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User Integration in New Product Development: Field Insights

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Abstract: The traditional new product development (NPD) process is vertically integrated within a company, resulting in internally developed products by professionals. However, it encounters difficulties to optimally capture all innovation-relevant knowledge, which is distributed also among external actors such as product end users. This paper investigates if the theoretically proposed positive effect of integrating users in NPD on new product success is supported by evidence from the field. The aim is to summarize existing field insights in a conceptual model outlining the paths of influence of user integration in NPD on subsequent new product performance. By reviewing the findings of empirical studies based exclusively on real-field data from various industries, I identify factors that can be assigned to three groups: (i) Stage of the NPD process in which users are integrated, (ii) User-level factors, and (iii) Innovation setting factors. I map the relationships between the different factors in a holistic framework that can serve as guidance for practitioners who consider involving users in their innovation process.

JEL Classification: M3, O31, O32, O33

Keywords: User innovation, user integration, new product development, new product success.

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1. Introduction

The process of new product development (NPD) or innovation is of vital importance for the businesses, since new products generate revenue and enhance profitability. Organizations with a capability to develop successful new products gain competitive advantage and manage to remain viable in the market. This is the reason why companies search for ways to create the best performing new products. The traditional NPD process is vertically integrated within the organization, focuses on internal technological know-how and R&D, and results in internally developed products by professional engineers and designers. This traditional innovation model, however, encounters difficulties to optimally capture all innovation-relevant knowledge. Chesbrough (2006) introduces a new paradigm of "open innovation" postulating the identification and integration of external knowledge sources in the corporate NPD, with the underlying assumption that useful knowledge is widely distributed among many internal as well as external actors. One source of useful external innovation-related knowledge are product end users, since they know best what they need.

Practice has shown that commercially important innovations, such as the mountain bike, in various industries were initially developed by users rather than by business organizations (von Hippel, 2005). Consequently, companies start to purposely empower users to take an active role in their innovation activities. Current practice includes a broad scope of NPD tasks, traditionally the exclusive domain of professional developers, being shifted to users – varying from idea generation to actual product design, prototyping and product testing. Moreover, the emergence of new technologies (e.g. the Internet) and the trend of digitization have enhanced the connectivity among innovation-involved parties and have increased the feasibility of user innovation in virtual communities (Dogson, Gann and Salter, 2006). Companies such as Dell, Nokia, Ducati and LEGO have built user community platforms for involving users in NPD.

The increased application of user innovation as an alternative method for NPD raises the question if integrating users in the process in fact leads to better performing new products. Theoretical investigations and laboratory experiments suggest a positive impact of user integration on the development of more successful new products[2] and on reducing NPD risks

[2] In this paper the new product success is regarded as two-dimensional, comprising the dimensions "Competitive superiority" and "Sales performance". Competitive superiority encompasses the outcome for the user – new product quality and user satisfaction with the new product. Sales performance encompasses financial indicators of the new product performance such as sales, sales growth, market share, and survival in the market.

(e.g., Ogawa and Piller, 2006). However, there is no comprehensive investigation on the real-field validity of this effect. Extant field research on the commercial success of user innovations is very fragmented (Bogers, Afuah and Bastian, 2010), falling short to provide a holistic framework that gives an overview of the underlying relationships. Moreover, the complexity of the NPD process issues the challenge to conceptualize the exact paths and conditions under which user integration in NPD positively influences new product performance. Lacking such knowledge may cause an investment in user innovation activities that do not lead to the desired positive outcome and, eventually, to new product flops.

In this paper I aim to investigate if and through which paths the integration of users in the NPD process positively influences new product success in the field. For this purpose, I review and summarize findings of empirical studies published in innovation and marketing journals based exclusively on real-field data from various industries. My goal is to outline the main factors which affect the new product success in the case of user integration and to summarize these field insights in a holistic conceptual model that can serve as guidance for practitioners. Based on this conceptual framework, my second goal is to derive implications for the business, answering important questions for an effective integration of users in NPD: In which stage of the process is user input relevant, which user-level factors differentiate users who develop commercially attractive innovations, what is the role of the innovation setting for stimulating continuous and valuable input from users to the NPD process.

