Digitization in Production: A Timely Opportunity

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ABSTRACT

Using modern digital technology, the production team aspires to innovate and enhance existing procedures. However, the majority of the time, information about these new technology exists outside of a company's walls. The idea of absorptive capacity, as well as literature on open innovation, are used by the authors to investigate the function of external search in the digitalization of the manufacturing industry. Companies in the manufacturing industry who want to digitize their processes can profit from inbound open process innovation, but the effectiveness of this approach differs depending on which cluster of digital technologies is being used. In general, the findings imply that enterprises should focus on developing strong links with a small number of external knowledge partners rather than maintaining superficial relationships with a large number. An investigation of the relationship between enterprises' external search and their use of digital technology is presented in this paper, which contributes to the expanding body of literature on the digitalization of manufacturing. It contributes to the literature on open process innovation by providing early empirical insights.

Key words

Digitization, Innovation, Process Innovation, Industry Revolution

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INTRODUCTION

Digitization is a hot topic in production. Digital technology may potentially be shaping a new industrial revolution (Kagermann, 2015). It enables dramatic and gradual process innovation. It offers lower manufacturing costs and greater flexibility, two competitive advantages generally considered as trade-offs (Boyer and Lewis, 2002). Due to these potentials, many firms are actively implementing new digital technology. Firms frequently lack expertise about new digital technologies, their benefits and downsides. They need technology knowledge to reinvent their processes, which may be lacking or rudimentary within the organization. So they must look for it elsewhere. In this research, we investigate the significance of external search in factory digitalization.

We employ the idea of absorptive capacity (Zahra and George, 2002) to examine how well organizations can absorb and apply external information. This theoretical approach is essential for open innovation, which is the ability to innovate through external information sharing (Chesbrough, 2003). The open innovation literature predicts that organizations will innovate more successfully when they are open to ideas (Reichstein and Salter, 2006). For example, open innovation refers to the free sharing of knowledge with third parties as opposed to no or limited knowledge interchange (i.e., closed innovation) (Chesbrough, 2003). Open innovation requires organizations to actively seek out and use information from beyond their own walls (Laursen and Salter, 2014; Pasupuleti, 2015a).

Manufacturing digitization requires process advancements. Despite this, open innovation has gotten little attention in the process innovation literature (Chesbrough, 2003). Customers, suppliers, rivals, technology vendors, research institutes, or other industries that use open process innovation to reinvent their processes. Lack of internal expertise and resources, fast technological development, and rising fragmentation of global value chains are all grounds for external search (Chesbrough, 2003).

One of the key goals of this article is to provide light on the relationship between external search efforts and the digitalization of industrial processes. We look at whether open process innovation is a helpful notion for firms who are attempting to implement digital technology into their operations. Although integrating technology for the purpose of technical maturity is beneficial to the firm's competitiveness, it does not inevitably boost the firm's competitiveness (Deuse et al., 2015). We are thus investigating the relationship between the extent of adoption of digital technology and operational performance as a secondary aim. The following is the research question:

RQ. What is the relationship between the deployment of digital technology and operational performance?

ROLE OF DIGITAL TECHNOLOGIES IN PROCESS INNOVATIONS

In industrial research, the management of process innovations has a long history, and it is often regarded as one of the most important aspects affecting competitiveness (Adner and Levinthal, 2001). Process innovation, according to the Organization for Economic Cooperation and Development (2005), is defined as "the introduction of a new or considerably better manufacturing or delivery technique" (p. 49). Not only can process innovations contribute to performance gains, but they are also required for the development of new goods, which is critical for the success of any company, but this is especially true in the manufacturing industry (Frishammar et al., 2012). Considering the onset of the Fourth Industrial Revolution (also known as Industry 4.0) (Kagermann, 2015; Pasupuleti, 2015b), it is projected that process improvements based on new digital technologies would fundamentally change the manufacturing industry.

In many cases, process innovation necessitates the use of new information and communication technologies. Manufacturing process innovation, in particular, is facilitated by the use of sophisticated manufacturing technologies, which are becoming increasingly popular. Today, digitalization is incorporated into all of these modern production methods, including additive manufacturing. It has been demonstrated in several studies that digitalization may have a major influence on the competitiveness of industrial organizations (Bauernhansl, 2014). Digital technologies exist in a variety of shapes and sizes, and include computing, communication, connection, and information processing capabilities, among other things. A great deal of effort has been put into

summarizing and grouping new digital technologies (for example, the major consulting firms have published white paper reports with varying degrees of content overlap), but there is no general agreement on which technologies should be included or excluded from the definition of "digital manufacturing."

