Digital Innovations in Healthcare Startups: Transforming Service Ecosystem

Swapnil Morande[1]*, Erica Del Vacchio [2] & Angelo Ranieri [3]

[1] Department of Economics, Management, Institutions. University of Naples FEDERICO II, Italy

[2] Department of Economics, Management, Institutions. University of Naples FEDERICO II, Italy

[3] Department of Economics, Management, Institutions. University of Naples FEDERICO II, Italy

Corresponding Author: Author's Name, Swapnil Morande E-mail: swapnil.morande@unina.it

ABSTRACT

Healthcare is a critical part of our lives. Technological developments in the modern era surmount geographical limitations to present greater opportunities. The proposed research focuses on current innovations in healthcare start-ups and evaluates the same using 'socio-material view'. The research elicits patterns using a qualitative methodology that could push technological evolution a bit further. Through proposed research, a service ecosystem view has been presented by studying a set of innovative entrepreneurial ventures in the field of healthcare. Innovations result from the 'Texture of Practices' that are woven through pairs of intertwining practices of resource integrating and co-creating. The study follows up on the state-of-the-art technologies in the healthcare ecosystem to present its findings. Technology does simplify not only the existing healthcare practices but also has the potential to go beyond by co-creating the value. Hence the research looks forward to reflecting on groundbreaking technologies and technological innovation in the healthcare sector. The research has been carried keeping an Italian context in mind. To achieve the same content analysis and data mining framework is applied. The outcome presents a significant insight into what technologies can offer to the healthcare industry. It includes the use of software applications as a gateway to access medical products on-demand. Further, it puts a patient at the center of the service ecosystem using E-commerce. Digital Innovations in Healthcare Start-ups should include efficient 'track & trace' feature and additionally, offer customized processes based on the aggregated data. With the active interaction taking place between consumer & service providers, it can transform the healthcare industry by offering the patient with both preventive and targeted healthcare activities.

1. Introduction

Recent research has shown that the distinctive elements of digital devices and technology, in general, have supported the emergence of new types of innovation processes (Yoo *et al.*, 2012). This trend has been applied in various sectors, including healthcare (Omachonu & Einspruch, 2010; Thakur *et al.* 2012). Digital health, defined as the application of information and communication technologies for the exchange of biomedical and clinical information (Zajicek & Meyers, 2018), is an example of technology-driven innovation in healthcare. Literature is full of matter on the potential of new technologies, capable of revolutionizing the world of medicine, producing effective results from different points of view: first of all, for the healthcare professional the use of applications is essential for sharing information on health-related topics, creating a digital health repository (Lupton, 2014); the end-user, on the other hand, through digital healthcare solutions, takes an active role in managing their own health and in the relationship with doctors and other health professionals (Appelboom *et al.*, 2013; Lupton, 2014; Asi & William, 2018). In light of the opportunities offered by new technologies, health companies have realized that they need to bring in innovation and change their way of functioning (Van Velthoven *et al.*, 2019). During this research, we talk about digital health entrepreneurship to look for opportunities that are able to support and transform the medical field, intending to improve patient outcomes, increasing the quality of healthcare, and improving healthcare experience

(Wulfovich & Meyers, 2019). In the literature, many examples illustrate how technology has the potential to support digital health start-ups and the world of healthcare (Lim & Anderson, 2016; Zajicek and Arlen Meyers, 2018; Wulfovich & Meyers, 2019). However, empirical research on the potential of digitization in Italian healthcare start-ups is limited. Hence, this research work attempts to fill the research gap by answering the following questions:

R.Q. 1 - How does groundbreaking technology help start-ups disrupt the healthcare industry?

Since the customer experience becomes the primary goal of any technology-driven company, even in the field of digital health, we need to find new ways to engage and retain users (Wulfovich & Meyers, 2019): This is the significant challenge that digital healthcare start-ups face.

Considering the TAM2 model (Venkatesh & Davis, 2000), technology, as of today, makes use of ubiquitous computing to affect cognitive factors such as time and convenience. Its e-commerce driven applications have the capability to fast-track the disruption process.

R.Q. 2 - What innovative practices can keep patients as a center of the healthcare service ecosystem?

The new era in healthcare is about keeping the patient at the center-stage to allow him/her an improved experience, especially when going through a stressful situation (Ko *et al.*, 2019)

Technological development has given rise to mobile applications (or apps) that present both the advantage and opportunity to provide 'hedonic value' to the consumer. With this study, researchers make an attempt to identify significant actors using a large sample of healthcare start-ups, and the paper is structured as follows:

Firstly, we analyze three vital elements of digital health innovation. Second, we briefly discuss the conceptual understanding of digital health entrepreneurship. Third, we explain the approach to study and present the finding and discussions. Finally, we deliver the conclusion along with managerial implications.

