How Resilience Management Principles could help in addressing the COVID-19 Crisis: Hints from a pilot exercise of the DARWIN H2020 Project.

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DARWIN was an EU funded research project under the Horizon 2020 research programme focusing on improving responses to expected and unexpected crises affecting critical societal structures, during both natural and man-made disasters. To achieve this, DARWIN developed European resilience management guidelines aimed at critical infrastructure managers, crisis and emergency response managers, service providers, first responders and policy makers. Developed by 9 different partners in Europe, the DARWIN Resilience Management Guidelines (DRMG) took the form of a collaborative Wiki, structured around 13 different Resilience Cards to help or advice critical infrastructure organisations in developing stronger crisis management practices (management of resources, procedures, training, etc.) based on resilience management concepts. The guidelines were tested in 4 different pilot exercises at different locations in Europe and focused on two main sectors: Healthcare and Aviation infrastructures. One of the pilot exercises organized in Italy in June 2017 provided interesting insights on resilience management practices addressing issues that have many aspects in common with the current worldwide COVID-19 pandemic crisis. The exercise involved healthcare and aviation elements, under coordination by the company Deep Blue srl and the Italian National Institute of Health. Representatives from 13 different institutions and organizations participated to the exercise, which turned around a fictitious disease outbreak scenario, described by the following narrative.

Pilot Exercise: "Novel disease outbreak during a flight due to land at Rome Fiumicino Airport"

During a flight due to land at Rome Fiumicino airport, one passenger shows symptoms like severe cough and initial respiratory distress. After consultation with the pilot in command, a flight attendant makes an announcement to the passenger asking if there were physicians among them. A passenger traveling with his family claims to be one. He accurately checks the passenger by measuring his temperature finding high fever and excessive sweating. The physician states to the on-board personnel that the case has to be notified to the pilot in command.

There are 20 minutes left before landing at Fiumicino airport. The pilot in command advises Roma Area Control Centre (ACC) that there is a person who needs to be immediately assisted. ACC warns the Control Tower supervisor that notifies the circumstance to the Airport Directorate that, in turn, informs USMAF (Maritime, Air and Border Health Office). The flight attendants ask all the other passengers on board to fill in a "passenger locator card". The Airport Directorate calls the USMAF and the airport E.R. in order to take charge of the passenger immediately after landing and carry him through the sanitary dedicated area, for further medical screenings.

The suspect is for a severe acute respiratory disease and therefore the patient is taken to the negative pressure room. The National Red Cross or the Regional emergency agency (118) provides the transfer to the nearest Hospital specialized in infectious diseases. There, physicians provide first aid to the patient and indicate the diagnostic tests to be performed, considering the country of origin of the case and the type of symptoms. The first laboratory results are suggestive for a novel influenza virus. The tested sample is immediately sent to the Influenza National Centre.

During the pilot exercise, experts from 13 different institutions and organizations were invited to make an in-depth analysis of the scenario, to image different developments of it and to simulate the application of 3 different DARWIN Resilience Cards:

1. Promoting common ground for cross-organizational collaboration in crisis management (Card 2.1)
2. Noticing brittleness (Card 4.3)
3. Communication strategies for interacting with the public (Card 7.1)

The application of the cards leaded to address a number of dilemmas that critical infrastructure organizations have to face as soon as the emergency starts, and can potentially develop into a real crisis. For example: should the passenger showing severe symptoms be the only one to isolate? Should the relevant authorities require that also other passengers are inspected? In case other passengers will not be allowed to immediately reach the airport terminal, what would be the cascading effects on other actors of the aviation systems? Who will be responsible to compensate for the economic losses to passengers and or the airline, if some of the passengers will be prevented from taking, for example, a connecting flight?

The COVID-19 crisis is characterized by a completely different scope and duration. However, the following sections describe a selection of resilience engineering principles and practices for each of the 3 DARWIN cards considered whose application presents interesting analogies with the COVID-19 scenario.

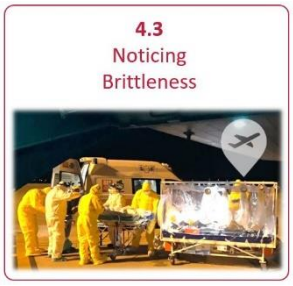
Are the different organizations prepared to collaborate?

