– SANCTUM –

Strategic anticipation in crisis management through the lens of societal values

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The SANCTUM Project (Crisis Anticipation by Uchronic Modeling Process) was created to meet the needs of senior decision-makers who lack the required tools to make a rational decision.

A "rational decision", as used here, is one that is free of subjective considerations of all kinds (be it cultural, cognitive biases, emotion, other influences, etc.) likely to skew the analytical process and sap decision efficiency (an efficient decision entails a balanced comparison of advantages and disadvantages).

SANCTUM's added value really comes to bear in times of complex crises during which severe challenges (national crises) necessarily require prioritization, for example, during intersectoral or systemic crises, with domino effects affecting separately or simultaneously various matters of concern to society (e.g., health, energy, transportation, housing, economy, education, public order, etc.). In France, the Interministerial Crisis Centre (CIC) is responsible for this level of crisis management.

SANCTUM's mission is to provide over time the tools required to strengthen the predictive capabilities of said crisis center via a specific methodology and a modelling of predictable situations, referred to as "uchronia"[i1] (alternate scenarios). It is not oriented toward tactical decisions entailing the operational implementation of crisis management measures at the territorial level (e.g., the Operational Centers of prefectures or local administrations).

[1] Neologism based on the prefix "u"-, already used by "utopia" and the Greek word "chronos". For this term, we attribute the meaning alternative history based on a total rationality.

I – SANCTUM: above all, an events crisis management system

Traditional crisis management methods usually consider the crisis management system to be implicit, where the crisis framework is assumed to be the usual (or everyday) environment, with the priority given to the search for the appropriate measures to contain and then make recede the crisis as soon as possible.

This is the "Common Operational Picture" describing the situation at a specific moment in time *t*, which, as Wybo and Latiers point out (2006[ii]), is difficult to construct, even in a crisis cell.

Beyond the different perceptions of the players concerned by the crisis (decision-makers, victims, rescue personnel, public opinion), intervention speed is almost systematically viewed as the qualitative crisis management factor.

However, with hindsight, whilst intervention speed is fully vindicated in terms of tactics, the move to the strategic level may require a substantial contextualizing effort. This is why SANCTUM endeavors to introduce a preliminary phase in crisis analysis, which consists of **making explicit the fundamentals of the human environment called into question by the crisis**. This clarification – in the case of a major crisis – must go beyond the analysis of the crisis's functional consequences on economic and social life, which is confined to ensuring business continuity, even under deteriorated conditions, and must not avoid ethical issues.

This amounts to questioning the **overall meaning that the concerned human society intends to give to its existence and future** and by what means of intervention and representation it can express this meaning. Only at the end of this stage will it be able to set the priorities imposed by the scarcity of resources specific to any crisis situation and to implement the decision-making processes (Anderson, 2010[iii]).

This approach, which constitutes the SANCTUM project's basic substance, offers a highly instructive analysis grid of measures taken throughout the Covid-19 crisis.

II – The fundamentals of the proposed crisis management system

The organization or agency impacted by the crisis will naturally seek to place itself in a defensive situation. It will thus adopt a **defensive posture** in order to mitigate the observed vulnerabilities. This posture necessarily includes constraints that are themselves sources of new vulnerabilities. In other words, the management of a crisis (initially exogenous) engenders another crisis, but this time endogenous.

Recent events provide us an example of this type of situation. Leaders responded to the pandemic (exogenous) by mandating strict lockdown measures (endogenous), which generated a diversity of concerns the dimensions of which are hard to gauge.

Lacking comprehensive control of the crisis's effects and the counter-effects of the response measures, crisis management can turn out to be, at minimum, inefficient and, at worst, aggravate the problem.

The response proposed by SANCTUM consists of defining an **automated crisis management system,** which seeks to describe as completely as possible the fundamentals of the **defending organization as per**:

- the system is the human, physical, legal and technological framework in which crisis unfolds. It brings together the defending organization and its organization.

- **the values** are definitions, essentially moral, which create public popular support at the time of the crisis; bear in mind that said values, by nature highly stable, are nonetheless designed by the automated crisis management system as likely to

evolve; they will thus be configurable in our modelling.

