Article

A disaster resilience-based approach for sustainable development: An example for managing the COVID-19 pandemic

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Abstract: This paper provides a disaster resilience-based approach. For the definition of the approach, a three-step method (definition of components, analysis of the resilience pillars and definitions of resilience-based actions) has been followed. To validate the approach, an application scenario for mitigating the COVID-19 pandemic is provided in the paper. The proposed approach contributes to stimulating the co-responsibility quadruple helix of actors in the implementation of actions for disaster management. Moreover, the approach is adaptable and flexible, as it can be used to manage different kinds of disasters, adjusting or changing itself to meet specific needs.

Keywords: disaster; resilience; multi-stakeholder; COVID-19 pandemic; quadruple helix

1. Introduction

Disasters are the consequences of phenomena that trigger processes leading to physical damage, loss of life and destruction of the affected areas (Cepal, 2014). Disasters have significant economic, environmental, and social impacts (Mata-Lima et al., 2013). Indeed, disaster events destroy the integrity of economic structures and infrastructures (tangible and intangible), the dynamics of the labor market and the production system (Tiraboschi, 2014); they cause structural changes in ecosystems and alter environmental habitat. At the social level, disasters affect the well-being of communities by causing loss of basic livelihoods, erosion of productive assets, and decreased access to essential services including health, education, and others. Disasters can produce strong cultural, economic and social damages, alo impacting the sense of belonging to a community, sometimes with psychological effects.

The effects of disasters on the economy, society, culture and environment are a hot topic for researchers and decision-makers. The focus is on defining disaster management approaches that can ensure not only the need for rapid and efficient reaction to disasters' effects as well as their prevention (Bello et al., 2021). According to the 2030 Agenda for Sustainable Development, disaster management is a crucial component of sustainable development.

For a long time, disaster management has generally been dominated by top-down approaches (Sim et al., 2017), in which targets were imposed on disaster-affected populations without considering their vulnerability to the associated risks. Although top-down approaches to disaster management should ensure greater objectivity and precision, they are less sensitive to the unique conditions and needs related to the disaster-affected communities (Cutter, 2015) For this reason, researchers and decision-makers have begun to look at defining approaches that enable to include also affected populations in the decision-making process (Crawford and Morrison, 2021;

Saeed Khan, 2019).

From this point of view, resilience-based approaches have been developed. Resilience is described as "the process of adapting well in the face of adversity, trauma, tragedy, threat, or even significant sources of stress" by the American Psychology Association (2014). The Italian Institute for Resilience defines resilience as the "ability of a system to prevent or delay the transition from crisis to emergency by absorbing a disruptive and invasive factor, external or internal, expected or unexpected, responding to it and modeling the reaction of its structure to overcome the negative event and restore a new equilibrium in the system". Resilience, then, is not a potentially immutable property of the community affected by a disaster, but it is a "process" set in motion by all actors to deal with a catastrophic event, leading to a state of equilibrium resulting from adjustments and changes in the functioning of the community, which is a prerequisite for rebuilding and reconstruction (Marotta and Zirilli, 2015).

Despite the increased interest in the concept of resilience, the approaches to disaster resilience make clear the existence of the gap between theory and practice (Manyena et al., 2019) . Moreover, most of the existing approaches are based on expert service delivery to recipient communities (Sim et al., 2017). These approaches are usually characterized by finalizing policy decisions (concentration of authority) without involving the other social actors, i.e., academia, industry, and/or society (Sim et al., 2017; Schütz et al., 2019).

This study contributes to filling these important gaps. Specifically, it attempts to go beyond theory providing a practical guide for defining and implementing a disaster resilience-based approach capable to promote resilience, fostering collaboration amongst all of the quadruple helix's (QH) actors, i.e., academia, government, industry, and society.

The following is the research question (RQ) that guides this paper:

"How to prevent and respond promptly and effectively to the impacts of disasters while building resilience through a multistakeholder perspective?"

To answer this question, the study describes the different steps for implementing a disaster resilience-based approach and a practical example of its use to mitigate infectious diseases (i.e., the COVID-19 pandemic).

The paper is organized as follows. Section 2 introduces existing studies on disaster resilience approaches, while Section 3 describes the different steps to implement the approach. A description of an application scenario is provided in Section 4 while a discussion is provided in Section 5. Finally, Section 6 concludes the paper.

2. Related works

The concept of resilience has been studied and applied in many different disciplines, including social sciences, socio-ecological systems, ecology, and psychology. Resilience to disasters has become more and more crucial during the last 20 years. This is the result of many major disaster events around the world and the recognition that disasters have a significant social dimension due to their increasingly devastating impact on people at different scales and, on local communities (Kyne,

2023). According to Sansavini (2017), resilience has emerged in the last decade as a concept to understand the ability of a system to withstand unexpected changes by reducing (absorptive capacity), adjusting to and recovering from the negative effects (adaptive and restorative capacity). In this perspective, resilience appears to be a necessary condition for the successful pursuit of sustainable development (Teigão dos Santos and Partidário, 2011). Resilience measures a system's capacity to absorb disruptions and reorganize itself without collapsing. In a sense, resilience could be incorporated into the concept of sustainability, where sustainability encompasses the ability of a system to maintain its ability to function when it is disturbed. Resilience and its interaction at different levels play a fundamental role in shaping the transition to more sustainable development. The promise of resilience in reducing the impact of disasters is explored in various studies (Rockerfeller Foundation, 2017; Santos and Leitmann, 2015; United Nations, 2015). Experts (policymakers, aid agencies, multilateral organisations, etc.) and academics provided definitions and approaches to disaster resilience (Bender and Benson, 2013; Field et al., 2012; Govenment, 2011; IFRC, 2012; UNISDR, 2009). Busch and Givens (2013) highlight the critical importance of collaborations between the public, nonprofit, and commercial sectors and give an example of a disaster where such a collaboration significantly reduced risk.