In order to collaborate effectively at the time of a crisis, the people jointly involved in crisis management from different organizations need to have sufficient understanding of their mutual goals, expectations, capabilities, and operational procedures. This is the main topic addressed in the DARWIN card Promoting common ground for cross-organizational collaboration in crisis management. Examples of proposed activities are: (a) Information sharing *workshop*, (b) Periodic *visits* of own staff to facilities of other organisations, (c) Joint crisis *preparation exercises*. Ideally, such activities are effective if organized prior to a crisis but, depending on cases, they may have a value also during crises with a long development or requiring unprecedented agreements among the organizations. When analysing the disease outbreak scenario chosen for the DARWIN pilot exercise, it became quite clear that there was a real need to increase the level of common ground among the stakeholders potentially involved in the management of the crisis. In principle, the reference to a number of official documents should have clearly ruled the way the different actors have to collaborate.
Examples were **the National Pandemic Plan, the national Airport Plan in case of Influenza Pandemic, the EU Decision on serious cross-border threats to health (Decision No 1082/2013/EU), the Decision on a Union Civil Protection Mechanism (Decision No 1313/2013/EU).** However, from the discussion among the experts, it emerged quite clearly that every actor had limited awareness on the best way to interact with the others during the development of the initial emergency. The table below compares some of these issues in the DARWIN Pilot Case in the current COVID-19 scenario.

DARWIN Pilot case	**COVID-19 scenario**
	
The representatives of airline pilots highlighted potential difficulties related to the initial diagnosis procedure suggested in the pandemic plan in a situation like the one described in the scenario. **What for the infectious disease experts participating to the exercise appeared as a simple check of the most severe symptoms, posed serious dilemmas if seen from the perspective of an airline captain who has to take a delicate decision when still flying.** I.e. whether to request to the Air Traffic Control the authorization to move to an isolated area shortly after landing, in order to ensure the possibility to immediately quarantine the patient	To allow a progressive softening of the most severe lock-down measures, most of the countries are studying protective measures and social distancing rules, allowing them to maintain and adequate level of control over the Convid-19 contagion rate. The identification of such measures, affecting many aspects of social life, require an active cooperation among institutional actors with completely different backgrounds. **For example, the medical authorities have to establish a constant dialogue with local administrations, law enforcement agencies and public transport managers in order to identify the best way to enable citizen urban mobility in a way**

with suspect symptoms, or to follow the ordinary path to the terminal and ask for the medical checks when all the other passengers are already getting off. The Captain has to take this first decision by remaining within the cockpit - whose door cannot be opened to external people since the 9/11 terrorist attack - with no possibilities to speak directly with a physician. Therefore, assuming a physician is actually available on board, it will be possible to consult her/him only with the mediation of a flight attendant, who has then to report to the captain via inter-phone communication. **In this respect, the scenario highlighted what *the airline experts saw as a lack of practical advice on how to prepare the work for their medical counterparts once the flight will have completed its landing procedure.*** Making the wrong decision in one direction or the other (by either overestimating or underestimating the symptoms) may actually have remarkable side effects on the passengers and airlines on one side or on the capability of the medical personnel to contain the potential disease outbreak on the other side.	**that does not compromise public health objectives.** To ensure their effectiveness, the instructions for the correct use of personal protective equipment (e.g. face masks) and the criteria for limiting the access to buses, metros or trains have to take into consideration the specific characteristics of such collective transportation means and the way they have been designed at the different local levels. The applications of such criteria and rules present significant challenges and a constant need for revision that will go well beyond the compliance with a written procedure and will require mutual understanding among actors normally not used to collaborate closely. A lack of flexibility or mutual understanding among the different institutional actors is likely make most of such measures difficult to apply by the citizen or largely ineffective.

Which is the best balance between public health objectives vs. production objectives?



The DARWIN card Noticing Brittleness deals with a characteristic of organizations that can be intended as the opposite of resilience. An organization is brittle when it is unable to react to a crisis without losing at least some of its essential properties and when it cannot ensure an adequate level of business continuity. Organizational brittleness can be experienced in different ways during the management of a crisis, including: (a) a difficult to manage *conflicting goals* and *trade-offs,* (b) a competition for resources and a potentially insufficient *buffer capacity*, (c) A difficulty to manage *functional interdependencies* between different parts of the organizations.

