

DIGITAL INNOVATION: AN ANTECEDENT FOR DIGITAL TRANSFORMATION

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Abstract

Digital innovation facilitates digital transformation of companies. Companies which conduct digital innovation can have and sustain competitive advantages in the market place. Digital product innovation, digital process innovation and digital business model innovation are major types of digital innovation. The purpose of this paper is to highlight the concept of digital innovation, explain its types and focus on its advantages for companies. Digital innovation is using information and communication technology (ICT) to create new and improved products, processes, business models, marketing and organizational methods and network. It has three main types namely digital product innovation, digital process innovation and digital business model innovation. Its advantages can be summarized as reducing costs, improving productivity and relationships with stakeholders, and increasing competitive advantages, market share, sales and profits..

Keywords: *Digital Innovation, Digital Transformation, Advantages*

1. Digital Technologies and Digital Transformation

Digital technologies are required to achieve digital transformation. Thus, companies need to implement digital innovation by using digital technologies to achieve digital transformation.

Digital technologies are composed of information, processing, communication and technology (Olszak 2015). The key low cost digital technologies are as follows: automation, digital platforms, mobile technologies, cloud computing, social media, big data analytics, artificial intelligence, blockchain, the internet of things, the internet of everything, 3D and 4D printing, robotics, autonomous vehicles, machine learning and augmented reality. Digital technologies are the reasons of comprehensive changes in the management (Nowicka, 2019, pp. 203-208).

New digital technologies such as big data analytics, application program interface (API), distributed ledger technology (DLT), cloud computing, machine learning are used to collect, store, exchange and analyze information in digital format (Pochenchuk, Babukh, and Baraniuk, 2018, p. 65).

Digitalization is transforming entirely or primarily physical contents, processes, and objects to be entirely or primarily digital (Negroponte, 1995) (Fichman, Dos Santos, and Zheng, 2014, p. 333).

Digitization is a continuous convergence process of the virtual and real world, is the driver of innovation and change in several sectors (Pieriegud, 2016) (Nowicka, 2019, p. 204).

Digitizing processes improve efficiency and make processes more malleable and tailorable. The advantages of digitized contents (text, video and images) are as follows: Making unlimited copies, transmitting, duplicating, decreasing costs, improving analyzing, searching, improving and correcting contents (Negroponte, 1995). Digitizing includes new properties to objects such as addressability, programmability, memorability, communicability, sensibility, associability, and traceability to manufacture malleable digital products and create new domains of potential functionality (Yoo, 2009) (Fichman, Dos Santos, and Zheng, 2014, p. 333).

There is a digital gap between expectations of customers and abilities of companies to meet them. Companies which can adapt to digital changes fast can survive. Competitive pressures lead companies adapting the process of digital transition to customer expectations and business conditions. Companies change their business strategies and models in an environment where market entry barriers are low and information is their resource. New technologies leading business changes increase revenues and profits. Digital transformation affects competition and market structure between enterprises. Competitiveness among companies in the digital environment is stronger especially when the elasticity of substitution is highlighted, when product interchangeability is high, and while building customer relationships is important by purchasing habits, customer services and after-sale maintenance services (Kostić and Radenović, 2017). Digital transformation is the main theme of the business strategies and company development. It is a way to reach better business results by using new technologies. Digital transformation is organizational change

management, new technology introduction, business model redefinition, product process customization, and business process optimization (Privredna komora Srbije, 2017). Digitization leads using of new technologies to transform a business model to customer needs and adapt to market demand. Digitalized enterprise increases automation of business processes to eliminate repetition of jobs, decrease operating costs and human error risk, connect business functions, automate communication with stakeholders, and perform jobs in a reliable business information system. Digitized business creates competitive advantages and stable market position. The digitization process is an technological advancement which will empower customers, increase competition, create added value, enable to reach customers directly, and price of product is decreased (Cominnng Computer Engineering, 2017) (Kostić, 2018, 18).