- **the governance** is made up of the bodies (institutions), which ensure the system's continuity in accordance with its values;

- **the supporting assets** are the material or intangible means that enable the system to continue functioning on an ongoing basis (e.g., economic and social infrastructures) or which support governance (e.g., public services);

- **the players** are the specific or specialized human resources who develop or operate the assets; they intervene, either on the governance level or with their own strategy, which may not entail cooperation;

- **the stakes** are the vital functions indispensable to ensuring the system's sustainability. The fulfilment of these functions established the conditions for the constitution of the assets and the organization of the players (e.g., housing, heating, healthcare, education, etc.). The term "impact(s)" signifies the total or partial loss of said vital functions (or stakes) following an event in which said support assets are damaged.

In the final analysis, the SANCTUM automated crisis management system brings forth a coherent interlocking of its constituents, **highlighting the key notion of stake**.

The calling into question of the stakes is what, in fact, triggers a crisis, and not the attack on the supporting assets, the value of which fluctuate over time (e.g., in 1940, the Maginot line was a major asset, but the issue was national defense).

III – The idea of "goal" and the practical definition of the crisis concept

We have spoken up to now of the term "crisis" without defining it, since, in our crisis management system, this concept's definition is not established early in the decision process -- as a sort of intrinsic dysfunction that only gets worse causing organizations to become overwhelmed – but later as a systemic deduction stemming from the analysis of the impacted organization.

We have made (I) a static description of our automated crisis management system. In reality, the system that it supports is in perpetual motion to ensure, among other things, its continuity. This self-sustaining dynamic enables it to attain the **goals necessary for its development**, because, as we have seen, we exclude that the defending organization remain in a vegetative or go into a regressive state.

These goals must concretely reflect the search for maximum value satisfaction. They constitute the roadmap for **governance**. Once the crisis breaks out, they become the **stakes** to be safeguarded. The stakes themselves are a function of the supporting assets and conditioned by the interaction of the players.

The goals to be determined are thus a function of the time concerned (health, education and material well-being), but their intrinsic consistence must be considered constant.

The following is a case in point. If the goal is the quality of human development, one stake is education whilst the supporting assets are the locations where education takes place, and the players are those who promote or hinder education.

The crisis, in the context proposed by SANCTUM, may then be seen as a disturbing phenomenon of the crisis management system that could call into question its goals.

The advantage of this definition, compared to the traditional, more qualitative ones referring more to the impairment of an equilibrium[iv], is that it is somewhat measurable (the state of crisis could be the gap between the situation and the goal) therefore suitable for modelling.

Practical examples of anticipation process

We propose, below, two simplified examples of SANCTUM's anticipation process: one entailing probabilistic risk and the other, a terrorist threat.

	Seismic risk	Terrorist threat
System in defense mode	A territorial district with its population	A country coming out of a civil war tries to begin reconstruction in the face of persistent political instability
Values and governance	A democratically elected government mandated to implement an economic, social and environment program	Power is held by the liberation army, which, above all, seeks to restore internal security
Goal	Among program points: improve quantity and quality of drinking water and sanitation	Put an end to terrorist acts carried out by small groups opposed to the restoration of order in the country.
Danger	Part of the population lives in the seismic zone	Persistent insecurity hinders the government's effort to attract investors
Definition of the state of crisis	Significant deterioration in the quality and quantity of drinking water and sanitation	Deterioration in popular and investor sentiment regarding security.
Stakes	Supply of drinking water Wastewater treatment	Lacking investment, the population's living condition remain poor, and authorities lose support.
Players	Local population using water Population living near wastewater discharge sites	Investors and public service providers.
Supporting Assets	Drinking water treatment plant Wastewater reprocessing plant	Public utility companies

IV – The "Oracles": control process of the automated crisis management system's dynamic

The automated crisis management system's development must be carried out in a controlled way to ensure its convergence towards **uchronia,** which will become the object of a decision proposal. We must exclude the fact that there is no solution found because decision-makers cannot avoid making a decision.

What we refer to as the **Oracles** intervene on the automated crisis management system's dynamic**.**

We distinguish between four different types of oracles:

- **The "Sages"**, who control the values-linked choices. These choices require compromises (e.g., risk acceptability thresholds). They can amend the governance rule to be established, if need be.

- **The "Judges"**, who apply the rules validated by the sages to estimate the impact and exposure levels and issue verdicts at this level.

- **The "Analysts"**, who determine, in the most quantitative way possible, the issues, the vulnerability of assets, the search for actions and inventory of available resources.

