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What does the Covid-19 crisis teach us about resilience?

In this *Tribune de la sécurité industrielle*, Jean Pariès, who became ICSI and FonCSI's new Scientific Director in early 2020, and who is an eminent specialist in resilience, examines the Covid-19 pandemic through the lens of resilience. We hope that this analysis will provide you with some food for thought on how to manage industrial risk, both now and in the future.

The launch, by the President of the French Republic, of a military operation called *Resilience*, to help combat the Covid-19 pandemic, gives us pause for thought. It is clear that the pandemic is an extraordinary illustration of the intuitive, but complex notion of *resilience*, and has opened up a unique opportunity for us to deepen our understanding. We can literally see it at work – or not. Moreover, we can transfer what that experience is unfolding to other domains, such as the management of industrial risk. These are the ideas that I will address in this article.

Resilience is commonly understood as the ability to cope well with unexpected events, and to overcome trauma. In the many, ongoing, debates it is the capacity of society to overcome the unprecedented crisis triggered by Covid-19. The metaphor is often warlike: we (the human species) have suffered a surprise attack, by a hitherto-unknown virus that has escaped from an exotic animal and crossed the species barrier. We are suffering, some of us are dying, but we are taking action and we will, once again, defeat this attack from nature. Our species is, and our societies are, resilient.

What happened?

In the midst of the crisis, we are developing a better idea of the conditions required for resilience. We need – or needed – stocks (masks,

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hydroalcoholic gel, toilet paper, etc.), a certain degree of overcapacity (intensive care beds and staff, etc.), the ability to reorganise (decision-making bodies, the 'social distance', supply chains, etc.), an ever-so-slightly decoupled economy (to avoid dependence on specific nodes), flexibility (to convert a production line for cars into a production line for respirators, or re-deploy surgical interns as care assistants, etc.), expertise, skills, creativity, diversity, etc. And, above all, solidarity, communication, impartiality, transparency, honesty, shared values; in short, social ties.

And we can see, just as clearly, that these conditions for resilience were not met in full. The pandemic can be compared to a gravitational lens: by distorting our social space-time, it shows us its hidden side. To date, the common assumption of the principle of 'economic rationality' needed no explanation – "faster better cheaper", ideal Darwinian competition based on greed, an extreme form of globalisation, the devastation of our planet. However, it now appears, at least for a while (and for some of its acolytes), as a questionable ideological choice. Like a stress test, the pandemic is revealing the disease that lies at the heart of society. In only a few days, it shone a light on the weaknesses in our hospital system that medical staff have vainly campaigned about for years. It has stripped down the boundary between the indispensable and the superfluous, and turned the social utility scale on its head. At the same time, it is raising questions about the foundations of the social contract, the fundaments of our democracy. Our perceptions

are shifting, as if we are looking at a bistable image of a young or old woman, or a dancer who turns either to the right or to the left[1]. We can ask how long the change is going to last, but we cannot deny that it is happening .

Lockdown: an about-turn in values

It is clear that the crisis is characterised by an about-turn in values. Covid-19 is not a crisis because it is a disease that can be transmitted from animals to humans: 60% of our infectious diseases fall into this category. Viruses have always been exchanged between animal species, and we must not forget that humans are an animal (and we exponentially increased the number of such diseases in the Neolithic period by inventing domestication, enclosed breeding and urban centres). Nor is it a crisis because there is a pandemic, because the virus is contagious, or because the disease kills people: plague, cholera, smallpox, typhoid and influenza have all done much worse in the past. Between December 1969 and January 1970, the so-called 'Hong Kong' flu caused 31,000 deaths in France, and a million worldwide, with no particular outpouring of emotion. What characterises Covid-19 is that it reveals a shift in values: perhaps for the first time in our history, humans are putting the lives of individuals before economics, conquest or war. We are not locked-down by a virus, but by a trade-off, a decision that is almost unanimous among world leaders. The pandemic seems to have brought to light a profound change in values. And that is what characterises a crisis: a trigger leads to the breakdown of an already-unstable balance between the system's key objectives, constraints and values; the event requires trade-offs to be renegotiated, along with an obligation to focus on the essentials and let go of the rest, or to take decisions that require a sacrifice.

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Resilience lies at the heart of future trade-offs

However, the most difficult trade-off is unrelated to the lockdown. In the aviation domain, I have always been impressed by the huge asymmetry between how easy it is to ground an aircraft after a serious incident, and how difficult it is to re-authorise it to fly (the Boeing 737 Max case is a good example). Everything stops when trust is lost, and trust can be lost very quickly. Rebuilding it is another matter. The real trade-off is, therefore, yet to come, and will be much more difficult. We will have to weigh multiple factors. Not only the effect of health protection measures on the economy, our freedoms, and social ties, but also the symmetrical effect of the economic slowdown on our physical and mental health, on the environment and thus, again, indirectly, on health. On the one hand, we can estimate the number of deaths that have been avoided. On the other hand, how many others have had their lives devastated, are suffering from depression, or have died from other causes? Who is being affected? Over what timescale? What kind of a society do we want to live in? The degree of complexity is overwhelming… and a fundamental challenge. Negotiating these compromises lies at the heart of resilience, which is seen here as a property of the system. It goes beyond the capacity of a metal, an individual or a society to withstand blows. It is the capacity of a system to maintain or redefine the dynamic equilibria that cause it to maintain a stable state in an unstable environment.