Advanced robots, additive manufacturing, and machine-to-machine (M2M) communication are transforming the way items are manufactured and processes are structured on the factory floor. These digital components of hardware-related technologies are primarily responsible for this transformation. Furthermore, innovations such as mobile devices, augmented reality, and drones can assist the manufacturing worker in his or her daily tasks. Product and process tracking is made possible through identifying systems such as barcodes, sensors, radio-frequency identification (RFID), and near-field communication (NFC). These data are collectively referred to as big data, and they may be mined and analyzed using traditional statistical or machine learning techniques. Digital twins of goods, processes, and assets may be created using the data, allowing for less expensive experimentation and problem-solving as a result of the data (Kagermann, 2015; Pasupuleti, 2015c). Sending data to cloud computing services that are accessible over the Internet may be utilized for remote analytics and the development of new product and service offerings. Finally, blockchain technology can assist in the management of data flow between companies in the supply chain.

OPEN INNOVATION AND OPEN PROCESS INNOVATION

Because of the wide range of digital technologies available and the inherent complexity of these technologies, it is difficult – if not impossible – for businesses to be fully informed about all of the potential presented by digital technologies. By pursuing an open strategy, according to the literature on open innovation, businesses may get access to information that is located beyond their own walls and, as a result, develop their own processes (Reichstein and Salter, 2006). Chesbrough is credited with coining the term "open innovation" (2003). While some have attacked the notion for being stale, others have stated that it provides a "new paradigm for managing innovation," according to them (Chesbrough and Bogers, 2014). Since its first appearance in the literature, open innovation has drawn a great deal of attention, with the majority of studies focusing on product innovation activities and less on process innovation (Crossan and Apaydin, 2010).

Reichstein and Salter (2006) stated that open innovation applies to process innovations as well as product innovations, and they used the phrase "open process innovation" to describe this. There is some evidence that organizations that are more open to acquiring external knowledge sources tend to be more innovative in their operations than firms that are more closed to external knowledge sources. A study published in the operations management literature found that an open relationship between a supplier and a buyer has a positive impact on the buyer's process innovation activities. Wagner and Bode (2014) found that an open relationship between a supplier and a buyer has an impact on the buyer's process innovation activities.

ABSORPTIVE CAPACITY

A company's ability to learn about new technologies depends on its ability to access external knowledge sources (Cohen and Levinthal, 1990). In order to enhance their operations, the firm's responsibility is to acquire this information, integrate it, then transform the new technologies inside the existing knowledge base and use the

technologies to achieve this goal (Zahra and George, 2002). The idea of absorptive capacity may be used to explain this process in more detail (Cohen and Levinthal, 1990). For example, although the first two jobs of obtaining and assimilation of information are concerned with the prospective absorptive capacity, the final two tasks of transformation and exploitation are concerned with the actual absorptive ability (Zahra and George, 2002). Manufacturing companies wishing to boost process innovation must prioritize increasing their ability to absorb information from both within and outside their own organizations' borders.

To boost a company's absorption capacity, one strategy is to make investments in internal research and development (Robertson et al., 2012). Despite the fact that Cohen and Levinthal (1990) used an internal viewpoint to develop absorptive capacity, the theory has expanded to include a more dynamic approach as a result of the work of Zahra and George (2002), among other researchers. For example, Lichtenthaler and Lichtenthaler (2009) used absorptive capacity to develop a capability-based framework for open innovation that was based on absorption capacity. They distinguished between the location of knowledge – either internal or external – and the subsequent tasks in the innovation process of knowledge exploration (i.e., searching for knowledge about new digital technologies), retention (i.e., absorbing knowledge about technologies), and exploitation (i.e., putting knowledge about technologies to use) (i.e. implementing new digital technologies). Absorbent capacity is a critical facilitator for the retention and utilization of information (Robertson et al., 2012). As a result, a current view of absorptive ability includes the investigation of external information (that is, knowledge that is located beyond the confines of the company).

The literature on open innovation, which is based on the notion of absorptive capacity, helps explain how information flows beyond the borders of organizations. Open innovation activities may be divided into two types of knowledge transfer: in-flow (from the outside in) and out-flow (from the inside out) (Enkel et al., 2009). For a corporation to be able to accept information into its organization, it must first look for external sources of knowledge from which it might absorb knowledge. Laursen and Salter (2006) divided the search process into two dimensions: the search breadth and the search depth. Laursen and Salter (2006) classified the search process as follows: According to the literature on open innovation, the breadth and depth of external search are significant ideas to consider when estimating the process innovation performance of a manufacturing firm's process.

MANAGERIAL IMPLICATIONS

We discuss three consequences for practitioners in this paper. First and foremost, when it comes to engaging in the digitalization of manufacturing, external search is quite crucial. Practitioners, in particular, must do in-depth rather than broad searches. According to the findings of this study, businesses would be better served by focusing on a few deep relationships rather than a large number of wide ones. Second, in accordance with the absorptive capacity perspective, practitioners should assess their internal knowledge before doing an external search since a larger internal knowledge base appears to boost the effectiveness of an external search Third, it was discovered that digitization was more closely connected with volume flexibility than it was with cost reduction. Because of this, utilizing digital technology as a way of generating short-term financial gains may result in expectations that are not met or exceeded.

