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Knowledge management in virtual community: some implications in COVID-19 pandemic

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Abstract. To reduce the COVID-19 contagion, the organizations have had to implement new organizational models based on the technology intensive, social distance and the reduction of face-to-face contacts. These conditions have led to the creation of virtual communities. A Virtual Community (VC) can be defined as a social entity which, using ICT, allows the sharing and transfer of knowledge between members of the community, bridging the geographical distance. VC are based on a Human-Device-Human interaction. For this reason, VC are based on the continuous and active participation of members, a rapid access to shared knowledge and reciprocity of information. Also in the healthcare sector, there has been the creation of VC. A VC in the healthcare sector aims to share knowledge related to the delivery of health services, provide support and discuss problems related to health and treatment, share documents and consult doctors. Few studies have focused on the VC in the healthcare sector, from the perspective of knowledge management.

This study aims to identify and understand the elements of the VC in the healthcare sector. An explorative-qualitative methodology was used. Mobile applications (M-apps) created by public authorities in Italy were analyzed.

The results highlighted that the VC, through the M-apps, is a complex system characterized by a reciprocal relationship between the members. Some aspects, such as trust and functionality of the M-app and speed of response, can allow the success of the virtual community. M-apps are a useful tool for KM and enable to support healthcare sector.

Keywords: Knowledge Management; Mobile Application; Virtual Community.

1 Introduction

The COVID-19 pandemic represented an unexpected event that had repercussions in all economic and social systems. The major consequences of the COVID-19 pandemic have manifested themselves in the health system. The health system has found itself facing new challenges to change imposed by COVID-19. Some phenomena such as social distancing, quarantine and the use of personal health protective devices are some of the main challenges facing the health system in the era of COVID-19. As a result, healthcare organizations have had to adopt new organizational solutions. The adoption of new solutions has a direct impact on the health of the local community. An organizational solution adopted by healthcare organizations is the use of information and communication technologies (ICT). ICT platforms have that facilitate and support interaction between individuals in geographically distant conditions. The implementation of ICT in the health system, with the aim of improving efficiency and reducing costs (Eng, 2001; Akter et.al. 2011, p.100–116), takes the name of E-Health, that is digital health.

Studies and empirical evidence (Granja, et al., 2018; Dugstad, et al., 2019), which dealt with E-Health, distinguish a growing line of studies based on the implementation and use of mobile devices (smartphone or tablet) and wearable sensors for health services and information (Steinhubl et.al., 2013; Nilsen, et al., 2020) under the name of Mobile Health (M-Health). With the rapid spread of smart devices and a distribution model of Mobile Applications (M-apps), through the mobile app stores, they are increasing.

In particular, M-apps have become a convenient way for the user to obtain valuable health information and advice.

The rapid evolution and diffusion of M-apps has made an important contribution to help people communicate and share, but also to collect and retrieve information and knowledge. M-apps have proved to be a powerful prospect in promoting healthcare sectors and enabling patient empowerment and disease management (Haluza and Jungwirth, 2014).

This study aims to understand the impact that the COVID-19 pandemic on the health system. In particular, the study, through the analysis of M-apps, issued by the Italian government and other Italian public bodies, analyzes the main characteristics of the creation of a virtual community in the healthcare sector.

We present the rest of this work as follows: after this (i) introduction, (ii) the main theoretical elements on the community and virtual community and knowledge management in healthcare are discussed. Below, (iii) the methodological steps and the data collection process are illustrated. Finally, (iv) the main findings and discussions.

2. Theoretical Framework

2.1 Community, community of practices and Virtual community

For several years, the concepts of "community" and "virtual community" have been a new trend topic in the academic debate. This growing attention to the phenomenon of "community" has generated a large number of theoretical and empirical studies. The concept of "community" has undergone significant changes in recent years. In the academic literature of social and managerial sciences, it is possible to define the concept of community. Communities are characterized by intense relationships between people due to a common interest or field of application (Lesser and Storck, 2001; Chiu, et al., 2006; Zboralski, 2009; Peñarroja, et al., 2019). In line with these studies, the typology and duration of interactions between a group of people is emphasized in order to learn and support each other, through the sharing and creation of relevant knowledge for members. From the perspective of knowledge management theory (Mårtensson, 2000), the concept of community is identified with the network of relationships between people who interact with each other through one or more organizational units with the aim of sharing and creating relevant knowledge for members. Often, the concept of community, from the perspective of knowledge management theory, finds application in the creation of communities of practice. The communities of practice are characterized as an active system on which the participants exchange a regular flow of information between the members of the community, allowing the creation and exchange of knowledge and practices (Gherardi, 2009; Hafeez, et al., 2018). KM's theories value interpersonal relationships as essential for learning. Established literature, it defines communities of practice as self-organizing networks in which a group of people from an organization participate in its boundaries. The community should be understood as a tool to support Knowledge Management (KM).

