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Potential-based Evaluation for Initial Selection of Technologies

Günther Schuh[1,2], Patrick Scholz[2], Ludwig Volbert[2], Julia Brennert[2]

[1]*Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University, Aachen, Germany*
[2]*Fraunhofer Institute for Production Technology IPT, Aachen, Germany*

Abstract

Due to the increasing internationalization of markets, rising cost pressure, and shortened product life cycles, manufacturing companies are facing increasing competition and innovation pressure. To secure competitiveness, the early development of new and innovative technologies and their implementation in the market as products or services is paramount. To use available resources for innovation efficiently, potentials of new technologies must be exploited at early stages. The main objective of this paper is to support companies in early decision-making processes regarding new technologies by providing a systematic approach to technology assessment. For this purpose, a model is developed which supports the evaluation of the technology potentials based on the limited information available at an early stage and, thus, creates the basis for an initial technology selection.

Keywords

Technology Potential; Technology Selection; Technology Assessment

1. Introduction

Currently, manufacturing companies are confronted with a multitude of new challenges. The globalization of markets leads to more intense competition and cost pressure on companies [1–3]. Together with increasing customer requirements, which are based on the change from a seller's market to a buyer's market [4–6], companies face constant pressure to use resources more efficiently [1,2]. Similarly, a rapid change in technology can be observed on global markets, which shortens the product and technology life cycles [7,2,5]. As a result, today's markets are characterized by a high degree of dynamism, which also affects those sectors of the economy that were previously rather slow in innovation [8]. Thereby, companies are forced to innovate quickly in order to stay competitive [1,2]. Technological innovations can strengthen the competitive position of a company by expanding the range of products and services offered [9]. However, the success of an innovation is not determined at its inception in the market. Already in the early phases of the innovation process, it is important to identify technologies offering long-term success potential to manufacturing companies and enabling differentiation from competitors [10]. Incomplete information and unavailable knowledge complicate the evaluation of technologies in these phases [3]. Hence, established evaluation methods, which mostly focus monetary criteria, are often not applicable and the evaluation of technologies at an early stage is often based on the intuition and assessments of the corresponding experts and rarely follows a transparent and systematic approach [11]. Consequently, a new approach is required, enabling evaluation of technologies in the early phases of the innovation process.

Therefore, the objective of this paper is to design an evaluation model to support companies for early selection of high potential product and process technologies. For this, systematization of technology

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potentials is presented in the following. The generic technology potentials utilized as a foundation for this model are identified through a comprehensive review of the relevant literature. This process is based on the research process of applied science according to BROCKE ET AL. It is used by the authors since it focuses on problems with practical relevance and is of particular importance in the context of engineering sciences. The approach applies models, which describe, explain, and configure certain parts of reality [12]. Finally, the overall result of the investigation represents the generic potential dimensions forming the basis for the decision on the initial technology selection.

2. Definitions and Fundamentals

To lay the foundation for the development of the evaluation model, the potential as the fundamental object of consideration of this paper is defined. Furthermore, the technology potential as an extension of the potential is defined.

Etymologically, the concept of potential can be traced back to the Latin term 'potens' or 'potentia', which can be translated as power, ability or capability [13]. Nowadays, potential is generally understood as the "totality of all existing, available means, possibilities, abilities, energies" [14] or also performance capability [15]. BINDER & KANTOWSKY deal with the potential-oriented management of companies and systematize the concept of potential. They distinguish between utility potentials, strategic success positions and strategic success potentials [16].

On a normative level, BINDER & KANTOWSKY formulate the utility potential. Utility potential is understood to mean "attractive constellations in the environment, the market or the company" [16] that enable the creation of benefits. To create benefits, companies must bundle relevant corporate capabilities in a competitive manner and thus build up strategic positions of success.

Strategic success positions of companies represent superior market positions compared to the competition. These superior market positions, in turn, are based on strategic success potentials of companies that enable them to achieve higher performance than the competition. In contrast to strategic success potential, strategic success positions can only be determined in relation to the company's environment. Finally, the competitive position of the company is described via the entire set of strategic success positions.

