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What Drives Innovation Activities in German SMEs in the Service and Production Sector? An Integration of Theoretical and Empirical Findings

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Abstract. Innovation management is an essential prerequisite for the effective and efficient generation, planning, and implementation of ideas and thus for the further development of companies in a dynamic market and competitive environment. In order to investigate the internal innovation potential of production and service companies, this article examines basic success factors and challenges of innovation management in German small and medium-sized enterprises (SMEs) with a view to the sector to which they belong. On the basis of a questionnaire and interviews with experts, companies were considered with regard to their assessment of their innovative capacity. Based on an analysis of data from 30 participants, we show that the innovation capacity of SMEs with regard to success factors and challenges in production companies differs significantly from that of service companies. We also find that there is a discrepancy in the assessment of the potential for improvement of success factors and challenges. Our study shows that in the field of German SMEs, there is no "best way" to increase innovative capacity, but that it depends on a combination of different factors.

Keywords: Innovation Management, Idea Management, Challenges, Success Factors.

1 Introduction

1.1 Significance of the Object of Study

The European Commission (EC) calls SMEs the "engine of the European economy" [1] as these companies have a significant influence in generating jobs stimulating economic growth and consequently ensuring social stability [1]. In 2021, more than 22.8 million SMEs (99.8% of all) in

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the EU provided 83 million jobs (65% of all employees) [2]. The high importance is also rooted in the German economy, where in 2020 nearly 2.5 million companies (99.4% of all) and thus about 29.4 million employees (55% of all) worked in SMEs [3]. Thus, they can be considered as the central pillar of the German market economy [4].

In principle, German companies are highly competitive in complex production processes [5]. However, the economic activity environment of German industrial enterprises is characterized by increasing knowledge intensification, increasingly lower productivity growth, and disruptive changes associated with digitalization [5]. The globalization of markets has also greatly increased competitive pressure [6]. This raises the question of how German SMEs can hold their own in global competition.

Cooper and Edgett imply with their statement "innovate or die" that innovations are vital for companies [7]. Consequently, innovation, as an important driver of economic growth [8] and the expansion of companies [6], is essential to boost the weakened productivity growth of German industry and to secure Germany's social prosperity in the long term [5]. It is therefore all the more critical that many companies do not give high priority to increasing their innovative capacity [9]. Furthermore, empirical studies show that the implementation of many innovative ideas fails [10]. Kriegesmann and Kerka found out that only 13% of all innovative ideas are implemented, of which only 50% are successful [11]. One reason is probably that innovations are fundamentally "uncertain, risky, and unpredictable" [12]. The realization of even a few unsuccessful innovations can threaten the existence of SMEs [13], [14]. Consequently, innovations are a risk [12] that companies must nevertheless take to secure their competitiveness and generate growth [11]. They are an opportunity and a necessity for SMEs and at the same time a major challenge [10].

For an understanding of the topic, it is essential to define the terms innovation and innovation management, used in this study. Different forms of definition for innovation are common in the literature [15], [16], [17]. The term innovation itself, results from the Latin word "innovation" or "innovare" for renewal, new launch, or novelty [16], [17] and in its use of "something new" [18] or "something Novelty" is spoken [15]. According to the initial definition by Hauschildt et al., innovations are qualitatively new products or processes that differ noticeably from a comparable state [27]. Vahs and Burmester define innovation as the targeted implementation of new technical, economic, organizational, and social solutions that are aimed at achieving companies' goals in a new way [17]. Lundvall, on the other hand, suggests innovation as an interactive learning process that involves many actors and extends over a certain period of time [19].

In this study, the definition of the "Oslo Manual", which has been published by the OECD and EC since 1992 [20], [21] is followed. This definition is of outstanding importance, as it is the international reference standard for conceptualizing and measuring innovation forms [21]. Hereby, innovation is defined as a new or improved product or process (or a combination thereof), which differs significantly from the previous ones and has been made accessible to possible users (product and service) or has been implemented and used in entrepreneurial activities (process, but also marketing or organizational methods) [20], [21]. Based on these forms of definition, it can therefore be stated that a common feature of an innovation is that it must be implemented, i.e., launched on the market [15], [20].

This implies innovation activities are all scientific, technological, organizational, financial, and commercial steps that lead to the implementation of innovations or at least intend to do so. Some innovation activities are innovative in themselves, while others are not new activities, but are necessary for the implementation of innovations [20].

Going beyond that, innovation management covers the systematic planning, implementation, management, and control of the innovation activity. It is an essential prerequisite for the resource-optimal realization of ideas and thus for the further development of enterprises in dynamic markets and competitive environments [17].

1.2 Aims and Structure of the Study

The objective of this study is to identify potentials, challenges, and success factors in German SMEs in the service and production sectors and to derive recommendations. The reason why a distinction is made between SMEs in the service and production sectors is explained below.

According to the three-sector theory, the primary sector develops first in national economies, which includes agriculture and forestry as well as animal husbandry and fisheries [21]. Later, the importance of industrial production as a secondary sector in generating GDP grows and finally, the tertiary sector, which is often referred to simply as the "service sector", assumes a dominant position [22]. In particular, Vahs and Brem describe the possibilities of information and communication technology as decisive for the transition from an industrial to a service society that is taking place in the Western world [23].

Consequently, services occupy an important position in all developed economies [15], since the service sector has the largest share of employment and output of economic growth [24]. The German Federal Ministry for Economic Affairs and Energy (BMWi) also names the service sector, which generates 69% of GDP and provides almost three-quarters of all jobs, as economically "the most important" for Germany [25]. Furthermore, the BMWi states that about 80% of all German enterprises are service ones [25]. Consequently, a high relevance of the service enterprises for the economy and society can be derived [25].

To achieve the desired goal, it is first necessary to analyze the current status of innovation activities in German SMEs. Moreover, it is required to find out which challenges and success factors are of particular relevance for them to be able to provide them with targeted recommendations for action and to utilize potentials. *However, SMEs differ in many respects, such as their structure, their processes, or even their value-added object. While production companies focus on the object to be produced, service companies focus on the activity to be performed. It can be assumed that these companies also differ in their innovation activity due to their different nature.* On this basis, the following guiding questions arise, which are to be answered within the framework of this work:

- **Q1**: What is the status of innovation processes and their IT support in German SMEs?
- **Q2**: What are the relevant success factors and challenges for the innovative capacity of SMEs and what potentials can be derived from this?
- **Q3**: What are the differences between service and production companies?
- **Q4**: How can IT support the success factors relevant to the innovative capacity of SMEs?
- **Q5**: What role does knowledge management play in this and can it provide support?

