



Journal of Product Innovation Management
Special Issue Call for Papers:

The Impact of Digital Manufacturing on Innovation Management

Guest Editors

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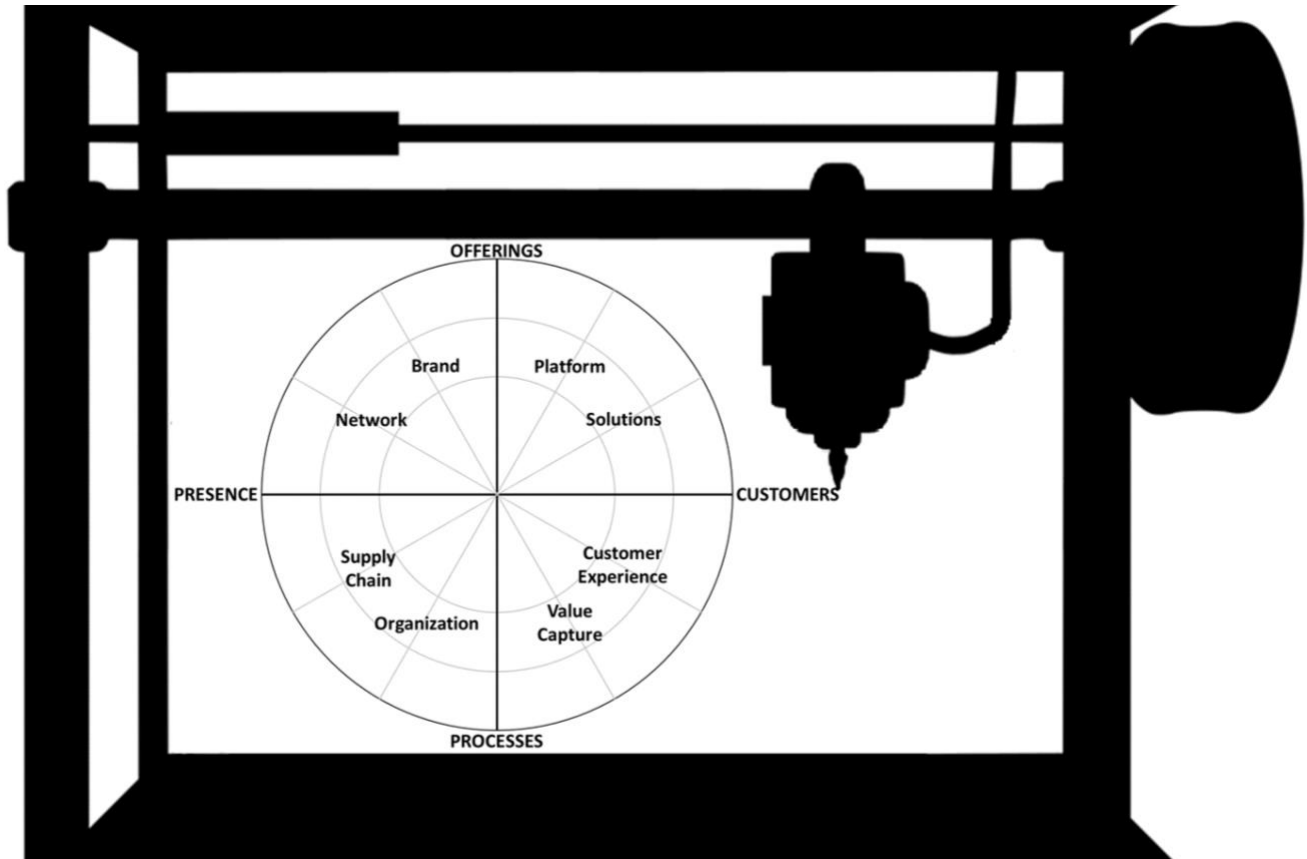
Motivation and Objective of the Special Issue

Product innovation scholars have a long tradition of interest in the manner that new products are *developed* (e.g., Cooper and Kleinschmidt, 1986; Griffin and Page, 1996; Montoya-Weiss and Calantone, 1994), however, this research has traditionally placed little emphasis on the manner in which new products are *manufactured*. This seems to be changing; there is growing interest in the impact of digital manufacturing technologies such as additive manufacturing (i.e., 3D printing), rapid manufacturing, and cloud-based manufacturing upon the manner in which new products are developed (Lilien, 2016; Rindfleisch et al., 2020). Digital manufacturing technologies blur the boundary between the digital and the physical and open up a new range of possibilities in terms of not only how new products are made, but also who is able to make them. These technologies have the potential to radically change the innovation landscape by allowing firms (and individuals) to economically manufacture small batches, customize products in ways not previously possible, reshape value chains, and engage in new forms of collaborative design (Cottelear and Joyce, 2014). Consider two digital manufacturing tactics used by Amazon that dramatically shift production activities when contrasted with traditional retailers' value chains. First, print on demand direct publishing allows book titles to be printed when ordered, enabling an extensive selection of titles to be offered to consumers without any inventory costs. Second, Merch by Amazon allows brands to upload digital designs that are printed on merchandise, providing value to both customers and brands by offering a variety of sizes and colors, again without inventory costs. The digitization of production has recently attracted the attention of scholars across a broad range of disciplines, who collectively recognize its potential to alter the way that products are developed, manufactured and distributed as well as its potential impact upon existing business models (Holmström et al., 2019; Rindfleisch et al., 2019). Researchers are only beginning to understand the implications of digital manufacturing; knowledge gaps with respect to innovation management are particularly relevant, timely and largely overlooked.