In contrast to the strategic success positions, the strategic success potentials are not dependent on the market or the environment of the enterprises but are determined by the enterprise-internal abilities. Strategic success potentials are therefore also referred to as "concentrations of entrepreneurial capabilities" [16]. In turn, entrepreneurial capabilities consist of combined resources and capabilities that are available to companies and thus form the basis for creating market performance. The interrelationships of the described types of potential according to BINDER & KANTOWSKY are depicted in Figure 2.

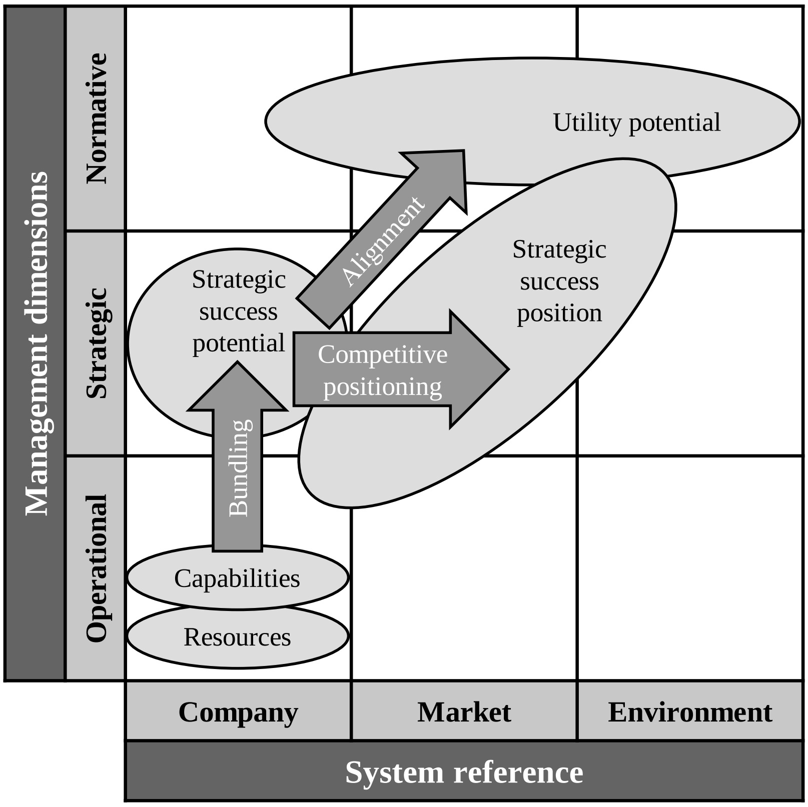

Figure 2. Systematization of the concept of potential according to BINDER & KANTOWSKY [16]

Technology potentials are a prerequisite for the development of strategic success positions [16]. Building on the described understanding of potential in the context of strategic management, technology potential is defined as *"The sum of technology-based opportunities for the company to achieve an advantageous competitive position"* in the scope of this paper. [16]. According to BINDER & KANTOWSKY's concept of potential, technologies thus represent strategic success potentials on which companies can build up strategic success positions and thus competitive advantages.

3. Related Work

Based on the objective and the terminological understandings, an overview of related work is presented and analyzed. To this end, relevant criteria for evaluating existing approaches are first formulated. Subsequently, the existing models are critically evaluated, and the research deficit is derived based on the analyzed state of research.

The scope of the paper is delimited to ensure the comprehensibility of the topic. The delimitation is made object- and process-related. In the object-related delimitation, the description of the objects considered in this work is intended. Technologies are an object of consideration in this work. The term technology is very general and therefore needs a more precise delimitation. The developed evaluation model of the present work is limited to the consideration of product and process technologies of companies. Since the assessment of technologies is potential based, the potential dimensions of technologies are another subject of consideration in this paper. In addition, the potential fields of application need to be considered when evaluating technologies. These are also considered in the evaluation model of this paper. In the process-related containment, the processes and activities affected by the model of the present work are listed. The evaluation model is intended to support companies in the initial selection of technologies with high potential based on imperfect information. Therefore, the focus lies on the early stages of technology identification and technology planning in the technology management process.