2. Literature Review
Digital Health Innovation
This section provides a review of the concept of digital health innovation, exploring the two key concepts: 'digital health' and 'digital innovation.'

Digital Health
Robinson *et al.* (2015), limit the concept of digital health solely to the use of digital media to transform the way health care is delivered. In contrast, Iyawa *et al.* (2016a, p.3) describe digital health as "*an improvement in the way health care delivery is designed and provided by health professionals through the use of information and communication technologies to monitor and improve well-being and health of patients and to empower patients in managing their health and that of their families*".

Several authors agree that digital health is the phenomenon of using technological tools to support different health services in order to improve people's lives (Parati *et al.*, 2019). The literature provides varied views on the potential of new technologies, capable of revolutionizing the world of medicines, producing better results for patients, supporting healthcare, reducing healthcare costs and collecting data on patients (Lupton, 2014; Robinson *et al.*, 2015; Asi & William, 2018). In most of the available literature, technologies contribute to a series of aspects mainly to use the data to share one's health experiences with others or to seek information on health, diseases, and clinical treatments (Lupton, 2013). Physicians and healthcare professionals use software apps and digital platforms to gather information on health topics, share opinions, and even work with non-healthcare professionals, creating a digital healthcare network (Lupton, 2014). Digital health is therefore linked to different technological tools through which users could take an active role in managing their health conditions and be encouraged to adhere better to the therapies prescribed by their doctors (Appelboom *et al.*, 2013; Asi & William, 2018). This consideration also implies a cost-related problem in some countries as the installation of a digital solution may hinder effective implementation. At the same time, trained healthcare profession – to use digital platforms – could limit the use of healthcare technologies. (Parati *et al.*, 2019).

Digital Innovation

The concept of innovation is not new to the existing literature. The authors agree in defining innovation as the creation of new ideas to support the development of business activities and, as such, involves an organizational change (Birkinshaw *et al.*, 2008; Janka *et al.*, 2019). According to Russo-Spena and Mele (2018), the process of 'innovating' can also be defined as the texture of practices that are woven through a pair of intertwining practices of resource integrating and co-creating.

Gherardi (2012) proposes the concept of the texture of practices to reveal ongoing interactions in action with interwoven practices. It advances the notion of innovation as an emergent and co-creating process involving an interconnected set of actors. Innovation has also been applied to the healthcare sector (Omachonu, V. K., & Einspruch, 2010; Thankur *et al*., 2012). Thankur *et al.* (2012, p. 564) define health innovation as *"as the adoption of those best-demonstrated practices that have been proven to be successful and implementation of those practices while ensuring the safety and best outcomes for patients and whose adoption might also affect the performance of the organization."*

With the advent of technology, the definition of innovation has evolved: today, the authors speak of digital innovation (Yoo *et al.*, 2010; Yoo *et al.*, 2012; Nambisan, 2017; Henfridsson *et al.*, 2018; Jordanius *et al.*, 2019). The term digital innovation means the phenomenon of the use of technology in the various innovation processes (e.g., a supply of products/services; creation of new offerings and market models) (Nambisan *et al.*, 2017). Unlike the search for Information Technolgy based innovation that focuses attention only on processes (Selander *et al.*, 2010), Yoo *et al.* (2010), with holistic understanding, defines digital innovation as a phenomenon that, through the combination of digital and physical elements, allows the delivery of innovative products. In other words, it represents the existence of digital touchpoints in the service ecosystem for the 'innovating process'. With digital innovation, we are witnessing a shift from the classical structure of the value chain, rooted in traditional companies, to the creation of value through dynamic and non-linear processes (Boland *et al.*, 2007; Westergren & Holmström, 2012; Holmström, 2018).

The new technologies, therefore, help companies to improve under different points of view: first of all, they can provide customers with various services and features thanks to the variety and flexibility of digital tools (Yoo *et al.*, 2010; Yoo *et al.*, 2012); secondly, by exploiting the silos of data, companies are able to identify new market opportunities and adapt their offers to the needs for the target market (Huang *et al.*, 2017); and finally, digital platforms allow the sharing of information and knowledge, allowing companies to pursue innovation in a collaborative way (Gawer & Cusumano, 2014; Nambisan, 2017) by democratizing the data access. However, technological innovations pave the way for complex challenges that companies must face and be able to solve adequately in order to ensure the continuity of the business. Furthermore, the unique characteristics of new technologies enable innovation processes that are rapid and difficult to predict and for which companies need adequate tools to support them in management (Yoo *et al.*, 2010; Yoo *et al.*, 2012; Henfridsson *et al.*, 2014).

