, in part, somewhat

arbitrary. The selection of the participants could influence the result.

- It can be observed in empirical studies that experts tend to overestimate the speed of technical developments. Above all, the rate of diffusion of an innovation in society is regularly overestimated. For example, In the aforementioned Delphi study by the Fraunhofer Institute in 1998, more than two thirds of all those surveyed assumed that the consequences of technical development would lead to more unemployment in the long term by 2010 and beyond (FraunhoferInstitute 1998, p. 14). The fact is, however, that Germany had virtually full employment at the beginning of 2020 (i.e., before the Coronavirus crisis).

For the entrepreneur, the Delphi method is suitable as an approach for forecasting demand, especially for situations in which a company,e.g., has developed a new product idea and wants to develop a broad-based sales forecast. However, it should not be overlooked that this method is rather complex and places very high demands on the existing methodological knowledge. In this respect, it can be assumed that the Delphi method as an instrument for forecasting demand will be of secondary importance for the SME.

3.5. Scenario Method

Scenario technology is an important method for the SME to generate the demand forecast. This is sometimes classified as a hybrid method between the quantitative and qualitative forecasting methods (Vogel 2015, p. 11). There is broad agreement in business literature that the scenario method is one of the most widely used forecasting techniques (Chermack 2007, pp. 1–3). Even if this is usually Rather used by larger companies, the Delphi method can easily provide valuable insights for medium-sized businesses in the context of demand forecasts. The scenario technique is dealt with in the literature as an instrument of strategic control. The essence of this technique is to develop different future scenarios for specific, economically relevant aspects by analyzing the environmental conditions in detail. Scenario analyses can basically cover all strategic planning measures; these include turnover, profit, liquidity, number of employees, costs, etc. The scenario technique considers both qualitative and quantitative information (Simon and von der Gathen 2010, p. 80). Figure 3 shows a schematic representation of the so-called scenario funnel (Hayn 1998, p. 315).

Example of a demand estimation for a medium-sized software company			
Project	volume in millions of euros	Probability in %	Demand estimate in millions of euros
Appdevelopment for company A	1.5	30	0.45
E-commerce platform for company B	5.0	100	5.00
Optimization project for company C	2.0	60	1.20

Maintenance for company D	3.0	100	3.00
Consolidated demand estimate for E-Software AG			9.65

Figure 3. Example of a demand estimate.

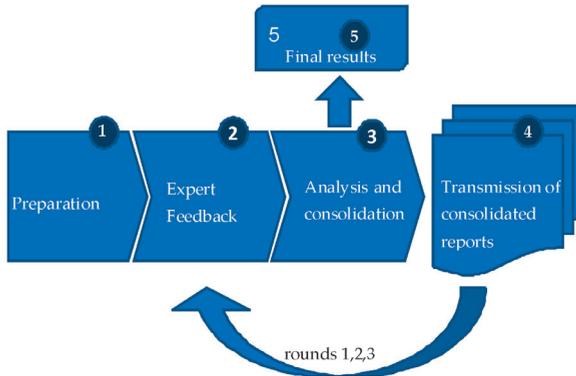


Figure 4. The Delphi method.

The starting point of the consideration is the so-called trend scenario. This describes the development assuming constant or stable environmental conditions. In the context of the demand forecast for the medium-sized company, this would, e.g., mean that sales for a product are updated based on the historical time series under ceteris paribus assumptions. Against the background of increasing volatility of the national and international sales markets, this assumption appears rather unrealistic, or at least rather risky; in this respect, there may be positive or negative deviations from the stable trend scenario in the future. The time factor is decisive; the further away the time to be observed is, the more uncertain the forecasts become, which means that the funnel spans over time and results in both a negative and a positive extreme scenario. The positive extreme scenario can also be seen as the “best case” and the negative scenario as the “worst case”.

In the present perspective, the funnel is still very narrow, i.e., The current environmental conditions in which the medium-sized company operates are largely known and can be mapped with a very short-term demand forecast (e.g., for the next two quarters) as part of a stable trend. If you follow the timeline, then the funnel opens and the possible scenarios drift apart.