Furthermore, to be effective, these partnerships must be based on the socialisation of ownership and network coordination (Allen, 2012; Lassa, 2015; Kapucu and Hu, 2014). This aspect leads to a discussion of disaster management that is different from traditional command models, as resilience implies a change in the way policy, planning and governance are conducted (Davoudi, et al. 2012). Over the last decade, different actors, such as policymakers, aid agencies, multilateral organisations and academics, have defined resilience-based approaches to disaster management (Alshehri et al., 2014; Ainuddin et al., 2015; Arbon et al., 2016; Burton, 2014; Chandra et al., 2013; Cox and Hamlen, 2014; Cutter et al., 2014; Frazier et al., 2013; Joerin et al., 2014; Kusumastuti et al., 2014; Leykin et al., 2016; Orencio and Fujii, 2013; Ostadtaghizadeh et al. 2016; Parsons et al., 2016; Pfefferbaum et al., 2013; Qasim et al. 2016; Taarup-Esbensen, 2020; Woolf et al., 2016; Yoon et al., 2015). Resilience-based approaches assume that people can grow and change, and that each person has a set of skills and strengths that can be inspired to work together to create a brighter future with the correct assistance. The second element is the recognition that as individuals we live in families, communities, society, and cultural contexts, and that all these factors together with our characteristics determine our well-being. They also help to create social capital and cohesion and the ability to solve problems together.

Several studies have also been produced highlighting the benefits of considering resilience within disaster management approaches (Keating, et al., 2016; Maîtrot et al., 2021; Santos and Leitmann, 2016; Wanczura et al., 2007). At the same time, other studies provided critical debates (Alexander, 2013; Brown, 2013; Mitchell, 2013; Winderl, 2014; Zhou et al., 2009) . Significant limitations have also been identified. The most important of these is that resilience-based approaches can reinforce unequal power relations and economic as well as environmental inequalities (Cretney, 2014; MacKinnon and Derickson, 2012; Weichselgartner and Kelman, 2014).

These studies have demonstrated the value of taking resilience into account when developing disaster management strategies. However, as mentioned in the

introduction, there is a need for further research in this area, particularly to bridge the gap between theory and training to defeat top-down strategies that encourage the participation of many social actors in the decision-making process.

To address these needs, this study provides a practical guide for implementing a disaster resilience-based approach, where all stakeholders of QH take actions at different stages of the disaster management process that contribute to building resilience.

3. Materials and methods

The implementation of the disaster resilience-based approach comprises a three-step method (definition of components, analysis of the resilience pillars and the definitions of resilience pillars-based actions). The different steps contribute answering the RQ guiding the study:

"How to prevent and respond promptly and effectively to the impacts of disasters while building resilience through a multistakeholder perspective?".

In particular the definition of the components of the approach allows including the different phases of disaster management (prevention, mitigation, and recovery phases) for promptly and effectively preventing and responding to the impacts of disasters. The analysis of resilience pillars enhances the resilience building while the definition of resilience pillars-based actions stimulates the adopt a multi-stakeholder perspective through a strong collaboration between the different actors of QH.

The following subsections describe in detail the various steps.

3.1. First step: Definition of the components of the approach

The definition of the components of the approach is based on the helix classification of disaster management phases provided by Bosher et al. (2012) and redefined in D'Andrea et al. (2022). The helix starts with the attempt to reduce the potential impact of the identified disaster risks (planning activities). When the disaster occurs, the risks are reduced (doing) and recovery activities are carried out (reacting) to ideally reduce and in some cases eliminate the risks of other possible disasters.

The preparation and prevention phases are part of the planning process. As mentioned in the introduction, the occurrence of a disaster causes major damage to infrastructure, productivity levels (decline) and resources (increased consumption). Instead, then spending money on readiness, response, and recovery, consider investing in disaster management plans. These components of the approach include all the measures needed to define disaster management plans. Defining plans means thinking about what could go wrong in a disaster and developing protocols to address the problems. The goal is to minimise the impact by doing everything possible before a disaster occurs to limit damage, protect lives, and strengthen the ability to recover quickly from the disaster. Preparing for a disaster can reduce the fear, anxiety and losses caused by a disaster and build resilient communities that can help limit the impact of the disaster. Once developed, disaster management plans need to be constantly updated through regular mid-term reviews to ensure that appropriate actions are identified. The review process should also involve the community to maximise consensus and disclosure and adjust as necessary to ensure proper

functioning.

The phases of protection and response are included in the doing component. When a calamity happens, in case of emergency it's crucial to adress the first necessities to safeguard citizens, save lives, and reduce long-term damage by improving the capacity of communities to manage economic and social risks. Although each disaster has its unique characteristics, the components of response are the same. These components of the approach include all the actions required for an emergency response, such as specific measures (which must include protective measures to save lives and support the community) and the communication/information guidelines to be followed.

Finally, the reacting component includes the recovery phase. After a disaster event, it is important to enable the community to return to normalcy and create safer conditions for the future. Recovery takes place in two phases: short-term and long-term. Short-term recovery aims to restore minimum operating standards, while long-term recovery aims to restore the previous state, combined with improvements that protect the community from future disasters. These components of the concept encompass all measures required for recovery. This includes not only the restoration of physical infrastructure, but also the restoration of basic services, the revitalisation of economic activities, and social support for those with specific needs. A recovery plan allows for the establishment of policies, operational strategies, and roles and responsibilities that guide decisions for the long-term recovery and rehabilitation of the community. Housing recovery, financial management, environmental restoration, health and social services, and economic development are some of the subjects covered.