While some of the current and potential implications of technologies that enable shifts in production are incremental in nature (e.g., 3D printing allows for faster, more affordable and realistic prototyping) others

could prompt drastic departures from existing innovation practices and business models (e.g., shifting the role of users to producers). Digital manufacturing can meaningfully impact all dimensions of innovation (see Figure 1), from the products firms develop, to the channel by which these are delivered and the experience of the end customer.

Figure 1: Digital Manufacturing Impacts Every Dimension of a Firm’s Innovation Radar



Innovation Radar simplified from Sawhney et al. (2006). 3D printer image derived from svgsilh.com, released under Creative Commons CCO (Public Domain).

Although the timeline and potential of these technologies is still unfolding (Jiang et al. 2017), many scholars and practitioners believe that they will likely disrupt product innovation, retailing, value chains, inventory management, customization and the role of brands (Berman, 2012; Bogers et al., 2016; Jiang et al., 2017; Maresch and Gartner, 2019; Rindfleisch et al., 2019). The implications for societal welfare are also significant. Consider that in response to the 2020 COVID-19 pandemic, a small group from Chile digitally designed a 3D printable mask made from a copper-infused thermoplastic. They uploaded the design so that anyone in the world who had access to a 3D printer and this material could download and print it out freely.

While this call for papers extends beyond 3D printing to other digital manufacturing technologies, we note that only one article focused on the impact of 3D printing has appeared in the *Journal of Product Innovation Management* to date (i.e., Rindfleisch et al., 2017). It is noteworthy that research has appeared in *JPIM* on many of the themes we touch on here without particular emphasis on digital manufacturing, for instance toolkits and mass customization (e.g., Franke and Hader, 2014; Jeppesen, 2005). It is our hope that researchers will extend this inquiry into these domains by investigating questions specifically related to one or more of the dimensions of innovation influenced by digital manufacturing (see Figure 1).

Given that 3D printing and other digital production technologies are meaningfully affecting innovation practice with respect to these research topics, and that research lags behind industry practice, this special issue of *JPIM* seeks out rigorous, meaningful research pertaining to digital manufacturing, the shift to distributed production and product innovation. The objective of this special issue is to stimulate new research at the intersection of digital manufacturing technologies and product innovation from an interdisciplinary group of scholars. The special issue seeks to spur new theoretical developments and practical insights to better prepare both scholars and managers to deal with the realities of production shifts as digital manufacturing technology continues to advance. We seek submissions that will explore not only the value of using digital manufacturing technologies for product innovation, but also their impact on a broader set of issues, ranging from business models to environmental sustainability.

Suggested Topics and Research Questions

As outlined by Rindfleisch et al. (2017), digital manufacturing technologies - such as 3D printing - raise a number of vital research questions for firms, supply chains, products and consumers. Thus, we welcome research that examines the impact of these technologies upon the manner in which firms engage in product development, the nature of products themselves and the role of consumers in this process. Consistent with *JPIM*'s research directives (Noble and Spanjol, 2019), we encourage rigorous, multidisciplinary submissions with clear relevance to business practice. We welcome all forms of inquiry, including quantitative, qualitative and conceptual submissions. A non-exhaustive sampling of research questions that are appropriate for this special issue is included below:

Dimension of Innovation (with <i>definitions</i> from Sawhney et al. 2006)	Research Challenges Related to Digital Manufacturing
Offerings <i>Develop innovative new products or services.</i>	<p>Given the potential to continuously iterate on digitally manufactured offerings (Bogers et al., 2016), what are best practices for “freezing” 3D printable product designs? How does this relate to existing notions of dominant design?</p> <p>Given the increasing use of 3D printing for large scale projects such as houses, apartment buildings and bridges (Economist, 2015) and the potential for more efficient materials usage (Maresch and Gartner, 2019) what are the sustainability considerations of 3D printable offerings and other digitally manufactured products?</p>
Platform <i>Use common components or building blocks to create derivative offerings.</i>	<p>How can firms leverage users/communities empowered to innovate derivatively via 3D printing (De Jong and De Bruijn, 2013; Rindfleisch et al., 2017)?</p> <p>How can intermediaries and platforms (e.g., 3D Hubs, Shapeways) facilitate innovation?</p>
Solutions <i>Create integrated and customized offerings that solve customer problems.</i>	<p>How can digitally-enabled mass customization best create differentiation and value to customers?</p>
Customers <i>Discover unmet customer needs or identify underserved customer segments.</i>	<p>Can the data generated by 3D printing technology be used to allow firms to better understand user needs (Rindfleisch et al., 2017)?</p> <p>How can 3D printing most effectively enable early product feedback from customers (West and Bogers, 2014)?</p>

