Advanced Crisis Management in Enterprise Networks: An Exploratory Study on the Effects of the Pandemic

Luigi Gentili[a]

Abstract

The aim of this article is to show the results of an exploratory study on crisis management in business networks. Using sociological research and the case study methodology, twenty-four questionnaires were handed out to managers of interorganizational networks, representative of the associations they belonged to. These are privileged witnesses, active in the most relevant production sectors. The research was carried out on a national level, region by region. The results describe an evolving business trend. According to the respondents, business networks are more efficient when dealing with a crisis. Flexibility, mutual support and territorial roots are the assets that make enterprise networks more competitive. By examining the data we can devise a new socializing practice, carried out in a structure with shared organization. According to the research findings, the identity dimension of business networks needs a deeper understanding. Network branding is a step in that direction. The correlation between network branding and Industry 4.0 policies, another important factor that emerges from the research results, allows us to create a matrix with four styles of crisis management. Together they make up a map of networks management, classified according to the response given to the current pandemic crisis. The advanced crisis management style in the matrix described in this article is an emerging form of inter-firm coordination.

Keywords: crisis management, enterprise networks, pandemic economics.

1. Introduction

The pandemic crisis had a destabilizing impact on firms. Abrupt and sweeping changes have forced companies to adapt quickly to an unprecedented

[a] Istituto Pantheon. Design & Technology, Rome, Italy.

situation (Eu Open for Business, 2020), as many entrepreneurial activities become obsolete in the face of such extreme events. The pandemic crisis, in fact, destroys all types of certainty, since companies are expected to come to terms with problems they have never faced before. The daily routine is no longer a reliable orientation. Issues addressed range from problems on information provision to decision-making and sensemaking of the current situation (Oord et al., 2020). However, many extreme events exhibit positive aspects. The crisis creates opportunities to rethink the companies' strategies, resources and relations (Mandják et al., 2017).

Because of the crisis, SMEs have the opportunity to progress through networking activities. The organization system of SMEs can evolve from a state of low cohesive links toward high cohesive ones, and this process has a specific motivation. The crisis entails a complex challenge that no actor can handle alone and which demands multi-organizational collaboration in impact assessment, planning response, and recovery from extreme events (Nohrstedt, 2018). Effective measures to face a crisis depend both on a large network and on the managerial practice sharing because mutual cooperation offers businesses a better chance to deal with uncertainties (Gentili, 2021). Joining forces, creating systems and weaving relationships through organisations becomes imperative. SMEs become stronger and more competitive in the market place because they can benefit from the 'systemic' economies of scale specific to medium and large businesses without losing their specificity (Tresca, 2016). However, a newly designed effective governance becomes necessary because of the sheer distance that exists between players and the different types of cognitive, psychological, cultural and geographical differences which separate businesses in the network. This evolution explains the benefit of new organizational and business strategies in the companies in order to direct, coordinate and run business networks.

It seems that the competitive advantage of a firm depends on its economic relationships with various entities. The competitiveness of firms is enhanced by a network of relationships developed through joint cooperation to achieve economic gains. The quality and number of links that one company has can shape its strategic relevance, affecting its performance (Abbas J. et al., 2019; Basole et al., 2018; Fonfara et al., 2021; Kim & Lee, 2018; Raza et al., 2018). The place of a firm in a business network influences its financial development (Seiler et al., 2020), the capitalization of knowledge (Eerme & Nummela, 2019), and innovation (Kim, 2019). The classic positional advantage conceived in terms of cost leadership or differentiation, as previously suggested by Michael Porter (1985), has become obsolete. The position of a company within a business network depends on collective relations and not on its isolation.

Enterprise networks, however, will have to rapidly rethink their

functioning in order to best deal with the post-pandemic context. They will be able to do so, for example, by adopting new management practices such as open innovation (Chesbrough & Bogers, 2014). A distributed innovation process through organic contributions from an open community allows firms to carry out more experiments, explore more ways and working methods of work, and apply more know-how in their own business (Chesbrough, 2020). It also appears beneficial to reconsider trade practices, not only by focusing more on clients, value propositions, sales and marketing channels, but also on the ability to manage the supply and product chains, as well as the productivity of employees (Ritter & Lund Pedersen, 2020). Redirecting production lines is another important element to consider: indeed, by redesigning their manufacturing layout, product sets and supply chains, many firms have repositioned themselves in a new enterprise network during and after the crisis, e.g., by producing items and personal protective equipment well-fitted to contrast the pandemic spread. This repurposing helps firms to continue to be active and present on the market, as well as to generate new revenues, and it positively impacts their reputation (Betti & Heinzmann, 2020). Thus, companies act within complex systems whose environment is analogous to an adaptive ecosystem, in which interaction and interdependence are established across indeterminate boundaries (Liu et al., 2021).

2. Literature summary

Despite the increasing importance of crisis management as a disciplinary domain, its application to business networks is still limited. For example, there is very little sociological research on crisis management in enterprise networks. Sociological studies focus on complexity of inter-organizational systems and their gradual and constant growth, underestimating crisis management applied to extreme and unscheduled events (Chabert-Liddell et al., 2021; De Vivo & Sacco, 2000; Powell et al., 1996; Schrank & Whitford, 2011). Extending the discussion to social science, instead, most researches concern individual organizations (Lagadec, 1997; Mitroff & Pauchant, 1988; Poma & Vecchiato, 2012; Seymour & Moore, 2000; Shrivastava et al., 1988; Sochelmaei, 2020) or territorial ecosystems (Gerke et al., 1999; Sidlo, 2021; Therrien et al., 2015; Wisniewski, 2022). As we will see, the existing research focuses primarily on the benefits of crisis management, overlooking the cultural evolution of the managerial styles that characterize business networks.

