Risk and Critical Infrastructures
An interpretation from the Transcurssive Logic

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ABSTRACT

The purpose of this article is to analyze risks that are related to critical infrastructures. The central idea is that the world is entering into an era of instability and turbulence, where the risks have a systemic character. This complexity cannot be understood in the abstract when studying its harmful effects and, in particular, the risks induced by it. The purpose of this paper is to investigate risks according to the Transcurssive Logic (TL) method. This complementary method establishes that, in order to relate a theory with the empirical aspects that support it, formal methods of analysis are not necessary, since it does not work with contents, but with "ontological niches". Its usefulness lies in being able to guide on what aspect of reality we can investigate, since it allows us to identify the basic elements that determine what is observable, and what their relationships are. Some emerging discussions are presented. It is proposed that the new branch of Infranomics is relevant for the comprehensive study of risks in critical infrastructures. It can be developed as a disciplinary matrix complementary to the analysis of Transcurssive Logic.

Keyword: Risks, Critical Infrastructures, Infranomics, Transcurssive Logic

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1.0 INTRODUCTION

It is essential to admit from the beginning that the question of "risk" is a critical issue in the contemporary world. Moreover, it is an experience that every person born after the second world war can confirm it. Since then, the generations have become accustomed to coexisting with severe situations and uncertainties that continuously question their existential security. In recent years, the list of problems has continued to increase in its extension, since risks can be derived from numerous factors and in different areas: Financial Cracks; food crisis; global warming; increase in desertification; stagnation of trade negotiations; supply problems and energy restrictions; renewed geopolitical conflicts; as well as failures in the socio-technological systems.

In general, it can be noted that -although there is no universally accepted definition of risk-, two possible categories have been classified (Arven and Renn, 2010). Those risks which are expressed through probabilities of an event combined with assessments of expectations; and the others, which maintain that the risks are mainly represented by the occurrence of unforeseen incidents and the consequences that may emanate from them, with an active component of uncertainty.

In a first approximation, the notion of risk refers to the uncertainty about the severity of the consequences (or results) of an activity, concerning something that society perceives as valuable, vital, or critical.

Thompson (1990) distinguishes between real risks, observed risks, and perceived risks. The real ones refer to what can happen, with negative consequences and that can happen with a probability known by statistics (earthquakes, the fall of an airplane). While the observed can be deduced from models, for example, on the possible effects of an epidemic. The perceived ones are subjective judgments that are issued in the absence of models or prior knowledge. Some factors that must be considered when discussing risks are: a) uncertainty about the probability of occurrence; b) uncertainty about the severity of the impact of a catastrophic failure; c) existence of possible victims and damages; d) reversibility of adverse effects; e) compensation for risk exposure; f) benefits, dangers and costs for the different actors.

For its part, the Transcurssive Logic (TL) is a method and perspective, from which risk is seen as the potential danger that threatens biological, psychic, and social life. TL divides risk into 1) The political risk or threat to society and as an element that corrupts culture. 2) The systemic risk or the threat to the relationship of the individual with his immediate environment (in this sense, it is related to the psychic function); and 3) The innate or connatural risk, the threat to one's life and the possibility of perpetuating oneself (imminently biological).

2.0 METHODOLOGY

As Ferrater Mora states: "*Polarities serve precisely to demarcate and situate effective realities ... nothing is 'absolutely subject' or 'absolutely object*'" (Ferrater Mora, 1967, p.301). Although the author assigns it to mere predicates, to emphasize that they are not absolutes, but expressions using which, such types of entities are qualified ontologically in variable terms, we can relate it to the principle elaborated by Moulines. The RDG (Relevance of Gradual Distributions) (Moulines, 1982, page 32). This principle establishes that the conceptual distinctions that are philosophically relevant attend only to a difference of degree and not to absolute differences, in the object or domain of study.