Based on this delimitation, works from SCHÖNING [17], SERVATIUS & PEIFFER [18], HALL [19], KRÖLL [20], UNTIEDT [21], SCHIMPF & RUMMEL [22], JOLLY [23], SCHINDLER [24], and BINDER & KANTOWKY [16] were studied to determine the current state of research, as they are the most important researchers in the field of technology management. With regard to the formulated criteria of the recent scope, the critical appraisal of previously mentioned approaches to technology assessment shows three research deficits:

First in the literature on technology assessment, there is no existing approach that provides a detailed systematization of technology potential. SCHÖNING, SCHINDLER, SERVATIUS and PEIFFER mention isolated dimensions of the potential of technologies. BINDER & KANTOWSKY deal intensively with technology potential. All of them do not undertake a detailed systematization of technology potential. Thus, an essential basis for the potential-based assessment of technologies is missing.

Second the current state of research does not include a comprehensive linkage of general technology properties and generic dimensions of technology potential. This research deficit is partly due to the above-mentioned lack of systematization of technology potential. Existing approaches mention links between technology properties and dimensions of technology potential, but there is no comprehensive explanation of these interrelationships.

Third against the background of ever shorter innovation cycles, early selection of high-potential technologies is a key success factor for companies. In the research to date, however, there are only few approaches whose evaluation basis is suitable for initial technology selection [59]. These suitable approaches, in turn, do not focus on a potential-oriented evaluation of technologies. Accordingly, current publications lack an approach that performs a differentiated assessment of technology potential and is suitable for the initial selection of technologies in early innovation phases.

4. Results

To close the identity gaps, the elaboration of a systematic and comprehensive structure of the technology potential is carried out in several main steps. Firstly, generic potential dimensions are described. Secondly, those potential dimensions are analyzed with regards to their interdependencies. Lastly, appropriate and selective dimensions for the proposed evaluation model are derived and operationalized by linking them to technology factors that influence these dimensions.

4.1 Identification and analysis of generic potential dimensions

Since the current state of research does not include a detailed systematization of technology potential, the literature research examined works from different subject areas, which are briefly explained below. To identify the generic dimensions, several publications are examined. Within the scope of this investigation, on one hand publications directly addressing technology potentials are considered, on the other hand publications of high reputation are analyzed. The potential dimensions to be analyzed in the further course and the literature consulted are shown in Table 1. The literature considered refers to the most widely used representatives in German-speaking countries.

Table 1: Result of the literature research on the potential dimensions

	Pümpin (1992)	Binder & Kantowsky (1996)	Schuh (2002)	Klein (1998)	Wolfrum (1991)	Gochermann (2015)	Wichert (2015)	Schidler (2015)	Schöning (2006)	Servatius & Peiffer (1992)
Cost reduction potential	X			X	X	X		X		
Synergy potential	X			X	X	X	X			
Human potential	X	X								
Image potential	X		X				X			
Market potential	X	X	X					X	X	
Quality potential			X	X		X	X	X		
Development potential				X	X	X				X
Innovation potential			X		X	X		X		
Differentiation potential					X			X		

X - Direct Addressment of Potential

The identified potential dimensions can be understood as elements of a system for the description of the technology potential. As system elements are need to be structured without redundancy, the methodology of networked thinking by PROBST & GOMEZ is used [17]. For this purpose, the relationships between the system elements (in this work the potential dimensions) are recorded and evaluated. The relations between the system elements are represented by arrow relations, which are provided with an effect direction, a time aspect and an intensity. When differentiating the relationships based on their direction of action, a distinction is made between positive (+) and negative (-) action relationships. In the case of a positive effect relationship, an increase in the characteristic of the influencing element also leads to an increase in the influenced element. This is therefore referred to as a rectified relationship. In contrast, negative interactions describe opposite relationships. The property of the influenced element decreases when the property of the influencing element increases.[25]

Furthermore, the elements can be categorized into four types based on their level of influence and susceptibility to influence. Active elements have high influence but low influenceability, inert elements have low influence but high influenceability, critical elements have high influence and high influenceability, while disjunctive elements have low influence and low influenceability. [25]

SCHÖNING uses this methodology to select relevant technological performance parameters for technology assessment, includes the active and, in individual cases, critical elements in the evaluation model, since these are relevant for the description. Inert elements are not considered due to their high influenceability. In the present work, the active elements are also included in the model, since they are little influenced and have a high influenceability. In addition, disjunctive elements are to be considered since they do not show correlations with other elements and thus do not generate redundancies. The inclusion of critical elements is decided on a case-by-case basis. [17] The result of the analysis of interdependencies between the potential dimensions is shown in Figure 4.