In literature, an important factor in crisis management concerns the existing links between organizational networks and the private or public sector. In the private business sector, crisis management in enterprise networks

depends on three factors: firstly, the relationship between network breadth and depth, and the organizational resilience capacity of firms; secondly, the firms' ambidexterous learning (exploratory learning and explorative learning); thirdly, the digital technology level (Xie et al., 2022). In the public sector, instead, crisis management in organizational networks depends on factors such as flexibility and frequent communication among participating organizations. In such a context, emergencies require immediate, well-coordinated responses across organizational boundaries, with the development of horizontal relationships (Comfort, 2007; Kapucu & Hu, 2020; Kettl, 2006). The aggregate capacity of diverse actors and stakeholders emerges to work together to ensure swift mobilization of knowledge and expertise, outstripping the limitations of single organizations (Bynander & Nohrstedt, 2019).

In general, research emphasizes several factors that a business network can implement to cope with a crisis. In crisis management, for example, the ability to share resources is fundamental. For a business network, coping with a crisis is possible by sharing particular resources - e.g., equipment and funds - and capabilities - e.g., knowledge and expertise (Crick & Crick, 2020). Access to a multitude of resources (natural, physical, financial, human, social) then strengthens social networks, to tackle external shocks (Pham et al., 2021). To decrease the impact of a crisis situation we must also mention supplier integration, that can facilitate a quicker response to the market changes, achieving mutual commitment, as well as information sharing (Li et al., 2016).

The role of social capital is just as important. Social capital allows to obtain a high degree of trust and cohesion, essential to attain deep collective thinking, greater understanding of problems, sharing of perceptions and perspectives with business partners and enrichment of information and knowledge (Al-Omoush et al., 2022).

In company networks, among other factors that increase the chance to overcome a crisis, there are the following: first, learning processes in a variety of ways - including virtual learning, the learning forum, and learning from the past (Moynihan, 2008) - and the role of social media in open organizational processes (Eismann et al., 2021); then the ability to establish permeable organizational boundaries to reduce losses and improve the effectiveness of the organization itself (Chen., 2014), and the entrepreneurship mobilization as a collective means to encourage adaptive behaviours (Hermes & Mainela, 2014). Moreover, there are the connections between the nodes of a network, evaluated according to their intensity and distance (Güreşci & Arpat, 2016), the organizational communities structured in cohesive subgroups (Kim, 2019), and the influence of the perceptions of a crisis by a focal company as a key to interpret the management attributes, behaviours, and decisions (Mandják et al., 2017).

Other studies are based on the relationship between collaboration levels and performance goals (Nohrstedt, 2018), the spatial structure of environmental management practice and technology (Dai et al., 2020), and the impact of community business, to increase collaboration and motivation (Dobson et al., 2020). Finally, there is the presence of an organizational atmosphere with a definite identity and culture (Rosińska-Bukowska, 2020).

It should be noted that the mentioned researches mainly show two priorities of crisis management: the structure of the network organizational, technological or financial) and the influence of network relationships (social, cyber or knowledge). With the recent pandemic crisis and its business impact, we question whether there are other important factors that may characterize the change in enterprise networks. We are referring specifically to intangible resources, such as common values, meanings, culture and image. Do business networks need a strong collective identity? Are they capable to communicate externally in a unitary way? Are there particular crisis managerial styles conditioned by these factors? Such questions have influenced the formulation of a research hypothesis.

3. Research methodology

The research project presented in this article results from the joint work done by ASSORETIPMI, and CEIMA, Centre for the Study of Managerial Innovation. It is based on a sociological study realized between 2020 and 2021. The research aims to understand how business networks cope with the pandemic and their organizational needs. The initial hypothesis is that the recent crisis pushes enterprise networks to search for a new business model to strengthen their collective identity. It could be a new business model required by business networks also to reposition themselves in the post-pandemic environment. Moreover, the research evaluates the possibility of identifying a particular style of crisis management, after selecting some relevant variables.

Like any exploratory study, this research is based on gathering information on an in-progress phenomenon that is often overlooked. Accordingly, the research technique is mainly qualitative, and it is supported by quantitative measurements only to a limited extent: more specifically, the method used focuses on the presentation and discussion of "case studies". It is a widely used method to study economic systems, both at the territorial and sectoral levels. This choice depends on the following reasons:
- the exploratory nature of the research;
- the nuanced approach of the research, in which the dividing line between the subject of study and its environment is not always apparent;

- the study refers to multiple interconnected phenomena.

Twenty-four network managers - i.e. people that have a role of responsibility in handing interorganizational project and processes -, representing and coming from two different business networks: network agreement and industrial clusters were selected. Network agreements are multi-annual and inter-corporate cooperation contracts regulated by the Italian law; business clusters, instead, are enterprise networks with a geographical location that host a significant number of businesses that are all interconnected in some way (formally, informally or both). The selection of two types of inter-organizational networks depends on the fact that the project takes into account dynamic realities that are representative of the ongoing evolution.