In some way, the previous philosophical principle is implicit in the epistemological framework that the Transcurssive Logic (TL) establishes to address any domain of knowledge, which lies in the broad spectrum of subjective reality. The 'conservative displacement' that permits the scrutiny of the sensitive or appearance world is not guided by absolute distinctions, but quite the opposite. For the "union of differences," which allows "incarnate" the "as if" to be the opposite element, while being completely himself. When the superficial, sensitive, apparent, evident cycle is completed; that is, when each of its elements in relation (subject, object, and transformation that binds them), return to occupy their continent, after a specific time, we will for sure, that the

relationships established between these minimum or elementary elements, for at least in the appearance of the operation of a model that responds to a particular hypothesis, are appropriate.

It remains to establish the value of a similar dynamic for those relationships that, although "do not exist" considering the evidence, meet the same requirement, certifying that the hypothesis and the model that she helped create have a firm theoretical base.

This simple scheme is universal and allows specifying some of the aspirations that have encouraged many of the epistemologists and philosophers of science, of the last six decades, who did not reach consensus on these issues.

Since TL, we do not make "conceptual distinctions." These are not discovered but is forged at the convenience of the scientist who is trying to establish the validity of an object of study. Instead, when invoking the point of view of the subject, that is, from outside the system that is being observed (so as not to modify the observation), it is about establishing "ontological distinctions", which may contain as content, the most varied elements that they give meaning to the laws that govern it.

In other words, the TL is an analysis of the relationships established between continents or "ontological niches," which are independent of the systems they contain. Since the domain we study from traditional science is divided into "categories" by a scientist, it is only possible to make "methodological distinctions" that adjust the focus. In other words, it ends by addressing the issue by referring to a controversial "theoretical-observational" distinction, which is either only semantic (specifying the meaning of the terms used), or it is merely pragmatic (leaving clear evidence of the function it fulfills each of those terms in theory). Then, everything is summarized to establish the distinction between descriptive, prescriptive or evaluative statements, but in the end, little is told over what a model is, what is the relationship between it and a given hypothesis, and how this fit with a theory. And not to speak about what a theory is or represents, and how it can be adjusted to practical purposes so that a model can "emulate," and not just "simulate" the analyzed reality.

From the objective reality, only, it is not possible to apply these concepts, because there is a flagrant and insoluble contradiction in its foundations. That is, the irresolute distinction between theoretical and observational concepts comes into force, based on not considering that a subject observes from outside the system, and not from within it.

If we persist in defending, as a definition of theory, that set of statements, or linguistic entities that can be true or false (as a product of a biased interpretation), we will never obtain the so-called "ideal theory", despite having a level of axiomatization and formalization to allow a deductive calculation. All this is because the set of axioms and their logical consequences that constitute a theory are nothing more than a set of statements (Ibidem, p.63). What Stegmüller calls "enunciative conception of theories." Something they share, to a greater or lesser extent, Carnap, Reichenbach, Popper, Hempel, among many others.

Despite the apparent advantages of the linguistic conception of a theory (simplicity, elegance, indiscriminate applicability), we must not forget that the set of axioms or fundamental hypotheses, is not necessarily telling us if the observed facts are being considered from the aspects essential that determine them. The only way we see being able to theorize about the processes that underlie our observation. No set of statements, no matter how formal, allow this to be achieved. Which does not mean that, when we analyze the "content" of our ontological niches, are not applicable with all the formal rigor required, and where we must add the usual "initial or basal conditions," to be able to justify the results. This is something that the TL does not consider since it does not operate on the studied system, it is only observed or studied its dynamics, without any intervention.

According to the LT, then, to relate theory with the practical aspects that support it, formal methods of analysis are not necessary, since we do not work with the contents. The TL is useful to guide on what we can investigate since it allows to individualize the essential elements that determine what is observable, and what their relationships are. Thus, unexplored "niches" may appear on which to focus an investigation. This is a practical and straightforward method of

analyzing evidence. Applying these simple and basic principles, we will try to deal below with the essential and current issue of risks.