System resilience before the about-turn

In systems ecology, *resilience* has traditionally been used to refer to the capacity of ecosystems to persist, despite the perturbations and disturbances they are exposed to, thanks to their compensatory, homeostatic ability to permanently regenerate. Up until the moment when compensation is no longer possible, they shift, often without any warning, to another equilibrium: the forest becomes savannah; the savannah becomes desert. This powerful definition of resilience as the depth of an 'attraction basin' can be applied to all complex, dynamic and self-reproducing systems, including, for example, our societies and our businesses. It can help us to model crises and catastrophic accidents in industrial safety, and provides some powerful tools for understanding, preventing and managing such situations.

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What is the Covid-19 system?

The first corollary of this view is that it makes no sense to talk about resilience, without specifying the system at stake. When applied to Covid-19, this means that we are part of the living world. Man (*homo*), even when he became wise (*sapiens*), never really left the primeval forest (the microbial moss that covered the Earth 3.8 billion years ago when life began). We remain inseparable from the few hundred thousand billion micro-organisms, more numerous than the cells in our body, that make up our microbial flora. We are just as inseparable from the living world that surrounds us. We cannot, therefore, be at war with this world. We are not at war with a virus: we are part of the same (eco)system. We cannot sterilise the world without destroying ourselves at the same time. We cannot destroy entire ecosystems without being invaded by migrating viruses. To bring things back into balance, we will have to find a solution that does not require a war.

"Crisis"… what crisis?

Another corollary of this view: the notion of a precursor, or weak signal, that could be detected before the crisis is, more often than not, an illusion. In the context of Covid-19,

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the French initially watched what was happening in China with a condescending calmness; the vast majority of experts asserted that the risk to France was minimal, that our hospitals were ready, and that we should not over-react. Then we saw what was unfolding in Italy. Then Trump noticed what was going on in Europe… But, notwithstanding the well-known psychological denial bias, it is 'objectively' difficult to see a looming crisis. As it is compensated for, the functioning and performance of the system does not reflect the effects of perturbations. Typically, effects build up over the long term, in an exponential process that initially seems to grow very slowly but then, literally, explodes, breaking down all of the defences that have been put in place. Earthquakes are an example. They are the result of the sudden release of energy that is accumulated by the elastic deformation of rock during inter-seismic periods where there is no sliding. The counterintuitive consequence of this is that the more often small earthquakes happen, with a concomitant discharge of energy, the lower the probability of a large-magnitude earthquake. As an aside, one school of thought in the domain of the management of social tensions draws their theory from this idea: there must be regular tugs-of-war between the different parties to identify and address problems. It goes by the curious name of *collibrationist*, from the ancient verb *collibrate*, which means to give a gentle push to a balance scale to check that it has not become stuck and is giving a false value. Is *collibration* another word for democracy?

What does this have to do with at-risk industries?

Similarly, in industrial safety, we find a lack of correlation, or even a negative correlation, between the frequency of incidents and that of disasters, or between the overall frequency of occupational accidents and that of fatalities. Modern approaches to safety risk management have, therefore, abandoned the classical idea that reducing the frequency of some types of accidents and disasters is a useful way to anticipate others. ICSI, in particular, is developing dedicated approaches to the prevention of serious and fatal accidents. At the same time, safety management in at-risk industries is being shaken up by the pandemic. The dominance of health concerns is changing the weight given to production, profitability, industrial safety, occupational health and safety, the environment, etc. In the field, the need to manage the pandemic has reduced the workforce and limited on-site working. It has resulted in the massive adoption of remote working; social distancing has become another constraint, as has protecting individuals who must work in teams. All of this is transforming and complicating the implementation of day-to-day safety practices. New trade-offs have to be made, and

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activities have to be modified, postponed or abandoned. The sudden eruption of the unforeseen and the unthought-of is destabilising a risk management model that heavily relies on anticipation and predetermination. We need to invent new ways to manage industrial safety.

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What about next time?

A final corollary of this view of resilience will serve as a conclusion. It concerns learning. I said in the introduction that we must learn from this unprecedented experience. In fact, the risk is not a lack of learning, but poor learning: "It's alright, we've understood what happened, next time we won't be surprised. We'll have enough masks". But we will, of course, be surprised, or it won't be "the next time"! It will not be enough to simply add SARS-Cov2 to the list of known problems. Obviously, it is not a completely useless exercise, but the next "total surprise" will be a new Maginot line. What we have to anticipate is that we *will* be surprised. What we have to be prepared for is to be unprepared. We need a meta-learning process. It is not a question of remembering what we did in response to the Covid-19 crisis, instead we have to remember what we did when we didn't know what to do. We must look back and consolidate on what it was that made the different trade-offs possible, how we came up with new solutions, and implemented them in society. Diversity, consensus, skills, social ties, flexibility, dedication, solidarity, creativity, reconfiguration, impartiality, key functions, redundancy, overcapacity, stocks, etc. How can we ensure that society does not forget what it did to succeed?

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> **TO FIND OUT MORE:**
>
> - RESILIENCE ENGINEERING ASSOCIATION:
>   https://www.resilience-engineering-association.org
>
> - [1]BISTABLE IMAGE OF A YOUNG WOMAN WHO TURNS RIGHT AND LEFT:
>   https://www.youtube.com/watch?v=i-yhtXAzYwc
>
> - PARIÈS J., "Complexity, Emergence, Resilience ...: Concepts and Precepts",
>   *Resilience Engineering* (pp.43-53), 2017

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A civil aviation engineer, Jean Pariès worked for 15 years with the French Civil Aviation Authority (DGAC). He then joined the Bureau d'enquêtes et d'analyses (BEA) for Civil Aviation Safety. Then, from 2000 to 2004, he was associate research director at the CNRS. He was Chairman of Dédale SA for 25 years. Finally, he has been Scientific Director of ICSI and FonCSI since the beginning of 2020.

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