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# Effective management support for design: towards a model of managerial competence

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**ABSTRACT:** Well-designed products are crucial to a company's business success. Management support is a critical success factor in ensuring that design-related aspects are given appropriate attention during product development. Despite the importance of management, the literature doesn't provide a clear picture of what characterizes a competent manager in product design. This gap impedes competence development and explains why organizations struggle to leverage the benefits of well-designed products. This research aims to address this gap by synthesizing important findings from the literature into a model of managerial competence. The model provides initial insight into the individual competencies managers need to meet their responsibility for good product design in organizations.

**KEYWORDS:** design management, new product development, industrial design, innovation, top management support

## 1. Introduction

Competition has led to a situation in product design where traditional means of differentiation, such as cost and quality, as well as the core technology of a product, are no longer sufficient to gain a sustainable competitive advantage. Consequently, companies are turning to (industrial-) design as a means of both meeting customer needs and differentiating their products from those of their competitors (Ulrich & Eppinger, 2016). The promises for companies associated with well-designed products are extremely attractive. Design can make an essential contribution to building successful brands (Goffin & Micheli, 2010). Economically, design-driven companies outperform their peers in financial performance and market success (Gemser & Leenders, 2001; Hertenstein et al., 2005). Despite the apparent benefits, there is strong evidence that companies still tend to neglect design or focus too much on technical and engineering-related aspects of product development (Gemser et al., 2006; Kashfi et al., 2017; Stoehr et al., 2024). As a result, companies fail to meet customer needs and miss out on the business benefits of well-designed products in increasingly competitive markets.

Management plays a key role in whether companies succeed in devoting the necessary attention to design-related aspects of the product development process. Despite the importance of management, the literature does not provide a comprehensive view of what characterizes a competent manager in product design. For example, the literature suggests managers have an obstructive, reductive view of design, implying that specific design knowledge is required (Goffin & Micheli, 2010). Other sources report an influence of education and professional experience (Candi & Saemundsson, 2008). Still others mention more behavior-related aspects, such as providing sufficient resources or general support for design (Venturi et al., 2006). The named aspects remain fragmented and imprecise, leading to an insufficient understanding of the required competence of managers when it comes to product design. Furthermore, although the mentioned aspects are facets of competence, there is a lack of integration of the existing literature in the established concept of competence. This gap impedes management competence development and explains why organizations still struggle to leverage the benefits of good product



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design. Our research aims to address this gap by developing a design-related model of managerial competence. This model provides insight into the individual competence managers need to fulfill their responsibility for good product design in organizations. It examines both the structure of competence as well as environmental determinants and organizational effects to be obtained.
The paper is structured as follows: In Chapter 2, we conceptualize our understanding of competence as a general model of competence. Chapter 3 provides an overview of the related work and identifies the research gap. Chapter 4 presents our research design. Chapter 5 presents our research results. A discussion of our research results, as well as known limitations and further research needs, will be presented in Chapter 6. The paper concludes in Chapter 7 with a summary of this publication.

## 2. Theoretical background on competence

"There is such confusion and debate concerning the concept of 'competence' that it is impossible [ . . . ] to arrive at a definition capable of accommodating and reconciling all the different ways that the term is used" (Le Deist & Winterton, 2005, p.29). It is, therefore, necessary to define a valid meaning for this publication. Robert White is widely credited with first introducing the concept of competence. He defined competence as an "effective interaction with the environment" (White, 1959, p.317). For some authors, competencies are behaviors or professional activities. For others, they are underlying knowledge, skills, abilities, etc.; for a third group, they are the results of behavior or activities. Competencies are used to define the minimum requirements of a position or describe the behavior of position holders with outstanding performance (Boyatzis, 1982).
In summary, three prominent aspects emerge from the different interpretations of competence in literature, irrespective of where exactly the boundary of the concept of competence is drawn. Those are KSAOs (knowledge, skills, abilities, and other characteristics), behavior, and the related effects. In the following, we will examine these key aspects and their relationship in more detail. We present our understanding as a general competence model (see Figure 1). KSAOs include knowledge (the extent of information and knowledge), skills (learnable characteristics to master a specific task), abilities (basic characteristics, e.g., intelligence to master a whole range of tasks), and other characteristics (personality traits, attitudes, motivation, values, and interests) (Aamodt, 2010). KSAOs are also central to our understanding of competence and manifest themselves in specific behaviors, understood as essential expressions of competence. The competence model presents these two aspects as interrelated elements.