The paper is structured as follows: The next section constitutes the theoretical argumentation why the integration of users in the NPD process is suggested to lead to better performing new products. It also outlines what are the main groups of factors that are expected to have an influence on the outcome of user innovation. The third section presents the summary of the empirical findings based on real-field data on user integration in NPD. The discussed field insights are summarized in a conceptual model illustrating the major relationships. The main groups of influence factors are discussed in three subsections: Section 3.1 reports on the general commercial performance of user innovations and its dependence on the stage of the NPD process in which users are integrated. Section 3.2 summarizes findings on user-level factors and Section 3.3 summarizes findings on innovation-setting factors, which both influence the outcomes of the different NPD stages. Implications for the business are derived. The paper concludes in the last section with a short summary of the presented findings and derived implications.

2. Theoretical background

2.1. New Product Development as an Information Exchange Process

The importance of user input in NPD is explained theoretically by the process' high dependence on user-owned information which is costly to transfer (Lüthje, Herstatt and von Hippel, 2005). Lüthje, Herstatt and von Hippel (2005) regard NPD as a problem-solving task that requires two types of essential information as a resource – information about user needs and experiences and information about a product solution. Important need- and use-environment-related information is "local" to the user, whereas solution-related expertise is "local" to the manufacturer. Both types of information are further characterized as "sticky", that is costly to acquire, transfer and use. The different locus and the stickiness of the information result in each party being better positioned to execute NPD tasks related to their local information – users focus on need design and manufacturers on technology design tasks (von Hippel, 1994). According to innovation researchers Hauser, Tellis and Griffin (2006), successful NPD depends mostly on a deep understanding of user needs and product development outcomes meeting those needs. Therefore, researchers hypothesize that the mutual exchange of users and companies as information resource owners, opposed to the traditional firm-centric NPD model, will lead to a better performance of user-developed products versus company-created products (e.g., Gruner and Homburg, 2000).

Given the suggested importance of information exchange between users and manufacturers for successful NPD, factors that facilitate it can be expected to positively influence the outcome of the process. The information exchange between companies and users can be facilitated by several factors. One factor is the availability of toolkits for user innovation - sets of user-friendly design tools that enable users to innovate by carrying out certain need-related subtasks of the traditional NPD (von Hippel, 2001). By shifting NPD tasks to users, the toolkits for user innovation allow access to sticky need-related information and ease information processing. They also allow users to exercise iterative learning-by-doing, which is claimed to be highly important for the outcome of the NPD process (von Hippel and Katz, 2002). Another factor, facilitating information exchange, is digitization and the emergence of new information and communication technologies and applications such as the Internet and Web 2.0. New technologies give the possibility of virtual customer integration in innovation by lowering the cost of communication and they create possibilities for virtual conceptualization and computation (Dahan and Hauser, 2002; Sawhney, Verona and

Prandelli, 2005). Moreover, digital technologies give firms the opportunity to exchange information and harness the creativity of many diverse users dispersed all over the world. They facilitate the formation of virtual user communities and social networks and become basis of community-based user innovation (Nambisan, 2002).

For the purposes of the paper, I summarize all the factors related to the setting in which user innovation takes place under "innovation setting". These factors comprise, i.a., the vehicles provided by companies to users, so they can obtain, transfer and share innovation-related information – such as toolkits for user innovation, virtual applications or firm-hosted community platforms. It is expected that by manipulating the factors of the innovation setting in a certain way that facilitates information exchange, companies can influence the outcomes of joint product development with users.

2.2. Users as a Source of Innovation-Related Information

Another group of factors outlined in the theoretical research on user innovation are user-level factors. Not all users might be equally likely to develop valuable innovations. Users might have limited imagination about novel product needs and potential solutions because they are constrained by their own real-world use experience. The explanation stems from research on problem solving, according to which problem solvers facing new situations tend to stick to their familiar experience, an effect called "functional fixedness" (German and Barrett, 2005). Researchers developed the idea that specific advanced users, such as lead users or product experts, due to their focused set of characteristics and product experience, could be better positioned to envision new ideas and solutions needed later by the majority in the market (Ozer, 1999; von Hippel, 1986). Ozer (1999) defines as product experts the consumers having high product expertise, or more knowledge about performance attributes and physical product components. Von Hippel (1986) defines as lead users the users in a given domain with two specific characteristics: 1) they are ahead of the marketplace in facing certain needs that will become general for the market in the future and 2) they expect to significantly benefit from obtaining a solution to those needs, so they are motivated to innovate. Since lead users' needs foreshadow general demand in the market, von Hippel (1986) argues that the problems and solutions of lead users constitute an important innovation-related information and that they are a base for commercially attractive innovations. Therefore lead users are investigated by a large body of empirical research on user innovation.