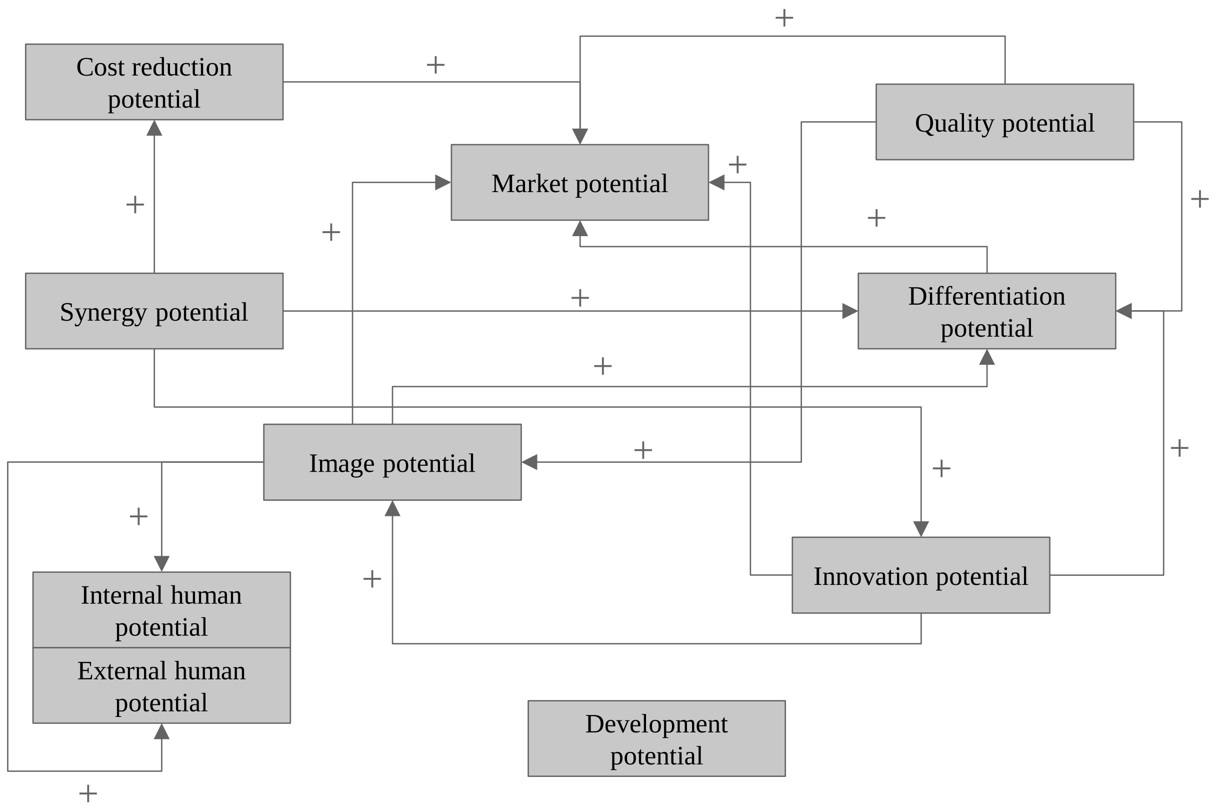

Figure 4. Interdependencies between the potential dimensions

As apparent in Figure 4, the development potential is neither influenced by nor does it influence other potentials. Thus, it is disjunct. The decision as to which dimensions are used for the systematic description of technology potential is made based on the distinction presented between reactive, inert, critical, and active elements. The market potential is the most strongly influenced potential dimension. Since no other element is influenced by the market potential, it is reactive. The differentiation potential is also assigned to the reactive elements and is therefore not considered in the following. The inert elements of the system include the internal and external human potential. These are influenced by the image potential and do not themselves contribute to a description of another potential dimension. An inert but at the same time disjunctive element is the development potential. The development potential does not create any redundancies and thus false evaluation, which is why it is a suitable dimension for describing the technology potential.