The territorial reference base has been selected so that it is representative of the entire country. The selected case studies belong to the following nine Italian regions: Lombardy, Veneto, Liguria, Piedmont, Trentino Alto Adige, Friuli Venezia Giulia, Emilia Romagna, Abruzzo, Lazio, Campania and Sicily.

The product sectors belonging to the inter-organizational networks analysed differ in many aspects. They include granular features of each area in the sector, in order to allow a comprehensive outlook of the ongoing change. The product areas of the selected case studies are as follows: Construction, ITC, mechanics, services, transport, energy, plant engineering, health, hospitality and agri-food.

The choice of case studies is a crucial aspect of the project, and it is based on the assumption that their analysis can provide meaningful answers to the issues at hand. This explains the adoption of a quota sample.

The sample was selected according to the following features:
- presence of the enterprises in an agreement network or business cluster;
- firm headquarters in the same location for at least three years;
- implementation of new projects by enterprises over the last three years;
- openness towards international markets.

The semi-structured questionnaire is based on ten open questions, with two or more in-depth sub-questions, many of which are in closed form. This choice is due to the ensuing possibility to understand both general and specific problems - through the open questions -, and to have detailed quantitative replies which allow to evaluate the consistency of data - using the closed questions -. The questionnaire addresses six aspects of the problems analysed:
- the impact of the crisis;
- the responses adopted at the inter-organizational level;
- the choices relative to positioning;
- openness to other countries;
- sensitivity to the importance of new technologies;
- concerns about the future.

The above-mentioned aspects have dictated the first and second level questions included in the questionnaire. First-level questions were open-ended, while second level questions were closed or semi-closed (table 1).

Table 1. Structure of the questionnaire.

The two levels of the questions
For every question in the questionnaire two levels of replies are provided

- First level:
one open question
- Second level:
two or three closed or semi-closed questions
The following scales have been used:
- single or multiple-choice questions
- frequency scale
- Likert scale
- semantic differential
- self-anchoring scale

4. Results

The following are the responses to the questionnaires. For each question there is a description of the first open-ended replies and the following closed-ended ones. The percentages indicate only the numerical values of the replies to the closed sub-questions.

The first question asked in the questionnaire deals with the overall impact of the crisis on business networks. Most of the managers consulted point out that the damage caused by the pandemic crisis is mainly due to lockdown policies, since they were characterized by pervasiveness and continuity. The majority of managers also seem to believe that the crisis impact on business networks was felt to a lesser degree than on individual companies: this is due to resilience and flexibility. According to the respondents, the current crisis is also an opportunity, provided that enterprise networks know how to update their business models, especially at the managerial level. Overall, 45.8% of the managers consulted believe that business networks, at the management level, were only partially prepared to face the crisis, while 20.8% of respondents appear to be skeptical or more positive. 83.3% of managers surveyed are, in any case, convinced that belonging to a network of companies entails more advantages in dealing with the crisis. The reasons supporting the answers of business networks can be summarized as follows: more flexible organizational structure, mutual support, reactivity in the managerial responses, peer comparison, cooperation and business dissemination in the territory.

The second question concerns the main difficulties faced by business networks in dealing with the crisis. A reduction in turnover and orders appears to be one of the most widespread difficulties, followed by supplying and reorganization problems due to remote working. Social distancing and fear of contamination are also regarded as difficulties, although with a much milder impact. Speaking of time spans, according to 62.5% of the managers polled the problems encountered in the crisis will have medium term consequences. Among the business functions that have been most affected by the crisis they list trade (50%), human resources (41.7%), and finance (37.5%), followed by production (33.3%) and external relations (33.3%).

The third question focuses on particular emergency measures adopted by the business networks at the inter-organizational level. Most of the managers report that they have not taken specific measures in response to the crisis. Some respondents approve the introduction of smart working and online platforms for meetings and joint undertakings, and in some cases the setting up of ad hoc working groups or joint projects. Management coordination problems have surfaced rarely for 41.7% of the managers, and occasionally for 29.2% of them. The main aggregation engines that powered inter-organizational networking were the value of the projects undertaken (58.3%), the affinity between partners (54.2%), a shared identity (50%) and the charisma of a leading enterprise (45.8%).

The subject of the fourth question was the most appropriate organizational model to deal with the crisis. Most of the managers are decidedly in favor of organizations capable of expressing a strong identity through shared projects. The answers given go in the direction of an agile organizational model with an interconnected and distributed structure. Among the stakeholders who have shown most difficulties during the crisis are, for 47.8% of questionnaire replies, public institutions and, with the same score (30.4%), suppliers and customers/users, followed by the financial community, distributors/representatives and the media (21.7%). Compared to the pre-crisis period, no competition problems appear to be present: a substantial number of the managers surveyed (29.2%) are moderately concerned about competition, and only a smaller percentage (25%) show deeper concern.

The subject of the fifth question is the main goals on which enterprise networks should focus. The majority of managers favor an updating of organizational structures in order to better fit the new post-pandemic scenarios. The most relevant questions concern the creation of dynamic organizations and a more widespread digitalization. The need to offer novel goods and to secure financial stability rank second in importance. On the other hand, regarding the skills that need to be improved, 62.5% of respondents think that they are limited to strategic functions, followed by organizational behaviour (45.8%) and, with

the same score, sales-marketing and networking (37.5%). In addition, 87.5% of managers deem necessary an updating of the evaluation criteria of performance. Among the evaluation criteria selected, the main ones relate to the internal innovation processes (81%), the interconnections between learning and growth (57,1%), and the development of new products (52,4%).