According to research, a valuable resource for NPD is also the innovation-related knowledge formed, developed and diffused in various forms of user communities. Terwiesch and Xu (2008) explain the potential of community-based innovation for companies with the dispersion of innovation-related knowledge among many actors. When user problem solvers are concentrated in a community around a certain interest, the collective intelligence coming from their diverse backgrounds could be leveraged for innovative efforts (Terwiesch and Xu, 2008). In their study of the Linux Kernel development, Lee and Cole (2003) give another explanation for the importance of user communities for innovation - communities comprise large numbers of individuals who can identify flaws and drive new product quality through constructive criticism and error correction, rarely exercised in firms with hierarchical structures. Howe (2008) defines the act of making an open call to user communities for participation in NPD as "crowdsourcing" for NPD and proposes that companies could actively leverage the benefits of user networks.

The field insights presented in the next section shed light on the profile of users that fits optimally to different NPD tasks and on how community-based innovation builds further on the benefits of interaction with certain selected individual users.

3. Conceptual Model of Field Insights and Implications

The theoretical background provides arguments that user integration in NPD should lead to an improved new product performance. After a detailed study of empirical research on this effect based on real-field data, I have conceptualized the identified relationships in a holistic framework presented in Figure 1. In this section I elaborate on the findings.

3.1. Direct relationship and NPD-Stage dependence

As the ultimate outcome of the NPD process, the main dependent variable is new product success in terms of competitive superiority of the product and sales performance. The direct relationship between user integration in NPD and new product success is examined by Gruner and Homburg (2000), who explore data about new product projects conducted by German firms, members of the German Chamber of Industry and Commerce, from various industries. They find that the intensity of customer interaction during the NPD process is generally positively related to new product success measured in terms of both product competitive superiority and better financial performance. Further, Nishikawa, Schreier and Ogawa (2012) conduct an analysis within the consumer goods field about NPD of the Japanese household

goods producer Muji and compare the actual market performance of user- versus designer generated products. In the case of Muji, users are integrated in the ideation stage of NPD by generating new product ideas based on product themes published online by the company. Their findings show that user-generated products exhibit significantly higher unit and value sales performance (Nishikawa, Schreier and Ogawa, 2012).