Key changes caused by digital transformation are as follows: a) Consumer experience: Traditional marketing techniques are expanded to understand consumer needs and behaviors: customer segmentation using tools and internet information, familiarity with consumer needs, tastes, and behaviors through social networks, development of predictive marketing, digital self-service, and customized applications. b) Business Processes: Employee networking, performance improvement, job mobility, decision-making based on advanced analytics and data. Employees and customers communicate with algorithms instead of other employees. c) Business models: There is a transformation from the physical into the digital by increasing digitalized products and services for redefining business boundaries and the organizational model transformation (Coming Computer Engineering, 2017) (Kostić, 2018, 19).

2. The Concept of Digital Innovation

Digital innovation can be defined as using information and communication technology (ICT) to implement new and improved products, processes, business models, network, and organizational and marketing methods.

Innovation is the role of architecture of information technology artifacts to constrain and enable developing new information technology artifacts and implying to structure and manage innovation in companies. Although digital innovation is related to design, it has more holistic perspective to focus wider concepts (Kohli and Melville, 2019, pp. 201-202).

Nambisan et al. (2017, p. 224) define digital innovation as “the creation of (and consequent change in) market offerings, business processes, or models that result from the use of digital technology”. Several authors such as Yoo et al. (2010) focused on innovating products (Hanelt et al., 2019, p. 59).

Henfridsson, Yoo, Svahn (2009) define digital innovation as using unused digital technology in a product. Yoo et al. (2010) believe that using digital technologies initiate digital innovation which create digital transformation. Akesson (2009) adds that digital innovation is a solution triggered by digital technologies for innovating information and communication technology (ICT) products (Nowicka, 2019, p. 204).

Digital innovation can be defined as implementing new or significantly improved ICT products and solutions. It can be defined as using ICT for implementing new or improved product, process, external relations, new marketing method and organizational method. It can be considered as innovation triggered by technology (Reimsbach-Kounatze, 2016). Digital innovation is defined as the creation of market offers, business models or processes which are created by using digital technologies (Nowicka, 2019, p. 204).

Digital innovation is a product-centric perspective with new combinations of digital and physical products to create new products (Lee and Berente, 2012; Yoo et al., 2010) (Kohli and Melville, 2019, p. 201).

Digital innovation is a new business model, product and process which requires significant changes of adopters, and is enabled and embodied by information technology (Fichman, Dos Santos, and Zheng, 2014, p. 330).

Digital innovation is the creation of and change in market offerings, business models and processes which use digital technology. Digital technologies and digitizing processes form, develop, diffuse and assimilate new idea in digital innovation. Digital innovation management is the principles, practices, and processes which underlie the effective orchestration of digital innovation (Nambisan et al., 2017, p. 224).

The digital innovation is technologies and digital working and project practices. It includes technologies for the design manipulation in the form of 3D or other visualization techniques such as virtual reality and the collaboration around and coordination of digital data by using workflows, processes, and standards (Shibeika and Harty, 2015, p. 455).

Digital innovation requires innovations for new platforms, products, services, customer experiences and ways of delivering value by using digital technologies. The results of these innovations may not be in digital form. Digital innovation occurs from using digital infrastructure and tools such as blockchain, mobile data processing, 3D printing, cloud computing and data analytics. Digital innovation effects may be disseminated, adapted, or adopted to applications such as digital platforms (Nowicka, 2019, p. 204).

According to Cooper and Zmud (1990), digital innovation consists of activities of initiating (triggering, identifying opportunities, making decisions), developing (designing, adopting, developing), implementing (maintaining, installing, providing incentives, training), and exploiting (return maximizing, system and data leveraging for new purposes) (Kohli and Melville, 2019, p. 202).

Nambisan (2016, p. 5) defined digital innovations as “infuse a degree of generativity, and hence an extent of unpredictability and fluidity, into entrepreneurial outcomes”. Tallon and Pinsonneault (2011) believe that digital innovation renders organizational agility as an essential capability to adapt to the turbulent environment. According to Yoo et al. (2012), digital innovation is flexible because it is built on digital technologies and innovation outcomes and processes become more complex when companies combine their products and services with products and services of their partners for digital innovation. They (2012, p. 1405) add that increased pace based on generative characteristics causing it “to be continuous, relentless, and fast” characterizes digital innovation. El Sawy and Perreira (2013) state that companies adopt digital innovation to satisfy their customers and have competitive advantages (Hanelt et al., 2019, p. 62).