Digital Innovation in Healthcare Context

In healthcare, the innovation of processes and tools to support the provision of different health services is necessary to maintain a high level of quality. (McGowan *et al.*, 2012). Innovation is primarily driven by emerging technologies for various reasons: first of all, integrated digital solutions to support continuity of care, through continuous monitoring of health even at a distance; furthermore, technology enables healthcare to be managed, creating a relationship of co-creation and co-production between patients and healthcare providers (Kuziemsky *et al.*, 2019), with improved patient involvement and empowerment (Ramachandran & Pai, 2014; Davies *et al.*, 2019). Above all, for patients who have chronic illnesses, it is necessary to provide information so that they help themselves and self-manage their health conditions. To this end, the technology has the potential to not only provide information provided on the diagnosis to both patients and healthcare professionals but also real-time monitoring of their conditions (Müller *et al.*, 2019).

In light of the above, a proposed definition of innovation for digital health should contain the essence of the definitions of digital health, innovation, and digital innovation. On the basis of discussions, a digital health innovation can be described as a process in which digital models, communication flow, and data are aligned with business models, design perspective, and other critical actors for the transformation of the healthcare sector.

Digital Healthcare and Start-ups

In light of the previous discussion, healthcare companies have realized that they need innovative solutions and to change their way of working (Van Velthoven *et al.*, 2019). Wulfovich & Meyers (2019, p. 1) define that digital health entrepreneurship as "*the pursuit of opportunity under conditions of uncertainty with the goal of creating user-defined value through the deployment of digital health innovations. It is the pursuit of information and communication technologies (ICT,*

including telemedicine, wearables, mobile health, and data analytics) to the medical field with the goal of improving patient outcomes, improving the quality of healthcare, and improving health and experience".

Digital healthcare entrepreneurs are not merely healthcare stakeholders, but they work with non-health subjects and also collaborate with large companies (e.g., Microsoft, Apple, Amazon). This has allowed the creation and development of digital health ecosystems, termed as 'digital health communities' consisting of healthcare stakeholders, health institutions, and health service providers (Iyawa *et al.*, 2016).

In light of the opportunities offered by new technologies, on the one hand, the funding that digital health start-ups need is increasing, thanks to a community of active investors that show greater confidence in this sector (e.g., subsidies, venture capitalists, crowdfunding) and on the other, courses in computer education and digital health entrepreneurship (Zajicek & Meyers, 2018). At the same time, positive impacts are observed from the consumer perspective as the ease of use of digital healthcare devices have increased, also benefit in the daily lives of patients (Wulfovich & Meyers, 2019).

The effects of healthcare digitization on digital health entrepreneurship, which emerged in the literature, are summarized in *Table 1* shown below.

Table 1. Effects of digitalization on digital health entrepreneurship-based literature

Effects of Digitization	Definition(s)
Evolution of Digital Health Ecosystem	*Healthcare entrepreneurs are working together with non-healthcare entities, thus creating a community that includes healthcare stakeholders, healthcare organizations, and digital healthcare practices situated in a digital health environment (Iyawa et al., 2016).*
Ease of Use	*All healthcare stakeholders are experiencing greater comfort while using digital technology in healthcare products (Wulfovich & Meyers, 2019).*
Higher Investments Levels	*Digital health start-ups required more significant investment by a community of investors active in the sector (Wulfovich & Meyers, 2019).*
Regulatory Changes	*The regulations are modified in order not to hinder innovation in the health sector (Cho & Mathiassen, 2007; Sia & Soh, 2007).*
IT Centered Education	*Information technology-driven courses in digital health entrepreneurship are being introduced (Zajicek & Meyers, 2018).*

However, compared to other sectors, the application and dissemination of digital solutions in the health sector have been prolonged (Lim & Anderson, 2016). One of the reasons is related to regulatory problems: before the regulatory authorities validate an innovation, it could take years, and this situation contrasts with the current and continuous development of digital solutions (Devlin *et al.*, 2015). Another reason that inhibits change is the concern that the current performance of digital healthcare solutions is not sustainable over time and does not guarantee the continuity of healthcare activities (Lim & Anderson, 2016).

Even though the digitization has offered solutions that can improve and support health services (e.g., electronic health records; mobile-app; Blockchain), health facilities continue to operate in a highly regulated environment that makes change difficult (Bhakoo & Choi, 2013). All this creates conflicting tensions between change and existing institutions (Scott, 2000).