In the disease outbreak scenario analysed during the DARWIN pilot exercise, the need to manage conflicting goals and trade-offs was one of the main aspects under analysis. The table below compares some of the results of such analysis with the elements that are emerging, in a completely different time and space dimension, in the COVID-19 crisis.

DARWIN Pilot case	**COVID-19 scenario**
	
The disease outbreak scenario puts a number of actors in front of a clear dilemma. **Whether to privilege public health objectives, thus applying all the protective measures available to minimize the risk of spreading a new contagious disease, or to focus the intervention only on the affected patient or on a limited number of other passengers who**	Nearly all countries in the world are currently facing with a trade-off between public health objectives (e.g. limiting the contagion rate to ensure the availability of an adequate number of intensive care units) and the need to preserve productive activities that have been largely damaged by lock-down measures. The entire socio-economic system in

were sitting close to him during the flight. The representatives of the National Institute for Infectious Disease attending the DARWIN Pilot Exercise highlighted the fact that waiting for the results of laboratory testing to ascertain if the passenger has contracted a new form of infective disease may require several hours (up to 8 or 12). This time is clearly incompatible with the needs of an airline and airport terminal running their business in very tight schedules and with a need to ensure timely access to connecting flights and other transportation means, especially in big regional hubs. However, if only the affected patient is quarantined upon arrival at the airport, there is a concrete risk that other passengers may quickly spread the infection either in other areas of the country or in other countries reached by the connecting flights. Furthermore, even if the other passengers have filled in a passenger locator card, one should not take for granted that it will be easy to get in touch with them afterwards, especially in the unlucky event that the laboratory tests will confirm the diagnosis of a dangerous infectious disease. Interesting enough, a very similar scenario occurred in New York about one year after the pilot exercise: it was at JFK airport on 5th September 2018. In that case, a large Emirate Airlines A380 arrived from Dubai was delayed of about 3 hours before departing back for Dubai and many passengers were subject to medical screening before being allowed to leave the terminal. Luckily, the laboratory tests made during the day revealed that all sick passengers were only suffering of an ordinary flu, despite the considerable delay caused to the aircraft, the big resonance on the media and the large amount of passengers involved in the medical screening.	several countries is manifesting al lack of resilience in the face of an unprecedented exogenous shock. Due to the difficulties to comply with social distancing requirements, many productive sectors and enterprises whose business rely on free circulation of people and face-to-face relationships with clients have been obliged to suspend their activities. In some cases, the suspension period is relatively short compared to the lifecycle of a typical enterprise (e.g. one month or two) however the economic sustainability is compromised by the impossibility to cope with fixed costs (e.g. salaries of the employees, renting of facilities, payment of taxes, etc.) in the lack of any income. Therefore, without provision of an adequate buffer capacity by public authorities, even economic investments made over several years are at risk of being lost in an incredibly short timeframe. To note that in this case, the public health objectives on one side and economic and production performances on the other side are clearly conflicting with each other only in the short term. In fact, in the medium-long term, any country experiencing an important loss of production capacity is likely to suffer an excessive reduction of tax revenues, with negative consequences also on their capability to found and maintain the healthcare infrastructures that are indispensable to achieve the above mentioned public health objectives. In this respect, limiting economic and societal brittleness in the face of major crises means first of all enforcing the capability of both public and private institutions to get prepared to manage trade-offs that are not experienced in ordinary life situations.

Are different organizations ready to communicate timely and in a coordinated manner?

The response of the public directly or indirectly affected by a crisis plays a critical role in determining how quickly and effectively the crisis will be resolved. Hence, organizations involved in crisis management activities need to develop and implement communication strategies for interacting with the public that facilitate the adoption of correct behaviours and encourage an active participation to the resolution of the crisis. The following list presents examples from the recommendations of the DARWIN resilience card Communication strategies for interacting with the public.

- Make sure the relevant institutions and organizations have a *strategy to coordinate their communication* during the crisis, to prevent the risk of sending contradictory messages.
- Make sure that the content of messages addressed to the public is *grounded on scientific data, but also sufficiently simple to prevent misunderstandings* by people with limited scientific background and to minimize the risk of oversimplifications by the media.
- Communicate essential and credible information in a *timely manner*, preventing the risk that other non-official sources of information will fill-in the empty space and encourage the spread of rumours and fake news.