The clearly active elements of this system include the image, synergy, quality, and innovation potential. These potentials exert a significant influence on the other elements while being influenced themselves to a lesser extent. The cost reduction potential, on the other hand, cannot be clearly assigned to a type. Since costs are a key determinant of the success of companies and are determined, among other things, by the technologies used, the cost reduction potential of a technology is considered relevant for describing the technology potential.[4] Consequently, the cost reduction, quality, synergy, image, innovation, and cost reduction potential constitute the dimensions of the technology potential model, which is detailed in the following section.

4.2 Technology potential dimensions

For the operationalization and evaluation of technologies, an understanding of the relationship between technologies in general and potential dimensions is required, therefore the different potential dimensions in the context of technologies are discussed in the following.

4.2.1 Cost reduction potential

The fact that costs are relevant for the success of companies is apparent. However, cost reduction can be achieved through many different measures. Among others, technological changes at the product and process level have the potential to reduce companies' costs. For example, product technologies can lead to material savings or standardization and process technologies to shorter lead times and increased resource efficiency. The cost reduction potential of a technology thus describes the possibilities for improving the cost position resulting from the technology under consideration. [26]

Existing cost structures of products and processes are often radically changed by technological innovations [27]. The cost effects of technological innovations are difficult to describe based on generic technology properties and must be analyzed in each individual case for a more detailed examination. A method that is suitable for such an analysis is, for example, the "technology cost analysis" according to HARTMANN [27]. Nevertheless, there are also general correlations between technology properties and cost reduction potentials, which are discussed in the following.

Cost reduction potentials are determined, by the breadth of application of a technology [28]. A technology with a wide range of applications (cross-cutting technologies) can be incorporated into various service creation processes within a company. Thus fixed cost degressions and economies of scale through standardization [27–29,26] are generated. Therefore, a large application area of a technology can be concluded to have a high cost-reduction potential.

In the literature, the concept of complexity is often associated with the costs incurred. The complexity of technology developments has risen sharply and has driven up development costs [4]. If technologies themselves as well as their application contexts are of high complexity, the company incurs complexity costs. On the one hand, complex technologies are associated with high R&D expenditure. On the other hand, mastering them demands a wide range of skills from companies and ties up many resources [30,4,31,32]. The complexity of a technology thus has a negative impact on its cost reduction potential.

Another indicator of cost reduction potential is the degree of novelty of a technology. The effect of a technological innovation with a high degree of novelty on the cost reduction potential is negative. This effect is due to higher R&D expenditures, since fewer internal resources can be used, and new resources as well as capabilities must be built up. In addition, companies lack experience with new technologies, so that there are initial instabilities and inefficiencies (process innovations) and market development costs (product innovations) [33,34,29,35]. The necessary R&D expenditure can also be described in terms of the speed at which a technological innovation is realized. In this context, an estimated low speed of implementation indicates high R&D expenditure and thus has a negative impact on the cost reduction potential. Finally, there is the correlation between the investment required for the introduction of a new technology and the cost reduction potential. Logically, this correlation usually is negative because the investment requirement represents a cost item for companies.

4.2.2 Quality potential

The increasing transparency of the markets not only enables customers to compare products better, but also raises their quality requirements [36]. In this regard, the quality potential of a product becomes a crucial factor in fulfilling these requirements by improving its characteristics, which can be achieved through advancements in product and process technologies [37]. This is particularly important given the quality competition companies face, where providing “qualitatively superior market performance", as stated by PÜMPIN, is seen as a strategic success position [38]. However, it is essential to note that increasing quality should only be pursued if it also enhances the company's competitiveness [37].

The quality of a product is thereby determined by the fulfillment of customer requirements or needs [16]. Quality therefore arises when these needs are implemented in product technologies and lead to customer satisfaction [39]. Customer satisfaction is determined, among other things, by the different degrees of customer anticipation. While basic characteristics cannot increase the customer satisfaction, but must be only fulfilled, in order to avoid dissatisfactions, enthusiasm characteristics increase the satisfaction of the customers disproportionately [40]. If companies anticipate an enthusiastic perception of a technology by customers, this has a positive influence on the quality potential.

Since the quality of a product depends on the requirements or satisfaction of the customers, companies striving for a leading quality position in competition must meet different customer needs. This requires offering a certain number of variants. One way to create new product variants is to combine complementary technologies, as this can lead to new problem solutions or application possibilities [41,29]. If new technologies exhibit complementary relationships to existing technologies, this has a correspondingly positive effect on the quality potential.