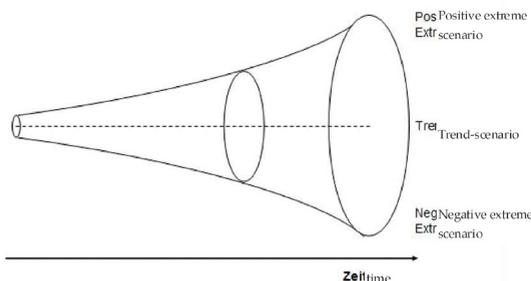


Figure 5. Scenario funnel.
 In the literature, scenario technology

is generally applied using a phase model, of which there are now countless variants. Gausemeier’s four-stage concept (Gausemeier et al. 1996, p. 101) is a simple model that is useful for the purpose of creating demand forecasts, which is to be expanded by a fifth step.

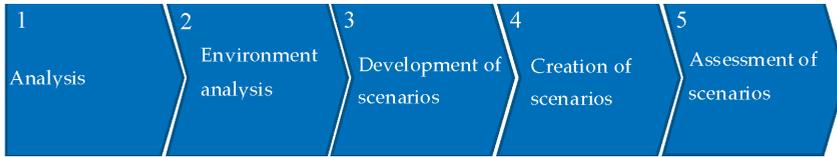


Figure 6. Model to implement the scenario concept.

In the first phase, the SME has to determine what is to be planned, whereby a distinction can be made between direct and indirect attributes. The direct attribute in the context of demand forecasts is the turnover itself. This, in turn, can be divided into sub-segments or according to product categories within a product class. In a subsequent step, the indirect attributes have to be defined, i.e., those factors that can have a concrete impact on sales. These are, e.g., the number of customers, price developments in the relevant market and the technological developments relevant to the product. An example would be the e-bike, the sales of which were directly influenced by the further development of the performance capacity of batteries. The second step is to analyze the most important factors influencing the sales of the product and to determine what influence one factor has on the other factors. In the example of the e-bike industry, demographic development has a significant influence on the product type of the e-bike. Another key factor is the number of direct competitors in the corresponding sub-segment of the market to be analyzed. The result of phase 2 is an overview of the influence of each individual factor and, based on this, a relevance matrix can be developed. As soon as this is available, only those factors should ultimately be considered, and these factors are particularly critical for the demand or particularly influential. The third phase of demand forecasting using scenario technology focuses on the development perspectives of the most important influencing factors. For example, the e-bike batteries installed today have a maximum output of 600 watts; in the context of the scenario development, it should be estimated how the capacity of batteries develops and what influence it has on the demand behavior of potential e-bike buyers. Then, 2–3 future projections should be sketched and analyzed for each key factor. Then these are to be weighted with a probability value; an example is shown in Figure 7.

Key factor	Projection (e.g., 24 months)	Probability
Demand for e-bikes	Demand falls	20%
	Demand increases	40%
	Demand stays flat	40%
No. of competitors	Stays flat	20%
	Increases	60%
	Decreases	20%

Figure 7. Example of a demand forecast.

In the practice of demand forecasting for SMEs, no more than 3–4 scenarios should

be developed regularly (Damodaran 2010, p. 64). Often, three scenarios are sufficient, e.g., the best case, worst case and management case scenario; the latter could be the scenario that would arise if the business developed constantly. In a fourth step, it is necessary to link the probabilities of occurrence of the key factors with concrete figures to form the actual scenarios. The result is the demand forecast based on a result matrix with three different scenarios determined using scenario technology. The fifth step, the interpretation and evaluation of the scenarios, should be decisive from the perspective of the medium-sized company. From a risk point of view in particular, it must be analyzed whether the company, e.g., is well prepared for the worst-case scenario. Fields of action here would be, e.g., the development of alternative production plans, the securing of liquidity reserves or the new planning of the production program. On the other hand, the company could also analyze, e.g., whether enough resources are available in the best-case scenario and how to ensure that enough employees can be recruited to the market. The medium-sized entrepreneur can therefore design options for action and strategies for different scenarios and implement them if necessary. Finally, the entrepreneur can analyze whether his current strategy is approximated by one of the scenarios developed; if this is not the case, then the entrepreneur may have to fundamentally rethink his strategy. Ultimately, the scenario method can also help to develop a future-proof strategy.

Conclusions

The article shows that the qualitative methods for carrying out demand forecasts for SMEs are generally applicable. In particular, it is shown that the expert survey and the sales estimate are very easy-to-use methods for the generation of demand forecasts or securing them qualitatively. Customer surveys also deliver good results but are somewhat more complex to carry out. The implementation of the Delphi method turns out to be quite complex and is therefore not considered as a method for generating demand forecasts for the medium-sized company. In contrast, the scenario analysis is of paramount importance. This method should also be used as a standard method by medium-sized companies to generate demand forecasts and/or to ensure their quality, as it is fairly easy to use and can be used in a wide variety of ways.

