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Digital Innovation Champions: Which Champions drive the Usage of Digital Innovation Management Systems and its Impact on New Product Development Performance

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Abstract

Managers and researchers lack an understanding of how specific new product development (NPD) software champions, i.e. digital innovation champions, function. This is particularly the case for digital innovation management systems (DIMS). Innovation, R&D, and IT managers and top management all might take distinct roles that influence the usage of such software. These distinct roles suggest the need for more detailed investigations of 1) which champions drive the usage of DIMS, 2) if they enhance distinct NPD applications, and 3) the links to NPD performance. This study addresses this need by developing and analyzing hypotheses for the role of digital innovation champions for DIMS usage. Therefore, the authors use unique survey data from managers together with objective patent and revenue data. The results reveal that executives as digital innovation champions encourage the usage and NPD performance of DIMS, whereas, IT and R&D managers can even hinder these outcomes.

Keywords: Digital Innovation Champions, Digital Innovation Management Systems, Innovation Management Software, New Product Development Performance

Introduction

Managing digital tool choices and applications represents an increasingly important aspect of innovation management, with direct impacts on project costs, design activities, and outcomes (Appio et al, 2021; Nambisan et al., 2019). Many firms turn to digital innovation management systems (DIMS), a software that supports the digitalization of innovation management activities (Endres et al., 2022). For instance, Siemens and Daimler collaboratively rely on DIMS from Innosabi (Innosabi, 2021). Such systems offer cloud-based communities for sharing ideas and experiences, along with mobile-enabled collaboration apps for more effective innovation planning (SAP, 2021).Research at the intersection of digitalization and innovation management deal with how and which digital tools can influence and improve innovation processes (Durmuşoğlu and Barczak, 2011; Kroh et al., 2018; Mauerhoefer et al., 2017; Marion and Fixson, 2021; Mendling et al. 2020); however, less is known about how and which managers support the effective use of digital tools in the innovation process such as DIMS.

Firms might install an executive champion for digital innovation into the already crowded C-suite (Rickards et al., 2015; Tumbas et al., 2018). However, installing a new executive champion for digital innovation alone might not be enough to prevent resistance from employees (Endres et al., 2015; Pesch et al., 2021; Vial, 2019). Inertia and resistance can hinder the unfolding of an organization's digital transformation (Baiyere et al. 2020; Endres et al., 2015; Endres et al., 2019; Endres et al., 2020; Vial, 2019; Hanelt et al., 2020; Hanelt et al., 2021).

Overcoming general barriers to change the value creation process by the means of champions has been suggested by Hauschildt and Kirchmann (2001) in terms of the promoter role theory going back to Witte (1973); however, they did neither consider the effect of champions on the usage of software such as DIMS nor on its effect on NPD performance. These researchers focused more on innovation and organizational change implementation in general (Huesig and Endres, 2019; Yrjönkoski et al., 2018).

Further, empirical research in the field of NPD software mainly establishes a generic influence from the top management in general on the use of general IT tools for NPD (e.g., Kawakami et al., 2015; Mauerhoefer et al., 2017), though without specifying the influence of specific champions. Nor do prior studies detail the different roles that champions might take to encourage usage of IT for innovation (Gemuenden et al., 2007; Hauschildt and Kirchmann, 2001). For example, in addition to executive champions or innovation managers, R&D managers, and IT managers can influence digitalization in the NPD process and the usage of NPD-specific software and tools such as DIMS (Marion and Fixson, 2021). We call these champions (or promotors) who encourage the usage of NPD-related IT tools digital innovation champions.

Thus, we do not know how effective (digital innovation) champions are for the usage of software including DIMS and its impact on the performance of NPD projects. This missing know-how might lead to the ineffective use of internal resources and time. Further, this lack of knowledge might hinder the digital transformation of firms. Therefore, our first research question is as follows:

- Which digital innovation champions affect DIMS usage and NPD performance in general?

Without a detailed account of these various promotor or champion roles, in relation to the usage of NPD-related IT tools, we lack insights into (1) which champions drive the usage of IT for NPD, (2) if different champions benefit distinct NPD application areas within the company, and (3) the effects on NPD performance. By moving beyond the limited existing state of knowledge (i.e., that executive champions are critical), we seek to provide insights for various managers and developers, regarding which champions drive (or hinder) the usage of IT tools most effectively and in which circumstances. As key circumstances, we focus on the internal application context, or the actors that help choose and then use digital tools to complete their tasks in the innovation process (Huesig and Kohn, 2009; Marion and Fixson, 2021). Business development and product management are two relevant internal areas with distinct organizational roles and professional compositions that might rely on different DIMS functionalities (Huesig and Endres, 2019; Huesig and Waldmannstetter, 2013). Thus, understanding if and which champions leverage these IT tools in which area of the NPD process can reveal insights that in turn might increase NPD performance and foster digitalization. To hypothesize about and empirically test this understanding, we also address the following research question in our study:

- How do the types of digital innovation champions influence DIMS usage and NPD performance depending on the context (business development versus product management)?

By combining our unique survey data with objective performance and patent data, we help clarify the digital innovation process and extend insights into the role of (digital innovation) champions, especially for DIMS. Surprisingly, the results reveal that IT and R&D managers can even reduce DIMS usage and its effects on NPD performance in business development settings while executive champions and innovation managers positively influence the usage and NPD performance of DIMS.