Finally, the quality potential is influenced by the ecological impact of a technology. In addition to technical functionalities, products are also described by symbolic properties, which also influence customer satisfaction [42]. One example of such a property is the ecological safety of products. Ecological sustainability is thus a quality criterion and has a positive effect on the quality potential. [57]

4.2.3 Synergy potential

The etymological origin of synergy lies in the Greek term "synergein", which translates as "to work together". In today's linguistic usage, synergies are considered to be overall performances which have a super additive effect due to the interaction of components [43–45]. In his work on strategic success positions, PÜMPIN considers synergy potentials to be the "possibilities of the company to use existing structures for new activities" [46]. If this view is followed, new technologies have synergy potential if their interaction with the existing structures of the company enables additional added value. Synergy potentials are based on synergy effects that can, for example, reduce costs or increase quality. In order to be able to identify synergy potentials of technologies, they must therefore be considered on a company-wide basis [26].

Synergy potentials should not be neglected when evaluating technologies, since some technologies only create added value when combined [47]. In the literature, especially cross-sectional technologies, i.e., those with a broad range of applications, are attributed high synergy potentials. Cross-cutting technologies can be used several times to produce services and thus offer companies the opportunity to standardize processes. This can result in cost advantages for companies in the form of economies of scale as well as increased performance from the transfer of technological advances. [28,48,26]

Synergy potentials are also influenced by interdependencies between technologies within a company. These interdependencies are described by the type of relationship and the degree of interconnectedness of a technology. Technologies that complement each other have a complementary relationship. If complementary technologies are combined, new application possibilities or better problem solutions can be created and thus the technological potential of a company can be increased synergistically [30,41,29,49]. Technologies that are strongly networked within a company and are therefore part of system technologies also exhibit synergetic effects [50,41,21]. In addition to complementary relationships, a high degree of networking also increases the synergy potential. In this respect, empirical studies have found that the use of such synergy effects is predominantly reserved for technological innovations of a low degree of novelty, which can be attributed to the use of existing R&D and marketing know-how. Developing and introducing new types of technological innovations, on the other hand, involves building up new resources and thus has a lower synergy potential [51,52,35,53].

4.2.4 Image potential

If companies are able to generate competitive advantages due to their good public reputation or their well-known brands and products, they possess image potentials [38]. The image of a company is influenced by many different factors. For example, companies can enhance their brand through their commitment to sustainability [54] or build a "quality image" by offering high-quality products. Such a quality image is often associated with technology leadership and incremental product innovation [55]. Furthermore, companies that hold a pioneering technological position usually benefit from image advantages [56,24].

Among other things, customers' purchasing decisions are influenced by a company's image and reputation. In addition to qualitative product characteristics, ecological and social aspects are decisive for the image of a company [57,58]. Therefore, the direct and indirect as well as the immediate and delayed consequences of technological innovations are estimated in a technology impact assessment [59,60]. Among the objectives of such an assessment are the avoidance of image damage and the identification of potential image enhancements [26]. In technology marketing the ecological and social consequences of technologies are taken into account in order to ensure their acceptance in the market [34]. In addition to positive environmental effects, such as resource-efficient and low-emission production, social aspects, such as good working conditions and fair pay for employees, also have a positive impact on the image of the company [61,62,58].

Furthermore, companies that possess technological uniqueness and hold a technological leadership position have image advantages over their competitors [42,56,24,29,58]. A technology that is unique or establishes a leadership position can also have a positive impact on the company's image. Therefore, it is essential to understand the key technology characteristics that contribute to achieving and maintaining these positions. The following list outlines some of these characteristics that are known to influence technological leadership and uniqueness.

Specific technologies (low scope of application) favor technological uniqueness, whereas cross-sectional technologies (high scope of application) tend to enable cost reductions through standardization [48]. The exclusivity of a technology, resulting for example from internal R&D, also favors unique technological features and is therefore associated with prestige and image advantages [29]. However, it must be possible to protect unique technological features from imitation in order to generate sustainable competitive advantages [16] and avoid damage to the company's image through product piracy [63] on global markets.