Within the framework of a quantitative survey, findings were collected on the innovation business of SMEs. The results, which emerged based on the quantitative survey, were then supplemented by guided interviews. With the help of these expert interviews, it was determined whether the use of IT systems can support the innovative capacity of these companies. Furthermore, the results were expanded by a systematic literature analysis and made available in aggregated form together with the results from the qualitative and quantitative survey.

2 Methods

2.1 Delimitation of the SME Concept

In order to filter out SMEs from the totality of all companies for the empirical study of this work, the quantitative and qualitative definition of the EC is used as a guide, as this is common and accepted in Europe [9] and is gaining even more acceptance [4]. This means the set definition is used by the EU itself, the OECD, national authorities, and organizations of EU Member States as well as in other non-EU countries in Europe, e.g., the UK, Norway, or Switzerland.

The “Commission Recommendation 2003/361/EC”, which is published in the Official Journal of the European Union, comprises the sole authentic basis for determining the conditions regarding qualification as an SME. In this recommendation, the EC states that the term SME covers companies that employ fewer than 250 people and have an annual turnover of no more than EUR 50 million and/or an annual balance sheet of no more than EUR 43 million [26].

Within this SME categorization, a microenterprise is defined as an enterprise that employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million. A small enterprise, on the other hand, is an enterprise with at least 10 and fewer than 50 persons and whose annual turnover and/or annual balance amounts to at least EUR 2 million and not more than EUR 10 million. In reverse, a medium enterprise is defined as an enterprise with at least 50 up to 249 people as well as an annual turnover and/or annual balance sheet of at least EUR 10 million up to EUR 50 million or EUR 43 million. In addition, the share of a SME held by a large company may not reach 25 percent, which is intended to underline the independence of the respective SME [2], [26].

The EC itself states in its recommendation that it will take the necessary measures to present the statistics that it produces in accordance with the following size classes of enterprises: (a) 0 to 1 person; (b) 2 to 9 persons; (c) 10 to 49 persons; (d) 50 to 249 persons [26].

For this reason, in this study, SMEs are classified as micro-, small, or medium enterprises based on their number of employees, up to 9, 49 or 249, as well as the criteria that the share of a large company does not reach 25 percent.

2.2 Data Acquisition

At the beginning, a structured literature analysis survey was conducted. The purpose was to be able to define innovation and innovation management and, furthermore, to identify success factors and challenges of the innovation activities of German SMEs. Here we concentrated our analysis on in-house innovation activities. With regard to the literature analysis, a successive procedure was applied. First, the initial findings of Kaschny et al. [9] were used as a starting point. With the help of initial terms, a first search query was carried out at Scopus and ScienceDirect. In addition, the online catalog of the Rostock University Library (https://opac.lbs-rostock.gbv.de/) served as the data basis. Here, freely available literature (professionals’ books) on the topic could be found. The revealed success factors and challenges were later asked in the questionnaire.

Within the scope of this work, only the in-house innovation activity, i.e., all tasks associated with the planning, implementation, management, and control of innovations carried out in the enterprise itself (closed innovation), are considered [17], [23]. A cooperation [16], in which the innovation activity extends to the inter-company area and includes other companies or scientific institutions in the innovation process or external innovations that can be taken over by them (open innovation), or a combination of both variants are neglected [17], [23]. The possibility of working with customers, suppliers, and public authorities is also not considered [27].

Subsequently, it was checked which terms lead to relevant results before a further search for keywords in found publications took place. In the course of the literature search, the following final search term was used:

TITLE-ABS-KEY ((“innovation” OR “types of innovation” OR “innovation management” OR “idea management” OR “idea”
AND ALL (((adopt*OR implement*)“company suggestion scheme” OR ((adopt*OR implement*)“qualitative content analysis”)))
AND (LIMIT-TO (SUBJAREA, “SOCI”) OR LIMIT-TO (SUB-JAREA, “BUSI”) OR LIMIT-TO (SUBJAREA,“COMP”))
AND PUBYEAR > 2012

A total of 346 sources were reviewed. Of these, 182 were considered relevant and served as the basis for the literature analysis and the creation of a questionnaire (see Figure 1). The relevance of the literature reviewed was assessed using previously selected criteria. Only literature that is not

older than 10 years was included. The focus of the relevant literature was placed on works in the field of innovation management in SMEs. The literature by Hauschildt, et al. [27], Vahs and Burmester [17], Vahs and Brem [23], Macharzina and Wolf [16], Schewe and Becker [42] – and especially the Oslo Manual [20] – were highly relevant. With the help of these sources, the terms innovation, innovation management, and SMEs could be meaningfully defined, compared, and understood. Furthermore, relevant success factors and challenges for SMEs could be identified and chosen.

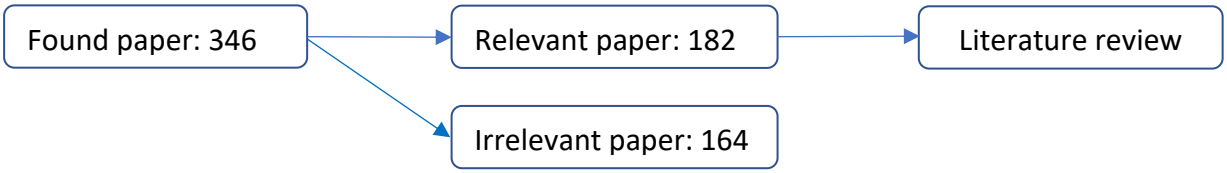

Figure 1. Overview of data collection

As a next step, qualitative interviews were conducted. They were carried out in two parts in parallel with the quantitative investigation. One part helped to answer Q1 and then Q4 and Q5. In between, the written questionnaire was filled out to answer Q2 and Q3. However, this questionnaire was also distributed and completed via other channels, which will be discussed in detail later.

With the help of the KOMPASS[†] database in Germany, SMEs could be identified and their industry affiliation determined at the same time. Quantitative and qualitative criteria based on the SME definition of the EC were used to differentiate SMEs from large companies.

A required number of employees of up to 249 employees was specified as a quantitative selection criterion based on the SME definition of the European Commission (see [2], [26]). It was only based on the number of employees, in the assumption that companies could be averted or deterred from querying sensitive financial data.

Furthermore, it was clarified in advance whether the enterprise was 25% or more owned by a large company (qualitative criterion) (see [4], [26]). If this was the case, that company was excluded from the investigation. This was decided after the first interview was conducted with an enterprise, in which it became clear that more than 25% of this is owned by a large company. On the other hand, the industries of the SMEs played no role in their selection.

