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A Knowledge Management Approach to Complex Crises

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Abstract: The purpose of this paper is to present a knowledge management approach to complex crises, having as a reference the multiple crises generated by COVID-19, crises we are living with, and for which we cannot anticipate a specific end due to the knowledge absence concerning this complexity. A complex crisis is a system crisis that induces new crises in connected systems. The knowledge management approach shows that understanding complex crises and managing them needs an excellent understanding of these crises' knowledge gaps and the knowledge dynamics phenomena able to describe their manifestation and evolution. There is no *a priori* knowledge or model to give us the key to coping with these crises and designing the best solutions for all the problems generated by them. The present research is based on qualitative research of the significant literature by using the Grounded Theory. The findings show that a knowledge management approach offers new insights into the complexity of these phenomena, which can be symbolized by the *Black Swan* metaphor defined by Nassim Taleb in his seminal book *The Black Swan. The impact of the highly improbable*.

Keywords: knowledge; knowledge dynamics; knowledge gap; knowledge management; complex crises; COVID-19.

Introduction

The COVID-19 outbreak happened in the City of Wuhan, Province of Hubei, China, in December 2019. The new type of coronavirus belongs to the "*Coronaviridae family* and is widely distributed in humans and in other mammals. The virus is responsible for a range of symptoms, including dry cough, fever, fatigue, breathing difficulty, and bilateral lung infiltrations in severe cases" (Nadim et al., 2020, p. 25). The new type of disease has many similarities with avian influenza, MERS, SARS, and Ebola, causing many deaths. However, COVID-19 made many more victims and spread very fast in many countries worldwide (Peeri et al., 2020; Solnit, 2020; Wang et al., 2020).

The World Health Organization (WHO) announced a COVID-19 pandemic on 11 March 2020, when 125 600 confirmed cases were reported from 118 countries and regions from all over the world. The *Situation Report* No. 177 published by WHO on 15 July 2020 showed that all indicators concerning COVID-19 had dramatic values: 13 150 645 – the total number of confirmed cases; 185 836 – the total number of confirmed new cases; 574 464 – the total number of deaths; and 4 176 – the total number of the new deaths from the outbreak of this disease (WHO, 2020). "All this is due to the highly contagious nature of the virus, and the inexorable implications of the explosive spread during the acceleration phase" (Baldwin & Weder di Mauro, 2020, p. 1).

Governments in many countries decided a set of drastic measures to flatten the epidemiological curve and to control the health crisis. At the limit, in many countries, governments introduced emergency states with severe restrictions, including lockdowns. For the business environment, lockdown came as a disruptive change, and new strategies for survival had to be developed fast (Alvarez et al., 2020; Baldwin & Weder di Mauro, 2020; Syrett & Divine, 2012). After all these restrictions and a period of flattening the epidemiological curve, governments introduced a set of relaxations, especially for summer vacations. Unfortunately, in many countries, COVID-19 came with a second wave.

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According to the WHO, the global situation on 1 October 2020 can be synthesized by two indicators: 33 842 281 confirmed cases and 1 010 634 deaths. The situation by WHO regions for confirmed cases is the following: Americas – 16 624 745; South-East Asia - 7 071 811; Europe – 5 937 969; East Mediterranean – 2 405 123; Africa – 1 187 269; Western Pacific – 614 623.

The COVID-19 is a unique and global phenomenon. Many experts consider it metaphorically a *Black Swan* phenomenon. The concept has been introduced by Taleb (2007), who defines it as "an outliner, as it lies outside the realm of regular expectations because nothing in the past can convincingly point to its possibility" (p. XVII). Also, Taleb underlines that the *Black Swan* phenomenon "carries an extreme impact" (Taleb, 2007, p. XVII). Although the COVID-19 began as an epidemic producing a health system crisis in China, it has been transformed rapidly into a pandemic that generated crises in many other systems, like the economy, business, finance, education, culture, religious institutions, sports. At a metacognitive level, the COVID-19 is a complex crisis that created many knowledge gaps and made all deliberate business and knowledge strategies useless. It raised the necessity of creating *emergent business and knowledge strategies* to react to all these new situations.