3.2. Second step: Analysis of the resilience pillars

Six elements that define the resilience idea are taken into consideration by the Baseline Resilience Indicators for Communities (BRIC) index: environmental (Ec), social (So), economic (EcN), infrastructural (In), organisational (Or), and community competence (Cc) (Cutter and Derakhshan, 2018). The pillars enable monitoring of existing attributes of resilience to disasters, identification of specific drivers of resilience and monitoring of improvements in resilience over time. The Ec pillar promotes a sustainable lifestyle that is in natural balance and respects humanity's symbiotic relationship with the Earth's natural ecology and cycles. This pillar promotes long-term environmental quality through responsible stewardship to avoid depletion or degradation of natural resources. To promote well-being, the So pillar aims to understand what people affected by a disaster need. It supports the development of a high level of social well-being in the long term and ensures social inclusion. The EcN pillar proposes responsible management of economic resources to mitigate or reduce the impact of disasters. Due to the destruction of public and private capital, production, and trade, as well as the lack of resources for relief and rehabilitation, disasters have a considerable negative impact on the economy and development prospects of impacted communities. The EcN promotes equitable distribution and efficient allocation of economic resources that provide both long-term benefits and profitability that persist over time. In determining which economic

activities to develop in a disaster-affected area, efficient infrastructure is also critical. The In pillar promotes the planning of good infrastructure, such as communication and transport infrastructure (roads, railways, ports, and air transport), which help to obtain goods and services in safe and timely conditions and facilitate the mobilisation of labour during a disaster event.

Disasters influence the commercial economy as well. Business organisations face a variety of economic challenges, including how to redefine their operations and business strategies. The Or pillar enables business organisations to sustain, absorb, recover, and adapt in an ever-changing and increasingly complex environment. The Cc pillar is the last supporter of resilience. It refers to the importance of co-creating the future by encouraging the participation of the widest possible diversity of stakeholders (including the social community).

3.3. Third step: Definition of resilience pillars-based actions

Social actors are a key element in disaster management. In this regard, it is important to adopt a multi-stakeholder perspective, with strong collaboration between the different actors of QH (Schütz et al., 2019) . According to the competencies, attitudes, and "institutional" roles that each sector of actors plays in society, the QH model is founded on the notion that the resilience concept is a component of an interaction process involving several sectors of players (von Schomberg, 2013). Greater cooperation between the different actors then makes it possible to align the actions to be taken and their outcomes with the values, needs and expectations of society. Based on the experience of many scientific projects and considering elements from the literature review, the different actions of societal actors based on the resilience pillars to reduce the impact of disasters have been defined. A detailed description of the actions to implement can be found in the following subsections.

3.3.1. Environmental pillar-based actions

Given the importance of the environment to human survival, practical measures must be taken to ensure the protection of the environment before, to facilitate emergency management both during and after a disaster and to restore environmental quality In this sense, the implementation of an environmental prevention plan can minimise the negative impact of a disaster on the environment. When establishing a prevention plan, it is important to demonstrate to all stakeholders that reducing environmental damage is a priority. The plan allows a community to be prepared for disaster situations by sharing knowledge about potential risks and taking steps to manage them. This allows community members to understand exactly what is expected of them on a day-to-day basis. Post-disaster ecosystem recovery measures are also necessary to reduce non-existent risk factors and mitigate the impact of future disasters. These measures help reduce environmental damage over the long run. Examples include rebuilding houses with improved local drainage and built-in roof water collection systems, rebuilding markets with facilities for personal and food hygiene, etc. In addition to decision-makers, academia, industry, and society can also put forward their initiatives. In this context, science must focus on the planning and mapping of ecologically sensitive areas and environmental monitoring systems to track trends of environmental degradation. In addition, recovery and reconstruction

must identify the environmental factors that contributed to the disaster, as well as priorities for environmental hazard reduction and other environmental protection measures. Environmental responsibility must be ingrained in the industry's culture. Production activities must be influenced by energy-saving production improvements and the introduction of recycling. To mitigate the environmental problem as much as possible, society also needs to think more environmentally friendly as early as the planning stage for disaster response. Examples include reinforcing the structure of one's house with environmentally friendly materials, and an environmentally friendly emergency kit with many disposable items such as towels, plastic bands, garbage bags, rain ponchos, bottles, diapers, cups, plates, cutlery, etc.

3.3.2. Social pillar-based actions

At the social level, the occurrence of a disaster causes stress that affects a community in all its aspects and components. It disrupts the normal flow of life and causes damage, illness, death, loss of goods and other serious deprivations. For the individual, the emergency represents an intense emotional experience that disrupts the "normalcy" of everyday life and the sense of continuity of one's existence. In a short period, patterns of behaviour that have been maintained over a long period are destroyed, requiring individual and collective responses to be rebuilt. In dealing with these consequences, knowledge of the right behaviour at the individual and collective level is an important aid. In this regard, defining a community-based preparedness plan that identifies collective practices for disaster response and recovery according to individual concerns, priorities, and values is key. When a plan is in place before a disaster, a community can act more quickly and efficiently to move the recovery process forward. During an emergency, citizens need to free up personal resources to maintain a healthy lifestyle to constructively cope with the emergency. Attention to personal and family health can be an opportunity to positively manage the complexity of emotions and moods and maintain personal and family well-being. In the recovery phase, reorganizing lifestyles and relationships with others and encouraging helping behaviors in various forms—from spontaneous efforts to assist with more formalized organizational interventions—are key elements. The primary responsibility for assisting residents in their recovery after a disaster lies with policymakers, who are the first line of defence against emergencies. Certain social groups are more susceptible than others to the harm and suffering brought on by a disaster event. Elderly people, women, children, the destitute, members of ethnic minorities, those who are disabled, etc., are among these particularly vulnerable populations, etc.) often lack access to vital economic and social resources or have limited autonomy and power and low levels of social capital. Identifying the most vulnerable groups allows for planning interventions that target these groups in the event of a disaster. During and after the disaster event, the implementation of social support measures in the form of material, emotional, and informational support allows for addressing the diverse needs of victims. Material support measures address specific problems, such as providing resources or services for health care, caring for children, helping in case of illness or disability, donating, or gifting money, and providing material resources such as shelter furniture. Emotional support activities, on the other hand, aid in the form of encouragement, human warmth, and love. They are relevant to the post-disaster period,

when the aim is to encourage victims and provide them with psychological support so that they can start a new life, albeit with difficulty. Finally, the informative support activities consist of providing health information or teaching practical behaviors that can help enhance self-care and control both during and after a crisis event. Given the importance of social ties to human survival, practical measures must be taken to ensure that social ties are restored as soon as possible, by providing meeting places, places of worship and places for recreational activities.