As recommended by Berger-Grabner, the subject of the research work was specified as the object of investigation – i.e., innovation management of SMEs [28].

The framework of these guided interviews is created based on a theoretical preliminary analysis of the research object and facilitates comparability [28] and evaluation [29]. The advantages of this method lie in the clear structuring of the interviews and questions, whereby the order of the questions can be seen as variable and space can be given for spontaneous statements [28]. Here certain people are interviewed as representatives of a group who count as experts depending on the respective research object [28]. These can be persons who have extensive knowledge or experience in a defined area or are responsible for a specific issue [28]. In this case, they are representatives of SMEs that deal with innovation or innovation management.

The survey procedure is a problem-centered interview, which is intended to summarize all open, semi-structured surveys [29]. The interview is aimed at a specific problem that was worked out beforehand and compiled in an interview guide and is addressed in the course of the conversation [29]. In this case, it is a question of the innovation management status quo as well as its possible IT support in the respective SME.

[†] https://de.kompass.com/

In summary, it can be said that the qualitative study served to gain personal insight into the experience and knowledge of experts regarding innovation management in SMEs, its detailed status as well as the role of IT and knowledge management as possibilities to support it.

At the beginning of the interviews, the respondents were asked about their definition/understanding of innovation. This was either approved or, if (much) deviating, explained according to the Oslo Manual [20] where innovation is a new or improved product, service, process, business model, or marketing method, which differs significantly from the previous one and has been made accessible to possible users (product and service innovation) or has been implemented and used in entrepreneurial activities (process, marketing, or organizational methods) [20], [21]. The reason is that the interviewees did not have a wrong and as equal as possible conception of innovation. The interview questions were essentially oriented towards Verworn et al. who also applied questions in the SME sector [30]. The list of questions include items from the standard innovation process according to Thom [31], a self-assessment of the company regarding their strengths and weaknesses in innovation management, and finally information on the realized innovations of the company. In addition, spontaneous ad hoc questions are formulated, which are important for the topic or the maintenance of the conversation [29].

The interviews took place either face-to-face at the company's premises or via telephone. Using the interviewee's place of work for the survey is an advantage since a familiar atmosphere usually leads to more openness [28].

Finally, the conversation has to be recorded, for which an audio recording should be made [29]. Such is recommended by the literature in the context of expert interviews to be able to save all of the spoken data [32], [33] and so that the interviewer can concentrate fully on the survey or can handle the guidelines flexibly [32]. Therefore, during the interviews, these audio recordings were made using a voice recorder.

As recommended in the literature, this was tested with one pretest [28] to obtain a satisfactory survey instrument [34]. It served to check the following aspects: comprehensibility and difficulty of the questions, interest of the respondent, continuity of the interview, effects of the questionnaire arrangement, duration of the survey, interest of the respondent in the survey as well as his stress during the survey [33].

The quantitative survey on success factors, challenges, and potentials of innovation management in the SME sector was conducted using a questionnaire. The form of investigation used is to be regarded as descriptive. Known success factors and challenges of the innovation activity or ability from the literature were empirically tested for their validity in SMEs and Q2 as well as Q3 were answered. By means of a procedure with standardized principles, results should be as comparable as possible [28]. The survey instrument for this study is the written and electronic questionnaire using a semi-standardized questionnaire. The written questionnaire was, as already mentioned, answered during interview appointments. Subjects who could or would not attend an interview in person or at all, completed an electronic version.

The questionnaire was therefore intended to weigh the success factors and challenges.

Consequently, the three methods (literature analysis, interviews, and questionnaires) complement each other in this study.

The population of the sample included executives, innovation managers, employees in marketing, technical design, and development, as well as other employees working in SMEs. The sample size was 30 respondents (n=30).

In detail, 11 micro, 14 small and 5 medium-sized enterprises took part in the survey. The respective percentages are therefore 36.67%, 46.67%, and 16.67%. As part of a questionnaire, the branch of the company was asked in the form of an open question. The following industries were specified: Plant engineering (1), architecture and construction (4), crafts (2), trade (2), real estate (5), IT (2), food (1), market research (1), medicine (1), recruitment (2), manufacturing (1), tax and legal (2), technology (1), sales (1) and advertising (1). Furthermore, the field of activity of the respondent in the company was also asked in the questionnaire. Five alternative options were given, to which the participants could assign themselves by ticking. The result is as follows:

manager (16), innovation manager (2), marketing (1), technical construction and development (6) and other employees (5).

2.3 Data Analysis

The qualitative interviews were evaluated using qualitative content analysis according to Mayring [29], [35], which made the content analysis procedure with the basic form of summary the obvious choice. The analysis aims to reduce the material in such a way that the essential content is retained but to create a manageable corpus through abstraction, which is still an image of the basic material. For this purpose, the first step was to form categories. After proportional processing of the material (10–50%), when almost no more categories could be formed, the category system was revised. A final material passed and a subsequent interpretation and analysis of the collected data took place. The result of the analysis comprises a set of categories on a topic, which are associated with specific text passages [29].

The evaluation of the quantitative survey was univariate. Thus, no interactions between success factors and challenges were examined with or among each other [28]. Within the framework of the survey, several pretests were carried out in which the feedback of the test persons was included and the questionnaire was adapted several times. The Likert scale was used to collect the data [36].

After a brief introduction to the questionnaire, basic questions were first asked about the company, the importance of innovations, and the company's current innovation activities. It is important in this context that innovations are novelties from the company's point of view [10].

In a second section, questions were asked specifically about how innovations are generated in the company, after which they are evaluated and innovation processes are planned and carried out in the company. Finally, the subjects were asked about the strengths or weaknesses of the company's innovation activities.

3 Results

3.1 Status Quo of Innovation Processes in SMEs (Q1)

The current status quo of innovation activities in the SME sector was examined on the basis of expert interviews with 18 companies, primarily from the districts of Rostock and Schwerin. Of these companies, three each from the service and production sectors were selected for more detailed analysis. These interviews provide an initial insight into innovation behavior in the service and production sectors. The reason for the differentiation between service and production companies is described in detail in Section 3.5.

On the basis of 11 items, the experts were asked about the company innovation processes, as well as the strengths and weaknesses within the innovation process of their companies.

