



# The role of users and customers in digital innovation: Insights from B2B manufacturing firms



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## ABSTRACT

Diffusion of digital technologies into the manufacturing industry has created new opportunities for innovation that firms must address to remain competitive. We investigate the role of customer and user knowledge in the digital innovation processes of three global B2B manufacturing companies. We find that the B2B manufacturing industry's characteristics influence how users and customers may be leveraged. Customers making the purchasing decisions are considered for knowledge about short-term changes in market needs, while users working directly with the products provide long-term guidance for digital innovation. We identify practices for acquiring, distributing, and using customer and user knowledge for digital innovation.

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## 1. Introduction

The diffusion of new digital technologies into the manufacturing industry creates new opportunities for digital innovation [69,73,104]. Combining digital technologies such as sensors, radio-frequency identification (RFID) tags, and cloud computing with non-digital products and services may give products and services new properties [100] and provide significant opportunities for new innovation [53,79,98,101]. Digitization of products is also likely to have significant disruptive effects [101,7,80,61,92] in that firms' competitiveness will depend heavily on the firms' ability to innovate using digital technologies.

Extant research on digital innovation has focused on the use of digital tools to facilitate innovation processes [80,4,25,68] and the innovation opportunities digital technologies create [100,30,102,103]. Managerial challenges associated with digital innovation processes have been of great interest, as the introduction of digital technologies to traditional innovation processes induces changes in architectures, development practices, cognitive framing

of problems, organizing logic, and interactions between actors [73,61,102,103,41,90]. However, little is known about the factors that influence the success of digital innovation processes [73,100].

For developing digital innovations, firms must have proficiency with digital technologies; however, they must also understand about their markets' needs [97], for which they must focus on their customers and users [17,34,49,63]. According to the knowledge-based view of the firm, interactions with customers and users can be examined from the viewpoint of customer knowledge and user knowledge, that is, knowledge *about* customers and users and knowledge obtained *from* customers and users [51]. How firms manage various types of customer knowledge and user knowledge is an important antecedent of their innovation outcomes [35,55]. User knowledge, in particular, is important for technological innovation and for the development of radical innovations [21].

This study addresses how B2B manufacturing firms leverage customer knowledge and user knowledge for the purposes of digital innovation. We analyze the data from a multi-case study of three firms that are presently adopting digital technologies for use in their product and service designs. The context of the study is that of a heavy manufacturing industry, and the case companies are component, system, and service providers related to, for example, marine vehicles, power plants, and production facilities. In this context, there is a need to distinguish between the roles of customers and users. Users, for example, vehicle or plant operators – who are not typically involved in purchasing decisions and the

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customers – who make the purchasing decisions, but do not directly use the products. The users are located in the customers' organizations or further down the supply chain. We focus on the differences between customer knowledge and user knowledge with respect to knowledge type and its influence on digital innovation. We also report on the practices firms use in acquiring, distributing, and using customer knowledge and user knowledge to support digital innovation and the challenges they face in doing so.

The study is organized as follows: first, we establish the theoretical background of the study by reviewing the literature on digital innovation and the role of customer knowledge and user knowledge in innovation. Next, we describe our research design, case selection, data collection, data analysis, and research context. Then we report the findings from the three cases. Finally, we explain our contributions to theory and practice.

## 2. Theoretical background

Digital technologies may have two kinds of impact on the innovation processes [69] of the manufacturing industry: they may facilitate the innovation process itself by providing tools for improving the performance of innovation process tasks, and they may make new kinds of digital innovations possible by adding new properties to the existing non-digital products and services. Following Yoo et al. [102], who build on a Schumpeterian definition of innovation, we define digital innovation as “carrying out new combinations of digital and physical components” to produce novel products and services.

Nambisan [68] reviews the extant literature on the use of digital technologies to facilitate innovation processes. Nambisan identifies four key dimensions of these technologies: First, IT tools for *process management* may help in the adoption of customized process models and promote integration between new product development and other organizational functions. Second, IT-based *project management* systems allow access to project information from diverse sources, which helps in project portfolio management and task coordination. Third, *information management* systems support information capture, sharing, and combination across the organization. Finally, digital technologies provide new means of *collaboration and communication* such as virtual innovation teams. More recent studies have investigated the adoption of digital 3D visualization tools [80]; the use of digital tools such as computational chemistry in drug development [25]; and the effect of simulation models on the automotive development process [4].