- **The "Spin doctors"** (communicators and influencers), who define the influence measures to be performed in the defending organization or vis-à-vis players.

The oracles, by virtue of their expertise, focus on carrying out corrective measures in their respec-

tive fields of competence in accordance with the automated crisis management system's values and the rules set forth by the "Judges".

V – Stages in the SANCTUM process

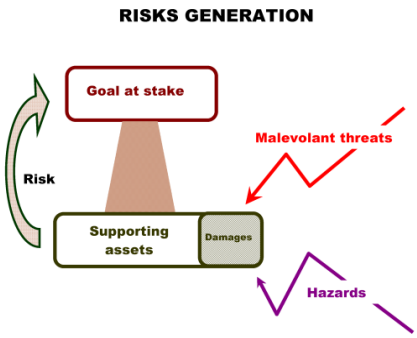
Let's now imagine ourselves in the anticipatory operating conditions of a crisis situation.

The first step will consist of identifying our automated crisis management system, notably, how the crisis is deemed to call into question the goals of the defending organization, undermine its values and handicap its governance.

The second step, which is meant to be more concrete, consists of identifying the stakes the impairment or destruction of which is likely to call into question the automated crisis management system's goals.

The results will allow us to deduce the list of supporting assets and players concerned by said stakes.

During the third step, SANCTUM gives way to classic risk analysis.



The high-stakes assets may be undermined by the vagaries of probabilistic occurrence (hazards) and/or determinist threats (malevolent).

In the first case, the asset's exposure level **L** is:

L = Probability * Destructive force

… in the second case, it is:

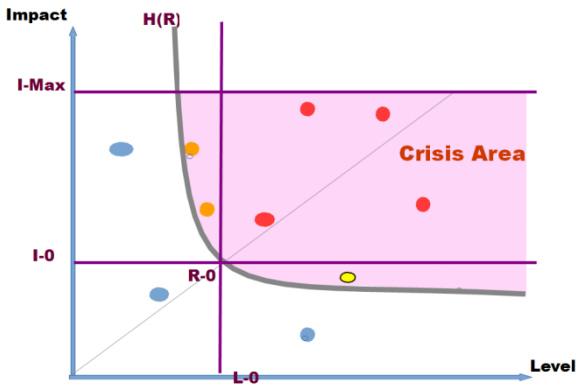
L = Feasibility * Attractiveness

In both cases, the impact **I** is the measure of harm (damage to one or more of the system's vital functions or stakes: loss of human life, production loss or decrease in activity, etc.).

Conventionally, risk **R** equals:

R = L x I

We can thus build a risk diagram on which we can locate each supporting asset according to its **L** and **I** coordinates.



The locus of the constant product of **L x I** is a hyperbola whose positioning on the plane depends on the value **R-0** set to **R**. This determination is fundamental because, by delineating the "crisis area" on the bi-dimensional risk space, it attributes a level of severity to the crisis. The **oracles** attribute this value of **R-0** and factor in the defending organization's admissible level of suffering, its societal effects, the scientific and technological response capacities, etc.

Keep in mind that, at this stage, this risk analysis is based on information "with a finite useful lifespan", which is equivalent to the time during which the data is deemed "stable" (Wybo, 2013[v]). The crisis management time is a structuring item of the dynamic and adaptive anticipatory

approach (November et al[vi]), which must be taken into account throughout the SANCTUM process.

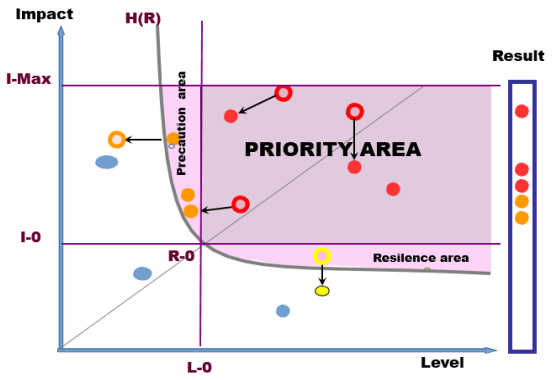
VI – The "progress loop" and the response measures

SANCTUM's "progress loop" is set to undergo digital modelling (see SANCTUM Package 3[vii]).