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References

- (Chermack 2007) Chermack, Thomas J. 2007. Disciplined imagination: Building scenarios and building theories. *Futures* 39: 1–15.
- (Cuhls 2007) Cuhls, Kerstin, Simone Kimpeler, and Felix Jansen. 2007. *Future Information Technology for the Health Sector*. Stuttgart: FAZIT-Schriftenreihe.
- (Damodaran 2010) Damodaran, A. 2010. *The Dark Side of Valuation. Valuing Young, Distressed, and Complex Businesses*, 2nd ed., New York: University Press
- (Die Welt 2020) Die Welt. 2020. Wir werden am Ende in Deutschland Milliarden Masken brauchen. *Veröffentlicht am*, 2 February 2020. Available online: <https://www.welt.de/politik/>

[deutschland/article206939175/Schutzmasken-Coronavirus-Wir-werden-in-Deutschland-Milliarden-davon-brauchen.html](https://www.iipcccl.org/deutschland/article206939175/Schutzmasken-Coronavirus-Wir-werden-in-Deutschland-Milliarden-davon-brauchen.html) (accessed on 29 April 2020).

(Doberanzke 1993) Doberanzke, Volker. 1993. *Exklusive Finanzierung Mittelständischer Unternehmen*. Wiesbaden: Gabler.

(Dömötör 2012) Dömötör, Rudolf. 2012. *Erfolgsfaktoren der Innovativität von Kleinen und Mittleren Unternehmen*. Wiesbaden: Gabler.

(EU-Commission 2003) EU-Commission. 2003. Empfehlung der Kommission vom 6. Mai 2003 betreffend die Definition der Kleinstunternehmen sowie der kleinen und mittleren Unternehmen (Bekannt gegeben unter Aktenzeichen K/2003/1422).

(Flick 2009) Flick, Uwe. 2009. *Sozialforschung*. Reinbek: Rowohlt.

(Fraunhofer-Institute 1998) Fraunhofer-Institute 1998. Delphi '98-Umfrage. Available online: <https://www.bmbf.de/files/55Delphi98-Ergebnisse.pdf> (accessed on 30 April 2020).

(Gausemeier et al. 1996) Gausemeier, John, A. Fink, and Oscar Schlake. 1996. *Szenario-Management. Planen und Führen mit Szenarien*. München: Vahlen.

(Gläser and Laudel 2010) Gläser, Jochenn, and Grit Laudel. 2010. *Experteninterviews und qualitative Inhaltsanalyse*, Wiesbaden: VS-Verlag.

(Gudehaus 2005) Gudehaus, Timm. 2005. *Logistik: Grundlagen—Strategien—Anwendungen*. Wiesbaden: Springer.

(Gutenberg 1963) Gutenberg, Erich. 1963. *Der Absatz*. Wiesbaden: Springer.

(Gutenberg 2013) Gutenberg, Erich. 2013. *Absatzplanung in der Praxis*. Wiesbaden: Springer.

(Häder 1998) Häder, Michael. 1998. Neuere Entwicklungen bei der Delphi methode: Literaturbericht II, Mannheim: Zentrum für Umfragen, Methoden und Analysen. Available online: <https://www.ssoar.info/ssoar/handle/document/20051> (accessed on 30 April 2020).

(Hamilton 1994) Hamilton, James D. 1994. *Time Series Analysis*. Princeton: University Press.

(Hayn 1998) Hayn, Michael. 1998. *Bewertung junger Unternehmen*. München.

(Heckert and Willson 1963) Heckert, Jason B., and John. D. Willson. 1963. *Controllershship*, 2nd ed. New York: University Press.

(Hopf 2004) Hopf, Christel. 2004. Qualitative Interviews—Ein Überblick. In *Qualitative Forschung. Ein Handbuch*. Edited by Uwe Flick, Ernst von Kardoff and Ines Steinke. Reinbek: Rowolt.

(Hüttner 1982) Hüttner, Manfred. 1982. *Markt- und Absatzprognosen*. Stuttgart: Kohlhammer.

(IfMBonn 2020) IfMBonn. 2020. KMU-Definition des IfMBonn. In: www.ifm-bonn.org. Available online: <https://www.ifm-bonn.org/statistiken/mittelstand-im-ueberblick/#accordion=0&tab=0> (accessed on 21 April 2020).