Digital innovation brings a new perspective and framework to the innovation process (Grover and Kohli, 2013; Nambisan et al., 2017; Nylén and Holmström, 2015). Digital innovation has a catalyst role for industrial convergence. It initiates collaborations among actors which used to be autonomous in different branches in the industries (Yoo et al., 2012). It leads to a multi-actor environment (Lyytinen, Yoo, and Boland, 2016; Svahn, Mathiassen, and Lindgren, 2017). It is essential to understand expectations from and contributions to the solution provided by innovation (Makkonen and Komulainen, 2018, 1016).

Digital innovation is created due to industrial requirements and engaged market actors into innovation, needs compatible technologies (Parker, Van Alstyne, and Jiang, 2017). It is linked to market dynamics, initiates market needs, complements and substitutes (Nambisan et al., 2017) (Makkonen and Komulainen, 2018, p. 1017).

Digital innovation is a strategic initiative effected and organized within the function of information technology (IT) services. The organization which is a backdrop of digital innovation has business strategies, cultures, and methods affecting digital innovation can be shaped by digital innovation initiatives and shape them (Pentland and Feldman, 2008). Digital innovation can change the company by enabling new business models (Fichman et al., 2014) (Kohli and Melville, 2019, p. 202).

Digital innovation diffusion focuses on complex elements of a business model or individual solutions. It is connected with digital business transformation process which uses digital technologies for changing the business model and providing opportunities for value and income. It is the process of converting the business model to the digital enterprise model (www.gartner.com/it-glossary/digitalization) including cooperation (Nowicka, 2019, p. 204)

Digital Innovation Actions

Outcomes

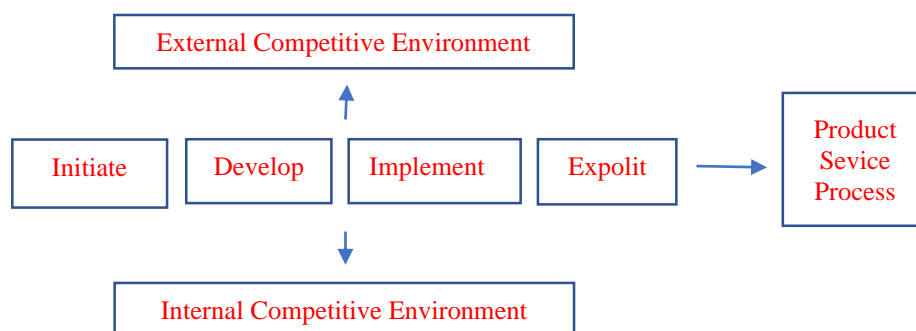


Figure 1. Theoretical Framework of Digital Innovation

Resource: The figure was adopted by the author from R. Kohli and N. P. Melville (2019) Digital innovation: A review and synthesis. *Information Systems Journal*, 29, p. 202.

Table1. The Management Framework for Digital Innovation

Technology Solutions	Market Needs
Management levels for digital innovation	Idea of digital innovation
Innovation Concept Level	Digital innovation as a defined solution to a defined need
Innovation Network Level	Digital innovation as interlinked solution couplings of the innovation network members
Interrelated Industries Level	Digital innovation as phenomenon in a dynamic web interlinked solution couplings of various suppliers and customers in interrelated industries

Resource: The figure was adopted by the author from H. Makkonen and H. Komulainen (2018) Explicating the market dimension in the study of digital innovation: A management framework for digital innovation. *Technology Analysis and Strategic Management*, 30(9), p. 1025. <https://doi.org/10.1080/09537325.2018.1433823>

Companies provide new solutions for new needs to by proceeding digital innovation. They form innovation networks with its stakeholders in their industry to focus on new solutions (Makkonen and Komulainen, 2018, p. 1017)