It takes as a starting point the risk mapping the creation of which was just described in (III). This mapping may be viewed as the conceptual projection of the crisis situation. In what follows, we assume that the supporting assets and players have their own temporal dynamics, the determinants of which can be known and modelled.

This modelling may initially be basic (e.g., linear changes as a function of time) or more complex (group or individual modelling of behavior to any laws of evolution). This complexity can today and, a fortiori, in the future, be taken on thanks to progress in the field of AI and possible learning from Big Data.

The next step in the SANCTUM process (Step 4) thus consists of performing risk reduction work by extracting a certain number of major supporting assets in the area at-risk and by reducing the exposure level or the impact of those that cannot be extracted → note du traducteur à l'auteur: a verifier la formulation du texte français **"l'impact de ceux qu'on ne peut en extraire"**.



We then bring in **mitigations** and **opportunities**.

These two types of measures consist of protecting the stakes:

- By reducing the risks via measures on the level of the impact and exposure level of supporting assets or players;
- By proposing new solutions when the risk-reduction measures are not successful in preventing risk materialization.

Mitigations consist of triggering a change in the system so as to reduce the level of risk, but by only intervening on factors currently known by the system. We may speak of endogenous evolution.

Opportunities assume the intervention of an outside factor, the effects of which are likely to reduce the risk level. It may be predictable, but this evolution is initially weighted by a low probability or unanticipated risk level. It may seek to adjust to the consequences of the destruction suffered to make acceptable another form of system organization.

The difference in nature between these two types of measures may be illustrated by the management of a power output crisis during exceptionally cold weather. Mitigations may be measures to protect generators so as to minimize production loss. On the other hand, higher-than-expected temperatures could constitute an opportunity to restructure the power transmission organization and eliminate weaknesses stemming from certain facilities.

VII – The conception of "uchronia"

The "progress loop" is a recursive phenomenon where the system re-assesses the overall situation and tests the crisis exit at the end of each loop.

The crisis exit is fundamentally decided by governance, but the latter intervenes in the final stages. The Sages, intervening in the early stages, assess quantitatively the convergence toward the desired goals.

Convergence is measures by comparing the changes in the indicators stemming from the adjustments (mitigations and opportunities) to the projected changes and by performing a projection of said changes over time. The system also draws from the measures taken to strengthen its self-learning and maximize the configuration of the progress loop, if the latter needs to be relaunched.

The Oracles carry out these functions on the operational level:

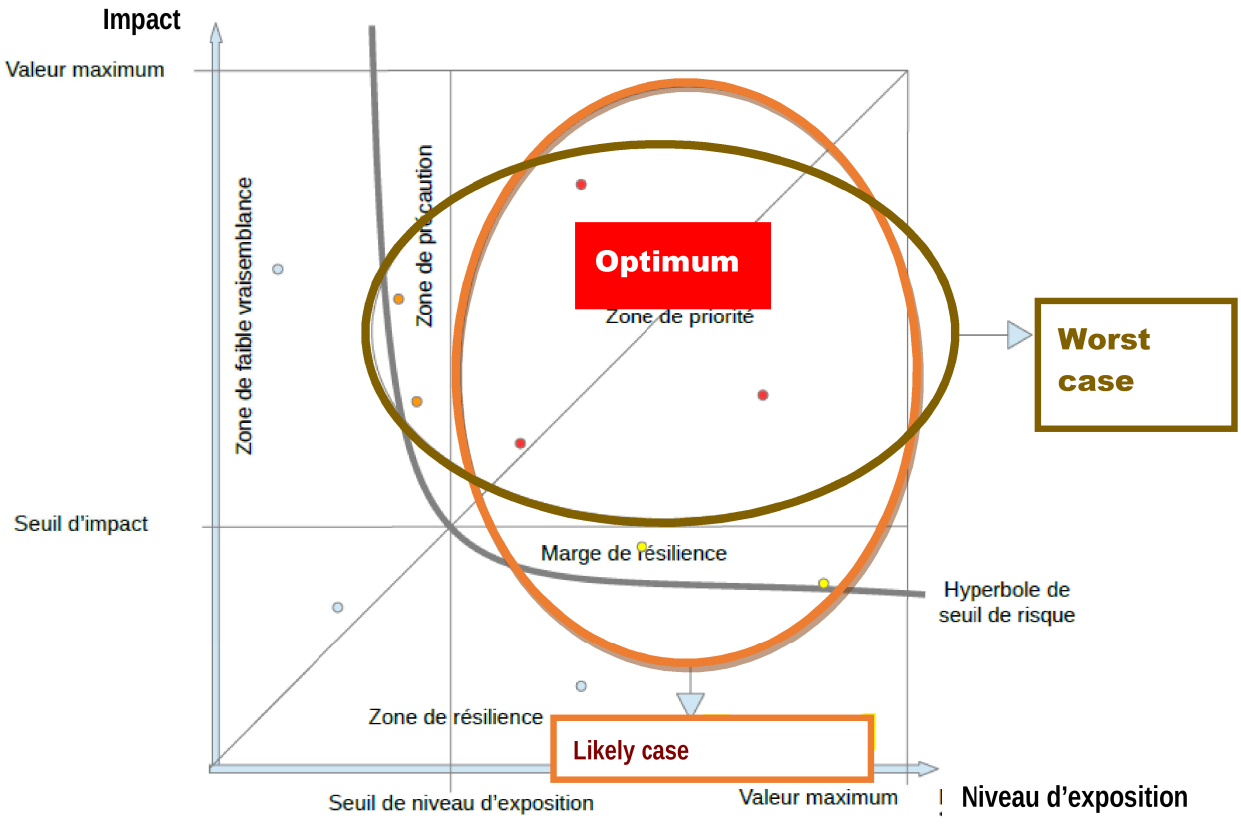
- The Sages, who assess the extent of the damage suffered and the gap to be closed in order to meet the goals and the time needed to return to "peace mode";
- The Analysts, who use the data produced and set forth the efforts to be asked of the players or the assets.

