

Sustainable Digital Innovation

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Digital innovation is referring to a product, process or business model that is new or requires significant changes and it is enabled by IT. Sustainable digital innovation supports the digitalization process of the economy in a green, long-lasting and organic way. Thus, it serves the need of a sustainable future. The regular digital innovation addresses performances, costs, technology and attractiveness to customers and business, while the sustainable one also addresses to the environmental and social factors. Sustainable digital innovation tries to create value for all the stakeholders involved in the production and distribution process, it is inspired by nature, not only by technology, it reduces resources waste and targets the societal goals, not only the commercial and business goals.

Keywords: sustainable digital innovation ; digital economy ; digital orientation

1. Digital Orientation and Sustainable Digital Innovation

The digital orientation is the adoption of the digital practices by utilizing advanced technologies like mobile applications, digitized processes, social networks and so on ^[1]. The digital orientation refers to an organization's strategic orientation towards using the advanced technologies and implementing the digitized processes in running its business in order to increase its value creation. This strategic orientation plays a supportive role for innovation considering the proper use of proactive innovation, market insight and candidness to new-fangled ideas ^[2]. For increasing the value business creation, the organizational strategy of the companies matters as much as the used technology. Thus, a more in-depth analysis is necessary to see how the business models can be re-designed to respond successfully to the digital transformation for achieving sustainable digital innovation. This way, the created value can increase, the organization's performance can rise and the company can gain competitive advantages. This can be beneficial for the whole economy, as some previous studies have demonstrated so far ^[3]. Adopting digital technologies and practices by the companies can support their performance in a sustainable way and can respond to some fundamental questions about how the companies contribute to society well-being and what tools they need for responding to the demands of the society ^{[3][4]}. A digital-oriented business can avail of the value creation and persuade business ^[4] to be an effective part of the digital economy ^[4]. The digital orientation suits business in this changing environment and ensures that businesses can only survive by adopting the latest and most innovative methods ^[5]. To differentiate the business from the competitors in order to benefit of the competitive advantage, the businesses are focused on managing the digital innovation by using the digital orientation ^[6]. The analysis of the role of the digital capabilities and internal resources through the digital orientation can provide an in-depth understanding of the digital innovation potential ^[7]. If the firms are capable of using the digital activities in their processes, they can potentially achieve the digital innovation according to the new technological ways ^[8].

Organizations need to adapt to the digital technologies and digital platforms, eventually adapting the products, work environments and the entire business context. This could be supported by designing new digital business models. The organizations displaying a high orientation towards optimization, customer interaction and utilization of the digital technologies are more susceptible to achieve a sustainable digital innovation and digital transformation ^[9]. Sustainable digital innovation is not only a result of the link between digital technologies and digital platforms, but is also influenced by the firms' digital orientation to speed-up the digital innovation. Thus, digital orientation is an enabler for achieving sustainable digital innovation. Activities have to be fitted to every individual business model so that the digitalization can be sustainable ^[10].

The existing studies empirically validated three major approaches of the innovation: the Schumpeterian view, the Marshallian view and the technology pull view. According to the Schumpeterian view, the entrepreneurs cause the disturbance of the market equilibrium on a continuous basis and contribute to innovation. According to the Marshallian view, the innovation system is the original notion of the industrial districts, while the technology push view states that the innovation adoption of the firm can be determined by the capability of the firm to adopt the new and innovative technology. The digital technology is the most contemporary form of technology that can push the SMEs to adopt innovation by the digital inputs ^[11]. The SMEs need to adopt the digital orientation for speeding up the process of the sustainable digital

innovation and this requires a huge investment ^[12]. The digitally-oriented firms are willing to bear the cost and risks for achieving the targets of the sustainable digital innovation and support the transformation of the traditional innovation process into the digital innovation ^[13]. Hence, the digital orientation is a major antecedent of the sustainable digital innovation. The technology acceptance model reflects that adopting attitude affects the innovation adoption decision ^[14]. If the organization has the capability to adopt the innovation through different means, it can achieve a high-level productivity from this ^[15]. From this model, it can be summarized that if the firm can adopt the digital technology, it can make its digital innovation productive ^[8]. Based on the above argument, it is justified to establish a positive link between the digital orientation and the sustainable digital innovation. Therefore, it leads to the following hypothesis:

2. Internet of Things and Sustainable Digital Innovation

Information and operational technology play a significant role in changing the society, the economy, and industries worldwide. It plays four major roles in entrepreneurial operations: as a facilitator, as a mediator and as an outcome; it redesigns and becomes the business model itself. Business models consider the technological change as an opportunity from the business value side. Entrepreneurs search for business model that determine value creation and incorporating the new technologies for achieving sustainable innovation into their businesses. The Internet of Things, big data analytics and artificial intelligence, leads to the adoption of new technologies into the business model in a sustainable way, because the scarcity of the available resources ^[16].