3.3.3. Economic pillar-based actions

Addressing economic impacts is a policy priority after, during and before a disaster occurs. Policymakers must ensure that the economic impact on the lives of citizens is less harsh after a disaster. To preserve prosperity, the policy must provide social insurance for the most vulnerable. The choice facing policymakers could be either to use existing social security mechanisms or to provide cash transfers to people. Policymakers must keep the economy's productive capability intact during the disaster. An effective and simple way for the government to provide credit to the economy is to postpone some or most tax payments or impose a moratorium on loan repayments. Finally, policymakers need to stimulate the economy. Temporary adjustments in fiscal or monetary policy are one way, but disasters can also lead to more fundamental changes that have longer-term budgetary implications. Economic recovery needs to be integrated into investment policies and adequately reflected in the allocation of financial resources. Policymakers need adequate financial strategies for future disasters, including medium- and long-term financial planning for 10–15 years. The funding base needs to be broadened by using a range of insurance and other mechanisms for different levels of damage.

3.3.4. Infrastructural pillar-based actions

The focus of disaster management is on the performance of inhabited structures, the failure of which poses an immediate risk of loss of life or injury. Networked infrastructure services' survival and restoration, however, are also crucial challenges. Losses associated with infrastructure failure are related to the costs of reinforcement and other disaster mitigation strategies. As infrastructure interventions are often subject to international investment and loans, standards for design, construction and maintenance should be introduced in the planning phase of disaster management, supported by investments in early warning systems and resilient infrastructure to ensure infrastructural protection in the recovery phase. Weaknesses in structures and the vulnerability of infrastructure need to be identified at this stage. This may include a study of the rate of degradation of the structure and its materials over time to assess resilience. It is also necessary to ensure that the responsible management maintains the infrastructure in the long term. Post-disaster construction of new infrastructure or replacement of infrastructure located in a disaster area as per the disaster assessment must be done through site selection based on availability, land use plans and economic criteria.

3.3.5. Organisational pillar-based actions

In the event of a disaster, the reduction in available human resources and limited financial resources limit the productivity of economic organisations (especially small

and medium enterprises). To cope with the impact of disasters, business organisations need to plan which services, processes, and functions they may have to temporarily abandon, and analyse of suppliers and customers. To avoid supply shortages of raw materials, supplies and consumables, supply chain management must be integrated into business continuity management. Many companies should set up support measures for workers (new health insurance, support services). At the level of reconstruction, it is necessary to rethink production processes starting from health; economic institutions based on the idea that having access to health care is a fundamental right are required, and this right must be upheld by offering universal public services that are created to address demands that defy market logic. It is also important to understand how to realign operations, investment decisions, cash options and human resource policies. With the new forms of business organisation, workplace spaces should also be redefined by adjusting the size of offices.

3.3.6. Community competence pillar-based actions

Effective involvement of various stakeholders (including the social community) should be included in the prevention, mitigation, and recovery phases of disaster management. As the different phases of disaster management overlap and intersect, different types of participation are required. For example, when preparing a disaster plan, a collaborative approach that incorporates the experiences, priorities, and knowledge of those affected and the social community is appropriate. However, when a disaster occurs, the legal obligations of responders to manage emergencies are likely to require a command-and-control approach that provides clear instructions and information to stakeholders and the social community. In addition, relief and recovery are most effective when carried out by empowered stakeholders and the community in collaboration with policymakers and disaster management organisations in the preparation of relief plans.

4. An application of the approach for mitigating an infectious disease

This section describes the application of the provided disaster resilience-based approach to infectious disease. It considers the different steps described in the previous sections. Infectious diseases are caused by germs (such as viruses and bacteria). Some infectious diseases require close contact between two people, while others can only be transmitted by germs in the air, water, food, or soil, or by the bite of insects or animals. Possible causes that have led to the development of infectious diseases include rapid trade (in goods and livestock), occupational or tourism-related movement of people, changes in the environment and land use, new microbial adaptations, antibiotic resistance, the updating of new biological agents in production technologies, the spread of additional arthropod vectors foreign to our fauna.

According to Artik et al. (2021), since the early 21st century, three types of coronavirus infection disease have been affected by people with deadly pneumonia around the world, including SARS-CoV, MERS-CoV, and nowadays, SARS-CoV2. The SARS-CoV (2003) emerged in China, affecting 8098 people in 29 different countries while the MERS-CoV emerged in Saudi Arabia and affected 27 different countries. In December 2019, a new type of coronavirus, SARS-CoV-2, caused a

global pandemic in the entire world in the Chinese city of Wuhan. SARS-CoV-2 caused a deadly disease termed COVID-19.

The following sections provide a preliminary discussion of the spread of COVID-19 in Italy and describe how the approach can be applied to infectious diseases.

4.1. An introduction to the COVID-19 pandemic in Italy

COVID-19, whose official name is Sars-CoV-2, belongs to the classification of "biological hazards" of disasters. The first significant outbreak happened between November and December of 2019 in China.

Since January it has spread worldwide and since 21 February (the day of the first patient in Codogno) Italy has been officially affected. COVID-19 was widespread and overtime it became a global emergency (see **Table 1**).

Table 1. The widespread of the COVID-19 pandemic in Italy.