The sixth question is about the importance of strengthening the network brand, in order to improve market positioning during the crisis. For almost all the managers polled, network branding is vital in times of crisis. Some respondents indicate the conditions required for brand improvement, such as a planned activity over time, and joint initiatives. Such a selection is warranted because of the importance of brand alliances, which should be built 'often' according to 66.7% of the respondents and 'always' for 25%. Among the strategies suggested to strengthen collective identity one may cite quality as perceived from the outside (54.2%,) followed by core values and loyalty of customers (both at 33.3%).

The seventh question addresses the type of advertising strategy considered most appropriate for business networks during the crisis. For most of the managers it is crucial to convey the strategic positioning of their business network and to emphasize the specific vision that lies behind it, commitment to the target audience and the results that one wants to achieve. 45.8% of the managers surveyed believe that the budget for advertising should be boosted during a crisis, while 25% consider that it should stay unchanged or, -with the same score, do not give an answer. Internet (75%) and the new media (70.8%) are predominantly considered the most apt tools for advertising in a time of crisis.

The eighth question refers to the internationalization process of business networks as a tool to tackle the crisis. Most of the managers surveyed believe that foreign activities are of the utmost importance, mostly because they allow to widen the target market, thus reducing economic risks. For 58.3% of the managers polled the 'Made in Italy' label is a side asset to face the crisis. 'Made in Italy' gets widespread recognition because of its intrinsic values and qualities. Most of the managers (37.5%) also believe that today it makes sense to repatriate their businesses.

The ninth question touches on economic gains from Industry 4.0 in the scenario of business networks during the crisis. Most of the managers believe that Industry 4.0 policies have proven most efficient during the pandemic crisis. Productivity growth and the quality of supply stand out. However, Industry 4.0 is relevant also regardless of the crisis. For 63.6% of respondents, the most efficient technology to deal with the crisis is based on integration and exchange of information systems, followed, for 54.5% of the answers, by big data and

analytics. Investment in research and development should be well-encouraged for most of the managers surveyed (54.2%).

The tenth and last question touches the issue of anxiety about the future in the post-crisis economy. The replies are quite varied: among them, there is concern about the timing of the recovery, the organisational culture, the difficulties with supply chains, disorientation of customers, reduction in turnover and the weakness of institutions. In the coming years, the lesson taught by the crisis could come in handy to enable a better performance of business networks: the replies go from 'perhaps' - for 50% of managers - to 'certainly' for 45.8% of them. After the current crisis, for most respondents, business networks will 'probably' (54.2%) be better prepared to deal with new emergencies, and a high likelihood of this happening is deemed positive, while such an occurrence is considered 'unlikely' only in a limited number of replies.

5.   Discussion of results

In this section of the article we give an interpretation of the answers to the questionnaire. It is a qualitative analysis derived from replies to the initial open questions, also taking into account the closed sub-questions.

From the first replies, the findings of the research point to a granular framework that is extremely varied. This outcome is typical of all the phenomena that have an extensive economic fallout and occur quite suddenly and in a radical way. Business networks are particularly affected by the ongoing crisis: this is due to the extension of lockdown in time and space, which has endangered production, commercial and social relations. "The crisis has had a significant impact on our activities - says one respondent - and this made us feel stifled". On the other hand, inter-organizational links have enabled companies to mitigate the damage caused by the pandemic event. As a manager surveyed said: "The network has allowed us to cope with the crisis using more resources and energies". Twenty-two respondents out of twenty-four say that business networks are indeed an essential asset, not only for ordinary business life but also to overcome periods of emergency. This is thanks to cooperative relationships based on flexibility, mutual support and territorial roots. According to the managers consulted, these three elements give resilience to the business networks (figure 1): in fact, the research project confirms that business networks are much more resilient than individual companies. However, we must invest in the future. "The crisis destroyed the old management styles - some may say - and now we need new organizational formulas". There is a strong desire to devise new business models, but at the moment this is just an idea. From the replies given, it appears that there is a

need to update the managerial infrastructure of business networks, in order to optimize existing resources with an eye to the post-pandemic economy.

*Figure 1. The elements of resiliency in enterprise networks.*
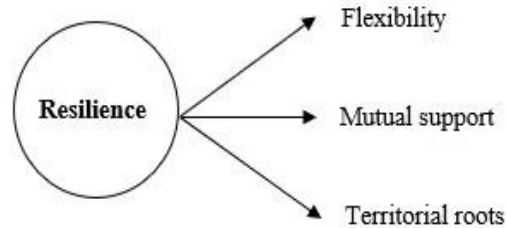
All the managers polled agree that the crisis highlights adverse impacts on trade, logistics and finance. Digital job restructuring also takes its toll when compared to the past, strongly reflecting repercussions on human resource management and external relations. For twenty respondents out of twenty-four all this entails structural changes that will not be just temporary, since the crisis will also have medium-term effects. "This crisis is not just about the present - as someone said - but it projects us towards the future, in a different and unprecedented setting". The impression one gets is that of an 'interregnum', i.e., a moment of transition, during which businesses must equip themselves so as to be ready for the 'new normality' that is taking shape on the horizon. Business networks have strategic importance, but the research shows they need to change course. This will be possible if business networks strengthen the common will to adopt new rules and experiment with different strategies, bringing management closer to a more change-oriented vision.