However, King *et al.* (1994) argued that institutional factors are essential to explain and understand Information Technology (IT) related innovations. For example, the adoption by healthcare organizations of digital solutions in response to institutional

changes or organizational pressures suggests that institutional actors can exert a strong influence on the diffusion of innovation (Greenwood & Hinings, 1996).

In this regard, Information Systems (IS) scholars have analyzed the interaction between institutions and IT, concluding that a technological solution will be implemented more easily only if it fits appropriately with the existing institution and vice versa (Cho & Mathiassen, 2007; Sia & Soh, 2007). Following this approach, digital health start-ups could be seen as actors seeking legitimacy to survive in the long run, through the implementation of new strategies. Presented research further reflects upon the same line of thought!

Although Italy lags behind the more advanced European countries, in recent years, the scenario has changed, undoubtedly due to more considerable political attention, which has begun to create a regulatory and incentive environment favorable to start-ups: a virtuous circle has thus begun who, starting from a more significant cultural diffusion, has led to the creation of more and more start-ups, more incubators, more venture capital funds. A significant indicator of what is happening is, for example, the investment has doubled in Hi-tech start-ups as compared to the last year (Rangone, 2019).

Based on the above literature given study explores technology-driven innovation in healthcare start-ups and its practical nature concerning the service ecosystem.

Using the metaphor of 'Texture of Practices,' the research acknowledges how practices rest on each other and move towards societal focus to emphasize the socio-contextual nature of innovating.

3. Methodology
An exploratory approach was adopted to evaluate the digital transformation of start-ups. Considering the limited insights available regarding healthcare start-ups in Italy, this study makes use of the 'Qualitative method' to understand the disruption and innovation process and relevant actors.

Data Collection
Considering the nascent state of start-ups and lack of well-developed case studies, the content analysis was carried out by retrieving meaningful information from artifacts.
According to Hsieh and Shannon (2005), it is a research technique capable of making replicable and valid inferences through interpretation and coding text-based material. Evaluating text in a systematic manner qualitative data can be converted into insights with the following –

1. Company Reports
2. Official Websites
3. Relevant Videos
4. Hypertexts &
5. Infographics

The data collection process was summative that involved a comparison of keywords followed by the interpretation of the underlying context. The breadth (across available content) and the depth (of data) were also considered during content selection along with availability (Darke *et al.* 1998; Perry 1998) and were focused on the start-up ventures in an Italian context.

Data Extraction
Data analysis was based on two academic frameworks presented by -

a) Kohlbacher (2006)

b) Bengtssons (2016)

'Content Extraction' using Kohlbackers Model (2006) describes the qualitative analysis that utilizes coding agenda derived from the content.

For analysis, (1) Summary, (2) Explication, and (3) Structuring can be carried out using a software application. In line with the same process, the content validation was achieved using another framework that included De-contextualisation, Re-contextualisation, Categorization, and Compilation of content yielding manifest and latent analysis. (Bengtssons, 2016).
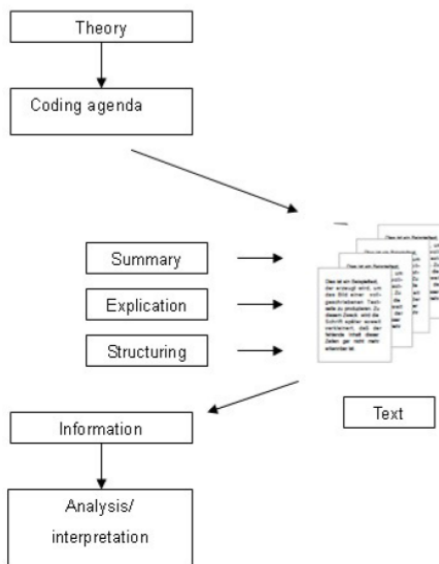
Figure 1: Basic proceedings of qualitative content analysis (Source: Glaser & Laudel 1999)

Using systematic classification, unstructured data can be segregated, and further classified to present collected information with insightful interpretation. This empowers the process of comprehensive data collection to explicate complex issues and advance existing knowledge (Gummesson 2005).