Some well-known examples of high impact businesses (Facebook, Amazon, Google) have encouraged entrepreneurs to consider that Internet supported business ideas ^[17].

The advancement of the technology has provided an opportunity to communicate and get connected constantly all around the world with the use of the internet and devices connected to it ^[18]. These developments in the field of the technology and communication are the Internet of Things (IoT). Every device that is connected to the internet can be an example of the technological wonder and can assist the businesses in the digital economy ^[19]. The development and advancement of the internet have extended the scope of IT drastically and leads towards the digital innovation. Internet of Things (IoT) bring together so many devices and the results consist of "smart" houses or cities, transportation systems, electricity networks, that will develop economic activities by cutting down the transaction costs ^[20] and will increase wellbeing of the population. In this way, digital technologies significantly enable the sustainable digital innovation, their effects and results depending on the aim and framework ^[21].

IoT is involved in every task and activity of the business and influences the operational mechanism. The digital innovation rises through the constant communication and information sharing across borders and among organizations through network connectivity provided by IoT ^[22]. The information sharing offered by IoT generates the new ideas of doing business gathered from all over the world ^[23]. The business models that are successfully adapted in some other country can be utilized by gathering knowledge through IoT ^[18]. A large number of businesses are conducting new ways of reaching their customers or for marketing purposes by using the digital media ^[24]. These innovative methods of performance of business activities are possible through IoT ^[8]. The information availability on the internet can support the businesses to implement some new and innovative solutions to the old problems ^[25]. The Internet-related information and devices allow businesses to develop a new strategy in the old business context leading to the digital innovation ^[26]. New software and platforms that are the outcomes of IoT are available to the businesses to innovate the old processes ^[27].

These implications of IoT have been overlooked by previous researchers and there is hardly any evidence about the IoT-digital innovation link so far ^[28]. Both digital orientation and IoT can determine sustainable digital innovation but this stance is meager at best and hence we have linked these factors: digital orientation and IoT with sustainable digital innovation through digital platform.

Hence, we argue that IoT is a very important factor to enhance the sustainable digital innovation in the digital economy. The socio-economic growth and development of the digital economy are based on the advancement and growth of the IoT-based digital innovation ^[8]. Therefore, based on this, it is justified to establish that IoT positively affects the sustainable digital innovation in all sizes of business, generally, and in SMEs, specifically. Therefore, the following hypothesis is derived:

3. Digital Orientation and Digital Platform

The digital platforms include online businesses that regulate the commercial communication between two different parties for mutual benefits ^[29]. The digital platforms have become very important in the digital economy for the success of the businesses ^[30]. However, the literature has mostly discussed ^[30] the outcomes of the digital platforms that are derived from

the business. Less attention is given to the capabilities and resources upon which the success or failure of the digital platforms depends on. This study highlights that the digital platforms are initiated through the digital orientation. The firm's culture plays a very significant role in the adoption of the digital platforms. If the firm has the digital orientation, then it will support the transformation of its traditional business activities into the digitalized ones ^[31]. Adopting the digital orientation for business processes can take place at a large scale if the managerial decision supports it. The digital orientation helps to show that more assets are required to be invested in the development and advancement of the increasingly digital platforms to get benefits from it up to its full potential ^[32]. The readiness of the management to invest in purchasing and implementing the digital technology in the business organization allows the business to benefit of the online digital platforms for the businesses ^[33]. The digital orientation shows that the firms should be ready to transform their traditional ways of business processes and methodologies into the digital platforms. As it has been discussed above, the firms that are digitally-oriented firms are more inclined toward the adaptation of the digital platforms. Therefore, based on it, the following hypothesis is developed:

4. Internet of Things and Digital Platform

IoT has extended the productivity and functions of connecting people and organizations through different platforms such as social network service, email, live conferences and other online information sharing and feedback to a large extent ^[34]. The amount of information sharing and production by the connected devices is also increasing rapidly with the growth of technology and an increase of the number of devices used in this context ^[32]. IoT has very wide dimensions that include environmental, social and economic impacts that contribute to the growth and sustainability of the digital economy ^[22]. IoT not only provides communication and connection among millions of devices across the world, but it also provides new opportunities, service paradigms, architectures and new capabilities as well. Online platforms for instance are the most frequently used outcomes of the IoT ^[28]. The effects of the IoT-based network also influence the digital platforms; as things are growing, they become more influential and valuable to the people. IoT strategy of the platform can be analyzed by the success of connection, data flow, information, knowledge, and attractiveness. The IoT provides an opportunity to develop network globally that connects the things, data and people and create a digital platform ^[12]. This development provides the capability to the smart devices that are connected through the internet to transmit and share the data and information. IoT enables the services that require connectivity and intelligence regarding analytics and information management on the online platforms ^[27]. IoT-based mobile devices, things and cloud use the technology for the data transmission boost the development of the digital platforms. Everyone can create and share the content and information using the services of cloud-based platforms and infrastructures that provide access to the global users ^[34].