The awareness of a new entrepreneurial dimension that is still unknown seems a widespread feeling. Twenty-two respondents out of twenty-four state that it is necessary to change course but also to understand which direction to go. Indeed, one can't help noticing a lack of ad hoc emergency measures adopted during the crisis. Apart from the transfer of many activities to online platforms, which was mostly dictated by the emergency, according to all managers surveyed there have been no significant organizational transformations. The respondents feel a need for radical managerial interventions but do not have adequate tools to implement them. Undoubtedly, business networks should evolve into a framework of better cohesion and integration. As someone said: "An open matrix is needed: an agile organizational model, able to undertake certain jointly actions". Values and identity, collective affinities and shared projects complement usual managerial

procedures. The path to pursue is one aimed at a shared organizational structure. The results of the research point out a need for new socializing practices (figure 2), which amounts to a deeper functional integration, in order to better face the crisis.

Figure 2. The three elements of a shared organizational structure.
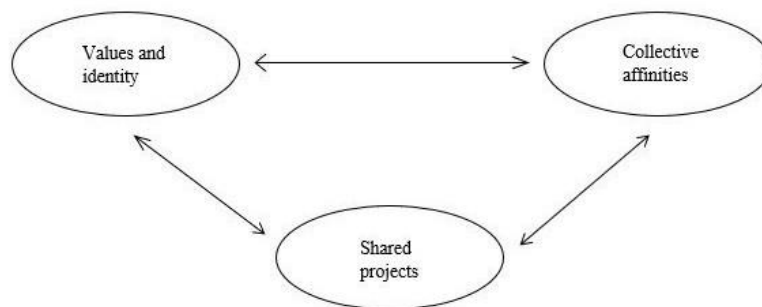
What seems to worry business networks is not competition, the danger of which is perhaps temporarily mitigated by the emergencies caused by the pandemic, but the creation of an organization capable of interconnecting with a world that is undergoing deep transformations. In order to better face these changes, business networks need to strengthen their 'soft' approach, leveraging their own values and creating a unifying cultural identity that may help bridge the distance between the projects undertaken by the various partners. "Firms in a network should share common values, not just formal contracts" says one respondent. All this must be accomplished by securing the response speed to the requests of state institutions, as well as to the needs of consumers, suppliers and distributors. In this respect the crisis seems to strengthen a desire for a greater unity of intent for business networks, overcoming the usual forms of bureaucratic aggregation. For eighteen respondents out of twenty-four, networks need to operate as a harmonic whole and not only as the sum of individual parts. Undoubtedly, culture-dictated features of management like shared leadership or a constructive relationship with stakeholders should be added to the formal organization of business networks, which holds them together on a techno-instrumental basis. Hence the need to shift from governance based only on rules, standards and procedures to one that enhances collective empowerment and shared decision-making processes.

Most of the managers surveyed believe that the main goal of a partnership must be the modernization of structure. The desire to make enterprise networks equipped to face uncertainty is widely recognized. "Business networks are

effective when they provide elasticity and a quick response to the needs of the market" said a respondent". This is, however, mostly a desire: new and unreleased management practices are still required. The new business networks should have a state-of-the-art facility with an informal dimension combined with a modular structure. Only this will allow them to have a corporate leadership, acquire new market shares and new financial opportunities. Hence the need to develop system skills, an adaptable network, complex positioning strategies, interdependency and cooperative businesses. Nineteen managers consulted out of twenty-four admit that the ability to assess one's collective actions will become more and more crucial to better adapt networks to the everchanging nature of today's economy. The assessment of collective actions is significant also to ensure continuous innovation, joint learning a developing market shares.

The importance of soft dimensions for enterprise networks emerges from the desire to establish network branding. "Business networks can have their own internal characterization - some respondents said - and communicate coherently externally thanks to a shared brand identity". For nineteen respondents out of twenty-four a strong network identity is needed in order to efficiently manage many organizations: this results from congruence of values, joint communication, and organizational symbology. Hence special importance is given to co-branding, to create a synergy among a large number of companies. This can be achieved with harmonic messages to all network partners. According to the managers surveyed, the loyalty of customers and employees to a network of companies, as opposed to individual organizations, has become the new milestone for branding strategies in a global market.

According to half of the respondents, in times of crisis network enterprises should not reduce their advertising budget. Doing so would mean giving up investing in one's positioning in a market that will be different from the past. If anything, it is necessary to manage the relationship between business networks and customers. The managers polled believe that it is fundamental for community marketing to increase its market. From this point of view, the internet and digital media are becoming increasingly relevant, and with them the new communication techniques oriented to interactivity and to the creation of online groups. These practices will have to be adopted more and more at the network level and not only by individual companies.

Technology as well is crucial for business networks. Twenty-one respondents out of twenty-four believe that Industry 4.0 policy plays a vital role in improving the productivity and efficiency of business networks, especially by favouring a functional and organizational integration. A manager surveyed said: "Industry 4.0 makes it possible to improve the organization by spreading knowledge, rationalizing the production process, and interconnecting business

functions". Other respondents list additional benefits. Thanks to Industry 4.0, production chains linked to the world of industrial automation are constantly growing in size. Today, technologies incorporate cyber-physical systems, the internet of things, cloud computing, and autonomous systems. This is, however, an advantage that should exist regardless of the current crisis. According to the respondents, Industry 4.0 is an opportunity linked to economic progress in general, and not only to situations of radical change.