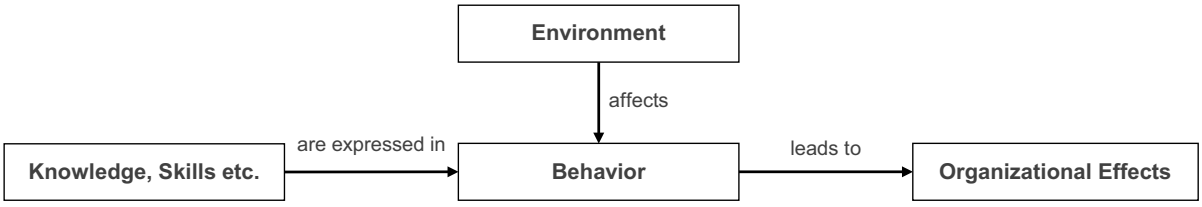



**Figure 1. General model of managerial competence**

From an organizational psychology perspective, human behavior is not isolated from a situational context. This refers to the environment outside the organization (e.g., legal influences) and within the organization (e.g., individual factors of the organization's members). For this reason, any consideration of behavior should include environmental factors as integral components (Naylor et al., 2013). Therefore, the model also includes an environmental element linked to behavior. According to management literature, behavior can be both effective and ineffective (Morse & Wagner, 1978). It is assumed that a favorable form of KSAOs leads to effective behavior. Effective and ineffective behavior must be defined regarding their objective. We assume that effective behavior leads to organizational effects that promote product design quality. Behaviors that undermine this goal are considered ineffective. The literature-based general competence model in this chapter represents our understanding valid for this work and serves as a template for the design-specific model of managerial competence developed in the subsequent chapters.

## 3. Related work

"The literature is filled with contrasting and sometimes contradictory definitions of design, and efforts to define design have often led to acrimony" (Buchanan, 2001, p.8). For this reason, it is necessary to derive



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a valid understanding of this publication. We focus on the user-facing side of the product, where the literature uses indistinct disciplines and product aspects such as usability, human factors, user experience, aesthetics, and the overarching umbrella term industrial design, as well as their associated roles. We will use these and related terms synonymously and use the terms design and designer throughout this publication.

The related work can be divided into three main research streams. First, there is a large body of management literature that examines what constitutes a competent or effective manager or leader (e.g., Borman & Brush, 1993; Yukl et al., 2002). For example, Borman and Brush (1993) conceptualized this behavior in 18 main behavioral dimensions (Borman & Brush, 1993). These range from decision-making and staffing to monitoring and controlling resources, briefly describing each dimension. This and similar research provide a valuable framework for this publication but focus primarily on behavioral aspects and miss the presumed design specifics.

In the product development context, there are numerous studies on factors that lead to successful products (e.g., Cooper & Kleinschmidt, 2007; Ernst, 2002). In these studies, management support is cited as one of these factors, along with, for example, cross-functional collaboration. Categorized in our competence model, success factors are primarily related to organizational effects, and the studies do not focus specifically on design. Concerning the individual perspective of managers, the excellent literature review by Felekoglu and Moultrie (2014) on the conceptualization of (top-) management support in new product development and its impact on new product development performance is particularly noteworthy (Felekoglu & Moultrie, 2014). Concerning our general model of managerial competence, the study focuses on the different conceptualizations of managerial behavior, such as the provision of resources and the expected impact on, for example, product quality. The authors note a general lack of consistency in the literature's conceptualization of management support. Furthermore, initial research was also conducted on the underlying characteristics of managers that are supposed to determine supportive behavior. Emphasis is primarily on motivational aspects, with, for example, the strategic relevance of a project being a key driver for the supportive behavior of managers (Felekoglu et al., 2024). Concerning our research focus, we believe that the mentioned studies miss a competence-related perspective, an integrated view of the different elements, and a specific focus on design.