If the model converges, it will be able to produce crisis exit scenarios. To "scenario", we prefer the term "uchronia", deemed to be devoid of any subjective bias.

If the model does not converge, the Sages must recalibrate the crisis, who establish a new value **R-0**. The progress loop is then relaunched, with fewer resolutory constraints, which assumes a heavier weight of the automated crisis management system (level of suffering or economic or social costs on the rise).

The progress loop ends up converging and the model provides us three uchronia scenarios:

- The Worst case;
- The Likely case;
- The Optimal case.



Risk mapping and representation of alternate scenarios

The Worst-case scenario may be defined as the cumulation of the impacts, if all the risks in the priority zone and those selected in the priority area materialize.

The Likely scenario may be defined as the cumulation of the impacts, if all the risks in the priority area and those selected in the resilience zone materialize.

The Optimal scenario may be defined as the list of residual impacts, if all the risks remaining in the priority area and those remaining and selected in the resilience margin zone materialize.

The five steps in the SANCTUM anticipation process

Preliminary step

Definition of the role, responsibilities and relationships of the anticipation cell's participants.
The mobilization of common intelligence requires maximum fluidity in exchanges.
The participants must perfectly understand their place in the system and identify the roles of the other participants. Relationship quality and efficiency are key to the success of the cell's work.

Step 1: stakes and the crisis management system

Participants share their thoughts about the situation.
Identification of the stakes.
Qualification of the crisis management system (values, governance, goal at stake).

Step 2: analysis of stakes

Further analysis of the stakes (public order, health, education, energy, transportation, economic performance, etc.).
Identification of the assets and players concerned by these stakes.

Step 3: risk analysis

Conventional analysis of risks to which the assets at-stake are exposed;
Risk = level of (asset's) exposure * impact sustained
The exposure level depends on the risk type (deterministic or probabilistic).
Preparation of crises map showing the "crisis area".

Step 4: treatment of the crisis area

Preparation of measures allowing for the reduction of the crisis area by using the assets:
by mitigation (internal actions in the system in crisis);
by taking advantage of opportunities (external actions).
The implementation of said measures and the projection of their effects enabling the emergence of evolving "alternate scenarios" (objectified scenarios).

Possible loop

Step 5: description of the evolving alternate scenarios

The anticipated situation may be frame by the following three alternate scenarios:

- The worst case (maximum impact);
- The likely case (maximum exposure level);
- The optimal case (maximization of the mitigation measures and opportunities).

Conclusion: decision-taking

The authority makes crisis-management decisions based on the description of alternate scenarios.