From a review of the literature, it is possible to identify some elements that characterize the communities of practice. In particular, interaction within a community can be influenced by: i) trust; ii) cohesion; iii) communication climate; and iv) frequency of interaction. An emerging line of community studies, starting from empirical observations, has shown that community building is a rich source of knowledge creation. From these studies it is possible to trace three dimensions that determine the development and effectiveness of the community: mutual commitment, a sense of common enterprise and a shared repertoire of common resources. The evolution of technology and information systems has led to the creation of virtual communities. In fact, in recent years, the scientific debate of various study sectors has focused on virtual communities. Although the literature on virtual communities is very wide, it is possible to identify and summarize a definition of virtual community. Virtual communities, through the use of intelligent and next-generation technologies, allow community members to exchange data and information, through a process of collaboration and integration. The virtual community in the healthcare sector connects

patients, doctors / nurses and healthcare facilities at a physical distance, through IoT technology

Despite the growing debate around the concept of virtual community, few empirical studies and research have focused on the healthcare sector. Indeed, new IoT devices can support healthcare organizations in responding to the new challenges posed by the COVID-19 pandemic. IoT devices are able to create virtual environments that include connected medical devices and wearable technology has allowed the continuous monitoring of vital values with the aim of continuing to provide services related to health and well-being. These conditions have led to the creation of virtual communities in the healthcare sector. The evolution of technology in the healthcare sector and the creation of virtual communities aims to improve healthcare efficiency and has a direct impact on the health of citizens. The first applications of IoT technology in the health sector were able to provide information on physical activity, advice for healthy nutrition and well-being (Bencardino and Greco, 2014; Wallezky, et al, 2016).

In traditional communities there was only one type of Human-Human interaction, characterized by a face-to-face relationship. In virtual communities, relationships between community members take place at a geographical distance and through interaction with different devices. For this reason, it is possible to distinguish two types of interaction: Human-Device and Human-Device-Human interaction.

In the first interaction - Human-Device - the human members of the community interact and collaborate with non-human agents of the virtual community (e.g., artificial intelligence or chatbot). In this interaction, human beings and devices collaborate to exchange data and information. In the second type of interaction - Human-Device-Human - the human members of a virtual community interact and exchange data, information and participate in the co-production process of new knowledge. In this type of interaction, the technological device is a tool used by the members of the virtual community to communicate with each other, overcoming the physical distance.

2.2 Knowledge management and virtual community and healthcare system

In the last decades, "knowledge" has been considered a strategic resource for the sustainable growth of organizations. For this reason, knowledge management (KM) has become fundamental for any type of organization. Focusing on the healthcare system, there are several studies (theoretical and practical applications) on knowledge management (KM) in healthcare system (Bordoloi and Islam, 2012; Tretiakov, et al., 2017; Karamat, et al., 2018; Popa and Stefan, 2019; Almansoori, et al., 2021). The healthcare system represents a specific application area for knowledge management (KM) scholars. The debate on the implementation of KM practices and models in the healthcare system assumes that the healthcare sector is one of the most complex systems (Anderson and McDaniel, 2000; Orr and Sankaran, 2007; Reinhardt et.al, 2004) made up of organizations of different nature (public, private and mixed) and

dimensional heterogeneity and high professionalism that offer services that directly affect the well-being of society.

Recent advances in ICT technology have strongly influenced every sector. The healthcare sector has also been influenced by ICT technological innovations. In the healthcare sector, the implementation of ICT practices, within KM studies, are important for the dissemination of knowledge and a key factor for organizational development and change. From these premises, it is possible to focus attention on the "knowledge co-production" process.

Knowledge co-production is based on a collaborative relationship and social interactions. In a virtual community in the healthcare system, knowledge co-production aims to support patients, caregivers, families and healthcare professionals through the exchange of information, data and communications between people who are not physically present at the same time in a single place. Therefore, knowledge co-production is influenced by the quality and typology of the relationships and the relationship between the interested parties. Common rules and mutual trust are important. Furthermore, in virtual communities, knowledge co-production is influenced by the practicability and ease of use of technological device and IT skills and experiences. Knowledge co-production consists of the exchange of user experience and relationships. From this perspective, the creation of knowledge is a social process determined by social interactions between individuals. Social capital, understood as networks of relationships and connections between members, becomes a precious source for knowledge co-production and the growth of the virtual community (Rezaei, et al., 2020). Social relationships, belonging to the social capital of the virtual community, are fundamental for creating and accumulating new knowledge. Social interactions, through technological devices, allow frequent dialogue, sharing of knowledge and continuous learning. Therefore, social capital plays a strategic role in knowledge management processes. Ultimately, interactions play a vital role in the creation and accumulation of collective knowledge.