The results of the expert interviews showed that none of the companies surveyed had a well-developed idea management system. The prevailing scarcity of resources in the SME sector can be assumed as the reason for non-institutional innovation management. The innovation process, on the other hand, was increasingly expressed in the form of projects among the respondents in the SME sector. Most SMEs make little use of concrete methods from theory. Self-developed methods and tools are often applied and given preference over approaches from theory. Only brainstorming, the Kanban method, and monthly idea pitches were used by the companies as scientifically based procedures. It turned out that innovation processes in the surveyed companies were not standardized, even if criteria were planned in advance and the innovation process depended strongly on the corresponding problem or other framework conditions, such as the available resources. In the context of idea acceptance, the aspects of feasibility and required know-how and economic efficiency in the form of turnover and cost-benefit analysis are taken into account above all.

3.2 Thematic Background (Q2)

Written and electronic semi-standardized questionnaires were used as a survey instrument to investigate the **success factors**. In addition to the written collection of the questionnaire data, a link to the survey was positioned in social networks and this was also included in the innovation newsletter of the Rostock Chamber of Industry and Commerce.

Only those factors that represent general causes for successful innovation and therefore for building innovation capacity were recorded as success factors [15]. The derivation of the success factors was essentially based on the works of Jaberg and Stern [37]. These success factors are presented in Table 1.

In the case of both the success factors and the challenges, three of each form a category. These categories were meaningfully created to fit the success factors and challenges.

Table 1. Overview of success factors from the literature

Category	Success factor
Leadership	• Management support for innovation [16] • Rewarding innovation activities [37] • Supervisors as teachers [37]
Organization	• Flat hierarchy [15], [37] • Decentralized structures [37] • Fast process flows [37]
Corporate culture	• Open communication [16] • Innovation-friendly climate [17], [38] • Sharing of knowledge [16]
Innovation Team	• Involvement of all corporate divisions [16], [37] • High willingness of employees to innovate [37] • Qualification of employees [9]
Idea generation	• Exploitation of all sources [37] • Application of idea generation methods [30], [39] • Coordination of idea generation/collection [30], [39]
Idea acceptance	• Clear evaluation criteria [30], [40], [41] • Prioritization and derivation of measures [40], [42] • Preparation of financial scenarios [37]
Idea realization	• Flexible project organization [16], [37] • Appropriate resourcing [27] • Use of project management measures [9], [37]

With regard to the **challenges** for the innovative capacity, in contrast to the success factors, these are barriers to innovation, i.e., factors that can lead to a delay, hindrance, or even premature termination of innovations or innovation projects [9]. Table 2 shows the major challenges for SMEs derived from the literature.

Table 2. Overview of challenges from the literature

Category	Challenge
Resources [15], [30]	• Insufficient financial/material resources [10] • Insufficient human resources [10] • Insufficient technical resources [10]
Strategy and methods	• Insufficient planning [9] • Insufficient methodological knowledge [9] • Insufficient early technology identification [15]
Barriers [15]	• Leadership that inhibits innovation [16], [43] • Knowledge and will barriers [9], [17], [27]

3.3 Success Factor Findings (Q2)

In this study, the success factors and challenges identified in the literature were investigated within the framework of a semi-standardized questionnaire.

In the course of evaluating the data, the arithmetic mean and the standard deviation of the success factors were calculated based on the absolute frequencies of the Likert scale (5–1). In the course of the data evaluation, the inverted Likert scale was transformed back into an ordinary Likert scale (1–5). The success factors with the highest standard deviation include flexible project organization ($\sigma = 1.19$), decentralized structures ($\sigma = 1.12$) as well as the rewarding of innovation activities, the inclusion of all company divisions, and the exploitation of all sources ($\sigma = 1.10$ each). This indicates a disagreement among the respondents regarding these aspects (see Table 3).

Table 3. Success factors – assessment and comparison

Success factor	SME (total)			Service company		Production company	
	$\bar{x}$	±	R*	$\bar{x}$	R	$\bar{x}$	R
Open communication	1.30	0.53	1	1.31	1	1.25	2
Innovation-friendly climate	1.47	0.68	2	1.46	2	1.50	4
Management support for innovation	1.53	0.78	3	1.62	3	1.00	1
Sharing of knowledge	1.90	0.84	4	1.81	4	2.50	14
Flat hierarchies	2.00	1.07	5	2.00	5	2.00	5
Fast process flows	2.03	0.72	6	2.15	8	1.25	2
Qualification and experience of staff	2.13	0.82	7	2.12	7	2.25	7
Adequate resources for the project	2.14	0.69	8	2.08	6	2.50	14
Involvement of all divisions	2.23	1.10	9	2.23	9	2.25	7
Rewarding of innovation activities by management	2.30	1.10	10	2.29	10	2.33	10
Exploitation of all sources for idea generation	2.37	1.10	11	2.42	12	2.00	5
Coordination of idea generation and collection	2.38	0.98	12	2.38	11	2.33	10
Flexible project organization	2.41	1.19	13	2.42	12	2.33	10
Prioritization of ideas and derivation of measures	2.53	0.97	14	2.46	14	3.00	19
Innovation activity enjoys high priority among employees	2.82	0.67	15	2.79	15	3.00	19
Application of project management measures	2.85	0.95	16	2.88	16	2.67	16
Preparation of financial scenarios	2.96	0.96	17	3.08	17	2.25	7
Clear criteria for evaluating ideas	3.00	1.09	18	3.08	17	2.33	10
Supervisors as teachers	3.07	1.04	19	3.13	19	2.67	16
Decentralized structures	3.09	1.12	20	3.13	19	2.67	16
Application of techniques for idea generation	3.15	1.03	21	3.13	19	3.33	21

*R = Ranking

These factors were rated as not very relevant in terms of their importance. In contrast, the success factors of open communication ($\sigma = 0.53$), high willingness to innovate among employees ($\sigma = 0.67$), and an innovation-friendly climate within the company ($\sigma = 0.68$) had significantly lower standard deviations. Open communication ($\bar{x} = 1.30$) and an innovation-friendly climate ($\bar{x} = 1.47$) were considered particularly significant. Decentralized structures ($\bar{x} = 3.09$) and superiors with a teaching function ($\bar{x} = 3.07$) were rated as factors with a rather subordinate role. In a further step, the findings obtained were assigned to the respondents' assessment of their category. It is clear that corporate culture was rated as being of the highest importance by the respondents. Leadership and organization also had a high relevance (see Table 4).

Table 4. Success factors – categorization with comparison

Category	SME (total)		Service company		Production company	
	$\bar{x}$	R	$\bar{x}$	R	$\bar{x}$	R
Corporate culture	1.56	1	1.53	1	1.68	1
Leadership	2.30	2	2.35	2	2.00	3
Organization	2.37	3	2.43	4	1.97	2
Innovation Team	2.39	4	2.38	3	2.50	4
Idea realization	2.47	5	2.46	5	3.00	7
Idea generation	2.63	6	2.64	6	2.55	6
Idea acceptance	2.83	7	2.87	7	2.53	5

Furthermore, the respondents were asked open-ended questions about other relevant success factors. The following were identified as additional relevant success factors:

- Acceptance of ideas according to customer needs.
- Realization of ideas according to a cooperation.
- Realization of ideas taking into account the employees' field of activity.
- Innovation experience of the employees.
- Innovation financing.