'Qualitative Content Analysis' was done using the following -

A) Qualitative Analysis Software - Atlas.ti (Suggested by Silver & Lewins, 2014)
- *Helps systematize the content*

B) Frameworks - Bengtsson (Supported by Kohlbacker, 2006)
- *Helps extract the content from unstructured form*

There were eight (8) start-ups studied for the same. The start-ups were selected based on the relevance to the healthcare sector that fulfilled purposive sampling, as suggested by Patton (2002). As there exists no ideal number of used for such analysis, multiple cases present a robust outcome, especially considering the inductive theory-building process (Eisenhardt & Graebner, 2007).

For qualitative content analysis purpose, researchers opted for Atlas.ti software, since it offers several advantages, enabling Visualization, Integration, Serendipity, and Exploration practices as follows –

A. **Visualization:** The visualization component of the program supports systemic activities in a creative manner. The data analysis application helps visualize complex relationships between the objects segregated during the process of eliciting meaning and structure from the analyzed data.
B. **Integration:** The tool also facilitates the hermeneutic unit that keeps all relevant entities at a single place. It integrates all pieces that are represented using unstructured data and lets the researcher not lose sight of the project when going into greater depths.
C. **Serendipity:** It presents the possibility of making fortunate discoveries accidentally with an intuitive approach to data. This view also supports data exploration using text search as well as the hypertext functionality.
D. **Exploration:** Through an intuitive but well-structured systematic approach to given data, it presents a productive approach to an exploratory data analysis.

Content Analysis

'Content analysis' helps elicit meaning from aggregated information from the text, images, and videos to draw a realistic conclusion. There were three companies that had their own data available in Italian; hence were required to be translated. Presented content analysis is based on the subjective interpretation of the content of textual data, images, and videos (Ary *et al.* 1996). This method follows a systematic classification process to identify patterns, making replicable and valid inferences from the unstructured content based on the context (Krippendorff, 1980).

The content analysis is fulfilled using a data extraction tool. It engineers the process to identify patterns from the case studies in a systematic way leveraging academic frameworks. In the process, it also makes use of applicable theories in innovation practices, making it interdisciplinary research. Such analysis further significantly reduces the volume of text collected and supports the researcher to identify and group categories to seek knowledge.

This can be re-confirmed with Kohlbacker's model for content analysis, as shown in above **Figure 1.**

4. Results and Discussion

Observations

The research observes a set of actors within which relationships are being established and re-established. Through this process of resource integration and value co-creation is expected to take place, leading to relevant, innovative practices.

Based on the qualitative content analysis with 24 Codes and using 79 quotations, data are extracted from the 19 artifacts that include images, videos, infographics, and documents **(Refer *Figure 2*)**. As per the research design, multiple sources of data - and multiple participants (Ponelis 2014, Maimbo & Pervan, 2005) are used to triangulate data (Yin, 2009). The process of data analysis from the triangulated data leads to the emergence of significant insights (Myers, 1997), as shown in the figure below-
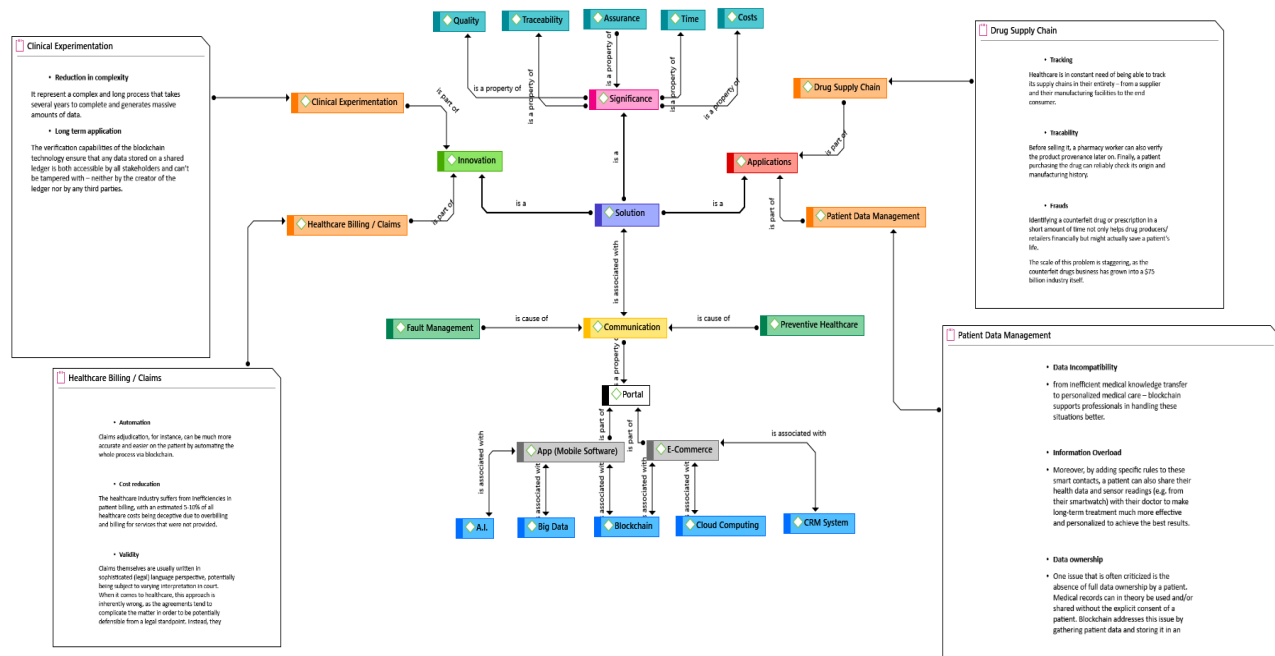