The third research stream relates to design-specific studies of challenges for design and designers or drivers for design in organizations. Some of these studies relate specifically to managers, and others to design-related aspects at the organizational level. For example, managers should value design and give design an appropriate priority (Stoehr et al., 2024). But managers are only partially aware of the contribution of designers, implying a need for specific knowledge about their contribution (Valencia et al., 2013). Managers and designers differ on what constitutes good design (Micheli et al., 2012). Furthermore, managers should support design-related activities (Inal et al., 2020; Kashfi et al., 2017; Micheli et al., 2018). Other sources mention the need for effective communication and collaboration in development teams, particularly between designers and non-designers, which relates more to a facilitating work environment to be established by management (Boivie et al., 2006; Goffin & Micheli, 2010). These examples give a vague idea of the design-related competence of managers, but overall, the literature remains superficial and unstructured, with no integrated perspective on the competence of managers. In addition, there is confusion about competence-related terms and concepts (knowledge, motivation, etc.) in this research area, making meaningful further research even more difficult. Overall, this presented research gap impedes the development of targeted approaches to design-related competence development for management and is likely an explanation for why organizations still struggle to leverage the benefits of good product design. Our research aims to address this gap by developing a model of managerial competence for good product design, integrating the various facets identified in the design literature, and anchoring them in the concept of competence.

## 4. Research design

The aim is to identify those aspects of competence scattered across the literature and synthesize them into a model of managerial competence. Developing the model is divided into six main steps: literature identification, extraction of competence-related text passages, clustering into competence-related elements, theme generation, theme characterization, and consolidation into the model. Therefore, we performed a systematic literature review following the guidelines of Webster and Watson with our search string shown in Table 1 (Webster & Watson, 2002). This string comprises terms used in our understanding of design, the competence-related aspects, and our focus on product



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development. Competence-related elements are usually found in the literature in studies on challenges, drivers, or best practices. We have used terms such as drivers, barriers, etc., and synonyms for competence.

**Table 1. Systematic literature review search string**

| Article Title | | Article Title, Abstract, Keywords | | Article Title, Abstract, Keywords |
|---|---|---|---|---|
| "industrial design*" OR "ux" OR "user experience" OR "ergonomic*" OR a "human factors" OR "usability" OR "aesthetic" OR "interaction design" OR "ui design" OR"interface design" OR "user center* design" OR "human center* design" | **AND** | "competenc*" OR "capacit*" OR "capabilit*" OR "maturity" OR "issue" OR "difficult*" OR "challeng*" OR "problem" OR "barrier" OR "obstacle" OR "emphasi*" OR "benefit" OR "value" OR "contribu*" OR "driver" OR "effect" OR "impact" | **AND** | "product development" OR "software development" OR "system development" |