The speed of innovation, quality requirements, innovative ability, exemplary behavior of managers, and public funding were mentioned only occasionally.

Finally, the survey evaluated the potential for improvement with regard to the success factors. The mean value of the potential for improvement was 2.43 and the standard deviation was 0.97. The respondents thus see a relatively high potential for improvement, although there are strong differences between the individual companies.

3.4 Challenges Findings (Q2)

The standard deviation of the factors was also first taken into account when assessing the challenges to innovation activity. Challenges with the highest standard deviations represent barriers to will ($\sigma = 1.39$), managers who inhibit innovation ($\sigma = 1.33$), and insufficient financial and material resources ($\sigma = 1.27$). The lowest standard deviations, on the other hand, are for insufficient technological foresight ($\sigma = 0.88$), insufficient technical resources, and insufficient planning ($\sigma = 0.98$ each). Insufficient human resources ($\bar{x} = 2.10$) are a particularly significant challenge. Together with insufficient planning ($\bar{x} = 2.90$), they represent the main obstacles to innovation capacity in SMEs. Insufficient methodological knowledge, inadequate early technology identification, and innovation-inhibiting leaders were rated as challenges of lesser importance for innovative capacity (Table 5).

Table 5. Challenges – assessment and comparison

Challenge	SME (total)			Service company		Production company	
	$\bar{x}$	±	R	$\bar{x}$	R	$\bar{x}$	R
Insufficient human resources (res.)	2.10	1.01	1	1.96	1	3.00	5
Insufficient planning	2.90	0.98	2	3.00	2	2.25	1
Insufficient financial/material resources	3.07	1.27	3	3.13	5	2.75	3
Insufficient technical resources	3.07	0.98	3	3.21	6	2.25	1
Knowledge barriers	3.07	1.22	3	3.08	4	3.00	5
Will barriers	3.07	1.39	3	3.04	3	3.25	7
Insufficient methodical knowledge	3.24	1.06	7	3.32	7	2.75	3
Insufficient early recognition of technology	3.58	0.88	8	3.50	8	4.00	8
Leaders who inhibit innovation	3.68	1.33	9	3.63	9	4.00	8

If individual challenges are assigned to their superordinate categories, it becomes clear that the category “resources” was rated as the most relevant for innovative capacity and thus has a significant influence on the innovative capacity of SMEs (see Table 6).

Table 6. Challenges – categorization with comparison

Category	SME (total)		Service company		Production company	
	$\bar{x}$	R	$\bar{x}$	R	$\bar{x}$	R
Resources	2.75	1	2.77	1	2.67	1
Strategy and methods	3.24	2	3.27	3	3.00	2
Barriers	3.27	3	3.25	2	3.42	3

Other relevant challenges identified in the questionnaire can be summarized as:

- Patentability;
- Legal aspects;
- Financing of industrial property rights;
- Dependency on the ERP system and the associated limitation;
- Reaction of the customers.

In this context, the dependence on ERP systems and the associated limitations and the reaction of the customers are particularly worthy of mention and were given high priority by the respondents.

The average potential based on the challenges is estimated by the respondents at 2.33. The associated standard deviation takes a value of 0.96. Thus, both the values of the arithmetic mean and the standard deviation of the challenges are lower than those of the success factors. Thus, the potential of the innovation challenges is estimated to be higher than the potential of the success factors.

Guiding question Q2 can therefore be answered by saying that the innovative capacity of small and medium-sized enterprises is primarily shaped by the success factors “open communication”, “climate conducive to innovation” and “support for innovation by managers”. In relation to the success factors, the corporate culture is also of great importance. Furthermore, they show a high potential for improvement in the innovative capacity of SMEs. With regard to challenges, insufficient human resources and inadequate planning are particularly noteworthy. In this context, insufficient resources show a hurdle or an important reason that prevents innovations in the SME sector. The estimated potential for improvement for the challenges to the innovative capacity of SMEs even exceeds the estimated potential of the success factors.

3.5 Different Preconditions for Innovation (Q3)

Product innovation refers to the introduction of a new or significantly improved product or service into the market [20], [21]. This includes technical specifications, components and materials, software, usability, or other functional characteristics [20]. Product innovation can thus result in new knowledge or new technologies, or new application scenarios for existing technology [20].

Service innovation, on the other hand, can differ significantly from innovation in production-oriented sectors, as these are often less formal and technologically organized, as well as more incremental [20]. In the case of services, significant improvements may lie in the way they are delivered, in the addition of new functions or features to existing services, or the introduction of entirely new services [20]. This type of innovation includes both, innovation of the service as such as well as its environment [24].

The comparison of service companies and production companies is made through a comparison of success factors and challenges. While open communication ($\bar{x}$ = 1.31) and an innovation-friendly climate ($\bar{x}$ = 1.46) are of the highest importance for service companies, the factors of support for innovations by superiors ($\bar{x}$ = 1.00), fast processes and also open communication ($\bar{x}$ =

1.25 each) are of the greatest importance in production companies. Although the ranking shows that open communication, an innovation-friendly climate, and support from superiors are of essential importance for all sectors, it should be noted that these are the most important factors for the service companies. There is a discrepancy in the assessment of the importance of fast processes, which is significantly more important in the production sector. Both service and production companies agree that supervisors as teachers, the use of project management measures, and decentralized structures play a less relevant role (see Table 4).

Taking into account the categories of success factors, it can be seen that corporate culture and leadership play a central role in both service and production companies. In contrast to the service sector, the production companies surveyed also place a high importance on the area of organization.

The average estimated potential for improvement of the service companies ($\overline{x} = 2.5$) is higher than that of the production companies ($\overline{x} = 2.0$). Accordingly, the respondents from the production companies rate the potential for improvement from the success factors significantly higher (see Table 4).

With regard to the challenges of innovative capacity, there are clear differences in the ranking between service providers and producers. While insufficient human resources, willpower, and knowledge barriers are of high importance in the service sector, they play a rather subordinate role in the production sector, where insufficient technical resources and inadequate planning are the central challenges (see Table 5). The respondents from both economic sectors agree on the challenge categories. A lack of resources poses significant challenges for SMEs. Unsuitable or even lacking strategies, methods, and other barriers play a rather subordinate role (see Table 6).