Thus, our findings support managers and developers to identify digital innovation champions that drive the usage and impact of IT tools in specific circumstances. This choice is particularly important in the context of digitalization, with its conflicting power constellations between traditional IT, R&D and innovation roles. Both the operational and strategic managers in the companies can leverage these insights to expand the usage of DIMS and its impact on the NPD performance. This, in turn, improves a firm's innovation performance and accelerate the digital transformation in firms.

Theoretical Background and Literature Review

Digitalization of NPD through DIMS

Specialized software applications support various NPD activities and innovation methods, thereby driving the digitalization of innovation processes and digital transformation of firms (Endres et al., 2022; Endres and Helm, 2015; Huesig and Endres, 2019; Marion and Fixson, 2021; Nambisan et al., 2017; Nijssen and Frambach, 2000). To build on research that highlights digitalization of innovation processes more generally, we focus on DIMS, as a specific class of software tools designed to support the digitalization of innovation management methods and activities. We posit that studies of specific classes of IT may be more beneficial for innovation mangers, who require less generic guidelines and results. As Durmuşoğlu and Barczak (2011) argue, the proliferation of IT tools makes it important for managers to determine in detail which ones provide value, not simply that IT tools can be valuable in general. Marion and Fixson (2021) also show that with the acceleration of digitalization of R&D activities in the past decade, the variety and intensity of use of digital tools has increased too. These well-developed digital tools get integrated into innovation processes (Endres et al., 2022; Huesig, 2015; Huesig and Waldmannstetter, 2013). However, a basic "the more, the better" logic likely is counterproductive for digitalization of innovation processes and leads to investments in IT tools that remain unused and produce unnecessary costs (Huesig and Endres, 2019).

To emphasize innovation management aspects, we focus on DIMS, which we define as advanced versions of innovation management software (IMS), which previously have been dismissed as computer-aided innovation (CAI) tools or not closely investigated (Huesig and Kohn, 2009; Huesig and Waldmannstetter, 2013).

DIMS also offer integrated solutions that capture the wider NPD process, as exemplified by Sopheon Accolade, SAP Innovation Management, or HYPE Enterprise. They connect all relevant NPD processes across business units and departments, as well as associated entrepreneurial ecosystems (Endres et al., 2022). DIMS establish a network of trusted partners and suppliers to work together on new solutions. And they provide a place where all of a company's technological knowledge and expertise can be shared and found when needed. This also includes the possibility of carrying out co-creation projects with customers in order to obtain their feedback. DIMS typically are used to provide an integrated solution to improve the NPD process quality and also support the critical methods, tasks and deliverables (Huesig and Endres, 2019; Huesig and Waldmannstetter, 2013). More and more they are embedded into ERP and PLM systems such as SAP Innovation Management (SAP, 2021) or Oracle Fusion Cloud PLM (Oracle 2022a; 2022b). This development shows the rising relevance of the digitalization in the innovation process.

DIMS promise potential benefits such as efficiency, effectiveness, competence, and creativity, though empirical studies of their actual usage and outcomes remain scare (Huesig, 2015; Huesig and Kohn, 2009).

Influence of Champions on IT Usage in NPD

According to the resource-based view (RBV) (Barney, 1991, 1997), IT resources such as software can create a competitive advantage if they are valuable, rare, inimitable, and nonsubstitutable (Bharadwaj, 2000), though the firm also needs to organize these resources appropriately to exploit their full potential. Such organization requires a digital resource such as DIMS to be used in the organization, especially for NPD, for which it can be critical (Durmuşoğlu and Barczak, 2011; Huesig, 2015). Such appropriate uses represent a precondition for reaping the benefits (e.g., efficiency, effectiveness, competence, creativity) of IT tools (Huesig and Kohn, 2009). When combined with complementary NPD capabilities, greater innovation capability in the organization, due to its use of DIMS, should increase the chances of successful innovations. Stated another way, the degree to which the benefits of DIMS can be realized depends on the firm's capability to use its functionality effectively.

Prior research in this field tends to focus on the uses of generic IT tools such as project management tools for NPD, covering frequency, extent, or effectiveness dimensions. These studies in turn demonstrate that champions affect both extent and frequency (e.g., Kawakami et al., 2015; Mauerhoefer et al., 2017). However, research into champions, promotors, and top management support for uses of IT tools has not differentiated their influence across different types of champions or areas affected by IT usage (e.g., business development, product management).

Championing behavior or promoter role theory in the context of innovation management goes back to Witte (1973) who refers to champions as promotors, described as people who seek to support the innovation process actively to advance innovation success. They can be distinguished as power promotors or specialist promotors. The former represent upper management and encourage innovation solely from their positions of power (Hauschildt et al., 2016), which also implies they bear financial responsibility for the decisions, know the company's long-term objectives and strategic orientation, and can secure necessary resources (Witte, 1973; Howell and Higgins, 1990), such as a strong innovation leader or political sponsorship (Jick, 1991). The latter, also known as technology promotors (Gurtner and Dorner, 2009), take lower hierarchical positions and drive innovation mostly by providing ideas that reflect their specialist insights and enthusiasm (Hauschildt et al., 2016). They can be influential though; as Lines (2007, p. 166) notes, "change recipients are more likely to accept influence attempts from persons perceived to possess critical and scarce knowledge." Hauschildt and Chakrabati (1988) propose adding process promotors, who function to overcome administrative barriers within an organization and mediate among various stakeholders using diplomacy (Nyström et al., 2014). Then relationship promotors take another role (Gurtner and Dorner 2009), such that they build internal and external networks to facilitate interorganizational communication (Gemuenden and Walter, 1995) and establish a foundation for cooperation in the innovation process. These various promotor concepts signal the differences in their roles and their potentially distinct effects on innovation success indicators (Gemuenden et al., 2007; Hauschildt and Kirchmann, 2001). We consider such distinctions in relation to DIMS usage.