3.0 POLITICAL RISK

It is that which arises from the decision making by the government which affects the safety and well-being of people.

Fig. 1 PAU Political risk

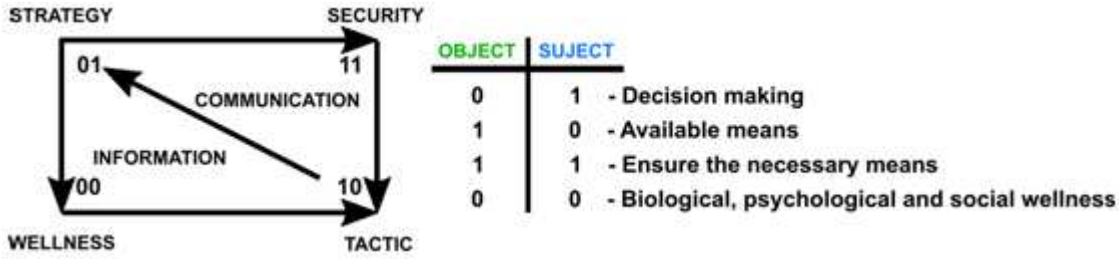


Figure 1 shows the sources of possible political risks. The strategy represents decision making: the tactics, the optimal means to carry out the decision made. Security is the way to allow the chosen strategy to have available the necessary means to fulfill it efficiently and effectively. The well-being (biological, psychic, and social) is what the policy must ensure as essential so that everything else has some meaning. It is noted that welfare does not depend on a subject or a generic object but on politics itself.

3.1 POLITICAL DYNAMICS

Decision-making, the main foundation of political activity, implies the tactical aspect that is based on the means necessary for a decision to show its results. Both elements define the security patterns to which every good ruler must adhere. This security must be applied in a double sense. On the one hand, to reduce the risk of having to apply improvised corrections. On the other, to minimize the collateral effects inherent in any decision making.

The welfare of the population must also always take priority over who (s) decide as a goal. This aspect is often opposed to the security measures implemented by the government since many factors tend to reduce risks in the most vulnerable sectors of society, which does not guarantee well-being for all. Equally, it is limited to cover only basic needs.

3.2 THE RISKS

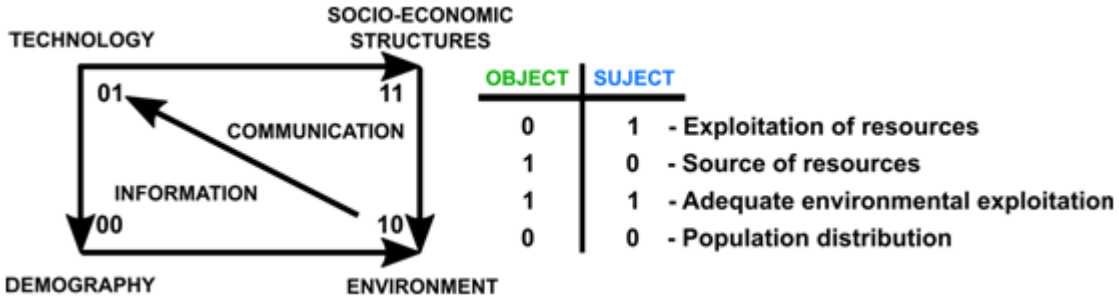
These arise from hasty decisions or with little support for planning, deficient tactics due to a poor calculation or lack of foresight; also, of a weak or too tight safety device. All of which threatens the welfare of the population.

All the above obviously refers to legal policy. In an illegal system (institutional corruption, coup d'état, collusion between states of law or with totalitarian regimes, etc.), political risk stops being limited and becomes a supreme threat that literally "kills" the subject, the individual and the person, for not allowing the defense to enter into force against systemic risks and non-legal risks. It produces, in this way, a subjection of human beings through hunger, poverty, ignorance, insalubrity, indoctrination, and seclusion.