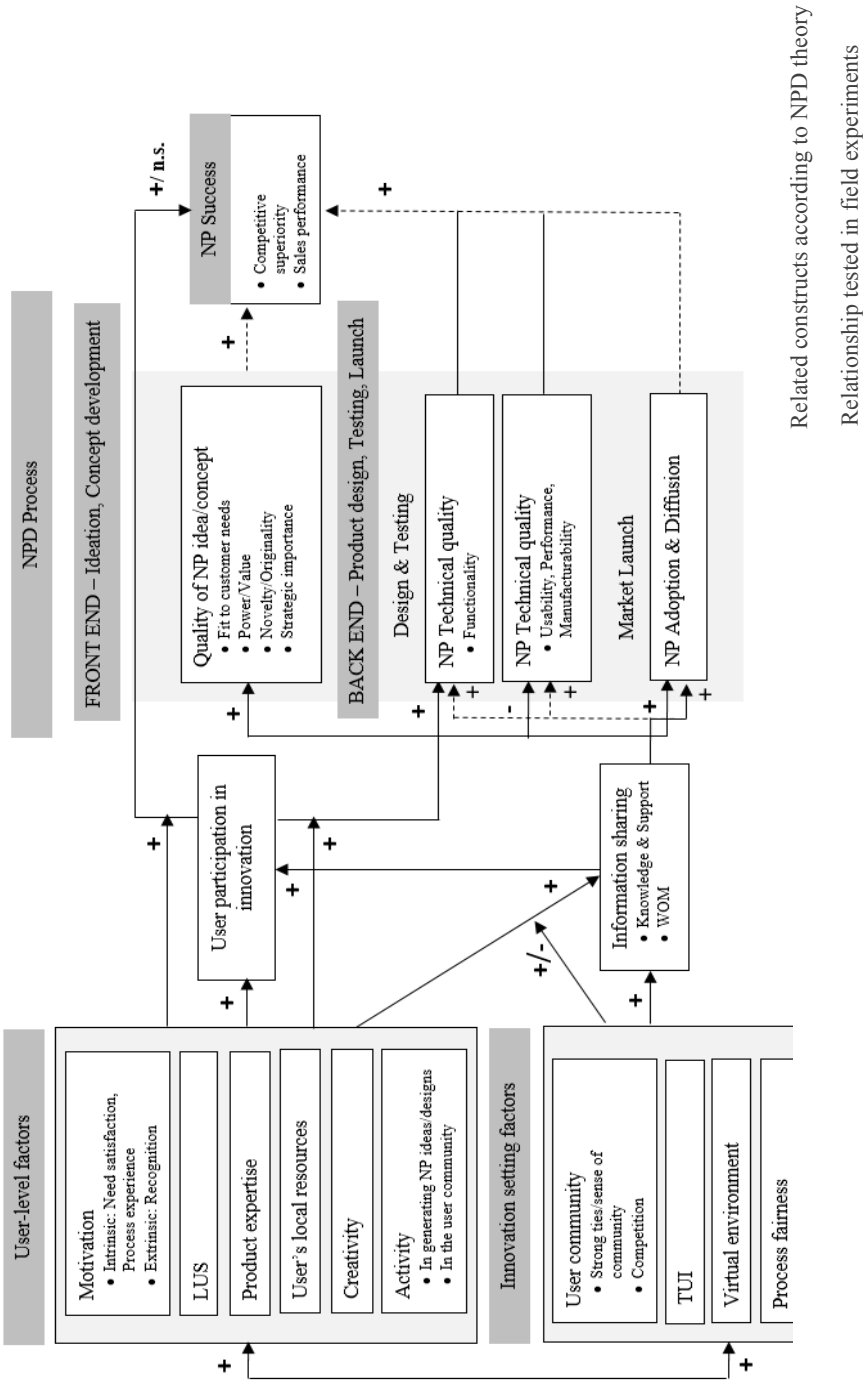

Figure 1: Conceptual model: User innovations and new product success from a NPD process perspective. NP stays for New Product. (Source: Author's own diagram)

However, other researchers report no significant direct effect, but rather a moderated relationship between user integration in NPD and new product success. Campbell and Cooper (1999) investigate various new product projects from the chemical, electronic, and industrial sectors and find that partnerships with customers for the development of new products do not directly influence new product performance in terms of profits and sales compared to in-house developed projects. They observe that sales performance is significantly correlated with the "level of product advantage" in terms of fit to consumer needs, which is significantly and positively influenced by interaction with users (Campbell and Cooper, 1999). These findings suggest that user innovation drives overall new product performance by the path of improving the new product concept quality – the outcome of the first NPD stages of ideation and concept development.[3]

In the service field, Carbonell, Rodriguez-Escudero and Pujari (2009) investigated the influence of the degree of customer involvement in NPD on its outcomes in a sample of Spanish firms that conducted service projects. The researchers find no significant direct relationship between customer involvement in NPD and competitive superiority or sales performance of the new product. Rather, they find that customer involvement in NPD is indirectly affecting product competitive superiority and sales performance through improved technical quality of the new service (Carbonell, Rodriguez-Escudero and Pujari, 2009).

In sum, the field research findings show that customer involvement in NPD does not necessarily directly predict the ultimate success of a product. First, as Gruner and Homburg (2000) find, the stage of the NPD process in which users are involved matters – intense interaction with customers yields a significant positive effect in the first two stages of the NPD process (idea generation and concept development) and in the last two stages (prototype testing and market launch) of the process whereas customer interaction in the project definition and engineering stage has no statistically significant impact on the new product performance. Moreover, rather than directly, user innovation is found to have a positive impact on the NPD outcome by positively affecting some drivers of new product performance that can be conceptualized as the outcomes of the different stages of NPD – new product idea/concept quality, new product technical quality, and new product adoption and diffusion (Campbell and Cooper, 1999; Carbonell, Rodriguez-Escudero and Pujari, 2009; Gruner and Homburg, 2000).