We used this search string, the Scopus database, and conducted forward and backward searches as channels to identify relevant literature. The criteria for literature selection were its alignment with our general model of competence, overall quality of the publication, and year of publication (more recent publications were preferred). The search in Scopus resulted in 1624 articles. Next, these articles were examined for relevance at title- and, if necessary, abstract-level. This filtering resulted in 152 relevant articles. These articles were read in full, with 12 of the 152 articles rated particularly relevant. Forward and backward searches complemented this database search process, resulting in seven additional articles. An additional three articles were identified through further exploratory searches. This process resulted in a final set of 22 articles for further analysis. In the second step, we extracted relevant text passages from the literature and performed deductive coding along the elements of our general model of managerial competence presented in Chapter 2. Within each cluster, we identified themes by following Braun and Clarke's (2006) approach by creating initial codes, searching and reviewing themes, and identifying and naming themes (Braun & Clarke, 2006). In supporting the coding of the behavioral themes, established taxonomies from the literature on effective managerial behavior were used as a coding scheme (Borman & Brush, 1993; Yukl et al., 2002). The relevance of the text passages for the clusters of KSAOs and behavior was assessed as follows. First, we considered passages relevant if they explicitly referred to managers. However, some of the passages from the literature are mentioned in a role-unspecific way. We retained those text passages that were close in content to a passage explicitly addressed to managers. This approach extracts a maximum of insights from literature and, at the same time, justifies the assumption that these role-unspecific aspects can also be related explicitly to managers. The relevant literature for the elements of the environment and organizational effects is always non-role specific. We reasonably assume that the extracted environmental aspects also influence managers and that desired organizational effects can largely be achieved through their behavior. After text extraction, clustering, and theme generation, each theme was characterized based on the literature, and the results were consolidated in the competence model for managers.

## 5. Competence model

Figure 2 presents the design-related model of managerial competence. Consistent with our general competence model (see Figure 1), it consists of the core elements of environment, KSAOs, behavior, and organizational effects, now supplemented by their design-specific conceptualizations. For example, managerial behavior is conceptualized in four distinct facets - "Planning and Organizing," "Decision Making," "Employee Development," and "Motivating and Recognizing." In the following, we only refer to knowledge and other characteristics of KSAOs, as only these have been identified in the literature. The model can be understood as follows. Suppose managers possess, e.g., a comprehensive knowledge about the contribution of designers. This will facilitate effective behavior, e.g., giving design-related aspects a high priority in decision-making, which leads to organizational effects that promote good product design quality. Likewise, it can be assumed that an unfavorable form of knowledge and other characteristics facilitate ineffective behavior, e.g., giving design a low priority in decision-making, which undermines product design quality. Each of the elements and their conceptualizations will be explained in more detail in the following sub-sections.



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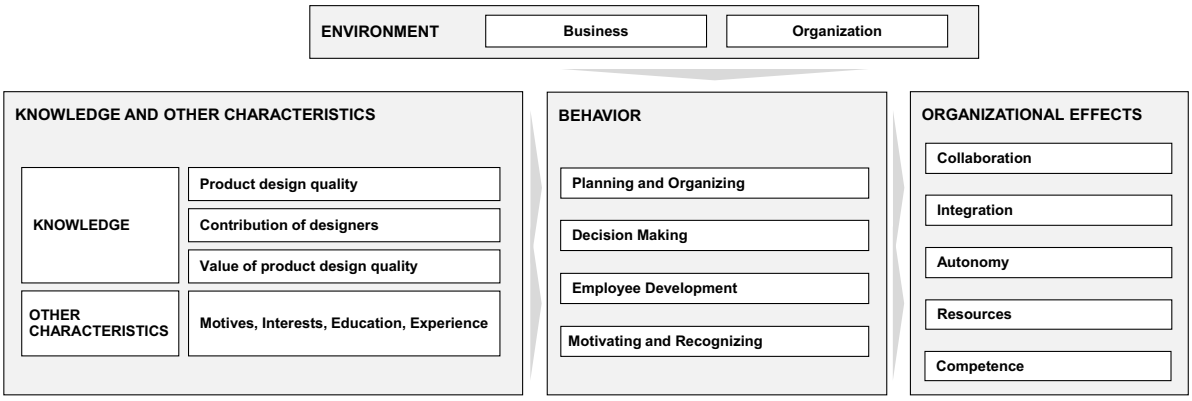



**Figure 2. Literature-based model of managerial competence**

## 5.1. Environment

The environment that influences managers' behavior is conceptualized in two themes: business and organization.