Table 2. Theoretical Framework Constructs for Digital Innovation

Construct	Description
Initiate	Identifying, applying, and assimilating valuable knowledge from outside and inside of a company pertaining opportunities and problems amenable to digital innovation.
Develop	Developing and designing a new information system, customizing an existing solution, adopting a pre-existing solution.
Implement	Maintaining and installing IS from an organizational and technical perspectives consisting of training, new governance processes and systems.
Exploit	Leveraging existing IS for maximum value. Reusing systems and data for new purposes.
Internal Competitive Environment	The organizational backdrop consisting of strategies, knowledge management, cultures, and methods.
External Competitive Environment	The competitive marketplace where company is embedded consisting of consumer segments, fashion and fads.
Outcomes	Projected or actual new products, processes, and services due to digital innovation.

Resource: The table was adopted by the author from R. Kohli and N. P. Melville (2019) Digital innovation: A review and synthesis. *Information Systems Journal*, 29, p. 203.

3. Types of Digital Innovation

Product innovation, process innovation and business model innovation are main types of digital innovation which companies implement to have and sustain their competitive advantages.

Digital product innovations are new products or services which are enabled by or embodied in information technology. Its examples are new enterprise platforms (CRM, ERP), new consumer products (smartphones), and existing products enhanced by adding a digital technology (Fichman, Dos Santos, and Zheng, 2014, p. 334).

Digital product innovation focuses on companies producing digital products, institutions, supply-side processes, structures, and market dynamics which support development and diffuse of new products. Product innovation is restricted by a core technology, and complementary products and services which are used to provide a product solution and a customer value (McKenna 1985, p. 918) (Fichman, Dos Santos, and Zheng, 2014, p. 334).

Digital process innovations are new ways to do thing in companies which are enabled by or embodied in information technology. Its examples are using social media to affect customers and getting their ideas for open innovation or using warehouse automation to manage inventory. Companies which apply digital innovations can develop or deploy them by themselves or adopt them from the market. Digital process innovations affect processing of transactions, making decisions, dealing with new and existing suppliers and customers. Digital process innovations lead to administrative changes such as governance and organizational structures (Daft, 1978; Markus, 2010 and Swanson, 1994). Digital process innovation encompasses core technology with organizational technical elements to support the business strategy (Fichman, Dos Santos, and Zheng, 2014, p. 334).

The business model concept is popular across several disciplines due to explicating the core business logics (Osterwalder et al., 2005). Chesbrough (2010) believes that a business model is a way of a company for creating and capturing value from technological advances. The value which is provided by underlying technologies depends on the integrated business model. Business models are a focus of information systems (IS) research on the transformative and disruptive potentials of enhancing business environment digitalization (Lucas and Goh, 2009; Kranz et al., 2016). Recent studies highlighted that digital technologies were a primary driver of business model innovation (BMI) (Teece, 2010; Fichman et al., 2014) (Hanelt et al., 2019, p. 59).

Fichman et al. (2014) acknowledge that digital business model is a company way for creating and delivering customer value for having profits by using information technology. Digital business model innovation is different from traditional business model innovation. Digital business innovation is flexible for using digital technologies (Yoo et al., 2012) and generativity (Zittrain, 2006) and is adaptable, incomplete and dynamic. Generativity is the fact that digital technologies create data traces which are basis for new innovations (Yoo et al., 2012). Digital business model innovation is convergence in several approaches stemming from the openness initiated by digital technologies (Yoo et al., 2012) (Hanelt et al., 2019, p. 60).

Companies face with challenges of intense competition, and digital technology development changes customer expectations and business models (Kostić, 2018, p. 17).

Business model innovation is considered as the third type of innovation by several researchers. Teece (2010, p. 173) believes that a business model “defines how the enterprise creates and delivers value to customers, and then converts payments received to profits”. Digital business model innovation is a new approach to create and capture business value which is enabled and embodied by information technology. Teece (2010) adds that information technology has become the main driver of business model innovation. Its examples are DVD-by-mail subscription service by Netflix’s, Ad-sponsored search business of Google. Business model innovation focuses on supply side of innovation and includes a product innovation as well. Digital innovation stages are discovery, development, diffusion, and impact (Fichman, Dos Santos, and Zheng, 2014, 335).