The current crisis will have uncertain outcomes - which seems to be causing anxiety about the future among business networks. This is highlighted by the high dispersion of replies regarding the post-crisis economy. In fact, the scenario outlined by the managers interviewed appears vague and indeterminate. Actually, there are many potential economic consequences that could affect business networks after the crisis: from recovery times to social transformations in organizations, changes in different target audiences, a reduction in procedures and in government aid. Replies to the questionnaire suggest that the managers polled don't believe that a full recovery will take place quickly. There is, however, a belief that the crisis has spurred firms to improve the performance of business networks, thus enabling them to deal with new emergencies. The decisions of utmost importance, though, must be taken now.

6. Some theoretical considerations

6.1. Managerial implications

Considering the results obtained, we can identify some managerial implications by isolating some variables. Two issues are particularly significant: network branding and Industry 4.0. According to the respondents, network branding is the desired managerial dimension, while Industry 4.0 is the existing dimension that should be preserved. These two issues are the future and the present of business networks, and combining them allows us to identify an effective crisis management style.

Network branding represents the identity dimension of enterprise networks, made up of soft components such as values, meanings, culture and collective image. Industry policy 4.0, on the other hand, is made up of hard components such as organizational assets, industrial processes, technology and information systems. In table 2 are highlights the networking brand and Industry 4.0 features analyzed in the questionnaire.

By plotting a Cartesian graph with the network brand on the verticalaxis and Industry 4.0 on the horizontal one, we get four styles of crisis management in business networks: outdated, idealistic, formalistic and advanced (figure 3).

Table 2. The features of Industry 4.0 and network branding entered in the questionnaire.

Network branding:	Industry 4.0:
- General awareness	- Integration and exchange of horizontal and vertical information
- Core values	- Industrial internet
- Perceived quality	- Simulations with interconnected machines
- Customer loyalty	- Collaborative robotics
- Registered patents and trade marks	- Additive manufacturing
	- Augmented reality
	- Cloud computing
	- Cyber security
	- Big data analytics

Figure 3. The crisis management in enterprise networks matrix.
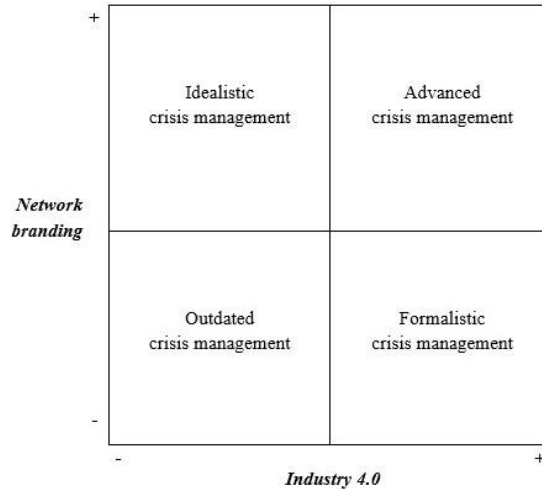
Outdated crisis management in enterprise networks uses neither network branding nor Industry 4.0: this style is detached from reality and unable both to address change and to manage a crisis. Idealistic crisis management in enterprise networks focuses on network branding techniques but rejects Industry 4.0: hence, it is an ephemeral, volatile and insubstantial style, and faces the crisis superficially. Formalistic crisis management in enterprise networks does not use network branding but focuses on Industry 4.0: this approach is cold and bureaucratic, clumsy in facing a crisis. Finally, advanced crisis management in enterprise networks uses both network branding and Industry 4.0: it is a cutting-edge style of business, promoting functional organization and attractive communication at the same time, and it allows to face crises successfully. Indeed, by combining network branding and Industry 4.0, we can bring together collective commitment and production efficiency, fostering the

development of an open organizational structure. Advanced crisis management represents the ideal style desired by respondents to face the crisis and relocate business networks in the post-pandemic economy.

6.2 Research contributions

This research points out some new contributions. In particular, taking as a reference the second section of the article (namely, the 'literature summary'), they can be noted as follows. Firstly, crisis management in business networks is not a technique created to cope with a temporary emergency, but it is seen as a strategic repositioning in a new economic context. Discontinuity and continuity therefore become integral parts of business conduct practices and network culture.

Secondly, the multifaced nature of crisis management in business networks is demonstrated: it concerns the dualistic functionality of organizations, where both hard and soft management dimensions are present. For example, hard dimensions are organizational structure, managerial objectives, or Industry 4.0. Regarding the second aspect, we are referring to network branding, which remains overlooked in other studies. In literature, indeed, crisis management is more focused on the organizational, technological or financial structure of the networks or on the influence of social, cyber, or knowledge network relationships.

Finally, in section five of 'managerial implications', another research contribution is evident. By selecting two significant variables, we have identified some crisis management styles in business networks. This aspect is also overlooked in literature and might inspire other works.

6.3 Suggestions for future research

Since this is an exploratory study, many issues covered in this article are susceptible to additional in-depth work. In relation to crisis management in business networks, issues such as brand networks require further studies. Also, an in-depth study of crisis management styles is just as necessary since it appears not to be adequately treated in literature. Advanced crisis management styles and the idealistic and formalistic approaches outlined in this article may guide further research.