Hypotheses Development

DIMS and NPD Performance

Arguably, general IT tools such as project management tools should enhance a firm's NPD performance, as measured by effectiveness or efficiency (Durmuşoğlu and Barczak, 2011; Heim et al., 2012; Mauerhoefer et al., 2017). IT can enhance NPD process efficiency by reducing cycle times and costs, as well as improving NPD process quality. Research shows that IT can both directly and indirectly effect NPD performance (e.g., Endres et al., 2022; Mauerhoefer et al., 2017). However, we lack empirical confirmation of such effects, or to which degree they depend specifically on DIMS usage. DIMS usage or DIMS usage frequency captures how often a digital system for innovation management is used in the firm. We argue that appropriate choices, implementation, and uses of different IT tools is a precondition of successful innovation that achieves efficiency, effectiveness, competence, and creativity outcomes (Huesig and Kohn, 2009; Huesig and Waldmannstetter, 2013). Given that usage has been appropriately embedded in NPD activities and processes, we predict that a greater degree of innovation capability in the firm that uses the DIMS contributes further to innovation success. Therefore, we propose:

H1: *DIMS usage frequency is positively related to NPD performance.*

Linking Digital Innovation Champions, through DIMS Use, to NPD Performance

Firms work to create the strategic, structural, and cultural conditions that enable NPD teams to innovate effectively (Wiengarten et al., 2013); they also need to create conditions to support the use of DIMS. A champion who supports IT initiatives, including DIMS usage, can be one such helpful condition (Felekoglu and Moultrie, 2014; Howell and Shea, 2006). This support increases initial and continued uses of the software (Venkatesh and Davis, 2000). In line with prior research, digital innovation champions promote the frequent usage of this tool by providing resources and encouraging employees to apply it more often to particular tasks (Barczak et al., 2007; Kawakami et al., 2015). In addition, promoter role theory suggests that introducing an innovation requires overcoming multiple barriers, each of which demands specific skills (Gemuenden et al., 2007; Hauschildt and Kirchmann, 2001; Witte, 1973). As Witte (1973) explains though, IT innovations need support from promotors, but their roles and competences are not necessarily embodied in single individuals. Rather, in larger organizations that apply divisions of labor, multiple members will be instrumental for providing the critical skills and taking promotor roles (Hauschildt and Kirchmann, 2001).

Ongoing uses of novel digital innovation tools also might require constant pressure from champions. We argue that the efforts of digital innovation champions, which we operationalize as the number of digital innovation champions, can help maintain NPD momentum inside the organization. Moreover, software tools generally provide benefits only if everyone in the target group (e.g., project team, ecosystem) uses them simultaneously. Joint usage ensures interoperability, smooth communication, and a common database (Endres et al., 2021; Marion and Fixson, 2021). Thus, we expect that champions increase DIMS usage frequency. By combining these insights with our prior arguments, we anticipate that digital innovation champions' effort, i.e., the degree of support by that person for DIMS, partly affect NPD performance through DIMS usage frequency. Formally, we hypothesize this logical connection as follows:

H2: DIMS usage frequency partially mediates the relationship between digital innovation champions' efforts and NPD performance.

Different Roles for Champions

We theorize that DIMS usage might depend on various champions, due to the unique forms of support they offer for innovation within the company. As we outlined previously, various promotor roles and skills facilitate various success dimensions of innovation (Gemuenden et al., 2007; Hauschildt and Kirchmann, 2001). Marion and Fixson (2021) offer evidence that management support for tool use can span various management levels, rather than being exclusive to the top management level, and managing tool choice and implementation is an increasingly important feature of innovation management. Therefore, we detail the roles of what we propose are key digital innovation champions, at both the C-suite and middle manager levels.

The *CEO* drives innovation through leadership (Sattayaraksa and Boon-itt, 2016) and decisive choices for the company (Papadakis, 2006). Innovations likely are important to CEOs, because they can influence profits, so they might allocate more resources for innovation (Yadav et al., 2007) or for DIMS. As a promotor, the CEO can overcome barriers, such as unwillingness, by sanctioning opponents and protecting supporters of DIMS usage (Hauschildt and Kirchmann, 2001).

The chief technology officer (*CTO*) also belongs to the top management team and takes responsibility for IT decisions (Nissen and Termer, 2014). This power promotor has an important role in innovation management (Medcof, 2008), especially if the company relies on technology as the basis for its innovations (Ehrlich, 2013). The CTO works to encourage other top managers to commit to and drive innovations (Garms and Engelen, 2018) and also provides necessary resources (Garms and Engelen, 2018; Mansfeld, 2011). In this view, CTOs might take dual roles: They exert power to overcome barriers, such as unwillingness, in a specific area of influence (e.g., technology decisions, R&D department) but also offer relevant insights into technological issues, in accordance with a technology promotor role (Hauschildt and Kirchmann, 2001).