Emergency characteristics	Italian context
Risk of the disease being introduced to and spreading throughout the population	In the first 52 days of the epidemic, the World Health Organization reports 133 thousand infections and 5000 deaths worldwide: according to estimates, each person contracts between 2 and 4 new infections.
It is possible to predict that many cases will occur.	Data updated on April 16th, 2020, show 106607 COVID-19 positive and 40164 healed.
The condition is so severe that it can cause death or severe disability.	As of April 16, 2020, there were 22170 fatalities.
Possibility of social or economic unrest brought on by the disease	As regards the economic impact - obtained by analyzing the related national and regional data on the value of production disclosed by Istat in 2018 and considering a hypothetical emergency period from the beginning of the infection (February 21) to the worst date scheduled for the end of the infection (July 25)—the consequences on Italian GDP are estimated at −4.57% for 2020 equal to 80.650 billion Euros with an estimated loss of over 800 million Euros for the First sector. The second sector will cost 13.5 billion euros, and the third sector will cost 137 billion euros.
Authorities are unable to cope adequately with the situation due to insufficient technical or professional, organizational experiences, and necessary supplies or equipment (e.g. Drugs, vaccinations, diagnostic tools for laboratories, materials for controlling vectors, etc.)	Lack of intensive care places but also no adequate hospital facilities to deal with the crisis, medical personnel, and therapeutic equipment.
Risk of international transmission	The number of COVID-19 cases reported to WHO (data updated as of 31 December 2023) was 773,819. 856. In Italy COVID-19 were 26,621,847 cases (World Health Organization, 2023).

The spread of the COVID-19 state of emergency in Italy had significant consequences for both Italian citizens and businesses. With the 11 March edict, the Italian government mandated that citizens remain at home. Few social contacts (other than the obligatory ones), the prohibition of work activities (except for food and medicine), the introduction of smart working and the closure of public places invite everyone to stay as isolated as possible in their own homes. These so-called "social distancing" actions intended to contain the COVID-19 virus from spreading infections over a longer period and treating people to avoid the collapse of the Italian health system. However, the social distancing measures, though necessary, had significant social and economic consequences. Seeing friends, joining groups and being close to each other is a human need for variety, and living under restrictive measures created

stress, anxiety, and depression. Domestic violence was another area of immediate concern. The WHO reports on the latest data released by Axios, which shows that the number of violent acts against women during the emergency of COVID-19 has tripled compared to the last year. Even children have been more exposed to domestic violence due to the closure of schools (decreed by the decree of March 9), which led them to spend more time at home. The school closure also created new stressors for parents who had to look for people to care for their children or give up work.

According to Save the Children (2020), only one in four families with children in Italy can count on free help from close people such as grandparents or other adults. Special attention was also paid to families that are already particularly vulnerable (families with vulnerable parents, unemployed or with precarious jobs or very low incomes). For children living in these families, the distance to school increased isolation and widened inequalities and educational poverty.

As mentioned above, the decree of 1 March introduced the smart working method mentioned in Law No. 81 of 22 May 2017 to avoid contagion risks. Smart working strengthed the dimension of autonomy and flexibility allowing individuals to choose the methods and place of work. However, it also had negative effects. Procrastination was undoubtedly the most immediate. Staying at home all day led to difficulties in managing time and creating an environment that minimised distractions; it also led to misunderstandings with family and friends who may "not see working from home as legitimate."

Furthermore, not all people had the necessary equipment and software to work from home: computers, phones, headsets with microphones, collaboration tools and remote communication tools. Although employees benefited from Smart Working, the same has not happened for the self-employed, temporary workers, those with Value Added Tax (VAT) numbers and small entrepreneurs who did not receive a minimum basic wage.

The state of COVID-19 emergency also had a significant impact on Italian business enterprises. The activities most affected were those related to the offline world (retail), event organisations, but also transport and tourism, as well as the automotive and manufacturing sectors. In contrast, companies in the pharmaceutical and health sectors performed better. The difficulties in air and sea transport also had a strong impact on national and international exports. Demand, supply, and finance have been disrupted by an unpredictable, ever-changing scenario, so companies looked for ways to develop their business models to not only withstand the crisis but also as an opportunity for strengthening.