The purpose of this paper is to analyze from a knowledge management perspective the complexity of the COVID-19 crisis by using the Grounded Theory in searching for published papers and documents about this phenomenon and trying to interpret them. The research question is the following:

RQ: How can Knowledge Management improve understanding of the COVID-19 complexity and find solutions to manage it.

The structure of the paper is as follows. The next section presents some basic ideas about the Grounded Theory in order to show its adequacy for the present research. Then, we present the methodology used, explaining how we applied the Grounded Theory for this qualitative research. It follows a section containing results and discussions of our analysis. Finally, we present some concluding remarks and limitations of the paper.

The Grounded Method

The inspiration and the first contributions for the Grounded Theory came from Barney G. Glaser and Anselm L. Strauss. They had the intuition of proposing a new approach to creating an emergent conceptual framework while analyzing the results of interviews (Corbin & Strauss, 2015; Glaser & Strauss, 2017; Remenyi, 2014). Although there are some variations in applying the Grounded Theory, the fundamental idea is the same: "it consists of systematic, yet flexible guidelines for collecting and analyzing qualitative data to construct theories 'grounded' in the data themselves" (Charmaz, 2006, p. 2).

When performing quantitative research, we formulate some hypotheses, and we design a questionnaire. Based on this questionnaire, we perform a survey asking people from a certain target group to evaluate the items contained in the questionnaire, and then we process statistical data by using specialized software like SPSS, STATA or PLS-SEM in order to identify different possible correlations between constructs and validate the research hypotheses (Bryman & Bell, 2007; Saunders et al., 2007). One main aspect of designing quantitative research is to determine the necessary sample from the target group and to get valid answers from as many as possible respondents. By contrast to this approach, in Grounded Theory, we define a certain topic of research and start getting data from interviews, papers, documents, and other useful materials and develop hypotheses while we advance in our inquiry. The emphasis is on our imagination and inspiration. As remarked by Maxwell (2013), "A conceptual framework for your research is something that is constructed, not found. It incorporates pieces that are borrowed from elsewhere,

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but the structure, the overall coherence, is something that you build, not something that exists ready-made" (p. 41).

The Grounded Theory is an interactive and iterative research approach. It is *interactive* because you can have a dialogue with the person who is interviewed, build new questions during that process, and extract as much information as possible. The method is *iterative* because it implies many steps or phases in which the observer comes over the same questions with other interviewees or by using other sources of information. The method implies a constant comparison between data collected from different sources in order to identify similarities and differences, based on which the next levels of iterations can be constructed. The advantage of using papers and documents as sources for the qualitative data is that these primary sources already represent the first order of data processing. Thus, applying Grounded Theory represents a meta-analysis of those primary sources, which leads the whole approach toward a higher level of abstraction (Bryman & Bell, 2007; Corbin & Strauss, 2015). "The impact comes in the meaning given the data, the concepts used to stand for that meaning, the questions that are asked, and the components that are made" (Corbin & Strauss, 2015, p. 46). Because any researcher thinks through the lenses of his education, including the whole spectrum of the knowledge fields (Bratianu & Bejinaru, 2019, 2020), the final analysis cannot be purely objective. It depends on the subjectivity of each researcher. The meta-analysis may lead to induction or to abduction. When using the induction method, we start with individual cases and increase their number to extract some generalizations from that analysis. In abduction, we examine the given data to find some meanings and then develop hypotheses, which need to be validated during the research. The whole process's purpose is "to arrive at the most plausible interpretation of the observed data" (Charmaz, 2006, p. 186).