Regarding the potential for improvement of the challenges to innovative capacity, both service ($\overline{x} = 2.31$) and production companies ($\overline{x} = 2.50$) are at a similar level. However, there is a contrast to the evaluation of the improvement potential of the success factors, which were rated significantly better by the production companies.

The differences in the innovative capacity of German SMEs between the service sector and the production sector can be summarized as follows. It becomes clear that success factors and challenges of the innovation capability of SMEs have a different impact on the respective economic sectors. While open communication, an innovation-friendly climate, and the support of innovations by superiors are particularly relevant in the service industry, in the production industry, in addition to open communication, particular value is placed on fast processes. The main challenges in the service sector were insufficient personnel resources, inadequate planning, and personnel will barriers. In contrast, the challenges in the production sector were identified as insufficient technical, material, and financial resources and inadequate planning. While in the service sector, the biggest challenge is insufficient human resources, in the production sector this is reflected in insufficient planning and a lack of technical resources. The sectors combine the challenges of lack of resources and insufficient planning, but a differentiated view of the challenges must be taken.

3.6 Supporting Innovation Capability through IT (Q4)

In the following section, the possible support of the innovative capacity of SMEs through the use of IT will be examined. For this purpose, detailed findings from other studies are summarized before the results of our investigation are presented.

The outstanding relevance of IT results from the fact that in today's world a functioning innovation management or idea management without IT support (for instance, in the form of software) is only conceivable in small companies [44]. Software products basically support, i.e., control and document [44], the entire innovation process from the generation of an idea to its evaluation and realization [9]. Blogs, information systems, wikis, databases, campaigns, and idea competitions have been identified as relevant IT support for the innovation process. They take on

tasks of communication support, data backup, information dissemination, and idea generation (see Table 7).

Table 7. IT deployment

IT deployment	Support from:
Blogs	Open communication and an innovation-friendly climate [4]
Information systems	Information sharing and changing power relations [45]
Wikis	Documentation of knowledge, work processes, manuals, and important issues [9], [46]
Databases	Medium- and long-term storage of ideas by means of a computer database [37]
Campaigns, idea competitions	Possibilities for idea generation with high acceptance in the workforce [27]

The survey of the companies made it clear that in-house tools and programs are used, which originate from European Social Fund (ESF) innovation projects and federal innovation projects. In addition, newsletters, portals, blogs, magazines, and journals were mentioned. The respondents agreed that IT is useful as a clear support in the innovation process, interpreting the support in different ways. One technology company clearly emphasized the use of software as IT support for innovation. Other respondents mentioned concrete measures, such as the use of online shops, bookkeeping, and merchandise management systems, which actively saved employees time. One participant from the field of personnel placement assessed the use of IT as a "co-component" of the innovation process. The focus was on process optimization. The stated goal of the recruitment company was to automate processes to relieve limited personnel resources. A similar picture emerged from the respondent of the mechanical engineering company, which used an invoicing system to visualize costs and benefits. The interviewees also agreed that IT can be used to create clarity in processes and structure. In addition to improved time management, an increase in creativity through the use of IT was agreed as well in principle. When asked about an idea platform, there was unanimous positive feedback and that some of these already existed. Such a platform can be used to manage, comment on, structure, and evaluate ideas. In addition, a duplication of ideas can be counteracted in this way.

3.7 The Role of Knowledge Management (Q5)

Knowledge management (KM) includes the search for, acquisition, and combination of information to reduce uncertainties [27]. Its relevance results from the fact that according to an investigation by Stern and Jaberg, methods for all its sub-areas are hardly available in SMEs, which means that non-existent or unused knowledge leads to missed innovation opportunities [37].

In the respective, relevant context, KM allows knowledge to emerge [37], [38]. Furthermore, knowledge can be divided into *explicit knowledge*, which is available as text, and *implicit knowledge / tacit knowledge*, which is relevant as practical knowledge in everyday life, but cannot be easily recorded in writing [44], [47]. It is stored in software, in the processes, and in the heads of the employees [44]. Therefore, existing knowledge must be sought, found, and made usable for innovation [27].

A central aspect of KM, especially in the context of innovation management [27], is the implementation of knowledge in new products or services [4]. In the context of idea management, its task is to ensure that generated knowledge is made usable for the company [44]. With advances in the form of knowledge and information, market opportunities can be recognized and used more easily [9]. The significant competitive advantage associated with this also consists of competent employees [38].

With regard to the survey, it emerged that KM is seen as supporting the success factors. In particular, the exchange of information with professional colleagues, further education, and training are seen as very relevant.

Typical obstacles of KM partly overlap with obstacles of idea management. An exemplary practical problem can be seen in the fact that knowledge from lower hierarchical levels is often not included or knowledge is not absorbed or transferred [44], [48]. Therefore, knowledge should also be transferred through personal contacts, such as in the form of cross-functional teams or meetings between different departments and hierarchical levels. A learning transfer, in which implicit knowledge is passed on, is, e.g., made possible by bringing together experienced with inexperienced employees in new development teams [37].

The survey showed that success factors for innovation capability are generally favored when processes are supported with training, information on materials, and process knowledge. The processes should be accompanied by manuals or application instructions. This provides security if knowledge carriers should retire or leave the company for other reasons. The participants stated that knowledge must be available in the company to be able to act innovatively. Therefore, knowledge carriers should be involved. The embedding of knowledge transfer in the organization is essential for the distribution of knowledge in the company [14]. A combination of IT and expert-based systems is recommended to compensate for the weaknesses of both approaches [44].

For the purpose of IT support, especially with regard to the identified success factors of open communication, an innovation-friendly climate, and support from superiors, it is imperative to include KM. Otherwise, potentials that are possible through the use of IT tools cannot be fully exploited. Because knowledge, as the most important resource of a company and the basic prerequisite for innovation [49], requires not only the technical provision of systems but also the willingness to pass on [37].

4 Discussion and Identification of Further Research Needs

4.1 Specific Results and Further Research Needs for Q1–Q5

In the following section, we briefly discuss our main results and some open questions in relation to the respective research questions. A more general discussion follows in Section 4.2

- **Q1**: What is the status of innovation processes and their IT support in German SMEs?