4.2. The application of the disaster-resilient approach to the COVID-19 pandemic

In this section, an example of the application of the disaster resilience-based approach for mitigating infectious diseases (i.e. COVID-19) is described. Following the three steps-based method, described in Section 3, resilience-based actions that each actor of the QH has to implement during the different phases of the disaster occurrences (before, during and after) also considering the different resilience pillars have been defined (see **Figure 1**).
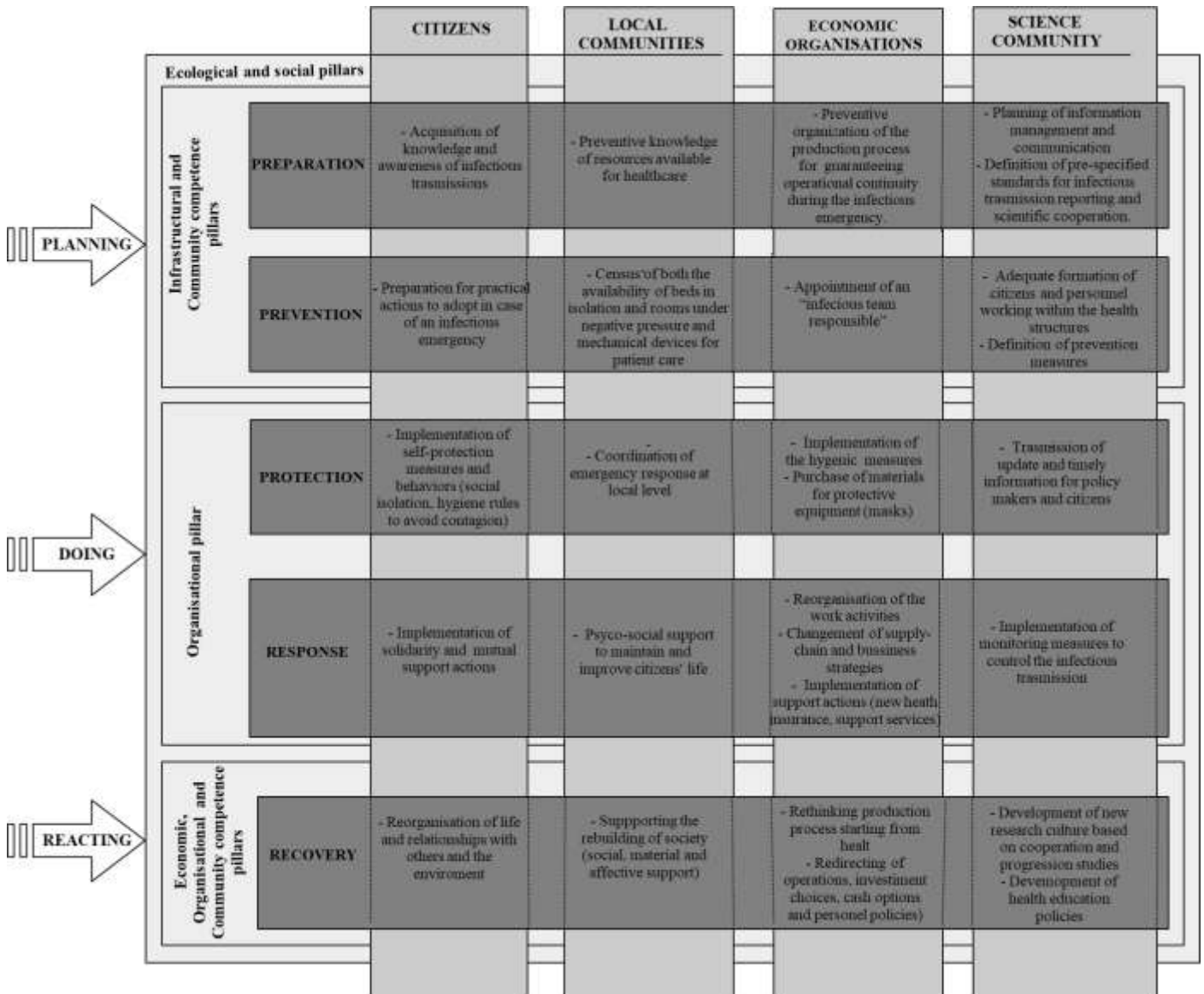
Figure 1. Resilience pillars-based actions by actors in the different phases of the COVID-19 pandemic occurrence.

In the following sub-sections, a detailed description of the actions in the different phases is provided.

4.2.1. Resilience-based actions in the planning component

During an infectious disease, the universal vulnerability of the population means that every element of society is likely to be affected. This has effects on how society functions. Extending the goal of protecting the population from any risk and reinforcing the concept of protection and prevention, where the population is an active part of the planning process in normal times and the management process at the moment of an emergency. Once this basic premise is recognised, the implementation of measures to manage and prevent an infectious emergency by all actors in the disaster management approach (citizens, local communities, environmental organizations, and the scientific community. Becomes vital.

What citizens do before an infectious disease can make a dramatic difference in their ability to cope and recover from the disease, and in their ability to protect family members. Citizens who are prepared can reduce the fear, anxiety and losses associated

with the emergency. They can evacuate their homes, survive a period of house arrest, make their stay in public shelters more comfortable, and attend to their basic medical needs. They can even save each other's lives. It is therefore clear that risk preparedness and prevention include as essential elements the training and information of citizens, who must be able to adopt correct behaviours and self-care procedures within the scope of their activities and abilities. It is appropriate for the scientific community to plan training measures based on the actual needs of citizens or possibly on the needs arising from infectious emergencies (e.g., in the case of avian influenza, special training was required for breeders). It is also particularly important to train staff working within health structures (including support staff, cleaners, and maintenance staff) to have a comprehensive knowledge of the issues involved in managing infectious emergencies and to acquire the skills needed to cope with events. Adequate communication about infectious disease transmission is also of particular importance, as the lack of specific knowledge or perception of risk can lead to the underestimation of hazards. Communication and information management should be included in the planning and execution phases. Unplanned interactions can be costly and produce subpar outcomes. It is important to keep in mind that during an emergency, stress, fear or a life-threatening condition, information is often interpreted with strong emotional overtones. Anxiety leads to impaired perception, orientation, thinking about design and memory. Therefore, the messages sent need to be clear, brief, repetitive, expressed in familiar language and conveyed positively. This helps to reduce fear and despair and avoid the spread of rumours. Planning information management and communication helps to reduce victims' feelings of vulnerability and centrality, reduce perceptions of the absence of help, inform about the nature of the infection, provide directions to first aid stations, and promote adaptive countermeasures.

The scientific community needs to cooperate both in disseminating correct, defusing information (to allay irrational collective fears) in providing simple and concise advice and in setting predetermined standards for disease reporting and scientific cooperation.

At the organisational level, local communities play a central role in preparing procedures for rescue operations. Although the timing, nature and severity of an infectious disaster cannot be predicted, planned, and coordinated procedures are essential to minimise public health, and the population's quality of life because of social and environmental impacts. In this sense, it is essential to know in advance what resources are available for health care and how many isolation beds, mechanical tools and negative pressure rooms are available for patient care. This meant that during infectious diseases, emergency physicians often lacked the necessary elements to avoid infection and prevent the worst scenarios.

Given the diverse spread or potential spread of microbial pathogens, it is therefore important to develop specific strategies for the prevention, control, and management of emergencies in the work environment. Although a survey by the International Facility Management Association (2006) found that many Italian business organisations have a consolidated emergency plan, most of the time, these are general protocols for infectious illness situations. A rapid analysis carried out by the High Lantern Group shows that the large Italian companies that move the global economy are essentially reactive, i.e., ill-prepared when it comes to discussing infectious disease

emergencies. They must ensure the continuity of business operations by preventing the planning of a possible interruption of activities and the planning of physical protection (from technological, human resources, organisational and logistical points of view). During an emergency caused by a contagious disease, the reduction of available staff limits the productivity of a business. It is, therefore, necessary to decide in advance which services, processes, and functions, if any, should be temporarily abandoned and to analyze suppliers and customers. To avoid supply shortages of raw materials, supplies and consumables, supply chain management must be integrated into business continuity management. In addition, it is essential to have an "emergency team" to ensure operational continuity and the company's production process, especially in times of crisis. Yet, many business enterprises use a highly complex emergency response mechanism that involves the establishment of a crisis committee that meets regularly to decide on the best strategies and ways to deal with a potential threat. The most common attitude seems to be to provide employees with all available knowledge about infectious diseases and then leave it to individual employees to decide whether to protect them by adopting behaviours to prevent infection.