After collecting the necessary qualitative data, the focus is on *codifying* them and storing them in a database. Codification can be performed in several ways, from the very simple one, i.e., word-by-word, to more sophisticated ones like axial coding and theoretical coding (Charmaz, 2006; Corbin & Strauss, 2015; Glaser & Strauss, 2017). Codification can be considered as an abstraction process. It is iterative and emergent. During codification, many new ideas may emerge, and they will come as a result of knowledge dynamics, the transformation of rational, emotional, and spiritual knowledge in one another. "When doing analysis, it is important to bring emotions and feelings into the analysis. Emotions and feelings cue the analysis as to the meaning of events to persons" (Corbin & Strauss, 2015, p. 100). The COVID-19 crisis can be a very good example because it created a state of fear and pessimism in the population with many influences in their decisions (Aum et al., 2020; Chang & Velasco, 2020; Greenberg et al., 2020).

The next stage in Grounded Theory is to write memos and to draw diagrams for expressing our ideas and aggregating them into new constructs and theories. Also, they help in analyzing the progress we make in designing a new theory. We can return anytime to some previous stages and re-analyze them through the new findings. Thus, the method looks like a circular process, but in reality, it is a nonlinear and complex one that allows as many iterations as necessary for developing new ideas and models. This nonlinear approach continues until the researcher reaches a level of data saturation that is "usually explained in terms of when no new categories or relevant themes are emerging" (Corbin & Strauss, 2015, p. 139). In this stage of data saturation, the researcher stops analyzing new qualitative data, and he integrates all the concepts and ideas into an abstract whole that represents the *emerging grounded theory*.

Methodology

The present research is based on the Grounded Theory (Corbin & Strauss, 2015; Glaser & Strauss, 2017; Charmaz, 2006) and systems thinking (Jackson, 2019; Senge, 1990) in understanding the complexity of the COVID-19 crisis and in revealing the potential of knowledge management (Nonaka & Takeuchi, 1995; Rhem, 2017). Both theories allow an

iterative process of collecting qualitative data and interpreting them, as well as integrating the emergent concepts and ideas into a conceptual framework. That opens a new way of investigating the complexity of COVID-19 crises created in the health systems, economic systems, educational systems, and many others. According to systems thinking the complexity theory, the focus should be not on the components but on their connections and interactivity, on systems' governance, on the nonlinearity processes, organizational entropy, and the dynamics of organizational knowledge (Bratianu, 2019; Bratianu et al., 2011; Bratianu & Pinzaru, 2015; Gleick, 2008; Jackson, 2019, Stacey, 2001). Only by understanding these crises, we will be able to develop adequate solutions. Our approach's novelty consists of using as qualitative data, papers, reports of different organizations, and documents issued by the European Commission and government from some countries. We followed each of the stages described above and obtained a series of results, which will be discussed in the next section.

Results and discussions

Understanding the meaning of a crisis

Any system can be characterized by three fundamental states of functioning: a) a state of *normal* functioning, when all the control parameters have values within the designed reference system; b) a state of *abnormal* functioning, when some parameters have values outside the reference framework, but the system can continue functioning for a very limited time, and c) a state of *breakdown* when the values of some parameters exploded and the system cannot function anymore. A crisis is a phenomenon when a system passes from a normal or abnormal state of functioning to a breakdown state. If that breakdown does not destroy the system, it can recover due to its resilience. There are several definitions for crises in the literature, each of them reflecting a specific domain of applicability or a certain experience of the authors.

Pearson & Clair (2008) define an organizational crisis as being "a low-probability, high-impact event that threatens the viability of the organization and is characterized by ambiguity of cause, effect, and means of resolution, as well as by a belief that decisions must be made swiftly" (p. 3). The authors identify the difficulty of anticipating such a phenomenon due to its low or extremely low probability of occurrence and the potential of a high impact on the organization. Also, they remark the absence of knowledge concerning the correlation between the cause and its effect and the difficulty of making decisions under the pressure of time and uncertainty. In these given conditions, the authors consider that "Organizational crisis management is a systematic attempt by organizational members with external stakeholders to avert crises or to effectively manage those that do occur" (Pearson & Clair, 2008, p. 3). Thus, crisis management differs from normal operation management. It has some new specific functions to interpret early signals of a possible crisis, to take any reasonable measures to avert the crisis, and if the crisis does happen to contribute to mitigating it and reducing its potential dramatic effects. In such a situation, "Organizational crisis management effectiveness is evidenced when potential crises are averted or when key stakeholders believe that the successful outcomes of short- and long-range impacts of crises outweigh the failure outcomes" (Pearson & Clair, 2008, p. 4).