[3] According to the literature, the process of NPD consists of five stages: 1) Ideation, 2) Concept development, 3) Product design/engineering, 4) Product testing, 5) Market launch (Urban and Hauser, 1993).

The interaction with users in the first stages of ideation and concept development is found to positively influence the outcome of these stages – the new product idea/concept quality, which then drives new product success. In the case of idea generation at Muji, user-generated ideas were found to be more novel, original and strategically important for the firm (Nishikawa, Schreier and Ogawa, 2012). Poetz and Schreier (2012) report the same findings in the context of an idea contest for baby products - user-generated ideas score significantly higher on the "overall quality" dimension as well as on the separate dimensions "novelty" and "customer benefit" compared to the ideas generated by firm's professionals (Poetz and Schreier, 2012). With regard to the last two stages of the NPD process – prototype testing and market launch - the studies of Carbonell, Rodríguez-Escudero and Pujari (2009) and Gruner and Homburg (2000) reveal a positive relationship between user integration in NPD and new product success drivers such as new product technical quality and new product adoption and diffusion.

These field insights imply that, in order to achieve the desired positive outcome of joint NPD with users, companies should carefully select the stage in which they integrate consumers and they should have clear goals which drivers of innovations' success they would like to improve together with users, backed up by an understanding how to achieve these improvements.

3.2. User-level factors

The outcomes of the NPD stages, which drive new product success, however, are not positively influenced by user integration per se. Field insights show that these new product success drivers are positively influenced when users with specific individual user-level characteristics are involved as partners.

A prerequisite for user integration in corporate NPD activities is users' willingness and capability to participate and to reveal their input to the manufacturer and/or to the user community. From field research findings, several factors can be outlined that identify users who are active innovation partners. User-level factors such as intrinsic and extrinsic motivation, lead user status, product expertise, creativity and technology- and community-based local resources are found to significantly influence user participation in innovation and information sharing by the user. Findings include several intrinsic motives of users to develop innovations such as satisfying one's unique needs through direct use of the product (Morrison, Roberts and von Hippel, 2000) as well as enjoyment derived from the innovation process experience (Füller, Hutter and Faullant, 2011).

Users mostly develop innovations for personal benefit and are motivated to innovate by feelings such as enjoyment, autonomy and competence that are elicited from the innovation experience rather than by monetary rewards (Lüthje, 2004; Morrison, Roberts and von Hippel, 2000). Lead users experience the highest benefits from a self-developed product and lead user status is found to positively influence innovation activities (Franke, von Hippel and Schreier, 2006). The intrinsic incentives to develop an innovation are complemented by an extrinsic motivation to receive acknowledgement for one's innovative behavior in order to reveal an innovation in a company domain, in terms of peer and firm recognition (Jeppesen and Frederiksen, 2006; Morrison, Roberts and von Hippel, 2000). Besides motivation, the other significant user-level factors that influence user participation and information sharing are related to reducing innovation-related costs for users. Such factors are product expertise, creativity and user's local resources in terms of general technical expertise and community-based resources (Füller, Matzler and Hoppe, 2008; Lüthje, 2004; Marchi, Giachetti and Gennaro, 2011; Morrison, Roberts and von Hippel, 2000). All these factors could be used by companies to identify users who can be valuable and active innovation partners.

With regard to the different new product success drivers - more powerful, novel, original, and strategically important new product ideas are found to be generated to a greater extent by advanced users, with local resources, motivated by a compelling innovation experience (Franke, von Hippel and Schreier, 2006; Füller, Hutter and Faullant, 2011; Prügl and Schreier, 2006). Findings imply for practitioners that a promising strategy in order to assure active user contributions and to collect high-quality new product ideas for a successful new product is to target lead users or highly experienced users for cooperation in the ideation and concept development stages. Another implication is to focus on crowdsourcing activities, since the community is a form of local resources for users as well as provides external social reinforcement – both positively affecting user participation and the quality of user input.