 Figure 2. Qualitative Content Analysis

The Texture of Practices plays a significant role where technology and patient (Human) interaction drives digital transformation in healthcare start-ups (Gherardi, 2010; Mele & Russo-Spena, 2019). Further technologies alter the broad nature of practices by re-configuring the contribution of human participation leading to innovation.

As per *Figure 2*, The set of technologies (including A.I., Big Data, Blockchain, CRM Systems, and Cloud computing) adapts to be able to communicate via the portal.

This arrangement can provide the customer with the ability to make relevant interactions. Such interactions are personal in nature can be facilitated using mobile applications (Apps) on smartphones. *The features of mobile Apps help start-ups develop emotional proximity and engagement*. On the other hand, the convergence of technologies directs the healthcare service providers (or start-ups) for customer inputs using E-commerce that can offer tracking capabilities to the consumer (or a patient). *This affirms the place of a consumer at the center stage of the service ecosystem.*

This portal can be accessed using a mobile app and can further be supported by online E-commerce practices. The portal-based services help *improve product safety by reducing the possibility of counterfeiting and guarantee the reliability within the supply chain*. At the same time, it allows patients to access multiple features placed at their fingertips.

Both the possibilities (use of mobile applications or use of online portal) generate data that can further be leveraged for digital transformation. In line with the above observations, the practices are seen as networks of heterogeneous elements kept together by active processes of relationships actions and performativity (Gherardi 2012). *The performativity view of practices contributes to advancement notions by continuously changing reality, rather than merely reproducing it.*

As shown in **Figure 2**, performativity - inspired by the convergence of technologies – yields' Fault management' and 'Preventive Healthcare' practices.

In the service ecosystem, both these practices can support a start-up to find traction in the healthcare market.
With significant data access during the interaction of start-ups and customer, the next layer of innovations supports communities to discover new evidence for studies on rare diseases. In a holistic manner, start-ups establish an active communication channel with the customers, the ability for dynamic reporting that provides enhanced care, and integrated care solutions that put the patient at the center of the healthcare services, and that is supported by data-driven research.

This observation is a testimony of the digital Innovation experience by Healthcare start-ups within the service ecosystem.

5. Discussions
Significance of Datum and Digital Start-ups
As identified during Qualitative Content Analysis, healthcare start-ups employ digital technologies, to perfect ICT Integration with product/service portfolio (Website Portal) and software applications (Mobile Apps) and ensure a greater quality of health services. In terms of quality, it can further be said that there exists an association of the use of mobile applications (App) and E-commerce practices that affect customer care. With more data derived from customer interaction, it can be operationalized to provide personalized choices to the consumer.

 Figure 3. Word Cloud

In this entire process, the role of 'Data' becomes essential, and the fact is supported by the word-cloud derived from the research artifact, as shown in **Figure 3.** Considering the democratization of data in the healthcare processes, a significant reduction in terms of cost as well as in time can be achieved.

Digital innovations reflect on both the start-ups as well as the consumer. Using online portals (using either Apps or E-commerce) - through consumers perspective in healthcare, patients can:

- *Access customized services*
- *Order medical tests*
- *Schedule doctors' appointments*

While healthcare start-ups can:

- *Deliver personalized services*
- *Sell medicines online*
- *Enhance the overall quality of service*

Digital Innovation using Texture of Practices

When both of these avenues are used simultaneously (using both Apps and E-commerce channel), it presents a win-win situation for both the entities in play that brings a higher level of transparency for the healthcare start-ups for the services while providing greater assurance to the patient.

The metaphor of a texture of practices acknowledges how practices rest on other practices and thereby move beyond solely economic focus to emphasize the socio- contextual nature of innovating and within which relationships can continuously be established and re-established, resources integrated, and value co-created. (Russo-Spena and Mele 2018).