**Business:** The business-related environment primarily relates to aspects such as business relationships, market environment, product type, and product positioning. For organizations that have a direct relationship with the end customer, the design of the product is more important, whereas this is less the case for B2B products (Kashfi et al., 2017). As technology becomes more commoditized in the market, companies will increasingly look to design as a means of differentiation (Gemser et al., 2006; Gemser & Leenders, 2001). Companies operating in industries where design is important are more likely to place greater emphasis on it (Candi & Saemundsson, 2008). However, additional design investment in sectors with high design maturity will also have less impact than in less mature industries (Gemser & Leenders, 2001). Technology-driven products are primarily purchased by customers for their technical performance, with the product's design playing a secondary role. For user-driven products, technology alone is not enough to create sufficient differentiation; interaction with the user is also crucial, making the design of the product much more important (Ulrich & Eppinger, 2016). Design is secondary for low-cost products but crucial for premium products (Valencia et al., 2013). Furthermore, projected sales price and profit margins are decisive aspects (van Kuijk et al., 2019).

**Organization:** Conditions within the organization that are supposed to influence the behavior of managers are related to the organizational size and the behavior and competence of designers. Larger organizations are more likely to use industrial design expertise than smaller ones (Slappendel, 1996). Furthermore, designers are credited with a particular influence. Designers who promote their discipline and added value, e.g., commercial successes, play a more important role in the organization, positively impacting design-related priorities (Micheli et al., 2018; Nielsen et al., 2023). Designers can also create learning opportunities and actively facilitate design-related knowledge creation (Beverland et al., 2016). Moreover, aspects such as experience, technical knowledge, and especially achievements of designers increase trust in their role, which in turn has a positive effect on behavior towards them (Kashfi et al., 2017; Micheli et al., 2018; Nielsen et al., 2023).

## 5.2. Knowledge and other characteristics

Design-related knowledge and other characteristics consist of three themes - knowledge about product design quality, knowledge about the contribution of designers, knowledge about the value of product design quality, and various aspects related to other characteristics.

**Knowledge about product design quality:** This aspect revolves around the concept of design, product design quality, and how to achieve good design quality. Conceptually, some studies in literature indicate the importance, but also a lack of understanding of design-related terms and concepts (Boivie et al., 2006; Kashfi et al., 2017). Micheli et al. (2012) examine, among other things, managers' knowledge about the key attributes of good product design (e.g., usability, aesthetics) and show that managers are aware of them (Micheli et al., 2012). But managers aim for "exclusivity and brand recognition," which would justify a premium price, while designers strive for a product to become "iconic" (Micheli et al., 2012). Achieving a well-designed product requires a well-thought-out choice of materials and a unique combination of materials, technology, and manufacturing processes.



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Managers need to understand the importance of this "subtle interplay" to make informed decisions (Micheli et al., 2012, p.703).

**Knowledge about the contribution of designers:** This aspect of knowledge is about the role of designers and their contribution to the organization. Designers contribute to the organization through a direct contribution to the product design, e.g., by guiding visual coherence in the product portfolio, and through their indirect process-related contribution, e.g., by facilitating improved interaction between different areas (Goffin & Micheli, 2010; Valencia et al., 2013). Managers should understand the contribution of designers and value their profession, but the literature indicates the opposite (Kaygan, 2014; Valencia et al., 2013). Designers' work is understood as "arty" or "making things good-looking, beautiful and pretty," they do not seem to be doing a "real job" (Kaygan, 2014, pp.79–80). Another author provides a more nuanced view, suggesting that managers know only parts of their contribution to products and processes, which in turn depends on their role and interests (Valencia et al., 2013). As designers bring new and enriching perspectives, managers should understand their different culture, vocabulary, and approaches (Goffin & Micheli, 2010).