In the succeeding product design and engineering stage, advanced users are found to develop significantly better new product technical functionalities but score significantly lower in creating usability, performance and manufacturability improvements[4] (Mahr and Lievens, 2012; Morrison, Roberts and von Hippel, 2000; Urban and von Hippel, 1988). These findings are in line with the statistically non-significant effect of user partnership in this stage on new

[4] The new product overall technical quality is determined by the degree to which it scores well on various physical aspects such as functionality, usability, and manufacturability (Urban and Hauser, 1993).

product performance in the study of German companies (Gruner and Homburg, 2000). The statistically non-significant effect of user partnership on new product performance in the engineering stage speaks for the necessity to keep this task for execution of the expert internal R&D team. However, the strongest impact of cooperation with users on new product performance is found in the next stage of product testing (Gruner and Homburg, 2000), implying that cooperation with general, representative users[5] in this stage could lead to improved new product usability and performance and thus to improved new product technical quality.

In the last market launch stage, advanced users are found to play again a major role as product disseminators – lead users are found to be opinion leaders who influence general demand in the market and thus speed up innovation diffusion (Schreier, Oberhauser and Prügl, 2007). This implies for companies that cooperation with lead users in the launch stage of the NPD process can increase the chances of new product adoption and reduce firm's marketing and customer education expenses.

3.3. Innovation-setting factors

Given the significant positive influence of user participation on certain new product success drivers, a main challenge for companies is to design a stimulating innovation setting that motivates and enables advanced and general users to provide valuable input. Users' motivation and ability to innovate are found to be affected by certain characteristics of the innovation setting. One such factor with positive influence is the existence of a vibrant and active user community with strong ties among participants, since this is found to induce compelling process experience, peer recognition, and by being a form of local resources for users (Bayus, 2013; Füller, Hutter and Faullant, 2011; Hung, Chou and Dong, 2011; Marchi, Giachetti and Gennaro, 2011). Another factor is the availability of toolkits for user innovation with diverse functionalities which are found to enhance users' lead user status (Prügl and Schreier, 2006).

Appropriate design of the innovation-setting factors is found to lead also to an improved quality of user contributions and improved NPD-stage outcomes. By manipulating the complexity of the toolkits for user innovation, companies attract different type of users and achieve different outcomes. More complex toolkits are manipulated to greater extent by lead users who develop radical innovations and they don't find simple, restricted-solution-space toolkits attractive. However, easy-to-use toolkits are found to be attractive for general users

[5] I regard as general users those users who do not possess lead user status or who are no product experts.

and they can enable the dissemination of user innovations among the general user population (Hung, Chou and Dong, 2011; Prügl and Schreier, 2006). Therefore, the application of toolkits for user innovation should be in line with the desired NPD-stage outcome and target users' needs and capabilities.

Besides affecting user-level factors and NPD-stage outcomes, the innovation setting design can facilitate information sharing such as the sharing of knowledge and support and Word-of-Mouth (WOM) and thus can further contribute to the quality of user innovations and accelerate their diffusion. For example, fostering user innovation in a community setting reduces firm support costs, because user community members share knowledge and provide informational support to each other (Franke and Shah, 2003). Another positive effect of the user community with respect to information sharing is that the interaction within the innovation community creates awareness of new products and fuels WOM with a certain valence. In this respect, Gebauer, Füller and Pezzei (2013) find that it is very important to act fair and transparent regarding the outcomes of the innovation process in order to avoid negative reactions in the community elicited by disregard of customer opinion. Companies are advised to pay attention to design the crowdsourcing assignment as a fair process.

A very favorable setting, where both toolkits for user innovation are easily applicable and user communities flourish, is the virtual environment. The use of Web 2.0 technologies, such as forums and online communities, is found to significantly positively influence innovation community members' intention of participation in innovation and on the provision of informational support. By building virtual communities and the application of virtual tools, companies could facilitate user-to-user interactions and information exchange, and so leverage the benefits from user innovation by receiving improved NPD input with lower costs (Bugshan, 2015; Mahr and Lievens, 2012).

In sum, findings show that the design of the innovation setting (toolkits for user innovation of different complexity, community with high activity and strong ties, virtual environment, fair process) affects user-level factors and the amount and quality of information sharing among users. Thus, it influences the outcomes of user innovation that drive new product success – generation of higher number of qualitative ideas, generation of radical new ideas, faster replication of user innovations. By manipulating the innovation setting, companies can leverage the benefits from user integration in NPD.