3. Methodology

This study has an exploratory purpose and aims to investigate the main characteristics of the virtual community, which was created during the COVID-19 pandemic, in the healthcare sector. For this reason, a qualitative and deductive approach was used. This qualitative research has a twofold objective. The first objective of a theoretical nature is aimed at building the theoretical premises of the characteristics and factors that led to the creation of a virtual community in the healthcare sector, with reference to M-apps. The second objective of an empirical nature, the study analyzed the M-apps, released by the Italian government and other public bodies (regions) and approved by the Regions as tools to combat COVID-19, have been observed and are present in the operating platforms. most popular (Play Store and iTunes). In addition, various data sources were used. A total of 10 M-apps were observed, of which 9 issued by the individual Italian regions. The regions that have released an M-app for the

management of the COVID-19 emergency are Calabria, Campania, Lazio, Lombardy, Puglia, Sardinia, Sicily, Trentino Alto Adige and Veneto. The identified M-apps were subsequently analyzed, highlighting the type (free or paid), number of downloads, technical functionality, description and user feedback. In this way it was possible to interpret some fundamental aspects to understand patient / user support during the COVID-19 emergency. Our research focuses on COVID-19 contact management, prevention and tracking. Each M-app has been rated based on a review of the product description, technical functionality and comments provided with current user reviews. All data was collected in an Excel sheet, which associates name, functionality, technical characteristics, n. download, nos. comments and average user rating.

4. Results and Discussions

The traditional face-to-face medical examination, based on trust between doctor and patient, has been partially replaced or integrated through the use of new IoT technology. The health system, therefore, takes on new tools for the transfer of knowledge. The reduction in face-to-face visits has generated an initial concern and distrust of patients towards new technologies to support the health system. This distrust has been overcome thanks to the continuous interaction between patients, doctors and healthcare professionals. This has led to the adoption and implementation of new organizational models capable of collecting data, information and knowledge transfer with the aim of developing and maintaining a doctor-patient relationship, through M-app. The M-apps, through a relationship and remote control, allows you to collect data, make diagnoses and care plans and provide support to the user / patient. Concentrating the analysis on M-apps issued by the Italian government and other Italian public bodies (regions). It is possible to understand the degree of integration with the regional health system and the impact in the process of managing patient care and assistance.

The study analyzed and observed the creation of virtual communities in the health sector during the period of the COVID-19 pandemic. As widely discussed in the literature, the virtual community phenomenon is large and complex. For this reason, the M-apps developed in Italy by public administrations were taken into consideration, defined as a tool for the transfer and co-production of knowledge. In particular, the observation of the M-apps was addressed to the "IMMUNI" app issued by the Italian Government and to 9 M-apps issued by the Italian regions (Calabria, Sicily, Sardinia, Puglia, Campania, Lazio, Veneto, Trentino Alto Adige, Lombardy). The primary and common function of all the M-apps considered is to provide reliable data and information to users / patients on the pandemic situation and to provide medical assistance in case of contagion or contact with a positive COVID-19. All M-apps are based on the use of Bluetooth technology, which allows for low energy consumption. This allowed for the rapid spread of M-apps and ease of use. The "IMMUNI" M-app released by the Ministry of Health has contact tracking and alert functions, downloadable and usable throughout the national territory (5 m +

download). Inside "IMMUNI" there are self-assessment questionnaires on the state of health, the behaviors (the various steps) to be implemented in case of contagion or contact with a positive COVID-19, information on the transmission speed of the virus, etc. Inside the M-apps there is a self-assessment and orientation questionnaire, a communication channel and medical support for diagnosis and advice on treatments, thus favoring the use of telemedicine, the only regional context. Only 8 Italian regions have developed an app that has the functions of symptom control, promotion of telemedicine and specifically: 1. Indication of diagnostic tests; 2. Information on self-isolation; 3. Integration with health surveillance (local health system). The only region that has created an M-app for contact traceability and alert functionality is Sardinia. They aim to offer residents and non-residents of the region a communication channel between user / patient and doctor for the diagnosis and advice on the treatment of COVID-19, with the specific purpose of 1. Monitoring of contacts; 2. Identify who you have come into contact with and 3. Provide information on dealing with the virus and identify the steps and steps you need to take next.

It is interesting to note that some authors (Zboralski, 2009) focus on some aspects that influence the creation of a community (trust, cohesion, communication climate and interaction frequency). Another aspect that emerges from the analysis of the virtual community in the healthcare sector is the coproduction of knowledge. In fact, thanks to the virtual community, patients can exchange information and data through Human-Device-Human interactions with other patients and doctors. In particular, the M-apps allow the exchange of opinions and information both through the dedicated virtual space in the store. In this case, the exchange of information between users is linked to the functions and use of M-apps. Therefore, relational capital is generated within the smart community. In fact, it is possible to understand the intensity of the relational capital by considering the Download Category and the territorial context of reference. All applications (except that of Sardinia, mandatory for those arriving in the region) can be installed voluntarily and the different functions have been grouped to allow people to give their consent separately. The data, if positive, can be shared, always voluntarily, with primary health care. Furthermore, through forums, chats and virtual spaces between users and doctors, it is possible to exchange information on medical care and assistance. These interactions represent the first source of knowledge co-production. The results of this study highlighted the main effects that the COVID-19 pandemic had on the Italian health system. In particular, attention was focused on the organizational response that the system had through the use of M-apps.

The main effect of this organizational response to change was the creation of a smart community in the healthcare system. The spread of smart and wearable devices has allowed the creation of a smart community, able to exchange data, information and start knowledge co-production processes.

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