(Kaiser 2014) Kaiser, Robert. 2014. *Qualitative Experteninterviews. Konzeptionelle Grundlagen und Praktische Durchführung*. Wiesbaden: Springer.

(Kiener et al. 2012) Kiener, Stefan, Nicolas Maier-Scheubeck, Robert Obermaier, and Manfred Weiß. 2012. *Produktions-Management. Grundlagen der Produktionsplanung und -Steuerung*. München: Oldenbourg.

(Knorren 1998) Knorren, Norbert. 1998. *Wertorientierte Gestaltung der Unternehmensführung*. Wiesbaden: Gabler

(Kühnapfel 2019) Kühnapfel, Jörg B. 2019. *Vertriebsprognosen*. Wiesbaden: Gabler.

(Manager Magazin 2020) Manager Magazin. 2020. Die größten Fahrradhersteller Deutschlands. *Manager Magazin*. Available online: <https://www.manager-magazin.de/fotostrecke/fahrrad-groesste-hersteller-in-deutschland-2017-fotostrecke-150235-2.html> (accessed on 29 April 2020).

(Meffert et al. 2008) Meffert, Heribert. 2008. *Marketing*. Wiesbaden: Gabler.

(Niederberger and Renn 2019) Niederberger, Marlen, and Ortwin Renn. 2019. *Delphi-Verfahren in den Sozial- und Gesundheitswissenschaften: Konzept, Varianten und Anwendungsbeispiele*. Wiesbaden: Springer.

(Noelle-Neumann and Petersen 1996) Noelle-Neumann, Elisabeth, and Thomas Petersen.

1996. *Alle, nicht Jeder. Einführung in die Methoden der Demoskopie*. München: dtv.
- (Reuters 2020) Reuters. 2020. Regierung will Schutzmasken in Europa Produzieren. Available online: <https://de.reuters.com/article/virus-deutschland-schutzmausr-stung-idDEKCN21R1O3> (accessed on 29 April 2020).
- (Rinne and Specht 2002) Rinne, Horst, and Katja Specht. 2002. *Zeitreihen. Statistische Modellierung, Schätzung und Prognose*. München: Vahlen.
- (Schneider and Kornmeier 2006) Schneider, Willy, and Martin Kornmeier. 2006. *Kundenzufriedenheit*. Bern: Haupt-Verlag.
- (Schroeter 2002) Schroeter, Bernhard. 2002. *Operatives Controlling*. Wiesbaden: Springer.
- (Simon and von der Gathen 2010) Simon, Hermann, and Arthur von der Gathen. 2010. *Das große Handbuch der Strategieinstrumente. Werkzeuge für eine erfolgreiche Unternehmensführung*, 2nd ed. Aufl. Wiesbaden: Gabler.
- (Thonemann 2015) Thonemann, Ulrich. 2014. *Operations Management: Konzepte, Methoden und Anwendungen*. München: Pearson Studium.
- (Vogel 2015) Vogel, Jürgen. 2015. *Prognose von Zeitreihen*. Wiesbaden: Gabler
- (von der Gracht 2010) von der Gracht, Heiko. 2010. Scenarios for the Logistics Service Industry: A Delphi-based analysis for 2025. *International Journal of Production Economics* 127: 46–59.
- (Wiktionary 2020) Wiktionary. 2020. Das freie Wörterbuch. *Prognose*. Available online: <https://de.wiktionary.org/wiki/Prognose> (accessed on 30 March 2020).
- (Wissen 2007) Wissen, Dieter. 2007. *Bibliographie der Zukunft – Zukunft der Bibliographie – Eine Expertenbefragung mittels Delphi-Technik in Archiven und Bibliotheken in Deutschland, Österreich und der Schweiz*. Berlin: Vahlen.
- (Wöhe and Döring 2013) Wöhe, Günther, and Ulrich Döring. 2013. *Einführung in die Betriebswirtschaftslehre*. München: Vahlen.
- (Wuest 2018) Wuest. 2018. *Pflegeheim-Atlas Deutschland 2018*. Hrsg: Wuest Partner Deutschland. Available online: <https://www.wuestpartner.com/de/publikationen/pflegeheim-atlas-2018> (accessed on 26 April 2020).
- (ZIV 2020) ZIV. 2020. Marktanteil von Elektrofahrrädern Wächst Auf 23.5%. Available online: <https://nationaler-radverkehrsplan.de/de/node/21072> (accessed on 29 April 2020).