Finally, among top management, the chief financial officer (*CFO*) (Menz, 2012) traditionally would control finances and accounting but today might be increasingly involved in strategy development and responsible for firm success (Göseke, 2008). These specialist promotors possess strong financial expertise, which they leverage to contribute to decisions about which IT tools to adopt (Hiebl et al., 2017). For example, they might analyze whether investing in DIMS is worthwhile and will provide added value for the company.

At the next level, innovation managers are instrumental and involved in all NDP processes (Sim et al., 2007; Maier and Brem, 2018). They provide the interface across various corporate departments (Servatius, 2012) and engage in broad fields of activity (Gernreich et al., 2018), as well as determining the procedure and goals of the innovation process. Thus, they are process promotors, but they also can function as technical or relationship promotors. Especially for innovation managers, software and IT tools are important, because the success of the innovation process and new products is a central focus. If they identify benefits of a DIMS, they will push its adoption and frequent use. Next, in promoting digitalization overall, IT managers influence the adoption and use of new software and IT tools for innovation (Krcmar, 2015). They recognize the potential benefits of such tools (Barczak et al., 2007), then integrate them into the existing IT and train organization members in their use while also encouraging their application to various NPD activities (Kawakami et al., 2015). These specialist promotors exploit their unique knowledge but also might have some degree of power to overcome barriers in a specific area of influence, such as IT decisions. Finally, the R&D manager is responsible for identifying new opportunities and selecting and pursuing new projects (Brettel et al., 2012; Engelen and Brettel, 2012). They provide a link between marketing and production, by receiving customer feedback from the marketing department and communicating it to the NPD team (Brettel et al., 2011), but also must plan for new projects and products (Teirlinck and Spithoven, 2013). To do so, they might develop an expanded innovation network in the company (Chiaroni et al., 2010). These specialist promotors have unique knowledge; they also might function as process promotors if they are responsible for leading the innovation project. They know about the potential benefits of software and IT tools, including enhanced information exchanges across departments (Kroh et al., 2018), such as marketing, production, and R&D. Project management and DIMS tools can help them pick appropriate projects (Durmuşoğlu and Barczak, 2011), so R&D managers may promote the adoption and use of DIMS.

In summary, DIMS usage frequency might be driven by various champions, which take on different tasks and roles within the company. Successful implementation then might depend on the selection of the best, or most appropriate, champions for a particular NPD process. We expect differences in their degree of importance, depending on their relevance for organizational decisions (power) or fit with the knowledge domain (innovation). The CEO and innovation manager typically combine power and knowledge promotor roles, implying they might have the greatest influence overall. But we also expect the other champions to encourage frequent uses of DIMS, even if to a lesser degree, because their influence or involvement might be relatively lower. Therefore, we propose:

H3: The (a) CEO and (b) innovation manager as digital innovation champions are more positively related to DIMS usage frequency, whereas the (c) CFO, (d) CTO, (e) IT manager, and (f) R&D manager as digital innovation champions are relatively less positively related to DIMS usage frequency.

DIMS Key Application Areas

Business development and product management both should be affected by DIMS within a firm, but they might rely on different DIMS functionalities (Huesig and Endres, 2019; Huesig and Waldmannstetter, 2013). Whereas business development engages in "tasks and processes aiming at preparing and supporting the implementation of growth opportunities within the constraints of a firm's strategic momentum" (Sørensen, 2016, p. 1), product management deals with forecasting, planning, developing, production, and promoting products at all stages of their lifecycles (Argouslidis and Baltas, 2007). That is, business development focuses on searching for and preparing growth opportunities, but product management integrates growth ideas into products and then promotes them. In the overall innovation process, business development thus tends to focus more in the front end. The importance of a CEO and innovation manager should affect both DIMS usage areas positively, but champions might have differentiated influences.

In detail, the CFO might seek controllability and reports of financial aspects. Although the financial function arguably is critical to innovation generally (Christensen, 1997; Christensen et al., 2008), CFOs also might promote financial transparency through innovation digitalization. Therefore, their primary interest likely focuses on the early, development stages of the NPD process, during which data availability tends to be limited, and financial projections are shaky. In product management areas though, outcomes tend to be more mature, so conventional reporting might be acceptable to the CFOs. In contrast, the CTO takes greater stakes in R&D operations and might delegate DIMS decisions to innovation managers when it comes to business development, rather than being the primary champion in this area. Instead, CTOs likely willingly promote digitalization on their "home turf" and exert more influence over the implementation of technological decisions.

We expect similar distinctions between IT managers and R&D managers. In both roles, actors mainly support product management and leave business development to innovation managers. The IT manager also might suspect DIMS uses for business development as illegitimate or threats to the consistency of the existing IT context. Marion and Fixson (2021) show that many choices are decentralized, made closer to the NPD process, such that they circumvent centralized IT systems. Such a scenario likely threatens IT managers' authority over the overall IT strategy, especially if the innovation manager promotes digital ambitions. For innovation managers, the challenge is to navigate the existing institutionalized context, manifested in the well-established roles of IT and R&D managers (Tumbas et al., 2018). These different areas of influence, insights, and interests thus should drive differences in DIMS usage, according to different management roles. Formally, we propose:

H4a: The CEO as a digital innovation champion is positively related to DIMS usage frequency in both business development and product management areas.