The analysis of 18 SMEs in the districts of Rostock and Schwerin reveals that none of them possesses a well-established idea management system, likely due to resource constraints. Self-developed approaches prevail, with only a few scientifically based methods being employed, such as brainstorming and the Kanban method. The lack of standardization suggests an adaptable innovation practice dependent on company-specific conditions. Despite the absence of formalized systems, companies prioritize feasibility, required expertise, and economic efficiency in idea acceptance, with revenue and cost-benefit analysis playing a central role. These findings offer potential for further research in the realm of innovation management strategies in resource-constrained business environments. *Taken together, companies favor project-based innovation processes, show limited use of standardized, theoretical methods, and prioritize ideas according to pragmatic and economic aspects*. Further research can engage, e.g., in tailoring existing innovation methods more to the specifics of SMEs or creating highly configurable methods and tools.

- **Q2**: What are relevant success factors and challenges for the innovative capacity of SMEs and what potentials can be derived from this?

In our survey, the ability of small and medium-sized companies to innovate was fundamentally influenced by “open communication”, “a climate that promotes innovation” and “support for innovation from managers”. Corporate culture was also a decisive success factor. In terms of

challenges, a lack of "financial, technical or human resources" in particular, along with "insufficient planning", proved to be major obstacles. It is worth noting that the respondents rated the potential arising from the elimination of obstacles higher than the potential of success factors. *Taken together, while the presence of an open climate and culture seems to foster innovation, the absence of obstacles (e.g., financial restrictions) is decisive*. Future research can engage, e.g., in the question of how to best "ignite" an innovation spirit in the enterprise or at least how to create partially open spaces and settings in which actors perceive (psychological) safety and freely contribute their ideas. In regard to obstacles, providing enough resources may be analyzed in relation to specific industries as well as to the economic and political conditions under which companies operate. Regarding planning, the potential of IT support and overlap to project management methods should be explored further.

- **Q3**: What are the differences between service and production companies?

The analysis of success factors and challenges between service and production companies in German SMEs shows clear differences. While open communication and a climate of innovation are key in the service sector, production companies primarily emphasize fast processes. Potential for improvement is rated higher in service companies, and the assessment of success factors is significantly better in production. Challenges vary, with the service sector focusing on human resources and resistance, while technical resources and planning predominate in production. *Taken together, while fast processes and technology, and resource-oriented innovation dominate in the production sector, human aspects play a more pronounced role in the service sector*. Since human aspects (e.g., overcoming resistance in middle management) are also relevant in production settings, further research on psychological and organizational aspects of innovation management could address both company types.

- **Q4**: How can IT support the success factors relevant to the innovative capacity of SMEs?

The work identified various IT tools such as blogs, information systems, wikis, databases, campaigns, and idea competitions to support different aspects of the innovation process, including communication, information sharing, knowledge documentation, and idea generation. Respondents emphasized IT as a valuable support in the innovation process. Companies focused on optimizing processes and automation to relieve limited human resources. *Taken together, IT is perceived to play a crucial role in bringing clarity to processes and structures, improving time management, and encouraging creativity*. In general, the effects of IT support for innovation management are still largely under-researched. For instance, an important question is how to deal with the tension between confidentiality and participation in IT-based innovation management and how to transition a project from highly confidential to more public or even involve the customer.

- **Q5**: What role does knowledge management play in this and can it provide support?

Knowledge management (KM) plays a critical role in innovation by seeking, acquiring, and combining information to reduce uncertainty. KM is particularly important as many small companies have little opportunity to use methodical approaches in their sub-areas, which can lead to missed innovation opportunities. KM supports success factors, especially in the exchange of information and further training. It enables the implementation of knowledge in new products or services. Success factors for innovation are additionally favored by supporting processes and training. The integration of knowledge carriers and the embedding of knowledge transfer in the organization are crucial to fully exploit potential. *Taken together, there seems to be a substantial overlap between knowledge management and innovation management*. Given the resource constraints of SMEs which may not engage in both, future research on hybrid, adjustable methods seems fruitful.

4.2 Limitation and General Discussion

As with any qualitative analysis, the sample and the sampling procedure must be clear to ensure generalizability. Our study focuses on the innovative capacity of SMEs and uses data from the area of Mecklenburg-Western Pomerania, Germany. The results of this work can be generalized to similar business cultures, but should be replicated and quantitatively tested in other cultures and regions to assess whether our results are affected by regional influences or other business cultures. In our work so far, only in-house innovation activities have been studied, leaving out open innovation in the form of collaborations and offering room for further research. Key innovation characteristics, such as time, cost, technical aspects, and efficiency, have been ignored in this work. Furthermore, important aspects of innovation management, such as innovation strategy, controlling, and financing, were not included and should be considered in further research.

The orientation of the innovation process to the three-phase model according to Thom [31] can also be viewed critically. Other important phase models, such as after Geschka [15], after Brockhoff [50], after Witt [51], after Pleschak and Sabisch [41], as well as the stage-gate process [52] or the basic scheme of the innovation process, with an appreciation of the innovation controlling, according to Vahs and Burmester [17] are not considered. The various models from theory and practice differ in their degree of detail and in their focus, which is reflected in their significance and practicability [17].

Furthermore, phase-related concepts of innovation management describe an ideal rather than a real-typical course, since, as empirically proven, the innovation process observed in company practices is not characterized by a strictly adhered-to sequence of steps [16]. Due to the complexity, variability, and uncertainty of innovation processes, phase models represent this in an abstract manner [17]. In practice, the individual phases cannot always be separated exactly [53], since certain sections may be skipped or several phases are iteratively linked [17]. While in the theoretical model, a phase only begins when the previous one has ended, in reality, several activities often take place in parallel, which results in interdependencies in terms of time and content [41], [54]. However, this aspect in particular is deliberately promoted with certain methods, such as Simultaneous Engineering, to make the process more efficient by parallelizing sub-processes and thereby realizing time and cost advantages [17].

An innovation model consequently shows an ideal-typical state, which, however, does not take into account the individual circumstances of companies. The division of the innovation process into different phases is to be understood as an aid, which enables a better understanding and a more effective and efficient handling of innovations [17]. A problem-oriented perspective, in which measures are consciously sought to improve entrepreneurial innovative power, would be appropriate here [16], which can, however, be seen as given by the justified challenges and success factors. In addition, such a procedure would be very time-consuming, since each enterprise must be dealt with individually and in great detail. Therefore, as we have also argued in the discussion of individual research questions (e.g., Q1 and Q5), highly configurable models and tools can improve the situation.

With regard to the quantitative methodology, a limitation is that the results are geographically and culturally limited. A restricted number of SMEs in a defined region were investigated. Hence, conclusions based on this data have to be made with caution, especially on the differences between the production and service sectors due to the small sample size of 25 service and five production companies. This allows researchers to further check these results on a larger scale or under different framework conditions.