The most significant application areas of IoT are related to the industrial organizations where most implemented projects are ^[35]. The IoT is responsible for the digital transformations of the organizations. IoT speeds up the process of the business involvement in the digital platforms through the internet devices and technological advancements, mobile applications and social network.

Users have to be taught how to operate on the digital platform to capture value. By shaping the online customer-centric market, the ability of users to achieve value from interactions increases. Therefore, the simplicity of the digital platforms is crucial ^[17].

Therefore, this study argues that the digital platforms majorly depend on IoT. The things connected with networks maintain the online identity and global connection, which are requirements of the digital platform. IoT-based developed digital platforms are a globally approachable network. These digital platforms are conjunctions of the consumers, users, and things, who contribute to develop businesses, create content and participate in the business transactions online. Based on the above discussion it is justified to establish the argument that the IoT has a direct influence on the digital platforms. Therefore, it leads to the following hypothesis:

5. Digital Platform and Sustainable Digital Innovation

In a changing and competitive environment, one of the crucial determinants is innovation. The ability to achieve the innovation targets and objectives of the organization with digital technology is referred to as digital innovation ^[36]. Digital technology platforms currently support the innovation of the most products, processes or services within and across the organizations; thus, the digital innovation can be noticed at a large number of firms ^[37].

The digital platforms offer an online platform to communicate with other organizations that may be business partners, competitors, suppliers or consumers ^[29]. The digital platforms provide the opportunity to the business to enhance its performance using digital platforms and technological advancements ^[38]. The interaction between the client and the supplier, or any other parties that are involved in the commercial or business activities by using an online platform is

known as a digital platform ^[39] and their major role in the economy was best emphasized during the current pandemic. Digital platforms gather together the customers, partners and developers and create large markets with significant scale economies and efficiency. They enable cooperation between organizations from many domains that can generate innovation of new products and services. The innovation phenomenon stresses that the digital platforms support innovation and the digital transformation of the organizations.

Digital technologies have generated tools such as digital crowdfunding platforms, social media, 3D printers and digital imaging processors that reduce the barriers for inventions and enable innovation ^[40]. Increasing number of the entrepreneurial projects using digital crowdfunding platforms for financing reasons determines the development of these platforms ^[41].

Li et al. ^[42] presented the transformation of SMEs in a digital ecosystem. This paper described how SMEs have transformed from local to successful cross-border e-commerce players on the digital platforms. "This took place through dynamic managerial capability, organization capability, and strategic changes. The platforms motivate SMEs, providing training on the use of the platform, providing social networking and mutual learning among SMEs, building tools to overcome trading barriers, and motivating SMEs for a strategic transformation".

Facing the digital economy scenarios, the digital platforms are developing and advancing with the advancement in the technology, because this advancement allows the digital innovation. The digital innovation is rooted through the production of the new and latest technologies and majorly based on digital platforms ^[24]. The digital platforms allow people and firms to get connected through the digital technology and offer the newest digitalized innovation. The sharing of the new ideas and information has also increased and become easy through the digital platforms. This generates the availability of every kind of information and knowledge on the digital platforms ^[30]. The digital innovation is responsible for bringing the innovation and advancement through the digital platforms. The digital innovation is based on the digital platforms as this helps to grant the opportunities of the innovation and new ideas for businesses that are now mostly based on by using the services of the digital platforms. The digital platforms provide the opportunities for businesses to get connected with their potential customers more effectively and efficiently in the newest ways. The digital platforms like Google search engine and other products and services of Google continuously derive digital innovation in order to create more opportunities and productivity for the businesses as well as for individuals ^[43]. The digital platforms have become the hub of the new business ideas and advertisements across the world ^[24]. The digital platforms develop technology, institutions and processes using 24/7 connections which turns to the digital innovation.

Achieving resource optimization for sustainable businesses can be reached using the digital technologies, that represent the pillar of the sustainable digital innovations in digital platforms and environments ^[44]. These digital innovations determine organizational digital transformation through digital technologies and new digital business models, which leads to sustainable implications for many business issues ^[45].