**Knowledge about the value of product design quality:** The third knowledge-related facet identified is the value of product design quality for customer satisfaction and business success. Well-designed products strengthen the company's brand and can create and maintain long-term business success. They differentiate businesses from competitors, ensure greater customer satisfaction, and require less helpdesk support. When managers know these aspects and are aware of the importance of good design, they seem to pay more attention to design quality (Gemser et al., 2006; Micheli et al., 2018).

**Other Characteristics:** Besides the mentioned knowledge-related aspects, the literature also vaguely indicates the relevance of motives, interests, and personal characteristics. For example, the literature refers to a "strong personal interest in design," defined as "an interest that went beyond the requirements of the job" or the motive of "excellence aspiration" to "design products that are among the best in the world" (Slappendel, 1996, pp.5–12). This study indicates how interest and motives can be measured, although behavioral relevance could not be demonstrated. A background in engineering or technical sciences is seen as an obstacle from a design perspective (Candi & Saemundsson, 2008; Kashfi et al., 2017; Kaygan, 2014). These findings support the anecdotal assumption that managers with technical backgrounds do not appreciate design's value, suggesting one reason for this is their education. Besides the appropriate educational background, professional experience in marketing or sales is considered an advantage (Candi & Saemundsson, 2008). Successful and positive experiences with design over time, such as increased sales, shape the image of design and designers and are supposed to facilitate the knowledge about design and design-related behavior of managers (Micheli et al., 2018).

## 5.3. Behavior

The design-related behavior of managers consists of four themes: planning and organizing, decision-making, employee development, and motivating and recognizing.

**Planning and Organizing:** This behavioral facet relates to setting goals and organizational priorities, their communication, and allocating resources to meet them. Managers should promote design as part of the company's business strategy and mission (Venturi et al., 2006). Effective behavior is also demonstrated in setting design-related goals to guide the organization, which is often neglected (Venturi et al., 2006). According to Venturi et al. (2006), there is a positive relationship between managers' behavior to know how the design of their products compares to that of their competitors and their design-related goal-setting behavior (Venturi et al., 2006). Giving design aspects a low priority by "playing down" the role of design is considered ineffective behavior (Goffin & Micheli, 2010, p.34; Inal et al., 2020; Nielsen et al., 2023). For example, when functional or engineering aspects of the product are constantly in focus, and design aspects are de-prioritized (Gemser et al., 2006; Kashfi et al., 2017; Nielsen et al., 2023). This implicit view about the value of design is indirectly communicated to the development team, making it difficult to get a commitment for design (Nielsen et al., 2023). Furthermore, appropriate resource allocation is an important aspect of planning and organizing. Adequate resources (time, people, budget) should be made available to achieve the objectives set while restricting them is seen as inefficient behavior (Micheli et al., 2018; Nielsen et al., 2023; van Kuijk et al., 2019; Venturi et al., 2006). When deciding on the level of resources for design, managers should consider the development of the industry; perhaps technological leveling has begun in specific sectors, making design an opportunity for differentiation. However, rather than waiting for all the functional



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benefits to be equalized before investing in design, managers should seize the opportunities early in the industry's evolution as a means of differentiation (Gemser & Leenders, 2001). Priorities, the value of designers, and good product design must be continuously communicated throughout the organization (Micheli et al., 2018; van Kuijk et al., 2019; Venturi et al., 2006). Managers should also raise the organization's design-related "awareness and culture" (Venturi et al., 2006, p.229). However, communicating an unrealistic contribution, "myths and promises of unattainable outcomes," can create unattainable expectations in the organization and thus jeopardize achieving desired objectives (Micheli et al., 2018, p.643). Managers communicate more effectively if they see design as part of the strategy (Venturi et al., 2006).