In the healthcare ecosystem –

➢ *The practices of co-creating a value reflects on the enhanced quality of healthcare products/services.*

➢ *The practices of resource integrating reflect on reduced Supply chain costs.*

It does not stop there –

➢ *The practices of co-creating a value reflects on preventive Healthcare practices.*

➢ *The practices of resource integrating reflect on the fault Management process within the supply chain.*

As per the definition, Innovating happens when the texture of practices that are woven through pairs of intertwining practices of resource integrating and co-creating. The above evidence fulfills the Digital innovation by presenting a strong positive case for both the customer (patients) as well as the healthcare the start-ups.

6. Findings

Applications in Healthcare practices

From the presented analysis, it can be found that a Healthcare start-up can focus on Applications and innovations. The Applications include Patient Data Management and Drug Supply Chain, while Healthcare billing and Clinical Experimentation can be derived from innovation.

In the service ecosystem, a network of entities made up of humans (Patients) and non-human actors (Technologies) extracts essentials factors for Digital transformation. As it can be observed from *Figure 2*, the factors including quality, traceability, and assurance along with time and cost demonstrate a new context of doing business and creating new solutions for individual and social challenges.

Innovation in Healthcare

The innovation in the Healthcare sector can help improve the well-being and lifestyle of an individual with a focus on health services. The solution offered by these start-ups can help maintain medical data with a doctor or make it accessible to healthcare professionals in case of an emergency.

As this involves significant data exchange, the start-ups can benefit from the same to be able to offer personalized solutions and gain a more significant market share. Healthcare Start-ups should focus on the design and deployment of integrated solutions in healthcare.

Digital Innovation in Healthcare Start-ups

Analyzing the dynamics of interconnected social and technological phenomena is highly complex; however, research displays how different actors (including technologies/gateways/elements, etc.) unfold in the service environment. The same is reflected in the co-occurrence table below that was retrieved from the content analysis.

As the co-occurrence table *(Table 2)* shows, the value of groundedness of significance and Innovations is considerably high. And the higher-order density (*Three*) accentuates the significance of 'innovation' that comes into fray within the presented study.

Table 2: Co-occurrence table

	● Applications Gr=14	● Innovation Gr=15
● Communication Gr=1	0	0
● Significance Gr=8	1	(3)
● Solution Gr=4	1	1

According to Russel and Norvig (1995), technologies like Artificial Intelligence (A.I.) encompass logic, probability, and continuous mathematics that evolves and reflects on digital transformation and the complexity of networked connections. This finding also fulfills the 'Systems theory' that considers a holistic approach towards the output delivered by interconnected elements of the system. (Capra 1996, Ahouse 1998).

It ultimately enables the service ecosystem to interactively manage its objective by self-configuring processes that can satisfy all the involved participants over time. (Barile and Poelse 2010). In line with the above findings, both the stakeholders in the healthcare ecosystem receives hedonic as well as societal benefits.

Insights

Based on the current trend observed from artifacts in Italian Healthcare start-ups, networked entities react with each other for digital innovations. It leads to the transformation of the service ecosystem that can be categorized into the following manner -

A) Healthcare Data Management:

 (i) Data Ownership – The patient's data access itself is governed by smart contracts and their own rules using Blockchain technology. This allows patients to share their medical records on their terms with complete ownership. Depending on a patient's needs, the data itself can be anonymized for research purposes or made entirely transparent.

(ii) Information Overload – With the explicit consent of a patient can also share their health data and sensor readings (e.g., from IoT devices) to make the medical treatment effective and personalized to achieve the best results.

> ➢ *It leads to benefits for patient (or customers in Healthcare ecosystem)*

B) Clinical Trials and Experimentation:

(i) Potential Discovery – It represents a complicated and lengthy process that takes several years to complete and generates massive amounts of data that can be stored using Cloud computing and Processed using Big Data Analytics for medical discoveries.

(ii) Data Validation & Trust – The verification capabilities of the blockchain technology validates the authenticity of data and ensuring privacy.

> ➤ *It leads to benefits for Healthcare start-ups*

C) Medical Billing and Claims:

(i) Automation – Healthcare practices such as Billing/Claims filing, can be much more streamlined by automating the whole process via Blockchain. A.I. technologies can support the settlement process using predictive modeling.

(ii) Data Access – Blockchain-powered smart contracts are capable of resolving the issue as the data is available in real-time. With A.I and Big Data-driven modeling, it is possible to predict associated healthcare costs.