Therefore, it would be interesting to examine SMEs in other countries, especially in the EU or in countries that are rated as successful innovators within the Global Innovation Index or European Innovation Scoreboard, to then compare them with the German SMEs to be able to identify and explain possible differences regarding their innovation activities as such, the related success factors and challenges as well as possible IT support solutions.

Moreover, it should be kept in mind that SMEs can be very diverse in terms of their characteristics, e.g., regarding their size, structure, and processes, which makes generalization difficult.

One test person remarked that such representativeness is hardly possible since individual SMEs differ too much in terms of innovation management. The participant mentioned that a company that installs and maintains the lighting in factory buildings has a completely different understanding of innovation (innovation behavior) than a battery manufacturer whose innovative activity or ability is essential for survival on the market. This is the case although both enterprises have an identical number of employees and operate in the same sector (energy). In addition, he pointed out that innovations could also be perceived differently within the company itself.

After all, respondents can differ greatly in their decision-making behavior and their expertise on the subject [36]. For this reason, there is always the risk of a possible answer distortion, which is why a systematic error in the test results in this regard cannot be ruled out with certainty [20].

Within the scope of this study, executives are overrepresented with regard to the area of activity in the company, as well as with regard to the production sector, which means that there is a high probability of such an answer bias. With regard to the methodology, it should be noted that a 7-digit Likert scale could have been used as an answer option instead of a 5-point Likert scale. The reason is to get a more accurate trend as well as not to allow a neutral (center) answer option as one of the respondents said.

Therefore, in subsequent studies, consideration should be given to changing the scale to obtain more detailed data.

4.3 Further Research Needs in SME-focused Innovation Management

“The prosperity of a country is primarily based on knowledge, because knowledge is the decisive basis for new ideas, better solutions and, associated with this, for sustainable growth. Excellent education, science and research are the sources of new knowledge and success in international competition.” [49]

As can be seen from this quote from the German Federal Ministry of Education and Research (BMBF), further research on the subject of innovation or innovation management is of great relevance due to its special importance for the company and national economies. On the one hand, this can be justified on a societal level with the fact that the ultimate effects of innovation lie in the satisfaction of present and future human needs on an individual or collective level [21]. At the same time, innovations make an important contribution to solving social challenges such as demographic change [55].

On the other hand, due to the increasing global market and competitive dynamics, constantly changing customer needs, and faster product life and innovation cycles, the topic will become even more important in the future [5], [23]. Research, development, and innovation form the basis for Germany’s prosperity and competitiveness [49]. Without progress in science and technology, sustainable solutions for environmentally friendly energy, efficient health care, sustainable mobility, and secure communication cannot be implemented and Germany cannot be guaranteed as a stable production and service location [49].

In the context of climate protection, for instance, according to the BMBF, lightweight construction represents a key technology and is recognized accordingly within the framework of materials research funding. Interestingly, in this context, the BMBF specifies both the technology innovation (“lightweight construction technologies include materials with improved functionalities (..)”) as well as the process innovation (“(...) also modern production processes as well as cost and Resource efficiency.”) [55]. Consequently, the various types of innovation and their connection (above all in the context of incremental and radical innovations) should be further examined in future studies. It should be advantageous for enterprises to combine types of innovation, such as in this case the technology innovation with the process innovation, instead of just focusing on one innovation type to be able to exploit a higher potential. However, as already

explained, SMEs should also specialize in incremental innovations, and large enterprises in radical innovations [27], [56].

This applies not only to Germany or the EU but to every country or economic region (see [49]). Just as industrial nations and developed economies can benefit from innovations, this also applies to emerging and developing countries or corresponding economic areas such as the Association of Southeast Asian Nations (ASEAN). For this purpose, further investigations should be made to determine hidden potential.

The incentive for companies to deal with the topic lies in the expected increases in market share, sales, or profits through innovations [21]. With the help of innovation activities, these can secure their existence on the market and jobs, which in turn are associated with social stability. Therefore, with the help of innovation data, the social and ecological effects of innovations should be further researched in addition to business indicators such as "productivity, profits and jobs" (see [21]), even if measuring the social, ecological, and individual consequences of innovations turns out to be complicated [21].

With regard to the long-term preservation of Germany's international competitive position, due to the outstanding importance of German medium-sized companies, SMEs should be explicitly addressed. Many SMEs are clearly not innovative enough and must be more involved in the innovation process [49]. Companies must keep up with the times to survive in the market in the future or to play an important role in competition. With a view to the future, it is of fundamental importance to be innovative and to align business activities accordingly.

For this reason, concrete measures and strategies should be derived from theory and practice so that these enterprises can increase their ability to innovate. The introduction of idea management with appropriate IT support and the consideration of the KM is could support this and should be further investigated. At the same time, the companies' reservations about innovative activity, e.g., for reasons of cost, must be dispelled and it must be made clear how much they can benefit from innovation. The responsibility for clarification and the promotion of innovation lies with the state in particular, but also with UN associations, clubs, research institutions, and ultimately the enterprise itself.

The simultaneous promotion and further development of key technology are decisive since new opportunities in fields of application such as AI and human-machine interaction will be opened up as part of digitization [49]. With an effective and efficient use of key technologies and innovations, economic growth, prosperity, and jobs can be secured and expanded [55].

It is of utmost importance to further explore the success factors and challenges of innovation to identify for SMEs (ideally for all enterprises) which factors favor or hinder innovations. Moreover, it is important to differentiate between the types of companies, i.e., in terms of their size, associated sector, or industry, and to compare the results with each other to gain new insights. Here, past investigations, e.g., in the form of meta-analyses, should be included to obtain the most comprehensive investigations possible. With comparative comparisons, deviations and new developments or trends can also be identified.

5 Conclusion

In the course of our work, challenges and success factors for the innovation activity of SMEs in Germany were investigated by means of a qualitative and quantitative analysis. The relevance of the topic becomes all the more apparent when it is taken into account that 31.1 million employees (57 % of all employees) in the European area worked in SMEs in 2018. Through a systematic literature analysis, findings from previous studies were included, and a basis for own findings was supported.

Key findings of the study show that SMEs face different challenges and success factors in their innovation activities, depending on the sector they belong to. Resources and corporate culture play a central role in both service and production companies. However, the companies differ on closer examination. While in service companies interpersonal aspects such as open communication, an

innovation-friendly climate, and management support for innovation are of the utmost importance, it becomes clear that in production companies fast processes, the availability of material resources, and targeted planning also play a central role. Furthermore, there are differences in the evaluation of potentials with regard to success factors and challenges of the innovation activities of the SMEs involved. The surveys also revealed that KM is of essential importance for the innovative capacity of companies and should be included as an IT-supported instrument.

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