H4b: The innovation manager as a digital innovation champion is positively related to DIMS usage frequency in both business development and product management areas.

H4c: The CFO as a digital innovation champion relates to DIMS usage frequency positively in business development and negatively in product management areas.

H4d: The CTO as a digital innovation champion is positively related to DIMS usage frequency in both product management and business development areas, but more weakly in the latter.

H4e: The IT manager as a digital innovation champion relates to DIMS usage frequency negatively in business development and positively in product management areas.

H4f: The R&D manager as a digital innovation champion relates to DIMS usage frequency negatively in business development and positively in product management areas.

The proposed theoretical relationships are summarized in our conceptual framework in Figure 1.

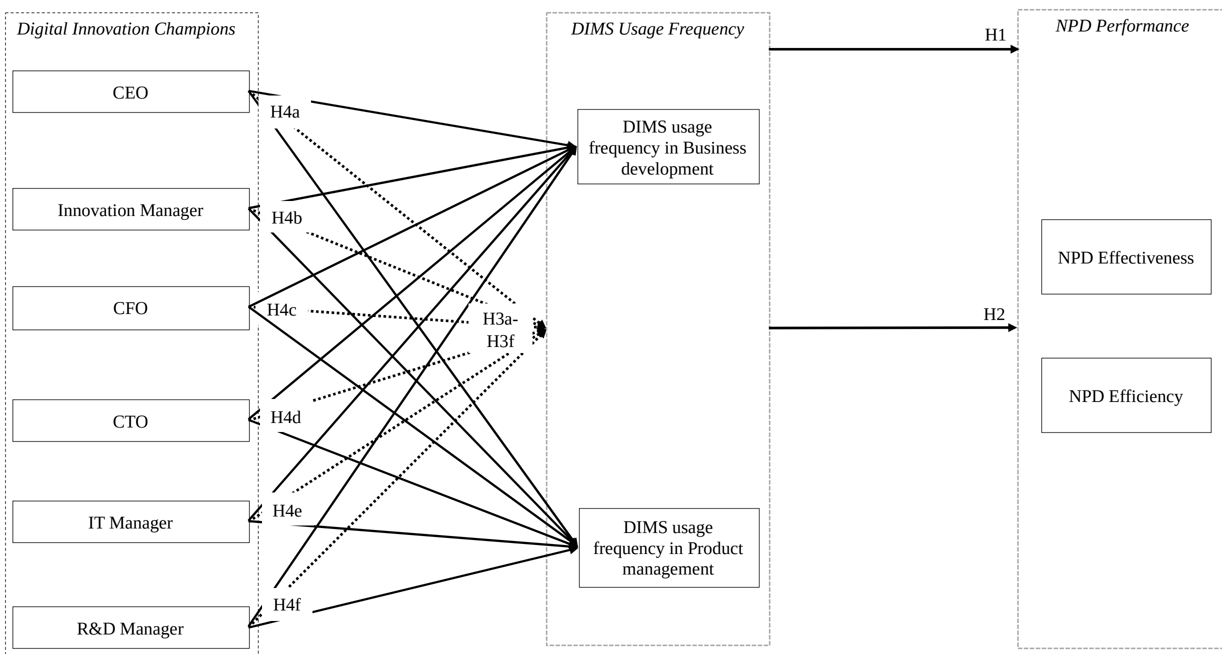

Figure 1. Conceptual Model

DATA

Data Collection and Sample Description

First, we randomly preselected 1540 firms with more than 50 employees from the DAFNE database; smaller companies usually do not use DIMS (Endres et al, 2021). Second, we randomly contacted managers from these firms, via email and the business platforms Xing and LinkedIn. Xing is the leading online business network in German-speaking countries, and LinkedIn is the leading international online business network. Through these networks, we could contact the informants personally. Third, we pretested the questionnaire with managers who were not included in the sample.

From the 520 personally contacted managers, 196 respondents were highly informed about the entire innovation process and projects as well as the use and performance of DIMS. Thus, we received 196 usable questionnaires for this study, for a response rate of 28%. Our respondents include IT managers, innovation managers, and R&D managers or equivalent. On average, our respondents have spent 10 years in their current management position. The sample covers a broad range of firms: 18% with more than 10,000 employees; 30% with 1000–10,000 employees, 27% with 250–1000 employees, and 25% with fewer than 250 employees.

We checked for potential nonresponse bias with two tests. First, we conducted a t-test of significant differences in the response behavior between early and late respondents. It did not reveal any significant differences between groups, so nonresponse bias is unlikely to be a concern (Armstrong and Overton, 1977). Second, we compared the distribution of the responding firms, in terms of firm size, with the original sample population (Rogelberg and Stanton, 2007). The results of the χ^2 test indicate no significant differences between the original population and our sample.