Although some crises may develop as evolutional processes, most of them appear as disruptive processes, as discontinuities. Some authors consider them disasters or catastrophes, like earthquakes, hurricanes, or floods. "Corporate crises are disasters precipitated by people, organizational structures, economics, and/or technology that cause extensive damage to human life and natural and social environments" (Mitroff, 1987, p. 283). For illustration, the authors cite some technological catastrophes. The worst industrial accident in history happened at a Union Carbide plant in Bhopal, India, 1984. Poisonous gas escaped from a storage tank killing 3,000 people and producing injuries to another 300,000. The accident analysis revealed the lack of adequate safety measures and

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a significant absence of knowledge concerning the potential dangers of operating those complex technologies.

Another complex crisis was created by the nuclear accident at the Chernobyl nuclear power plant at 26 April 1986 (Baker & Chesser, 2000; Burghers & Stefan, 2008). The complexity of this crisis comes from an unfortunate combination of an old technology without adequate safety systems, a lack of significant knowledge concerning thermodynamics of boiling nuclear reactors from the training programs of the operational staff, and a dramatic absence of knowledge for nuclear reactors in the education of the military staff in charge with running a safety test coupled with the shutdown of the reactor. The military staff's presence can be explained as a result of the strategic importance of any nuclear power plant. The event triggering that nuclear accident was a safety test for the whole complex installation during a forced shutdown of the nuclear reactor. During the test, experts in nuclear energy identified some early signals that there were some problems with the control systems and requested immediately to stop the test. Unfortunately, the military staff in charge of the test's supervision had a task, and they wanted to be completed. Thus, the vulnerability of the technological design, coupled with the absence of adequate knowledge of the operational staff and the military staff's ignorance, lead to a powerful steam explosion within the nuclear reactor that cause the destruction of the nuclear reactor core. That explosion released considerable airborne radioactive material for about nine days with catastrophic consequences for the wild environment and for many communities of people. This is an example of a crisis that developed from an abnormal state of the nuclear reactor that could have been averted if the military staff in charge of running the safety test would have listened to the nuclear engineering experts. It is also a good example of the need to perform a thorough analysis of the vulnerabilities of a system and to construct safety barriers for preventing possible crises.

A complex corporate crisis that became a case study in business schools is that of Nokia (Laamanen et al., 2016; Lamberg et al., 2014). Nokia is a Finnish multinational company specialized in information and communication technologies. Nokia was founded in 1865 as a pulp factory and developed in time by changing not only technologies but also its vision, mission, and strategies. Since 1990s Nokia had focused on telecommunication technologies, becoming a global leader in mobile telephony until about the year 2000 when its business started to decay. A crisis in leadership and strategic thinking made Nokia lose global competition with Apple and Samsung. Finally, the crisis led to selling its mobile phone business to Microsoft in 2014. From that time on, Nokia makes hard efforts to re-invent itself in other businesses related to its capabilities and technologies.

Strategic management implies a visionary leadership that can be constructed on entropic, nonlinear, probabilistic, and creative thinking (Bratianu, 2015; Bratianu et al., 2020; Bratianu & Vatamanescu, 2017). Nokia took advantage of such leadership with the nomination of Jorma Olila as CEO. According to Laamanen et al. (2016), "Jorma Olila was Nokia's CEO when the company turned around in the 1990s from near bankruptcy to extraordinary growth … Moreover, many accounts glorify Olila's personality and skills as the sources of Nokia's success. Whether it is Olila's public presentations, organizational skills, innovativeness, vision, or negotiation skills, many authors recognize him as a major contributor to Nokia's success story" (p. 10). Also, that strategic thinking proved inspired in Nokia's business acquisitions and investments in risky new technology domains. From a knowledge management perspective, many authors recognize the knowledge capabilities (Garcia-Perez et al., 2020) developed by the Nokia's leadership. "Jorma Olila, for example, argued that Nokia's strength was its effective intraorganizational communication and the company's values, strategies, and vision, along with the quick dissemination of everyday information in an easily accessible manner throughout the company" (Laamanen et al., 2016, p. 11). The downfall of Nokia's evolution started with the end of Olila's "Dream Team" in the strategic thinking and the nomination of Oli-Pekka Kallasvuo as CEO. That declining evolution continued in an accelerated way with the new CEO in the person of Stephan Elop. "During his two-year tenure in Espoo, he was