CONCLUSION

This research contributes to a better understanding of the relationship between open process innovation and the digitalization of manufacturing. It was discovered that a higher degree of adoption of digital technology in a company was associated with a greater depth of external search for process innovations. The breadth of search results, on the other hand, did not appear to be a statistically significant determinant of digital technology adoption. In general, this means that when looking to boost their usage of digital technology, businesses should look deeply rather than broadly. It is more noticeable for certain technological clusters that the influence of external search depth is greater than for others. Search depth is particularly beneficial for systems that enable networking and shop floor connectivity. Finally, we discovered that a higher degree of adoption of digital technology is associated with enhanced volume flexibility, but that there is no statistical evidence that this connects with improved cost competitiveness in the manufacturing industry. In general, we believe that open process innovation is a promising notion for scholars as well as practitioners alike.

REFERENCES

Adner, R. and Levinthal, D. (2001). Demand heterogeneity and technology evolution: implications for product and process innovation. *Journal of Manufacturing Science and Engineering, 47*(5), 611-628.

Bauernhansl, T. (Ed.) (2014). Industrie 4.0 in Produktion, Automatisierung und Logistik, Springer, Wiesbaden.

Boyer, K.K. and Lewis, M.W. (2002). Competitive priorities: investigating the need for trade-offs in operations strategy. *Production and Operations Management, 11*(1), 9-20.

Chesbrough, H. and Bogers, M. (2014). Explicating open innovation: clarifying an emerging paradigm for understanding innovation. New Frontiers in Open Innovation, Oxford University Press, Oxford, 3-28.

Chesbrough, H. W. (2003). Open Innovation: The New Imperative for Creating and Profiting from Technology. Harvard Business School, McGraw-Hill, Maidenhead, Boston, Mass.

Cohen, W. M. and Levinthal, D. A. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128-152.

Crossan, M.M. and Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: a systematic review of the literature. *Journal of Management Studies, 47*(6), 1154-1191.

Deuse, J., Weisner, K., Hengstebeck, A. and Busch, F. (2015). Gestaltung von Produktionssystemen im Kontext von Industrie 4.0", in Botthof, A. and Hartmann, E.A. (Eds), Zukunft der Arbeit in Industrie 4.0, Springer Berlin Heidelberg, Berlin, Heidelberg, 99-109.

Frishammar, J., Kurkkio, M., Abrahamsson, L. and Lichtenthaler, U. (2012). Antecedents and consequences of firms' process innovation capability. A literature review and a conceptual framework. *IEEE Transactions on Engineering Management, 59*(4), 519-529

Kagermann, H. (2015). Change through digitization – value creation in the age of Industry 4.0. In Albach, H. and Meffert, H. (Eds), Management of Permanent Change, Springer Gabler, Wiesbaden, 23-45.

Laursen, K. and Salter, A. (2006). Open for innovation. The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal, 27*(2), 131-150.

Laursen, K. and Salter, A. J. (2014). The paradox of openness: appropriability, external search and collaboration. *Research Policy, 43*(4), 867-878.

Lichtenthaler, U. and Lichtenthaler, E. (2009). A capability-based framework for open innovation: complementing absorptive capacity. *Journal of Management Studies, 46*(8), 1315-1338

Organisation for Economic Co-operation and Development (2005). Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd ed., OECD Publishing, Paris.

Pasupuleti, M. B. (2015a). Data Science: The Sexiest Job in this Century. *International Journal of Reciprocal Symmetry and Physical Sciences*, *2*, 8–11. Retrieved from https://upright.pub/index.php/ijrsps/article/view/56

Pasupuleti, M. B. (2015b). Problems from the Past, Problems from the Future, and Data Science Solutions. *ABC Journal of Advanced Research*, *4*(2), 153-160. https://doi.org/10.18034/abcjar.v4i2.614

Pasupuleti, M. B. (2015c). Stimulating Statistics in the Epoch of Data-Driven Innovations and Data Science. *Asian Journal of Applied Science and Engineering*, *4*, 251–254. Retrieved from https://upright.pub/index.php/ajase/article/view/55

Reichstein, T. and Salter, A. (2006). Investigating the sources of process innovation among UK manufacturing firms. *Industrial and Corporate Change, 15*(4), 653-682.

Robertson, P. L., Casali, G. L. and Jacobson, D. (2012). Managing open incremental process innovation, absorptive Capacity and distributed learning. *Research Policy, 41*(5), 822-832.

Wagner, S.M. and Bode, C. (2014). Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing. *Journal of Operations Management, 32*(3), 65-78.

Zahra, S.A. and George, G. (2002). Absorptive capacity: a review, reconceptualization, and extension. *Academy of Management Review, 27*(2), 185-203.

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