Measurements

We developed the questionnaire on the basis of a review of IT tools/software research for NPD and innovation management, websites from international innovation management software providers, five in-depth interviews, and the survey pretest (Huesig and Endres 2019; Gerbing and Anderson, 1988). We validated the content and refined the adapted scales and questionnaire for clarity and specificity, based on the content evaluations and editorial suggestions (DeVellis, 2016). We pretested the adapted, structured questionnaire among diverse research experts from academia and top managers not included in the survey sample.

All variables were measured with five-point Likert scales. According to a confirmatory factor analysis, composite reliability exceeded the threshold of .70. In support of convergent validity, the average variance extracted (AVE) was greater than .50 for each construct, and as an indicator of discriminant validity, the AVE of each construct exceeded the squared correlation of all other pairs of constructs (Bagozzi and Yi, 2012; Fornell and Larcker, 1981). Table 2 provides the descriptive statistics and intercorrelations for the variables.

	1	2	3	4	5	6	7	8	9	10	11	12
1. CEO	1.00	.51**	.58**	.66**	.60**	.38*	.64**	.25	.05	-.02	.35	.54*
2. Innovation manager	.51**	1.00	.34	.47**	.43**	.38*	.27	.43*	.10	.41*	-.04	.45*
3. CFO	.58**	.34	1.00	.58**	.50**	.26	.48*	.36	.52**	.02	.30	.32
4. CTO	.66**	.47**	.58**	1.00	.47**	.57**	.51**	.36	-.10	-.02	.27	.44*
5. IT manager	.60**	.43**	.50**	.47**	1.00	.45**	.30	.02	-.12	.33	.10	-.23
6. R&D manager	.38*	.38*	.26	.57**	.45**	1.00	.38	.17	-.13	.15	.42	-.05
7. DIMS usage frequency, product management	.64**	.27	.48*	.51**	.30	.38	1.00	.83**	.92**	.19	.23	.40**
8. DIMS usage frequency, business development	.25	.43*	.36	.36	.02	.17	.83**	1.00	.94**	.42**	.21	.42**
9. DIMS usage frequency	.05	.10	.52**	-.10	-.12	-.13	.92**	.94**	1.00	.27*	.21	.46**
10. Firm size	-.02	.41*	.02	-.02	.33	.15	.19	.42**	.27*	1.00	.19	.23

11. NPD effectiveness	.35	-.04	.30	.27	.10	.42	.23	.21	.21	.19	1.00	.57**
12. NPD efficiency	.54*	.45*	.32	.44*	-.23	-.05	.40**	.42**	.46**	.23	.57**	1.00
Mean	2.50	3.63	2.19	2.84	2.87	3.00	1.45	1.45	1.72	12730	3.37	3.12
SD	1.52	1.20	1.23	1.62	1.49	1.32	1.04	1.04	1.30	39252	.79	.82

*$p < .05$ (two-tailed).

**$p < .01$ (two-tailed).

Table 2. Descriptive Statistics and Intercorrelation Matrix

The DIMS usage frequency scale captures how often a digital system for innovation management is used and is based on Huesig and Endres (2019); we adapted it to refer to the business development and product management areas that we investigate. We adapted the scales measuring NPD effectiveness and NPD efficiency from Mauerhoefer et al. (2017) and Brettel et al. (2011). Our scale for the variables for the different digital innovation champions (CEO, CFO, CTO, innovation manager, IT manager, and R&D manager) reflect the degree of support by that person for DIMS and is based on Mauerhoefer et al. (2017). As a control variable, we include firm size, measured as the number of employees.

Common Method Bias

To obtain data about intrafirm processes, the use of key informants is common (e.g., Danneels, 2008; Gruber et al., 2010), but self-reports can create common method variance that biases the outcomes. This concern also might be exaggerated (for a summary of this controversy, see Schaller et al., 2015). Nevertheless, our statistical conclusions might be biased, so to minimize the risk of common method variance, we followed Podsakoff et al.'s (2003) recommendations and additionally conducted a marker variable test (Lindell and Whitney, 2001). First, we formulated the questions in the survey as precisely as possible. Second, we separated the dependent variables from the independent variables. Third, we guaranteed anonymity to the respondents. Fourth, we used a pretest to improve and ensure the comprehension of the questions before conducting the survey. Fifth, similar to Love et al. (2014), in the marker variable test to detect common method bias (Lindell and Whitney, 2001), we compare pairwise correlations of the key variables. In this technique, the marker variable should be theoretically unrelated to at least one variable in the study. Our marker variable does not significantly affect the correlations of the variables in the regression analysis. Thus, common method variance does not appear to be a serious concern for this study.

Analysis and Results

To test H1–H4, we employ ordinary least squares regression analysis in SPSS 26.0 (Cohen et al., 2003). To test for potential multicollinearity among the predictors, we used variance inflation factors. The calculation reveals no concerns about multicollinearity (Kleinbaum et al., 1998).

As the R^2 values show, the influence of digital innovation champions accounts for about 27% of the variance in DIMS usage frequency; the model with all the digital innovation champions attains an R^2 of .62. The R^2 values pertaining to DIMS usage frequency for the NPD effectiveness (.40) and NPD efficiency (.38) highlight the relevance of DIMS usage for NPD performance. Notably, the R^2 for usage frequency in business development (.78) strongly differs from that in product management (.37), implying a stronger impact of DIMS use for business development.

In Table 3, we note that DIMS usage frequency has a positive significant influence on NPD performance, including NPD effectiveness ($\beta = .56$; $p < .01$) and NPD efficiency ($\beta = .57$; $p < .01$), in support of H1.