**Decision Making:** Another frequently mentioned aspect of behavior relates to decision-making about product design, mainly how decisions are made and influenced. Managers should carefully consider the interplay of technology, materials, and manufacturing processes and their impact on product design quality (Micheli et al., 2012). Effective behavior is considering the long-term consequences, e.g., the service costs of products (Gemser et al., 2006). Examples of ineffective behavior include making decisions without involving the product development team, especially designers, or rejecting designs because of their cost without considering the added value of good design (Boivie et al., 2003; Goffin & Micheli, 2010). Managers' behavior is critical in interdisciplinary and conflicting decision situations as they can push for solutions conducive to good product design (Kaygan, 2014). Of particular importance to decision-making is coping with the inherent uncertainties of the design process, with product design-related decisions, and with designers who feel more comfortable with "uncertainty and plurality" (Kaygan, 2014, p.81). The added value of specific design solutions is challenging to measure (Gemser et al., 2006; Kashfi et al., 2017; Szabó & Hercegfi, 2023). Ineffective behavior manifests itself in excessive questioning and demands for definitive proof of the added value of specific designs or a fixation on objectively measurable aspects to the detriment of design-related product aspects, out of habit and as an easy way out, or dismissing designers' opinions as subjective and less valid (Kashfi et al., 2017; Kaygan, 2014; Micheli et al., 2018). Furthermore, design is an area where everyone feels entitled to have an opinion (Boivie et al., 2006; Kashfi et al., 2017; Kaygan, 2014; Micheli et al., 2018; Nielsen et al., 2023). Another expression of ineffective decision-making-related behavior is influencing decision-making by insisting on one's unsupported opinions and conceptions rather than relying on contrary expert opinions (Micheli et al., 2018).

**Employee Development:** This behavioral facet relates to how knowledge and appreciation about design and designers are built and maintained within the organization for other members and the manager's role. Effective managers take action to generate design skills and knowledge in the organization, e.g., by exposing non-designers to design processes and practices in dedicated design training (Micheli et al., 2018; Venturi et al., 2006). For managers, participating in design education programs is one tool to learn about design and designers (Micheli et al., 2018). Beverland et al. (2016) show how "horizon-expanding discourse" between managers and designers can lead to an appreciation of the other's point of view, taking into account the other's concepts, thus ensuring better product design (Beverland et al., 2016, p.628). Engagement with designers can be formal and informal, including planned interaction sessions and spontaneous engagement with designers' practice (Beverland et al., 2016).

**Motivating and Recognizing:** This behavioral facet relates to encouraging members of the organization to achieve the organization's goals and recognizing their performance. Effective behavior is expressed by providing incentives to reward results if design-related goals are met or exceeded (van Kuijk et al., 2019; Venturi et al., 2006). There is a positive relationship between managers' behavior who seek information on how their products' design compares to those of their competitors and their design-related incentivizing behavior (Venturi et al., 2006).

## 5.4. Organizational effects

The organizational effects that are beneficial or obstructive to good product design are conceptualized in five themes: collaboration, integration, autonomy, resources, and competence.

**Collaboration:** Reflects the extent to which the interdisciplinary development team communicates and collaborates (Boivie et al., 2006; Gemser et al., 2006; Goffin & Micheli, 2010; Inal et al., 2020; Kashfi et al., 2017; Kaygan, 2014; Micheli et al., 2018; Nielsen et al., 2023; Pei et al., 2010; Szabó & Hercegfi, 2023; Venturi et al., 2006; Zhang et al., 2011). This involves especially continuous communication and collaboration between designers and non-designers throughout product development.