Conclusion

SANCTUM remains a conceptual project for the time being, but one that lays the groundwork for a new crisis management approach, the need for which has become particularly apparent in the course of the Covid-19 pandemic. Its purpose is to show that, in spite of the complexity of organizations, all the functions of an automated crisis management system can be analyzed as a flow of iterative processes controlled through a "progress loop", which benefits from a self-learning system using artificial intelligence-specific resources to assess and improve performances.

SANCTUM's innovation consists in proposing a comprehensive breakdown of the automated crisis management system in which the crisis unfolds by considering from the outset, for example, that the values of the society affected by it are configurable and that the decision-making processes can be rendered perfectly objective by bypassing humans in favor of the Oracles.

This resolutely rational approach does not dehumanize the crisis management because, by endeavoring to remove man from the cogs of crisis management – where he can be as disruptive as he is productive – it leaves man the key role of final decision-maker, but with the essential predictive tools, alternate scenarios (uchronia), at his disposal.

Appendix: SANCTUM and the Covid-19 pandemic in France

The purpose of this appendix is to provide a general illustration of SANCTUM's analytical system, previously described from a theoretical standpoint, in light of an overall review of the management of the Covid-19 crisis in France.

Notwithstanding the impressive number of its victims, this pandemic, which has affected the quasi-totality of humanity in 2020 and 2021, amounts to an exceptional benchmarking tool for testing the SANCTUM system's consistency and potential added value.

Conversely, the absence of a coherent model to describe the situation can largely explain the various controversies that have arisen during the management of this pandemic, including the restrictions and, especially, the lockdown justifications.

The comments we have collected from crisis managers in "classic" mode[2] can illustrate this situation. In response to our questions about the determinants of the Covid-19 crisis, they first cite the problems with the hospital response, in particular, the lack of material and human resources in intensive care.

From the perspective of SANCTUM's analytical model, this vision is narrow in that it had the effect of circumscribing the analysis to the healthcare sector and, thus, limit the scope of decision-making. One of the visible effects was the alteration of the country's governance. The traditional institutions – which, it is worth recalling, are the legal institutions – found themselves vying with an institution, the Scientific Council.

Governance

Without going farther into the matter, much less engaging in a political discussion, the introduction of a derogatory governance mode in the midst of the crisis raises an issue. This question is characteristic of SANCTUM's analytical contribution: are we sure of the governance model we have designated to navigate the crisis? Let's consider what actually happened.

The government's traditional crisis management bodies assumed control of the Covid crisis in early March: initially, by an Interministerial task force within the "leading" ministry" i.e., that in charge of health matters, which evolved, in accordance with the government's directives, into the Interministerial Crisis Unit within the Ministry of Interior.

The jurisdiction of government bodies was thus respected. In fact, a parallel governance was set up with the emergence of an "Interministerial crisis unit bis" headed by Jean Castex. In parallel, "Scientific Council" rose in importance, which, given the importance of its decisions, became a sort of core government health advisory.

The purpose of the SANCTUM model is, of course, not call into question this special organization, but it must be cognizant of its real powers and acknowledge that the relevant institutions no longer exercised effective governance of the crisis. The integration of this change in the decision-making process is essential for the management of the crisis.

Values

SANCTUM considers that, like in the case of governance, the automated crisis management system's values can evolve. In this regard, the French president's now famous quote "whatever the cost" is far from being trivial. On first reading, one has the impression that he views the value system as intangible. After a second look, it seems like an unrealistic assertion; it introduces the "wolf", which is the cost of the measures to be taken, into the sheepfold of values.

This context presents the following question for SANCTUM: <u>what are the actual values of the automated crisis management system applicable to the pandemic?</u>

The "whatever the cost" may be considered as the constant line of conduct of governance in just

[2] As opposed to SANCTUM mode

about all crises (excluding wars, which fall outside the scope of our analysis). There have been a number of situations where considerable human and technical means (sometimes seemingly disproportionate) have been deployed to save a handful of individuals whose lives were not necessarily at risk!

With the implied "hope of lives saved"/"risk of lives put at risk" ratio always being above 1 ab initio, the question of values did not seem to exist.

The pandemic has reshuffled the cards on the quantitative level. This is nothing new, since the treatment of epidemics has throughout history given rise to measures that, from a distance, seem cruel. But crises of such magnitude have slipped from memory. Even memories of the Spanish flu epidemic of 1918-1920 were largely eclipsed by the trauma of the first world war.