7. Conclusion

The results of this study, confirming the opening assumption, highlight the transitory nature that currently characterizes the management of business networks. In this research, respondents seem to be aware that the economic scenario is changing and that the future will be different. They are also aware of the fact that enterprise networks must evolve to strategically reposition themselves in a new competitive system. They know that the managerial tools used until yesterday are no longer sufficient. At the moment, however, these are just sensations: the managerial transitioning appears nebulous and undefined. This is the reason why the questionnaire asks specific questions. Today, business networks need to experiment with new business models and new strategic assets. According to the respondents, this is the right time to change: tomorrow might be too late. The general feeling is one of being in an 'interregnum', where there is a strong need to invest in growth.

One fact, however, immediately draws our attention. The answers to the questionnaire show that crisis management abilities are higher for business networks than for individual organizations. All the respondents say that business networks are more resilient in dealing with the emergency. This finding motivates them to push towards a managerial model that is more advanced, to align the managerial infrastructure of enterprise networks with the new emerging needs. The favourite model envisioned by respondents is advanced crisis management, able to combine the cultural and symbolic dimensions with the industrial components of enterprise networks: a type of management which today is still underdeveloped. By combining networking branding and Industry 4.0, we can reach this goal. We could therefore envisage a progressive management, with the ability to enforce greater harmony among businesses in the network. In other words, a management capable of implementing the new ecosystemic type of governance that the crisis scenario requires.

References

Abbas, J., Raza, S., & Nurunnabi, M. (2019). The Impact of Entrepreneurial Business Networks on Firms' Performance Through a Mediating Role of Dynamic Capabilities. *Sustainability, 11*, 3006.

Al-Omoush, K. S., Ribeiro-Navarrete, S., Lassala, C., & Skare, M. (2022). Networking and knowledge creation: Social capital and collaborative innovation in responding to the COVID-19 crisis. *Journal of Innovation & Knowledge, 7*(2), 100181.

Basole, R. C., Ghosh, S., & Hora, M. S. (2018). Supply Network Structure and Firm Performance: Evidence from the Electronics Industry. *IEEE Transactions on Engineering Management, 65*(1), 141-154.

Betti, F., & Heinzmann, T. (2020, March). From perfume to hand sanitiser, TVs to face masks: how companies are changing track to fight COVID-19. *World Economic Forum* (Vol. 24).

Bynander, F., & Nohrstedt, D. (2019). *Collaborative Crisis Management. Inter-Organizational Approaches to Extreme Events*, New York: Routledge.

Chabert-Liddell, S.-C., Barbillon, P., Donnet, S., & Lazega, E. (2021). A stochastic block model approach for the analysis of multilevel networks: An application to the sociology of organizations. *Computational Statistics & Data Analysis, 158*, 107179.

Chen, X. (2014). Discussion on Establishment of Project Dynamic Network Crisis Management Organization, ASCE, *International Conference on Construction and Real Estate Management*, September 27-28, 2014.

Chesbrough, H. (2020). To recover faster from Covid-19, open up: Managerial implications from an open innovation perspective. *Industrial Marketing Management, 88*, 410-413.

Chesbrough, H., & Bogers, M. (2014). *Explicating open innovation: Clarifying an emerging paradigm for understanding innovation. New frontiers in open innovation* (pp. 3-28), Oxford: Oxford University Press.

Comfort, L. K. (2007). Crisis Management in Hindsight: Cognition, Communication, Coordination, and Control. *Public Administration Review, 67*, 189-197.

Crick, J. M., & Crick, D. (2020). Coopetition and COVID-19: Collaborative business-to-business marketing strategies in a pandemic crisis. *Industrial Marketing Management, 88*, 206-213.

Dai, S., Duan, X., & Zhang, W. (2020). Knowledge map of environmental crisis management based on keywords network and co-word analysis, 2005-2018. *Journal of Cleaner Production, 262*, 121168.

De Vivo, P., & Sacco, E. (2000). *Le reti d'impresa nella politica industriale*, Milano: Franco Angeli.

Dobson, J., Harris, C., & Macmillan, D. (2020). *Community business peer networking before and during coronavirus, A report prepared for Power to Change, November 2020*.

Eerme, T., & Nummela, N. (2019). Capitalising on knowledge from big-science centres for internationalisation. *International Marketing Review, 36(1)*, 108-130.

Eismann, K., Posegga, O., & Fischbach, K. (2021). Opening organizational learning in crisis management: On the affordances of social media. *The Journal of Strategic Information Systems, 30(4)*, 101692.

Eu Open for Business (2020). *Enterprise Europe Network, helping SMEs navigate in the Covid-19 crisis, 27 May 2020.*

Fonfara, K., Malys, Ł., & Ratajczak-Mrozek, M. (2021). Firm's Network Position and Business Performance. *Gospodarka Narodowa, 306*(2), 51-66.

Gentili, L. (2021). Management lessons from the pandemic chaos. *King's Business Review,* 26 Julu 2021.

Gerke, S., Evers, H.-D., & Menkhoff, T. (1999). Crisis Management: Chinese Entrepreneurs and Business Networks in Southeast Asia. *Bulletin of Indonesian Economic Studies, 35*(2), 155-156.

Güreşci, H., & Arpat, R. S. (2016). Usage of Social Network Analysis (Sna) in Crisis Management. *Journal on Baltic Security, 2*(1), 72-88.