Another indicator of high image potential is the degree of technological novelty. Developments based on technologies with a high degree of novelty represent radical innovations. These are usually associated with high costs for companies, but in return they offer them the opportunity to achieve unique technological selling points and leadership positions [56,29,35]. A technological leadership position is determined by the performance capability of a technology, so that a performance advantage on the market is a decisive indicator of such a position [64]. To achieve technology leadership, it is also crucial to act with around the forefront area when it comes to technology market readiness. A technology that can be realized quickly therefore favors such a leading position [65].

4.2.5 Innovation potential

The etymological origin of the term innovation lies in the Latin expressions "novus" (e.g. "new") and "innovatio" (e.g. "innovation" or "renewal") and thus describes a renewal or a differentiation from the status quo [66]. In addition to the novelty, an innovation must be relevant for the customer and sellable on the market, otherwise it is merely an invention. HAUSCHILDT distinguishes between product and process innovations, i.e. successful innovations on the product or process level [67]. The basis of all innovations is the technological innovation ability of the companies, which has become an essential component of competitiveness due to the increasing competition on the global markets [68]. Technologies that represent a potential basis for innovations are therefore of great importance for companies.

The term innovation describes the innovation or differentiation from a reference state [66], which is represented in this paper by the state of the art. In the literature, the terms degree of novelty and degree of innovation are often used synonymously [69,70]. In addition, technological innovations are differentiated with regard to the level of innovation or the degree of novelty in radical and incremental innovations [71,35]. From this, a close relationship can be derived between the degree of novelty of a technology and its innovation potential.

The market performance advantage of a technology also influences the innovation potential. However, this performance advantage must be significant to overcome implementation or acceptance barriers. The greater the market-side performance advantage of a technology, the higher the technology-induced innovation potential. [23,72]

The innovation potential also depends on the time required for a technology to reach market maturity. The speed at which a technological change is implemented is therefore crucial to success to gain an innovative edge and possibly a technological lead over the competition. A high speed of implementation or a short time to market therefore has a positive effect on the innovation potential. [73,65]

Lastly, an innovation is not defined exclusively by an innovation in the technological sense. HAUSCHILDT, on the other hand, postulates: "Innovation is [...] what is considered innovative" [67]. The customer must therefore also perceive a technological change as an improvement or innovation [67]. If technological changes create features that make products attractive, this perception is to be expected. Enthusiasm characteristics are new characteristics of products that customers do not anticipate. Customer satisfaction is disproportionately increased by these features and improves the competitive position of companies [74]. If companies anticipate potential excitement features in technologies, this has a positive effect on the innovation potential of the companies.

4.2.6 Development potential

Companies must continuously develop their products as well as their product and process technologies in order to remain competitive [75]. The extent to which technologies can be further developed is described by the development potential. The term development potential is also frequently used in the literature, but its meaning is identical. Technologies with a high development potential are particularly attractive for companies for the following reasons. On the one hand, technologies with a high development potential have a high future competitive relevance for companies. On the other hand, these technologies favor the pursuit of a pioneer strategy and can thus generate first-mover advantages. To generate these advantages, companies must tap into the further development potential and expand their technological know-how in this area. In R&D companies tend to ignore the development limits of technologies and thus invest resources in technologies that have small further development potential. [26]

The development potential of a technology is limited above all by its physical performance limit. This is illustrated by the S-curve concept of McKinsey, which relates the performance of a technology to the cumulative R&D expenditure. If further R&D expenditure leads only to marginal increases in performance, the technology has reached its physical performance limit and has hardly any development potential left [41]. The closer a technology is to its physical performance limit, the smaller its potential for further development.

On the other hand, the range of applications of a technology has a positive effect on its further development potential. Cross-cutting technologies can be developed further in different applications, whereas the development potential of specific technologies is limited to one application [76]. Therefore, the greater the range of applications for a technology, the more opportunities companies have to develop it further and the greater the potential for further development.

If technologies have a high degree of market novelty, they are assigned to the development phase in the technology life cycle. Technologies in this phase are characterized by a high potential for further development combined with a high degree of uncertainty. If companies invest in such technologies and exploit the potential for further development, they can become highly relevant to competition. [77]

4.2.7 Application of the evaluation model using the example of PV systems

To demonstrate the practical application of the evaluation model based on potential dimensions, a real-world example of its use in evaluating the potential of renewable energy technologies, more specific a new PV system, will be considered.