All the above-stated arguments about the digital platform in perspective of the sustainable digital innovation show that the digital platforms play a significant role in bringing sustainable digital innovation into the business. Therefore, the following hypothesis is derived:

6. Digital Platform as the Mediator between Digital Orientation and Sustainable Digital Innovation

The platform age is dominant in this era because of the development of powerful information and communication technologies that have decreased the cost and increased the reach of connecting platform sides, but the entrepreneurship research has ignored the role of the digital technologies in entrepreneurship ^[46].

This study argues that the digital platforms act as a mediator between the digital orientation and the sustainable digital innovation. Digital orientation leads towards the development of the digital platform for attaining the sustainable digital innovation. The previous studies have presented that the digital orientation predicts the digital platforms ^[29]. The digital platform provide opportunity to stay connected with top rated firms and can provide a competitive advantage for the businesses to develop the newest technology and creativity in the long run ^[47]. The digital platforms contribute as a driver for the digital orientation to achieve the sustainable digital innovation. The inclination of the digitally-oriented firms is toward the adoption of the digital technology for its processes (innovation); therefore, they do this through the online media and digital platforms. The willingness and desire of the firms to innovate their processes in a sustainable way can be fulfilled by the applications and information provided by the digital platforms. The digital orientation enables the firms to built-up their web-based business capabilities to go online and develop digital platforms for offering the latest products and services in a digitized innovative way ^[32].

Therefore, it is argued that the digital orientation initiates the process of the developing digital platform which in turn enhances the sustainable digital innovation.

7. Digital Platform as a Mediator between the Internet of Things and Sustainable Digital Innovation

IoT brings benefits for both businesses and individuals in the form of developing the connections with the latest technology and its applications with the continuous innovation [34]. Similarly, the creation of the digital platform majorly depends on IoT. This research argues that the digital platforms mediate the IoT and sustainable digital innovation link. Different firms and organizations are taking advantage of IoT for achieving the digital platforms through the latest technology and advanced means of communication [29]. These digital platforms help to collect relevant data, information and knowledge to increase the efficiency of all functions of businesses for achieving the digital innovation [33]. The IoT has offered a wide variety of platforms that are present online to perform various functions of the business related to the digital innovation. These digital platforms are helping the businesses to gather the information for bringing the sustainable innovation. These platforms have also offered a wide range of innovative models for doing business in a sustainable way. By offering a wide range of business digital platform opportunities, IoT is deriving sustainable innovation into the business. By linking the IoT for bringing the sustainable digital innovation, the digital platforms may represent a strong connection bridge [28][30]. Therefore, based on it, the following hypothesis is derived:

8. Theoretical Framework

The theoretical underpinning of this study is linked with two major theories, i.e., (1) Theory of Innovation and (2) dynamic capability theory DCT.

Coenen and Lopez [48] reported that Theory of Innovation is based on three major elements, i.e., (1) Sectoral System, (2) Technological System and (3) Socio-Technical System. This study expanded the domain of these three dimensions with the respect of sustainable digital innovation. The Sectoral System highlights the directions sector-based synergies to improve innovation and performance, hence it is related to the sustainable digital innovation. Similarly, Technological System is advancement in technology using the latest knowledge and skills to enhance overall innovation. Finally, Socio-Technical System means radical innovations and transitional innovation based on technology and this innovation is in the best interest of society. The second basis of our theoretical framework is based on dynamic capability theory (DCT) that refers to firms' skills to be flexible and innovative for achieving sustainable performance [49]. It is timely adjustments in a firm's strategies and processes to adopt innovative methods in order to sustain its performance. Hence, sustainable digital innovation is the main concern for firms operating in the current dynamic world. Figure 1 show the theoretical framework of this study.

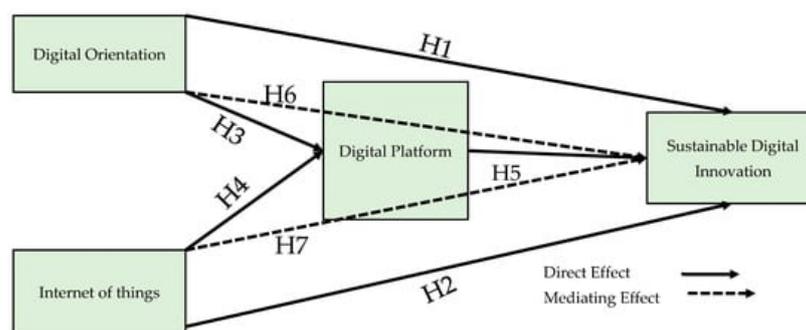


Figure 1. Theoretical framework.

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