- Do not assume the public is a unique entity and consider different targets to *tailor the messages* and communication strategies (e.g. different age, cultural and social groups).
- Base your strategy on *different communication channels* (including both social media and traditional media), making sure that you have the required competences to manage them.

In the DARWIN disease outbreak scenario, one of the most relevant issues was the ability of the involved organizations (e.g. the Airport Authority, the involved airline, the National Institute for Infectious Diseases, etc.) to communicate as quickly as possible with the passengers and with the media on the status and management of the ongoing emergency. In the COVID-19 scenario, the management of communication has of course different requirements, since the initial sanitary emergency has now developed into a long lasting and global crisis. However, most of the criteria analysed during the DARWIN pilot remain valid.

DARWIN Pilot case	**COVID-19 scenario**
	
In the era of social media, **a too long time to provide the public with a credible update of the situation can actually pave the way for the spread of information by non-official sources that may be easily misinterpreted, leading in some cases to uncooperative behaviours, especially by the people more directly involved in the emergency.** One should imagine the situation of many passengers leaving a large aircraft and being blocked at the airport terminal, with no clear information on the time it will pass before being allowed to continue their travel or to leave the airport. In these circumstances, many messages, picture, videos are almost immediately sent by the passengers via their smartphones and possibly propagated by the relatives or friends waiting for them at the airport. In the lack of a credible explanation of what is happening, the potential effect is a negative impact on the image of both the airline and the airport and a risk of generating panic in the people trying to understand the nature and severity of the sanitary emergency. However, rather than being just timely and credible, the messages should also be adequately coordinated among the involved stakeholders. If one of the institutional actors start sending messages that appear to put the blame for what is happening on another stakeholder, it will likely cause such stakeholder to defend its image and just tell another version of the same story. In such a way, the content of the communication shifts away from the most important role of guiding the public in assuming a cooperative behaviour and is likely to generate a sense of mistrust in all messages the authorities will send, with the result of compromising their effectiveness.	In the COVID-19 crisis, **the responsibility to communicate with citizen on the risks associated to the pandemics and to provide guidance on the safest prevention practices is up to multiple institutions. An adequate level of coordination among them is an essential prerequisite**. Persuading citizens to follow preventive measures that require radical changes of day-by-day habits and are based on a sometimes difficult to understand scientific background may not be easy, where different and equally important information sources are not consistent among each other. This is for example a quite critical problem for countries whose Healthcare system is mostly organized on a regional basis, like in the case of Italy. Being the first country in Europe strongly impacted by the COVID-19 contagion, Italy was mostly unprepared to a coordinated national response to the crisis in the first days in which this was developing, also because the Italian Constitution assigns to regional governments most of the power to decide on public health measures. Examples of issues were the difficulties to ensure a timely communication of the most restrictive lockdown measures, such as the ones concerning school closures and the restrictions to the mobility among the different regions. In the same moment in which the central government was discussing with the regional governments the plans for preventing any movement from one region to the other, the lengthy and transparency of such discussion went at the detriment of the effectiveness of the resulting decisions. Hence, many citizens took the initiative to travel back to their originating regions before the restrictive measures entered in force, causing an increase of the contagion rate in the regions initially less affected by the pandemics.

Lessons from the DARWIN experience

The DARWIN resilience management guidelines are not ready-for-use policies, procedures or prescriptions for first responder organizations. Rather, they are principles to help or advice such organisations in the creation, assessment and improvement of their own guidelines and procedures. Decision makers and managers at different levels in an organization can adopt these principles and translate them into policies or procedures for front line operators, adapted to their specific needs.

By a larger extent, the severity and magnitude of the COVID-19 crisis has shown to be greater than the crisis and emergency situations imagined during the project. However, the example of the three cards analysed and the pilot exercise made in Rome shows the relevance of the principles underlying the DARWIN guidelines also for addressing global pandemics. The need to establish a common ground among the different organizations cooperating in the management of the crisis, the importance of anticipating and managing trade-offs and conflicting goals, as well as the importance of coordinating communication activities appear as crucial elements to improve the effectiveness of the measures to contain the effects of such a dramatic crisis.

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