<p>Customer Experience <i>Redesign customer interactions across all touch points and all moments of contact.</i></p>	<p>Will consumers shift en masse to online repositories for product design or will this be contained to tinkerers (Jiang et al., 2017)?</p> <p>What are the most appropriate theories to understand consumer response to the option to produce products themselves?</p>
<p>Value Capture <i>Redefine how company gets paid or create innovative new revenue streams.</i></p>	<p>Intellectual property protection has been problematic for digital goods (Jiang et al., 2017). What is the role of intellectual property protection for digitally manufactured innovations?</p> <p>3D printers have been one of few highly visible examples of open hardware, particularly through the RepRap (<i>replicating rapid prototyper</i>) community (Stanko, 2020; West and Kuk, 2016) where firms have been seen switching from more open business models to more closed ones as well as blending these two models (Appleyard and Chesbrough, 2017). What are the causes and effects of blending and switching behaviors?</p>
<p>Processes <i>Redesign core operating processes to improve efficiency and effectiveness.</i></p>	<p>How should product design be changed to best take advantage of 3D printing for rapid prototyping (Luchs et al., 2016)? What are the best practices for 3D printing-enabled rapid prototyping?</p> <p>How does digital manufacturing impact the optimal timing, sequence and scope of traditional innovation activities? How do long established NPD practices, such as the stage gate model, require adaptation for digitization and the ability to quickly iterate (Rindfleisch et al., 2017)?</p> <p>What are the conditions under which 3D printing is most (least) effective? What is the role and effect of 3D printing upon prototyping compared to other digital alternatives (e.g., augmented/virtual reality)?</p>
<p>Organization <i>Change form, function or activity scope of the firm.</i></p>	<p>Can digital technologies be helpful in reducing barriers to communication and cooperation between design and marketing (Beverland et al., 2016)?</p> <p>Does a shift towards distributed production imply that a smaller group of less diverse firms will be involved with some aspects of product innovation?</p> <p>Makerspaces have played a significant role in providing access to hardware and training related to 3D printing and other technologies (Svensson and Hartmann, 2018). Can firm involvement in makerspaces have positive implications for innovation?</p>
<p>Supply Chain <i>Think differently about sourcing and fulfillment.</i></p>	<p>Given the shifts that these technologies allow in production and the reorganization of channel responsibilities, what are best practices for collaborative innovation with distributed production? How does digital manufacturing enable B2B collaboration, for instance between established firms and startups/SMEs?</p> <p>What theories are most appropriate for understanding the nature of production shifts and their impact on product innovation?</p>
<p>Presence <i>Create new distribution channels or innovative points of presence, including the places where</i></p>	<p>What is the potential of dispersed 3D printing “micro-production” centers located close to customers (Luchs et al., 2016)?</p> <p>Given the potential to bypass traditional manufacturing, under what conditions should firms market digital rather than physical goods ("digital encapsulation", Holmström et al., 2019)?</p>

<i>offerings can be bought or used.</i>	How does the sharing economy facilitate digital manufacturing and its impact on innovation?
Network <i>Create network-centric intelligent and integrated offerings.</i>	While 3D printing communities have enabled informal collaboration via remixing (Friesike et al., 2019; Stanko, 2016), the implications for marketable products and business models are not well established. Will a price per print, subscription or open access model prevail (Bogers et al., 2016)?
Brand <i>Leverage a brand into new domains.</i>	What is the role of brand in an environment in which 3D printing has the potential to separate product design from manufacturing (Rindfleisch and O’Hern, 2015; Wang et al., 2019)?

Submission Deadline and Anticipated Publication Timeline

<i>Milestone</i>	<i>Date</i>
Call for Papers announcement	April 15, 2020
Ideation session at 2021 JPIM Research Forum (optional)	September 19-20, 2020
Submission deadline	April 15, 2021
First round decisions	August 1, 2021
Virtual conference (for authors with invited revisions)	Fall 2021
Revision due	March 15, 2021
Second round decisions	June 15, 2022
Second revision due	August 31, 2022
Third round decisions, accepted articles begin appearing online	November 15, 2022
Third revision due (if necessary)	January 31, 2023
Final editorial decisions completed	February 15, 2023
Anticipated issue publication	Summer 2023

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