To test H2, we used the SPSS-Plugin-In PROCESS for Model 4 with 5000 Bootstrapping Samples and a CI of 95% (Hayes, 2017). Also consistent with H2, we find that DIMS usage frequency partially mediates the relationship between digital innovation champions' efforts and NPD performance ($p < .05$). The results support the predicted influence of the CEO ($\beta = .40$; $p < .10$) and the innovation manager ($\beta = .25$; $p < .10$) on the general DIMS usage frequency too, independent of the application area. However, the influence of the other champions on general DIMS usage is not significant ($p > .10$), so we cannot fully confirm H3.

We report the H4 results in Table 4. For H4a, the CEO as a champion for DIMS has a positive influence on DIMS usage frequency in both business development ($\beta = .31$; $p < .05$) and product management ($\beta = .33$; $p < .10$) areas. Although the innovation manager has a positive impact on DIMS usage frequency in business development ($\beta = .42$; $p < .01$), we find no significant impact on product management and thus only partly confirm H4b. The CFO is positively related to business development ($\beta = .30$; $p < .10$), but we find no significant effect on product management ($p > .10$) and thus only partly confirm H4c too. The results for the CTO are not significant, and we cannot confirm H4d. Finally, we find support for H4e and H4f, because the IT manager and R&D manager both show negative links to DIMS usage frequency in business development (H4e: $\beta = -.28$; $p < .05$; H4f: $\beta = -.22$; $p < .10$) but positive connections in relation to product management (H4e: $\beta = .37$; $p < .10$; H4f: $\beta = .38$; $p < .05$).

Path from	**To DIMS usage frequency**	**To NPD Performance**		**Results**
		NPD Effectiveness (t-Values)	**NPD Efficiency** (t-Values)	
Digital Innovation Champions	.52*** (2.97)			H1: supported
DIMS usage frequency		.56*** (2.80)	.57*** (2.82)	H2(mediation): supported
CEO	.40* (2.01)	.43* (1.6)	.37** (1.80)	H3a: supported
Innovation manager	.25*(1.52)	-.17(-.76)	.36** (2.10)	H3b: partly supported
CFO	.23 (.95)	.22 (.79)	.12 (.56)	H3c: not significant
CTO	.11 (.61)	-.23 (-.78)	.26 (1.13)	H3d: not significant
IT manager	-.11 (-.59)	-.20 (-.82)	-.43** (-2.28)	H3e: not significant
R&D manager	.12 (.66)	.51** (2.1)	-.09 (-.48)	H3f: not significant
Firm size		.25 (1.22)	.20 (1.0)	

*$p \leq .10$. **$p \leq .05$. ***$p \leq .01$.

Notes: Significance tests are one-tailed for hypothesized relations and two-tailed for controls.

Table 3. Regression Results for DIMS Usage Frequency and NPD Performance

		Dependent Variables		**Results**
		Business Development	Product Management	
H4a	CEO	.31**(2.07)	.33*(1.31)	Supported
H4b	Innovation manager	.42***(3.35)	-.10(-.46)	Partly supported
H4c	CFO	.30* (1.68)	-.28(-.92)	Partly supported
H4d	CTO	.14 (.89)	-.19(-.70)	Not significant
H4e	IT manager	-.28**(-2.11)	.37*(1.62)	Supported
H4f	R&D manager	-.22*(-1.66)	.38**(1.72)	Supported
R^2		.78	.37	

*$p \leq .10$. **$p \leq .05$. ***$p \leq .01$.

Notes: This table reports ß-values, with t-values in brackets. Significance tests are one-tailed for hypothesized relations and two-tailed for controls.

Table 4. Regression Results for DIMS Usage Frequency by Area

Following Homburg et al.'s (2017) approach to evaluate the external validity of NPD effectiveness, we examine whether the variables are positively associated with firms' realized revenue growth (average revenue change rate in the previous two years) and patent growth (average change rate in the number of patents each firm registered in the previous two years). We obtained the revenue growth information from the DAFNE database (from Bureau van Dijk, a Moody's analytics company) and the patent growth data from the German and European Patent Offices' database. We calculated a simple ordinary least squares regression and found a significant effect of NPD effectiveness on both revenue growth and patent growth. These two measures of growth serve as indicators of a company's innovativeness (Baum et al., 2001; Endres et al. 2020; Kohli and Melville, 2019). Thus, these results indicate that the NPD effectiveness measure displays external validity.

General Discussion

Theoretical Contributions

With this study, we have sought to examine whether and how different champions influence DIMS usage frequency and the impact on NPD performance. Our results provide support for our hypothesized relationships, grounded in the RBV and the role of IT (Barney, 1991, 1997; Bharadwaj, 2000), as well as in the promoter role theory and discussions of innovation champions (Gemuenden and Walter, 1995; Hauschildt and Chakrabati, 1988; Hauschildt and Kirchmann, 2001; Witte, 1973). Specifically, we find a strong, positive relationship between the number of digital innovation champions and DIMS usage frequency, in line with research that indicates that champions in general have positive influences on uses of NPD IT tools (Barczak et al., 2007; Kawakami et al., 2015; Mauerhoefer et al., 2017).