ultimately responsible for a 62 percent drop in Nokia's stock price, a halving of their mobile phone market share, a precipitous fall in the smart-phone market share from 33 to 3 percent, and a cumulative loss of 4.9 billion euros" (Laamenen et al., 2016, p. 13). That loss can be explained, among other things, as a result of the *knowledge gap* between the technology level of the Nokia's mobile phone and that of iPhone. That knowledge gap and the leadership's incapacity of recognizing it constituted the main reason for the business crisis that culminated with the selling of telephone business to Microsoft.

A generic model of crisis management has been presented by Mitroff et all. (1987). Figure 1 illustrates this model.

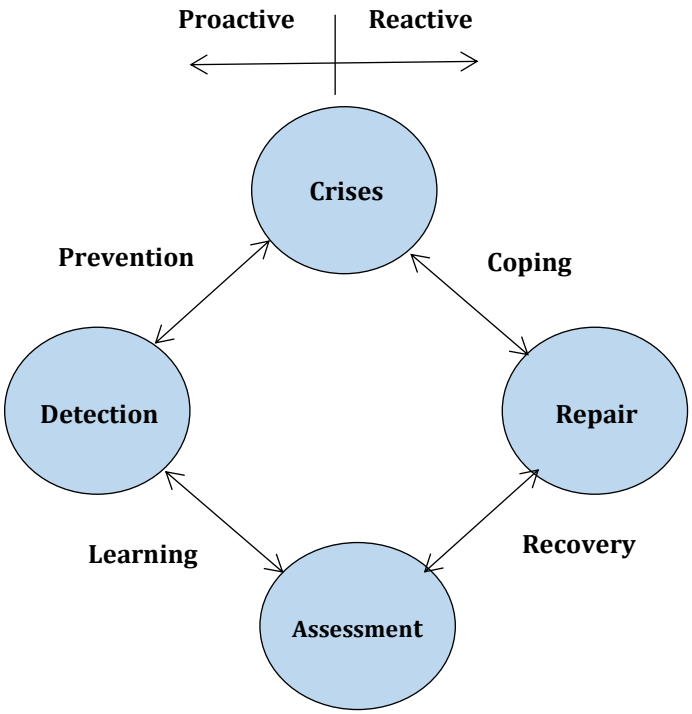

Figure 1. A model of crisis management
(Source: Mitroff et al., 1987)

The *detection* phase is an endless search of experts in scanning the environment and in sensing early signals from possible disruptive forces (Murgatroyd, 2015; Syrett & Devine, 2012). When crises develop within some evolutional processes, this phase must be used for interpreting early signals of any organizational dysfunction or abnormal events coming from the external environment. For the case of a disruptive crisis without any early signals, managers should think about prevention measures and designing barriers to stop or delay the outbreak. These barriers can be tangible, like those described for nuclear reactors' security, or intangible, like those built the organizational culture and people's behavior. From the knowledge management perspective, managers should identify any knowledge gaps and find solutions for their closure.

The *crisis* phase is the most difficult and most dangerous. Managers must understand the causes that generated the crisis, and then they must look for the knowledge gaps created by that crisis. Learning from previous experiences or similar phenomena are the most accessible ways of looking for knowledge to be exploited. At the same time, experts should be stimulated to share their experience with such kind of crises and to increase the

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organizational knowledge entropy (Bratianu, 2019). Managers must make all necessary efforts to contain the crisis effects and to reduce their destructive potential. That is about coping with disruptive forces.