Hermes, J. W. S., & Mainela, T. (2014). Mobilizing crisis management networks - Entrepreneurial behavior in turbulent contexts. *Industrial Marketing Journal, 43(6)*, 967-976.

Kapucu, N., & Hu, Q. (2020). *Networks in emergency and crisis management, in Network governance. Concepts, Theories, and Applications.* New York: Routledge.

Kettl, D. F. (2006). Managing Boundaries in American Administration: The Collaboration Imperative. *Public Administration Review, 66(s1)*, 10-19.

Kim, C., & Lee, J. (2018). The Effect of Network Structure on Performance in South Korea SMEs: The Moderating Effects of Absorptive Capacity. *Sustainability, 10*, 3174.

Kim, H. S. (2019). How a firm's position in a whole network affects innovation performance. *Technology Analysis and Strategic Management, 31(2)*, 155-168.

Lagadec, P. (1997). Learning process for crisis management in complex organizations. *Journal of Contingencies and crisis management, 5*, 24-31.

Li, W.-Y., Chow, P.-S., Choi, T.-M., & Chan, H.-L. (2016). Supplier integration, green sustainability programs, and financial performance of fashion enterprises under global financial crisis. *Journal of Cleaner Production, 135*, 57-70.

Liu, W., Beltagui, A., & Ye, S. (2021). Accelerated innovation through repurposing: exaptation of design and manufacturing in response to COVID-19. *R&D Management, 51*(4), 410-426.

Mandják, T., Wimmer, Á., & Durrieu, F. (2017). The influence of economic crises on network behavior. *Journal of Business & Industrial Marketing, 32*(3), 445-456.

Mitroff, I., & Pauchant, T. C. (1988). *Crisis management: An interpreted approach, Document Special 88-108-* Faculté des Science de l'Administration Université Laval, Quebec, Canada.

Moynihan, D. P. (2008). Learning under Uncertainty: Networks in Crisis Management. *Public Administration Review, 68*, 350-365.

Nohrstedt, D. (2018). Networking and Crisis Management Capacity: A Nested Analysis of Local-Level Collaboration in Sweden. *American Review of Public Administration*, *48(3)*, 232-244.

Oord, S., Vanlaer, N., Marynissen, H., Brugghemans, B., Van Roey, J., Albers, S., Cambré, B., & Kenis, P. (2020). Network of Networks: Preliminary Lessons from the Antwerp Port Authority on Crisis Management and Network Governance to Deal with theCOVID-19 Pandemic. *Public Administration Review, 80*(5), 880-894.

Pham, L. D. Q., Coles, T., Ritchie, B. W., & Wang, J. (2021). Building business resilience to external shocks: Conceptualising the role of social networks to small tourism & hospitality businesses. *Journal of Hospitality and Tourism Management, 48*, 210-219.

Poma, L., & Vecchiato, G. (2012). *Crisis management*. Milano: Il Sole 24Ore.

Porter, M. E. (1985). *Competitive Advantage*. New York, NY: The Free Press.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology. *Administrative Science Quarterly*, 41(1), 116-145.

Raza, S., Minai, M. S., & Haq ul, M. A. (2018). Entrepreneurial network towards small firm performance through dynamic capabilities: the conceptual perspective. *Academy of Entrepreneurship Journal*, 24(4), 1-9.

Ritter, T., & Lund Pedersen, C. (2020). Assessing Coronavirus's Impact on Your Business Model. *Harvard Business Review Digital Articles*, 2-4.

Rosińska-Bukowska, M. (2020). *Global business network*. Łódź: Łódź University Press.

Schrank, A., & Whitford, J. (2011). The anatomy of network failure. *Sociological Theory*, 29, 151-177.

Seiler, A., Papanagnou, C., & Scarf, P. (2020). On the relationship between financial performance and position of businesses in supply chain networks. *International Journal of Production Economics*, *227*.

Seymour, M., & Moore, S. (2000). *Effective crisis management*. London: Cassell.

Shrivastava, P., Mitroff, I. I., Miller, D., & Miclani, A. (1988). Undertanding Industrial Crises. *Journal of Management Studies, 25*(4), 285-303.

Sidlo, K. (2021). *Innovation ecosystems and start-ups in the Mediterranean as a means of recovering from the COVID-19 crisis*. European Committee of the Regions.

Sochelmaei, H. S. (2020). *Crisis management and analysis of its consequences and achievements*. Chisinau: Scholars' Press.

Therrien, M. C., Beauregard, S., & Valiquette-L'Heureux, A. (2015). Iterative Factors Favoring Collaboration for Interorganizational Resilience: The Case of the Greater Montreʹal Transportation Infrastructure. *International Journal of Disaster Risk Science, 6*, 75-86.

Tresca, R. (2016). The Network Manager and the Governance of Business Networks: Comparison with Managerial Figures in Management Literature. *International Journal of Social Ecology and Sustainable Development, 7(4)*, 35-46.

Wisniewski, M. (2022). Analysis of the integrity of district crisis management plans in Poland. *International Journal of Disaster Risk Reduction*, 67.

Xie, X., Wu, Y., Palacios-Marqués, D., & Ribeiro-Navarrete, S. (2022). Business networks and organizational resilience capacity in the digital age during COVID-19: A perspective utilizing organizational information processing theory. *Technological Forecasting and Social Change, 177*, 121548.