A summary of the implications discussed in the section this presented in Figure 2.

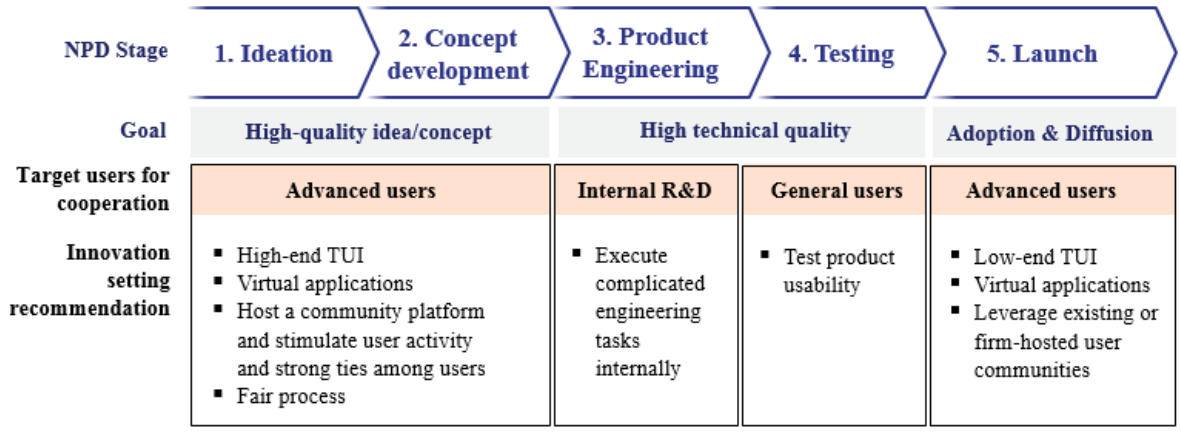

Figure 2: Target users for cooperation and innovation setting recommendations for different NPD stages

4. Conclusion

Empirical findings of field research show that cooperation with users for NPD can have a positive influence on new product success measures but under certain conditions. Rather than directly affecting commercial performance, user innovation is found to influence the product competitive superiority through certain drivers such as improved new product idea/concept quality and improved technical quality. In order to achieve the desired positive outcome of joint NPD with users, companies should carefully select the stage in which they integrate consumers and they should have clear goals which outcomes of which NPD stage they would like to improve together with users. The desired outcomes are achieved only when there is a fit between the transferred NPD task and the required user-level competences of the involved users.

In the first NPD process stages of ideation and concept development high-quality new product ideas are generated by more experienced, advanced users and they are the best target for cooperation. Providing users with toolkits of higher complexity will attract advanced users and will give them freedom to create more novel and radical solutions. Another recommendation is to engage in crowdsourcing activities in the first stages, since the community is a form of local resources as well as provides external social reinforcement and a compelling process experience for users – positively related to users' willingness to participate in innovation and to their ability to develop valuable input. When hosting an innovation community platform, several characteristics of the community should be taken into account, that have a positive influence on the innovation output. Companies should stimulate

high activity in the community, they should foster the creation of strong ties among participants and they should design the crowdsourcing assignment in a fair way. The statistically non-significant effect of user partnership in the next stage of product engineering speaks for the necessity to keep this task for execution by the expert internal R&D team. Users can be involved again in the testing stage of the NPD process by executing product usability tests with rather general users. In the launch stage the cooperation with lead users can increase the chances of new product adoption and reduce firm's marketing and customer education expenses. By building communities in a virtual environment and the application of virtual tools, companies can further facilitate user-to-user interactions and information sharing, and thus leverage the benefits from user innovation by receiving improved NPD input with lower costs for process support.

Drawing on the introduced field research findings, the advancement in technologies and possibilities to integrate users in corporate processes does not necessarily mean the outcome will be positive. However, if companies have a good understanding of the underlying mechanism how exactly value is created, developing innovations together with external actors, such as product end users, might lead to increased new product commercial success and become a source of competitive advantage. The introduced conceptual model can serve as a guidance for practitioners who are willing to engage in user innovation by helping them in related decisions, such as which users to involve in the different stages of the NPD process and how to design the innovation setting to reach the desired positive effects.

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