The *repair* phase refers to the ending phase as a result of implementing adequate solutions. Also, the organization's resilience plays an important role in the recovery process. The organization returns to a new dynamic equilibrium with the external business environment. We must underline the fact that the whole process is irreversible (Bratianu, 2015), and the organization cannot return to its initial state. There are many changes determined by that crisis that remain. Also, there is residual stress in people that may have some negative consequences upon their behavior. The COVID-19 will have such kind of behavior modifications, and we should be aware of them.

The *assessment* phase is very important because it is the time for evaluating all damages produced by the crisis and all probable long-term consequences. From the knowledge management perspective, it is the time for learning by interpreting all new aspects revealed by crisis and then to integrate them into some lessons to be learned and used in future similar situations. Also, the organization "assesses the effectiveness of its crisis handling strategies and identifies areas in which better crisis management capabilities need to be developed" (Mitroff et al., 1987).

Knowledge gaps

The concept of *knowledge gap* has been introduced by Zack (1999) in correlation with the concept of *knowledge strategy*. Both concepts are paramount within the perspective of the *resource-based theory* of strategic management (Barney, 1991; Barney & Hesterly, 2012), because *knowledge* became a strategic resource in the last decades (Bratianu et al., 2011; Grant, 1997; Nonaka & Takeuchi, 1995; Spender, 1996; Sveiby, 2001). "At the same time, underlying a firm's strategic gap is a potential *knowledge gap*. That is, given a gap between what a firm must do to compete and what it can do, there may also be a gap between what the firm must know to execute its strategy and what it does know" (Zack, 1999, p. 135). A crisis always comes with a knowledge gap because it is unexpected, and it brings with it new aspects and problems by comparison with some of the previous ones. Each crisis is unique. There are some common grounds between the same types of crises, but there are also many differences. These differences create the knowledge gap (Holland, 2010; Pearson & Clair, 2008).

Knowledge managers should identify the knowledge gap associated with a crisis, and they should develop solutions for knowledge acquisition and creation such that the knowledge gap can be closed. "Having performed a strategic evaluation of its knowledge-based resources and capabilities, an organization can determine which knowledge should be developed or acquired" (Zack, 1999, p. 135). In the "known-unknown dynamics" matrix, this state of knowing is characterized by the expression "I don't know what I don't know" (Bratianu, 2020; Dalkir, 2005). The COVID-19 crisis produced in the health system generated many other crises in all connected systems, like the economy, finance, education, culture, sports, etc. There were created specific knowledge gaps for each of these crises, which must be closed as soon as possible to find adequate solutions for this extremely complex problem.

Knowledge assets, competencies, and capabilities

In the knowledge economy, knowledge becomes *a strategic resource*, and companies must develop new managerial capacities to deal efficiently with it (Lafayette et al., 2019; Nonaka & Takeuchi, 1995; Spender, 2014). *Knowledge assets* are knowledge resources that can be managed within a given organization. Unlike the physical assets, which are owned and controlled fully by the organization, knowledge assets are intangible and cannot be fully owned and controlled. They are embedded in the workers' minds and experiences and can be managed indirectly by managing the true owners of that

knowledge. Knowledge assets have different characteristics than tangible assets, and those differences led to a new type of capabilities, competencies, and management. "Economic properties of knowledge vary from other kinds of capital because the concept of scarcity does not apply, they grow rather than diminish through use and expenditure, are an experience good, are public goods rather than singular products, carry high opportunity costs associated with consumption rather than acquisition, and have imperfect and non-competitive markets" (Handa et al., 2019, p. 91).