4.2.2. Resilience-based actions in the doing component

Self-protection practices and behaviors must be used to secure people's safety to stop the spread of contagious diseases. Self-protection extends to a pre-crisis preparation phase in which exposure risks are identified, resources are prepared, and self-rescue training is conducted. Integral self-protection must also consider post-disaster behaviours and link them to other aspects of survival. Effective help for citizens in understanding the phenomena and self-protection procedures and behaviours must come from science, which is also responsible for the flow of communication. The need for information surges during an emergency. Information may appear insufficient and contradictory, and the need and desire for information about those involved is very high. The emergency continues until the communication channels are not longer able to transmit enough data to produce information that triggers adaptive responses. An excess of data (an excess of data creates information complexity that is difficult to manage in the event of an emergency) or a lack of data, both mean a lack of information. However, correct information, the arrival of emergency services and the establishment of first aid posts have a calming psychological effect.

Economic organisations are responsible for ensuring the purchase of materials and personal protective and hygienic materials, disinfectants, protective masks and others, as well as the implementation of appropriate measures to monitor the health of citizens following infectious development by local communities. To assist the citizens, who are on the frontline of the emergency and those who are suffering the most, a variety of activities from individuals, local communities, and commercial organizations must be implemented The goal of the massive emergency response is to address the physical and emotional requirements of each person and the community as a whole. The goal of the relief intervention is to promote the mobilisation of resources for the community, the goal is to help each other, i.e., to provide the basic tools with which the community can solve its problems in the most autonomous way possible and be reborn in its completeness, both physically and psychologically.

Psychosocial support measures should not be understood in a narrow sense as the sum of psychological and social interventions but as a coordinated approach to address issues that affect both the individual and the community in which they reside. The promotion of social support measures such as the reduction of food waste (especially food that is not put on the table by restaurants and even meals from school canteens that are not consumed because schools are closed) must be implemented. An example is the city of Milan, which is serving 75 thousand meals a day in the city's school canteens during the emergency COVID -19. It has organised itself to give the food to social organisations that distribute the meals to the less well-off population.

Other social assistance activities such as the distribution of social spending at home (necessities are purchased through donations and distributed to those who need them) can also be implemented by social assistance organisations that during the infectious emergency, cannot stop, but must change the way of donating meals, for example through lunch boxes instead of serving in canteens. Telephone help services must be activated to offer practical information, emotional support, and proximity, even if at a distance to the sick and their families. Donations of large amounts to face the infectious emergency will be encouraged by the government as can be seen from art. 66 of the "Cura Italia" decree. There are many large Italian companies such as Dolce & Gabbana, Armani, Prada, Moncler, Campari, Coca-Cola, Unipol SAI, and UBI Banca, whose donations have been specifically directed towards the purchase of intensive care machinery or the construction of ad hoc emergency departments; others towards fundraising for the realities affected by the emergency. Many companies should create new health insurance coverage available to employees, specifically in case of an infectious disease (i.e. COVID-19), and provide the implementation of services to (i) help businesses and citizens in smart working activities. An example is Cisco Italy and IBM which provides the Cisco Webex Meetings platform for smart working available for free. (ii) help with e-learning activities. An example is "WeSchool" (powered by TIM) a platform to create a digital classroom, with which teachers can share content, organize works, and test. They also can make video streaming, to lectures just as if students were in the classroom(iii) for information and entertainment. An example is the Mondadori Group which offered three months of free subscription to the group's magazines. Those who live in the red zone can read an e-book for free from the Mondadori catalogue. Activities also to support retailers must be carried out through the creation of consortiums among companies such as the consortium created by Le Piantagioni del Caffè, Granda Brewery, and ADI Apicoltura to provide the public with food, entertainment, and a sense of community. The consumers, with an order of at least 25 euros from one of the producers, receive a voucher for a film on the Chili platform. To take advantage of this promotion, it is not only the three realities and consumers by the entire supply chain that are supported with a percentage on sales to the distributor, the consumer's neighborhood bar or pub. At the organisation level, many companies and factories must change or accelerate their production of materials essential for the fight against the virus. An example is the Armani brand which is producing single-use smocks for the individual protection of healthcare providers as the designer ups his donations to reach 2 million euros.

4.2.3. Resilience-based actions in the restarting component

Many of the points envisaged during disasters caused by infectious diseases, and especially during the COVID-19 pandemic, are extremely useful to understand what we can learn and what can we change at a social, cultural, and economic level in managing infectious disease emergencies. At the social level, the deepest changes result from dramatic contingencies that force people to radically re-examine their behaviors and way of life. The occurrence of infectious diseases causes stress that affects a community in all its aspects and all its components. It disrupts daily life, causing harm, illnesses, fatalities, lost property, and other severe afflictions for a substantial portion of the populace residing in the affected area. For individuals, the emergency is configured as an extremely stressful situation, an intense emotional experience that interrupts the "normalcy" of everyday life, and the sense of continuity of one's existence. Both at the time immediately following the infectious sickness people affected by the disaster react to new environmental conditions brought on directly and indirectly by the disaster, both in the phase immediately following the infectious disaster and in that of an eventual exodus or removal and the most distant and prolonged moment in time of the reconstruction and restoration of normal life. In a short time, patterns of behaviour that are maintained for a long are destroyed periods, placing the need to rebuild and regenerate individual and collective responses. Local governments are the first line of defence against emergencies and are primarily responsible for managing the recovery from infectious diseases. It is important first to assess how existing community groups (religious groups/churches, sports groups) can contribute to the rebuilding of society by defining responsibilities for social support to affected citizens. Social support responds to different needs and includes material, emotional, and informative support. Material support is given for the solution of concrete problems, such as providing resources or services for healthcare assistance, taking care of children, offering help in case of illness or disability, giving or giving money, and providing material resources such as protection furniture. This kind of support is particularly important for the elderly and in general for people who live in a condition of extreme hardship, especially economically. Emotional support is a form of help in terms of encouragement, human warmth, and love. It is relevant in post-disaster intervention, when it becomes necessary to encourage the victims, supporting them psychologically, to start again, even if with difficulty, a new life. Finally, informative support consists of providing health information or transmitting practical behavioural skills that can contribute to the increasing feeling of control and self-care.