The harsh lockdown measures inflicted on France from 17 March 2020 gradually brought to the surface this forgotten question of the variability of values. The confrontation sharpened as the days passed between the values relating to health security, basic freedoms, essential economic and social functions and the exigencies of cultural and spiritual life.

SANCTUM, which already identified a health governance, can predict a priority given to health values.

Goal

Bear in mind that an automated crisis management system like SANCTUM's sets itself an overall goal over time; it is the calling of this goal into question that characterizes the state of crisis. The pandemic has assuredly shaken up matters. The question raised by SANCTUM is to identify the nature of said challenges by structuring them so as to distinguish those which can be offset by a palliative and those which may lead to a redefinition of goals.

This leads us to revisit the classic dichotomy between the existential and the essential. By sticking to the economic and social aspects, specifically the work world, the pandemic has called into question the notion that work must be performed at a set location at a set time period. Telework, long dismissed by employers – public administrations not being less resistant than the private sector – became acceptable, recommended and then, obligatory[3] !

But, whilst telework offers an existential response to the pandemic's economic and social impact, SANCTUM suggests that reflection be extended at the existential level. In a context characterized by material abundance, overconsumption of resources, etc., can productive work and its added value remain goals likely to influence those of health security?

The question of "goals' is of an eminently political and philosophical nature. SANCTUM's job is not to intercede in this type of choice, but simply to make explicit its components and to bring them to governance, which may revise them as a function of the values such as they were defined, above, in the automated crisis management system.

Stakes, assets and players

Crisis managers typically begin their analysis at this stage, attributing only relative importance to previous stages whilst the SANCTUM model said the earlier stages as essential.

Keep in mind that the "stakes" are the vital functions indispensable to the system's sustainability. In the case of Covid, the traditional analysis will quickly put forth the volume of the health and hospital responses as one of the predominant stakes. The supporting assets are the intensive care capacity and the availability of competent staff. The capacity of said facilities in increased somewhat and the country is locked down in order to prevent the development of an imbalance in the supply and demand of said assets.

At the beginning of the crisis, the principle of this reaction, dictated by the emergency, seems to make sense. However, the other stakes must be very quickly considered. But how do we prioritize them all? SANCTUM's response is to review

[3] A bit like Christianity before Constantine. History contains other examples of this sort of counterintuitive development!

the data of the automated crisis management system that may be called into question: governance, values, goals. A quantitative approach can be performed, like that relating to the value of human life, making it possible to determine an equilibrium point from which the effects of the lockdown measures become more predatory than life-saving.

Decision support

Management of the pandemic crisis, based on SANCTUM's model, would have been highlighted by the following points:

- The exigency to make governance explicit;
- Periodic reviews of the value system;
- Revision of the exigencies and the guidelines of the automated crisis management system;
- A greater weighting for non-health states.

As for a decision, this would've led to an early easing of the March-April 2020 lockdown measures with a more nuanced approach, involving, for example, keeping schools open.

These thoughts were developed at the height of the lockdown in early April 2020. We note that the proposed approach closely resembles that which the government adopted during the pandemic's second wave from October 2020.

iNotes

i Neologism based on the prefix “u”-, already used by “utopia” and the Greek word “chronos”. For this term, we attribute the meaning alternative history based on a total rationality.

ii Wybo J.L., Latiers M., 2006. Exploring complex emergency situations’ dynamic: Theoretical, epistemological and methodological proposals. Int. J. Emergency Management, vol. 3, n° 1, p.40-51.

i Anderson B., 2010. Preemption, precaution, preparedness: Anticipatory action and future geographies. Progress in Human Geography, vol. 34, n° 6, p. 777-798.

iii

iviv “Situation in which a system suffers disruptions that cannot be accounted for by the usual mechanism or regulatory processes”, common definition.

v Wybo J.L., 2013. Percolation, temporal coherence of information, and crisis prevention. Safety Science, n° 57, p. 60-68.

vi Valérie November, Alice Azémar, Sophie Lecacheux and Thierry Winter (2020), Le couple anticipation/décision aux prises avec l’exceptionnel, l’imprévu et l’incertitude, EchoGéo, 51, 20p

vii The SANCTUM Project Package 3 (Fertier, Bénaben, & Dolidon, 2019) “consists of dynamically generating models to describe a crisis situation and provide support for decisions made by government authorities in the face of a crisis. It then proposes to study, define and implement a dedicated information system”.

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