When companies use digital technologies in business model innovation, they are involved in external knowledge integration (Yoo et al., 2012), benefiting their abilities to do so in the future (Cohen and Levinthal, 1990). The openness afforded by digital technologies drives an absorptive capacity of the company (Roberts et al., 2012) (Hanelt et al., 2019, p. 65).

Huang et al., (2017) believe that digital innovations led rapid scaling by using digital platforms. Companies should give response to changing demands to profit from digital innovation scalability. Sambamurthy et al. (2003) highlight that digital innovations lead to a turbulent business environment, the ability to sense and respond to change regarding operations, competitors, and customers (Sambamurthy et al., 2003). Bharadwaj et al. (2013) and El Sawy and Pereira (2013) believe that digital innovation is a vital factor to innovate digital business model effectively. Tallon

and Pinsonneault (2011, p. 464) define organizational agility as “the ability to detect and respond to opportunities and threats with ease, speed, and dexterity.” Although innovation success is connected to integrating new knowledge (Carlile, 2002), the convergence of digital innovations increases external knowledge resources dependence (Yoo, 2010). Collaboration in digital ecosystems is based on couplings, and the speed of network formation is increasing at a faster rate in digital ecosystems than traditional industries requiring development of organizational capabilities to exploit information, data, and knowledge (Bharadwaj et al., 2013). Business models relying on cloud computing technologies is characterized by customer relationships requiring companies gather information about customer preferences to be successful (Kranz et al., 2016) (Hanelt et al., 2019, p. 63).

4. Advantages and Outcomes of Digital Innovation

Companies achieve digital innovation to be ahead of their competitors. Creating values to stakeholders, satisfying and surprising customers, increasing market share, profits and corporate image are main advantages for companies to implement and use digital innovation.

Reasons for using digital technologies are as follows (Nowicka, 2019, p. 209): Pressures of customers, shortening the supply chain and eliminating intermediaries, pressures of competitors, improving transparency, synchronizing activities, making more innovations, shortening process implementation time, accessing to an internet platform, connecting partner’s data, reducing process implementation costs, improving communication and coordination, using less employees and decision of the leader.

Changes occurring from implementing digital technologies are as follows (Lei et al., 2010; Agrawal and Narain, 2018) (Nowicka, 2019, pp. 207-208): Redesigning business process models including their standardization, digitization, and improvement, process automation and improvement based on a new way of access to information, cooperation among actors and stakeholders including connectivity, data exchange, partnership, integrating business functions, implementing product and process innovations, greater transparency for better decisions, reducing inventory levels due to just-in-time deliveries, better visibility of resources due to full integration of systems, greater decentralization of storage to reduce costs associated with deliveries, understanding customer needs much better and improving customer relationships, reacting quickly to demand changes, accessing to current sales information, and increasing sales, profit margins and competitive advantages.

Impacts of digital innovation are as follows (Fichman, Dos Santos, and Zheng, 2014, 338): Industrial transformation, distinctive diffusion dynamics, diversity of product and service, personalization of product and service, faster innovation cycles and processes, faster and broader diffusion of product, pricing and distribution flexibility, marketing new products with new approaches, using smart technologies and servitization, moving to real-time question answering systems, creating analytics-driven digital innovation opportunities and democratized innovation.

Changes occurring from using digital technologies are as follows (Nowicka, 2019, p. 210): Increasing level of process automation, eliminating unnecessary activities, adding new distribution channels, communicating with stakeholders and partners at the same time, and increasing efficiency of logistics activities.

Increase in the number of patents is the major outcome of digital innovation (Cockburn and Griliches, 1988; Gittelman and Kogut, 2003). Digital innovation will affect risk mitigation, productivity, customer loyalty, and profitability. Other digital innovation outcomes are risk mitigation, process redesign, error reduction, sales increase (Menon and Kohli, 2013), customer satisfaction and market share. Digital innovation affects features of products, time-to-market, and customer reach (Kohli and Melville, 2019, p. 213).