At the economic level, there is the need to rethink production processes starting from health as a fundamental right which must be secured through the provision of universal services intended to address requirements outside the logic of the market.

It is also important to understand, almost daily, how to redirect operations, investment choices, cash options, and personnel policies. With the new forms of business organisation, the spaces in the workplace should be redefined, with the resizing of the offices. The explosion in digital commerce during the COVID-19 emergency represented the solution to stem the crisis and continue to fuel sales, thereby choosing the sector as the growth-driver. But the surge in online purchases could turn into a habit of consumption even in the long run; it can bring many

inhabitants to see the convenience that before they didn't notice in this type of service. Furthermore, not to be excluded, it will certainly also be a sort of digital convergence between offline and online which will most likely invest in many traditional retailers.

At the cultural level, many of the points envisaged during disasters caused by infectious diseases, especially during the COVID-19 pandemic are extremely useful for the scientific community. One of these points is represented by the availability and distribution of pertinent scientific literature, which is a service offered to all citizens in the end as well as to authorities and political decision-makers. An informed and culturally and scientifically equipped population will be able to improve better by appreciating the dimension of risk without panicking. Prepared citizen-patients will necessarily be more collaborative with health authorities and will, for example, be more prepared to follow quarantine measures and other public order provisions, will contact doctors more quickly in case of symptoms, and, if necessary, will accept willingly the necessary clinical treatments and any vaccines. This emphasizes how crucial health education is. One of the most significant social determinants of health is education; there is a direct correlation between low health literacy and disease. Proper health education allows people to understand why quarantine is needed, why team sports cannot take place, and why it is better not to run to hospitals for the first suspicious symptoms. Not only the public sector but also the private sector, from multinationals to small businesses, can no longer ignore the importance of health education and those who can contribute clearly to it are undoubtedly the companies. The private sector is in a unique position to have a significant impact on a lot of consumers through their brands encourage their education in health and ultimately empower them. At least for the latter point, the commitment of the private sector could be fundamental to a more complete preparation framework that should become a sine qua non for any company in the future.

5. Discussion

The study underlined the important benefits of using the disaster resilience-based approach for managing disaster impacts. First, the approach makes it possible to consider all the disaster management phases considered in the helix classification provided by Bosher et al. (2021); this allows for providing relief, thereby reducing the negative impacts, and preventing its recurrence or consequences in the future. Moreover, the approach mobilizes a wider range of actors, thereby creating a more powerful constituency for the process. According to Gray et al. (2018) collaboration among different stakeholders has been recognized as a key element in aligning the activities and their outcomes with the values, needs and expectations of the whole society. Finally, the application of the approach to the COVID-19 pandemic demonstrates the need for implementing preparation and preservation strategies able to safeguard people's lifestyles in a coherent and collaborative vision during a disaster. Alonge et al. (2019) claim that community-wide efforts assisted in directing response measures from higher levels of the health system toward the community. The application of the approach to the COVID-19 pandemic revealed important elements to consider. First, the importance of the citizens' training for the exchange of global knowledge of the problems connected with the management of an infectious

emergency (Hantoko et al., 2021). Proper coordination of activities for the prevention, control, and management of infectious transmission is needed both at the public level and in working environments together with a planned communication strategy for the dissemination of pertinent information to the public, partners, and stakeholders (Tam, et al., 2021). When infectious disease occurs self-protection measures and behaviours aimed at safeguarding the safety of individuals must be implemented together with adequate measures for monitoring citizens' health following the infectious evolution (Cheng, et al., 2020). In line with Meng et al. (2020) and Liang et al. (2020), a strong number of initiatives were considered necessary to be implemented to satisfy the material and psychological needs of the individual and the entire community both during and after the infectious emergency occurs. After the infectious emergency, the overall goal of actions is to address the health and social impact, as well as to prepare for potential future infectious waves. Particular attention has to be given to the development of a new research culture based on cooperation and progression studies as well as the education of the citizens, which is one of the most significant socioeconomic determinants of health (Shaw et al., 2021).

6. Conclusion

The paper provided a disaster resilience-based approach. It allows promptly and effectively preventing and responding to the impacts of disasters while building resilience through a multistakeholder perspective. The benefits of the approach are multiple: (i) it involves a wide range of actors, thus creating a powerful constituency for the disaster mitigation process (ii) it provides a good manner to prevent duplication, overlaps and gaps in the preparedness and response efforts to disaster emergencies and (iii) it is a means for increasing the effectiveness and efficiency of coordinated efforts to address disasters emergencies. All the advantages of the approach can be obtained only if its implementation takes into account practical and theoretical implications. On a practical level, implementation requires adequate policies and funding. Furthermore, it also requires the involvement of many different actors at different levels of government. At a theoretical level, further demonstration of the relationships of the approach with existing measures at the local and national levels to prevent and reduce exposure and vulnerability to disasters can increase the validity of the approach.

Future research will focus on applying the approach in other contexts to test its effectiveness. Furthermore, the approach should be extended by integrating resilient pillars with pillars based on sustainability and responsible research and innovation (RRI) aiming to consider social, economic and environmental expectations and foster collaboration between actors at different levels (local, national, etc.).

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