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**Integration:** Reflects the extent to which design activities and the design function are integrated into the organizational structure and processes (Boivie et al., 2003; Micheli et al., 2018; Szabó & Hercegfi, 2023; Venturi et al., 2006). This involves a high-level position in the organizational hierarchy, a direct organizational link to management, and explicit integration of design processes into product development processes.
**Autonomy:** Reflects the extent to which the product development team, and the design function in particular, can pursue a desired product design and make design decisions that they believe will result in a well-designed product (Micheli et al., 2018; van Kuijk et al., 2019).
**Resources:** Reflects the extent to which the product development team, and specifically the design function, are supported with adequate resources (budget, time, professionals) (Boivie et al., 2003; Boivie et al., 2006; Gemser et al., 2006; Gemser & Leenders, 2001; Hertenstein et al., 2005; Inal et al., 2020; Nielsen et al., 2023; Szabó & Hercegfi, 2023; van Kuijk et al., 2019; Venturi et al., 2006).
**Competence:** Reflects the extent to which the interdisciplinary product development team has the required competence to deliver a product with high design quality (Boivie et al., 2003; Boivie et al., 2006; Inal et al., 2020; Kashfi et al., 2017; Micheli et al., 2018; Szabó & Hercegfi, 2023; van Kuijk et al., 2019). This relates, for example, to designers' technical knowledge about the product, their competence to promote design in the organization, and non-designers' knowledge about design.

## 6. Discussion

This research contributes to academia in two distinct ways. First, the developed model of managerial competence goes beyond the fragmented state-of-the-art and provides an integrated perspective on the structure of the required individual competence, its environmental determinants, and the organizational effects to be obtained for good product design. Secondly, the model is grounded in the concept of competence. This allows further refinement of the model in the future based on a solid design literature-based conceptualization and established competence-related terminology and concepts.
Comparing the structure of the model with the state-of-the-art provides important findings. The derived model reflects only some of the behavioral facets mentioned in the general management literature. This could indicate behavioral facets of particular importance for good product design. A comparison of the organizational effects of the model with the success factors of the general product development literature shows clear similarities, whereby the design function and design-related aspects take on a more prominent role, most probably due to the focus of our study. Comparing the behavioral aspects of the model to the literature on management support for new product development is difficult because of a general lack of consistency in the conceptualization of management support. On a high level, there is considerable behavioral overlap in some of the studies. Still, the developed model has a different focus and provides a much deeper and more design-specific characterization of behavioral aspects. Design specificities are also reflected in the KSAOs. For example, the known literature on management support in new product development does not reflect knowledge-related facets. In general, it is worth noting that the understanding of KSAOs in existing literature remains limited. This general observation is also consistent with the findings of Felekoglu and Moultrie (2014) in the broader literature on product development, highlighting that the rationale behind behaviors remains poorly understood (Felekoglu & Moultrie, 2014). Overall, this confirms that there are design-related specificities in competence-related elements that are inadequately reflected in more generalized considerations of management or product development. Understanding these specificities, especially in KSAOs and behaviors, is crucial because they can be developed through training. Additionally, much of the existing support (e.g., maturity models) aims to address these aspects, which is perhaps insufficient. Further investigation is required to inform the development of more effective competence development approaches.
The main limitations of our study are the exclusively literature-based approach and the fact that most of the studies analyzed were not entirely centered around the role of managers and were conducted from the designers' perspective. The main research findings, as well as the limitations, open up a variety of possible directions for further research. The literature-based model should be further developed through empirical studies related explicitly to managers and from perspectives other than designers. Future research may identify additional facets, e.g., behavior or knowledge, and should seek to substantiate and elaborate on those already identified and further comprehend the relationships in the model. In addition, it is worth investigating the relationship between KSAOs and behavior in dedicated studies to substantiate their behavioral relevance. A mature model will help organizations close competence gaps and empower them to realize the potential associated with good product design in the future.



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## 7. Summary

Well-designed products are associated with many benefits for businesses. However, there is strong evidence that companies struggle to devote the necessary attention to design-related aspects in the product development process, particularly due to managers not living up to their responsibility for good product design. Our research has addressed this situation by developing a design-related model of managerial competence. This model provides insights into the necessary individual competence as well as environmental determinants and organizational effects to be obtained for good product design. Based on this, further research directions were derived, and future practical implications were presented. In the long term, a refined competence model and associated training should enable managers to leverage their given operational leeway for good product design and lead their companies to greater economic success.

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