In terms of cost reduction potential, the evaluation model would analyze factors such as economies of scale, advancements in PV panel manufacturing processes, and potential material savings. Additionally, the model would assess the cost effects of PV technology on existing energy generation methods and the potential for reducing overall energy costs.

The quality potential of solar PV technology would involve evaluating factors such as panel efficiency, durability, and the ability to generate consistent power output under varying weather conditions. Moreover, the assessment would consider customer satisfaction and meeting regulatory standards. These factors are particularly relevant for the evaluation of quality, as these aspects have the greatest influence on performance or adoption on the market.

When it comes to synergy potential, the evaluation model would examine how solar PV technology can be integrated with other renewable energy sources, such as wind or hydropower, to create hybrid energy systems. This integration can lead to more reliable and efficient power generation, as well as the ability to store and distribute renewable energy.

The image potential of solar PV technology would involve assessing its positive environmental impact, sustainability credentials, and its contribution to reducing carbon emissions. Companies that invest in solar PV technology and promote clean energy initiatives can enhance their brand image and reputation.

In terms of innovation potential, the evaluation model would consider advancements in PV panel efficiency, energy storage technologies, and new installation methods. It would also assess the market disruption potential of solar PV technology and its ability to drive changes in the energy industry.

Lastly, the evaluation model would analyze the development potential of solar PV technology by considering ongoing research and development efforts, scalability, and the potential for performance improvements. It would also assess the ability of solar PV technology to adapt to changing market dynamics and evolving energy needs.

5. Limitations of the developed evaluation model

The evaluation model based on potential dimensions in context of technologies provides a useful framework for assessing the potential of technologies. However, it has certain limitations that need to be considered. Firstly, the model simplifies the evaluation process by. These factors are particularly relevant for the evaluation of quality, as these aspects have the greatest influence on performance or adoption on the market., potentially oversimplifying the complex and multifaceted nature of technologies. Additionally, the subjective nature of evaluating potential dimensions can lead to variances and subjective judgments in the assessment. The model primarily relies on qualitative assessments and lacks specific quantitative measures, making it challenging to objectively compare and prioritize technologies. Extensive knowledge of the assessor is required for this. Moreover, the model may not fully account for contextual factors that significantly influence technology potential, such as market conditions, industry dynamics, regulatory environment, and organizational capabilities. Thus, it potentially overlooks other important dimensions. Furthermore, the model provides a static snapshot of technology potential at a specific point in time and does not consider the dynamic nature of technologies and their potential to evolve over time. Data availability is another challenge, as conducting a comprehensive evaluation based on the potential dimensions may require extensive data collection and analysis. The availability of reliable and up-to-date data can impact the accuracy of the evaluation. To overcome these limitations, it is important to complement the evaluation model with additional methods and approaches, considering the specific context and objectives of the evaluation. This will help provide a more comprehensive understanding of the potential of a technology.

6. Conclusion and Outlook

The aim of the presented paper is to systematize the potential of a technology. First, potential dimensions of technologies were identified from works on strategic success positions and from existing approaches to technology assessment. These were then analyzed and selected using the method of networked thinking. This led to the identification of the technology potential dimensions for the evaluation model. The developed evaluation model provides a comprehensive and differentiated basis for decision-making when selecting an initial technology.

Through the derived technology potential dimensions as well as the respective technology requirements, companies are supported in the evaluation and selection of technologies with high potential. Based on the potential dimensions and the technology dependencies, decision makers are supported in the prioritization of technology innovations and, hence, enables companies to gain competitive advantages. However, the presented results are limited to qualitative interdependencies between generic technology properties and their contribution to the existence of a technology potential. Due to contradictory statements in the literature, a more detailed analysis of the practicability of the evaluation model should be carried out in the course of further research activities. This analysis should examine not only the general validity but also the weighting of the individual cause-effect relationships to enhance the quality of the assessment. Additionally, it should be noted that besides potentials, also risks are to be considered for decisions under uncertainty. Thus, in the sense of a holistic technology assessment, future research should extend the model by respective risk dimensions within the technology selection process at an early stage. In addition, there would be a need for further research to validate the cause-effect relationships identified in the study through empirical studies or conducting comparative analyses of different assessment models for technology selection.

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