Competence is a construct reflecting the integration of knowledge, skills, and attitudes of an individual (Bratianu et al., 2020). The meaning can be extended to an organization when trying to evaluate its capacity to leverage knowledge (Garcia-Perez et al., 2020). A *capability* is a managerial capacity of a group or company to integrate resources and competencies across the organization and to use them for achieving a competitive advantage. When we consider knowledge resources and knowledge competencies, then we talk about *knowledge capabilities*. "By capabilities we mean what an organization or an individual does to deliver value to its stakeholders. Our competency models will transition from technical and behavioural competencies to knowledge capital attributes" (Garcia-Perez et al., 2020, p. 14). The most significant knowledge capabilities refer to managing knowledge dynamics, knowledge creation, knowledge sharing, knowledge transfer, and knowledge use, and developing knowledge strategies (Bratianu, 2020; Dalkir, 2005; Nonaka & Takeuchi, 1995).

Knowledge management goes beyond the industrial management of command-and-control and aims at creating valuable knowledge structures, knowledge competencies, and knowledge capabilities. Thus, knowledge management can evaluate the knowledge gaps associated with different crises and contribute with creative solutions in closing those gaps (Jennex & Raman, 2009; Moynihan, 2008). "Managing knowledge well is key to enhance an organization's ability to deal with business crises" (Wang & Belardo, 2005, p. 7). Because business crises have a low probability of occurrence, it is critical for knowledge managers to stimulate organizational learning and to learn what is new and specific to each new business crisis. Learning helps people discover and integrate new knowledge in their knowledge structures and prepares them for fast emergent strategies to business crises. Thus, learning and developing emergent knowledge strategies should be key actions during crazy times (Bratianu, 2020).

COVID-19 as a complex crisis

COVID-19 started as an *epidemic* in the city of Wuhan, Hubei Province of China in December 2019. It immediately created a crisis in the health system of that region, and due to its fast spread and aggression, COVID-19 was declared on 11 March 2020 a *pandemic* by WHO (Baldwin & Di Mauro, 2020; Spinelli & Pellino, 2020; Zhou, 2020). Due to its destructive power, governments in many countries introduce emergency states and drastic measures concerning people's liberty for traveling and gathering. Many domestic and international flights were canceled, train and bus transportation had severe limitations, and even individuals walking around was drastically limited. The purpose of all these measures was to flatten the epidemiological curve and to contain the pandemic within certain boundaries (Alvarez et al., 2020; Chang & Velasco, 2020; Gounrinchas, 2020).

All these drastic measures considered within the health system induced new crises in many other systems like economy, finance, business, education, culture, sports and religion. Moreover, these crises spread very fast all over the world as a result of globalization. When WHO declared COVID-19 a pandemic, its global influence has been recognized officially. The COVID-19 is a singular phenomenon like the *Black Swan* (Taleb, 2007), but it has immense destructive power and a global area of manifestation.

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Conclusions

This paper aims to analyze the dynamics of complex crises from the knowledge management perspective and from a holistic and strategic framework. We based our approach on the Grounded Theory method of searching and interpreting the adequate literature and extracting the ideas that can help us better understand the COVID-19 complex crisis. The most significant aspect we revealed in our study is the creation of a *knowledge gap* between the current state of knowing and the state of knowing necessary for finding adequate solutions to all the problems generated by a given crisis. Identification of the knowledge gap is not so easy because it assumes a very good understanding of the present level of available knowledge and the novelty of the crisis. Also, it implies the existence of functional crisis management based on previous experiences. The crisis management model elaborated by Mitroff and his collaborators refers to a generic crisis and identifies four basic phases: detection, crises, repair, and assessment. From detection to the outbreak of a certain crisis, there is a period of prevention and preparation when the crisis management design barriers to prevent or to delay the crisis' outbreak. During the crisis, managers must find practical solutions for containment and limitation of the manifestation zone. The repair phase shows the end of the crisis phenomenon and the starting of a new effort for recovery. However, we should underline the fact that a crisis is an irreversible process, and the ending phase is not the initial state of affairs but a new normal state. The knowledge cycle associated with a crisis ends with a critical learning phase for preventing and managing new crises.

The limitations of our research come from the qualitative method used and from the limited access to all the published works in this complex domain. Also, we used as qualitative data, papers, and official reports without any empirical research.

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