We also specify the distinct influences of different champions on DIMS usage frequency. According to our results, only CEOs and innovation managers exert significant influences regardless of application area. These findings support the idea that promotors function like teams and take on the multiple roles needed to implement an innovation. The CEO, as might be expected, functions as a senior power promotor; the innovation manager instead takes complementary, potentially multiple roles, including process promotor but also technical or relationship promotor. Software and IT tools can be critical to innovation processes, especially when formalization is sufficiently high (Kock, et al, 2020), so if innovation managers are convinced of the benefits of DIMS, they drive its usage. These results also align with the idea that a team of champions who take multiple roles, rather than a single champion, is especially helpful for implementing digitalization in innovation processes (Hauschildt and Chakrabati, 1988; Witte, 1973).

With regard to the different application areas, we also reveal new insights. First, the CEO as a digital innovation champion encourages usage frequency in both business development and product management, as a universal power promotor. Second, the CFO and innovation managers both enhance DIMS usage frequency for business development but have no significant effect for product management. Therefore, identifying and relying on specific promotors to encourage DIMS usage in specific areas, for which they feel especially responsible or reap benefits, appears effective. For example, the CFO can better direct attention and energy toward the support of innovations. Surprisingly though, the CTO appears to have no influence in DIMS usage; perhaps people in this role rely on their subordinates, who are closer to the innovation action. Third and accordingly, the IT manager and R&D manager take operational roles. As champions for DIMS, they show a negative relationship with DIMS usage frequency for business development but a positive one for product management.

These findings regarding the need to choose champions carefully, according to functional areas, also raises the possibility of functional conflicts or institutionalized roles that might lead to counterproductive results for the organization (Tumbas et al., 2018). Counterproductive conflicts also could explain the performance implications stemming from the negative impact of IT managers on NPD efficiency. With exploratory evidence, Marion and Fixson (2021) suggest that operational digitalization choices are decentralized, which may create conflict with centralized IT departments. Our results hint in this direction: If IT managers use their authority over IT to overrule decentralized digitalization choices, NPD efficiency may suffer.

Finally, we show that through their effects on DIMS usage frequency, champions improve NPD performance, because DIMS is positively related to NPD performance, including effectiveness and efficiency. This finding resonates with studies of the general effects of IT for NPD (Barczak et al., 2007, 2008; Kawakami et al., 2015; Mauerhoefer et al., 2017) and offers empirical support for the benefits of DIMS, as claimed by Huesig and Waldmannstetter (2013).

Theoretical Implications

This study extends prior literature by examining particular types of champions and their relationships with DIMS usage frequency and, accordingly, their impacts on NPD performance. Our findings confirm studies that suggest IT resources combined with structural conditions within the company can increase technology effectiveness and improve NPD performance (Weingarten et al., 2013). That is, by examining the effect on DIMS usage frequency in general but also testing its effects on specific application areas (business development and product management), we extend existing theory about NPD champions (Barczak et al., 2007; Kawakami et al., 2015; Mauerhoefer et al., 2017), especially in relation to DIMS (Endres et al., 2022; Huesig and Waldmannstetter, 2013). Moreover, our study expands considerations of teams of champions with multiple roles, by denoting how different features of organizational areas can inform the implementation of digitalization in innovation processes (Hauschildt and Chakrabati, 1988; Witte, 1973). In an RBV context, our findings contribute to the ongoing debate within IT business literature regarding whether organizational resources (e.g., champion for DIMS) need to be combined with IT resources (e.g., DIMS) to explain sustainable competitive advantages (Wiengarten et al., 2013).

Managerial Implications

This study also advances managerial understanding. First, it demonstrates that firms using DIMS frequently experience better NPD performance than firms that use it less. Therefore, managers must pay attention to IT-related competences and how they leverage them to achieve NPD. Second, the support of champions is crucial to promote frequent DIMS uses. Champions can help employees involved in innovation processes apply DIMS effectively, such as by providing more IT training or aligning processes with DIMS more closely. To secure strong management support, the structure that incentivizes senior-level managers should emphasize IT usage. Firms might introduce a formal role, such as an NPD information officer, or expand an existing role to encompass digitalization while also working to raise DIMS awareness throughout more traditional IT management domains (Lanzolla et al., 2021; Singh and Hess, 2017). Some firms also might explicitly assign championing responsibilities to an existing top management team member (e.g., CEO, chief innovation officer), but others might establish a new role to complement the firm's senior management. Third, our findings can aid DIMS suppliers in consulting with their customers regarding how to improve utilization of their products for innovation.

Conclusion

Empirical research mainly establishes a general influence of executive champions on software uses for NPD, though without specifying the influence of these champions. Nor do prior studies detail the different roles that champions might take to encourage usage of IT technologies for innovation. By combining unique survey data with objective performance and patent data, we help clarify the digital innovation process and extend insights into the role of (digital innovation) champions, especially for DIMS. Surprisingly, the results reveal that IT and R&D managers can even reduce DIMS usage and its effects on NPD performance in business development settings while executive champions and innovation managers positively influence the usage and NPD performance of DIMS. These results demonstrate to firms that they might take a differentiated view of the effectiveness of champions and carefully select (digital innovation) champions to foster digitalization. This choice is particularly important in the context of digitalization, with its conflicting power constellations between traditional IT and innovation roles.

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