> ➤ *It leads to benefits for patient (or customers in Healthcare ecosystem)*

D) Drugs Supply Chain:

(i) Tracking/tracing – Healthcare sectors need to track their supply chains to facilitate consumer demands. At the same time, the Pharmacies can verify the medicines - using Blockchain - in order to confirm its reliability and origin.

(ii) Fraud Management – Identifying a counterfeit drug or prescription helps drug retailers financially but might actually save a patient's life and also makes sure that resources are not wasted, confirming the authenticity of products.

> ➤ *It leads to benefits for Healthcare start-ups*

That said, in the Italian context, the evolution of technology is already addressing many of the industry's issues by transforming the approach to patient data ownership or supporting drug manufacturers in the distribution process. Digital transformation further helps automate processes related to the healthcare sectors that result in supporting healthcare professionals to concentrate on core operations.

7. Implications for Managers

Digitization in healthcare can be time-consuming and expensive; at the same time, it can present several benefits for healthcare start-ups and customers. There are several implications for managers that improve the quality of health services and enhance patients' involvement in care practices. Based on the observations and insights, it must lead to a focus on supply chain management and customer care solutions.

- **Customer Experience:** Integrated care solutions using a set of technologies helps obtain relevant, reliable information and respond promptly with early diagnosis and timely personalized intervention.

- **Customer Engagement:** Process Re-engineering in healthcare can seek 'patients' involvement' as an essential aspect of digital transformation.

- **Integrated Solutions:** Healthcare start-ups can harness the capabilities of the Blockchain (such as traceability) to provide robust healthcare platforms.

- **Improved Interaction:** By adapting stringent data privacy and security guidelines, it is possible to establish a continuous exchange of data between in healthcare industry can contribute towards advancements for research purposes.

Improved access to data can lead to greater participation of stakeholders as well as the community.

8. Limitations and Future Research

Some of the limitations of our study can be resolved during the course of future research.

The choice of the methodology used, qualitative content analysis, does not allow the comparison of what the content affirms with what reality reveals, furthermore, it should be noted that the research uses only information that has been publicly disclosed by the start-ups of the sample analyzed. Qualitative studies present a limitation on validation of observation drawn from the given case studies, and hence knowledge can be subjective! On similar lines, translation from Italian to the English language may have a possibility of data being lost in translation.

In the future, research can be extended for further inquiry on how digital innovation impacts Italian start-ups:

(1) **An exploratory investigation of the Italian Healthcare Ecosystem:**

Using service-dominant logic (SD-L) and service-dominant architecture (SDA), future research could explore how actors and different start-ups could cooperate in analyzing customer needs and formulate a digital strategy that effectively meets patient demands.

(2) **Longitudinal studies of impact digital innovation in the Italian healthcare:**

Future research could investigate the customer experience and how the digitization relates to satisfactory health services. Such studies should be carried out for an extended period than has been done so far in the current research. These studies could discuss and analyze the development of how start-ups have responded to the digitization process by adapting to their services.

9. Conclusion

Digital innovation is a product of human and non-human actors. Human actors include patients, while non-human actors include technologies. Technological actors adapt and configure itself to the data retrieved during interaction with patients. The nature of the Texture of Practices - give rise to Innovative healthcare practices. Using technologies, It possesses the capability to provide hedonic value in terms of customer experience and societal value to transform the healthcare sector. The opportunity of providing personalized solutions and maintaining quality leads to the transformation of the healthcare ecosystem. Digital innovations in Healthcare start-ups make higher utilization of cost as well as resources.

It can be inferred that supply chain management and consumer participation are of great importance for healthcare start-ups. The research further concludes that the application of technologies is associated with two (2) channels where E-Commerce (that provides transparency to the supply chain to a start-up) and Mobile Application (that offer customized services to patients). Both these channels can be embedded on an online portal in order to communicate with patients and deliver healthcare services effectively.

The patient can be subjected to the convergence of technologies to leverage preventive healthcare practices and benefit from the healthcare supply chain in a proactive manner. This makes healthcare processes more effective for patients by putting a patient at the center of the healthcare service ecosystem facilitating digital transformation. Research suggests that digital transformation in Healthcare Start-ups includes, Healthcare Data Management, Clinical Trials and Experimentation, Healthcare Billings/Claims Settlement, and Drugs Supply Chain management.

In the healthcare sector, digital innovation can tackle the complexity of practices by proactively re-aligning human and non-human actors. In the service ecosystem, it offers greater involvement of patients and empowers them with healthcare information and relevant knowledge.

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