Digital innovation offers innovation outcomes such as new platforms, customer experiences, products, and services and other value pathways which are created by using digitized processes and digital technologies. On the other hand, outcomes don’t have to be digital. Digital innovation has digital infrastructure and tools (3D printing, mobile computing, data analytics etc.) for occurrence of innovation. Digital innovation outcomes may be assimilated, adapted and diffused to contexts of digital platforms (Swanson, 1994; Bharadwaj et al., 2013; Tilson et al., 2010; Tiwana et al., 2010; Yoo et al., 2012; Yoo et al., 2010) (Nambisan et al., 2017, p. 224).

Companies make investment to digital transformation to increase productivity. They should increase digital transformation investments if they want to be market leader and defeat competitors. According to an empirical research conducted on 644 production companies in five European countries which analyzed what extent companies used advanced technologies and how it reflected on growth of productivity, most companies (55.9%) adopted at least one IT instrument, there was a positive link between the company size and the digitization degree. There were

few companies which were international, dealt with digitization, conducted research and development and grew with their size (Veugelers, 2017). Company productivity grows consistent with applied information and communication tools number. There is an increasing productivity by using new information communication tools. If effects of introducing digital tools by market leaders on productivity are examined, it will be observed that digitally active companies which adopt an information and communication instrument generates 3% more productivity growth than digitally inactive companies, and additional tool usage improves productivity (Kostić, 2018, p. 19).

There is a positive relationship between digitization and productivity. One of the regressive models regards labor productivity is a function of internationalization, investing in research and development, and company ownership structures. If digitization is adopting minimum one information-communication tool, there will be a positive correlation between digitization and organizational productivity level. When most productive companies apply advanced tools by 20%, they will have higher productivity growth (over 18%). Also, there will be bigger gap between leaders and followers (Altomonte, Aquilante and Ottaviano, 2012). Digital Economy and Society Index (DESI) was created to combine the following indicators to monitor the development of digital performance: 1) human capital (skills and development); 2) integration of digital technologies (e-commerce and business process digitalization); 3) connectivity (fixed and mobile internet accesses, internet speed and accessibility); 4) using internet (content, online transactions, and communication); 5) digital and public services (e-government) (European Commission, 2017) (Kostić, 2018, p. 20).

High performance digital companies have the following elements; (1) organization; (2) customer decision making; (3) process automation; (4) technology; (5) strategy and innovation, and (6) analytics and data (McKinsey and Company, 2017) (Kostić, 2018, p. 19).

Digital technologies play a more supportive and indirect role in orchestration of innovation. Problems and solutions emerge from the functional potential initiated by joint and opportunistic sensemaking around digital technologies and formation of new couplings between needs, artifacts, sociotechnical environment, and affordances in digital innovation. Digital platforms support innovation orchestration for finding solutions to problems. The potential digital platforms features to find solutions to problems lead to study the intermingling of digital and human agencies in innovation orchestration (Nambisan et al., 2017, p. 231).

Barriers to the implementation of digital technologies are as follows (Nowicka, 2019, p. 211): High cost of technology, excluding intermediaries, not having specialists to use the technology, lack of knowledge about technologies and their impact on processes, data security concerns, dependence on the leader who determines the implementation of a technology and fear of losing relationships with partners.

5. Conclusion

Implementing and using digital innovation are required for companies to achieve digital transformation. Digital innovation implementations are expected to increase in and after 2020 due to pandemic and other global changes. Digital transformation is triggered by pandemic so it leads companies to implement digital innovations to gain and sustain competitive advantages, satisfy their stakeholders and provide more values to them, improve productivity, decrease costs, increase their market shares, sales and profits, and expand in global markets. Companies can implement digital innovation by getting the advantages of their network of their stakeholders. Thus, they can offer more appropriate digital solutions to market needs and expectations. Companies should formulate a digital innovation strategy which is consistent to their corporate strategies, they should allocate enough resources to form the appropriate infrastructure and teams to implement digital innovation, and market its products and services to achieve their performance goals. It can be summarized that digital innovation is a pathway for digital existence, appearance and image of companies in the global marketplace.

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