The second branch of literature considers the impact of digital technologies on innovation outcomes [69]. As the price-to-performance relationship of digital technologies improves, opportunities for digital innovations open up in diverse contexts [73,104,101]. In the manufacturing industry, digital technologies such as sensors, RFID tags, and cloud computing can be embedded into non-digital products and services to produce networked “smart factories” with flexible and adaptive production processes [53,79,98] and they give the existing non-digital products and services new properties. Yoo [100] proposes seven properties of digital artifacts including programmability, addressability, sensibility, communicability, memorability, traceability, and associability, which provide digital artifacts the ability to modify their operation logics, respond to messages and environmental changes, send and receive messages, record and store information, interrelate events over time, and relate to and identify with other entities. These properties provide significant possibilities for digital innovations [101].

While the innovation potential of digital technologies is widely recognized, few studies address the management of digital innovation processes [102,103,90]. Digital technologies have induced “non-reversible and deep changes in computing infrastructures, development practices, and cognitive framing of

computing problems” in both services and development processes [61]. Compared to traditional product innovation, digital innovation poses new challenges with respect to organizing logic, market dynamics, and architectural design [90]. Yoo et al. [102] propose that new digital innovations give birth to novel product architectures that require substantial organizational changes in the innovating companies. Moreover, digital innovation processes may instigate interactions between heterogeneous actors which create coordination challenges [103]. Additional challenges arise in matching digital and traditional innovation processes with varying paces of development when digital technologies are embedded into non-digital products [73,41].

The diffusion of digital technologies into new areas of application is likely to have far-reaching effects. Digital technologies open new opportunities but in doing so also create competitive pressure. As digital innovation has the potential to revolutionize the manufacturing industry by disrupting the existing product designs and business models [98,48,58], manufacturing firms must learn to adapt to such disruptions in order to ensure their long-term survival [29,91]. In the process of Schumpeterian creative destruction, some firms fail and new entrants take their place, as incumbent firms often have difficulty in adapting to disruptions from technological developments [22,93]. When disruptive technologies enter an industry, firms compete to develop novel designs based on new technologies and try out variations based on emerging opportunities [2]. As disruptions create opportunities outside traditional areas, they also enable radical innovation, that is, innovation that creates a new development trajectory [9]. In the end, dominant designs emerge as winners and become industry standards. Under such circumstances, managers should focus on the right innovation processes, but little is known about the factors that influence the success of digital innovation in organizations [100]. Our study addresses this issue.

Firms require knowledge about market *needs* and the *solutions* to fulfill those needs to develop successful innovations [97]. The properties of digital technologies make solutions for a wide range of needs possible [100,101]; hence, it is essential to understand the kinds of needs and also those that require utmost attention. Digital innovation is usually associated with agile innovation processes, characterized by short development cycles and quick accommodation to the changing needs [43,94]. However, in the B2B manufacturing industry on which the present study focuses, products are complex with long life cycles. Therefore, innovation comes with large investment, and major changes in development trajectories are rarely feasible. Consequently, identifying the right long-term direction early is more important in this industry than in industries wherein frequent adaptive readjustments are more practicable.

Firms must focus on their customers and users to understand the “need side” of innovation. The role of interacting with customers and users in the development of new processes and services has been recognized since the 1960s [17,34,63]. More recently, the literature on open innovation in particular has shown how firms can leverage customers and users to benefit innovation processes. Acquiring users' knowledge by involving advanced users early in the innovation process helps firms understand their needs and guides development in the right direction [55,95,54]. In addition, evidence suggests that orienting innovations on the customer improves the innovations' performance in times of technological turbulence [5,47]. Because of the wide use of IT technologies, new ways to acquire customer knowledge and user knowledge, such as online forums on product web sites and open source communities, have emerged [31,44]. Companies are also referring to end users in the search for new ideas [62]. Product inventions in which users are involved are more likely to succeed leading to innovations that the firm would not otherwise have developed [21]. However, systematic

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