4.0 SYSTEMIC RISKS

Of those that arise from a misapplication of state policies or the absence of these. Its fundamental elements are shown in Figure 2.

Fig. 2 PAU Of systemic risk



The population distribution does not depend on the subject or the object but the systemic integration.

4.1. SYSTEMIC DYNAMICS

Better technology allows taking advantage of what the environment provides and to carry out a decision-making process. For this, it is essential to establish stable socioeconomic structures, but at the same time, flexible enough to adapt to the circumstances posed by the environment, for its use.

Technology also influences the distribution of the population in a given territory, since it is usually applied to a greater extent and with a better level, in large urban centers and industrial centers. This is essential to take into account to ensure the welfare of the population and to protect the environment from the use of alternative procedures of low technological level, for the exploitation of nature that can be very harmful.

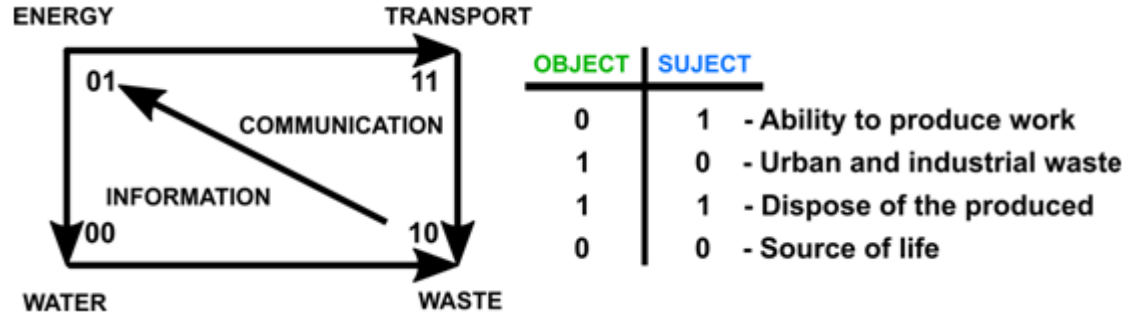
4.2 THE RISKS

There is a potential danger in the irresponsible use of technology, and in the presence of a natural catastrophe (Earthquakes, tsunamis, typhoons, hurricanes, epidemics, etc.). There is a risk when the socioeconomic structures are weak or collapse. In short, there is substantial risk in the wrong or poor distribution of the population in a territory. This last situation is the one that most seriously affects the well-being of people.

5.0 INNATE OR CONNATURAL RISKS

They are those that derive from the same critical infrastructures that concur in every organized community (Figure 3).

Fig. 3. PAU of critical infrastructures



The existence of water does not depend on the subject or object but nature.

5.1 DYNAMICS OF CRITICAL INFRASTRUCTURES

The dynamics that relate the fundamental structures have as a central axis, the production and use of energy, as well as the type of energy in question. Energy sources can be divided into conventional (fossil - petroleum, natural gas, coal - or nuclear). Which are finite and highly polluting; and

renewable or virtually inexhaustible, which in turn are divided into clean (wind, geothermal, hydraulics or hydroelectric, tidal, solar and wave energy), and pollutants (obtained from organic matter or biomass). The latter is either used as fuel (wood or other solid vegetable material) or converted into bioethanol or biogas (by organic fermentation), or biodiesel (by transesterification), and urban waste.

Energy is one of the high gauges of progress and welfare of society. The energetic use dedicated to the development of a community is mainly directed, to transport, a parameter that sustains the socioeconomic structures. Beyond urban waste, transport also produces polluting waste that alters the environment. However, it is possible to obtain energy from urban solid waste, although it is a source of polluting energy, which is the same if it is not used, as the rotting process of organic matter produces emissions of natural gas and carbon dioxide.

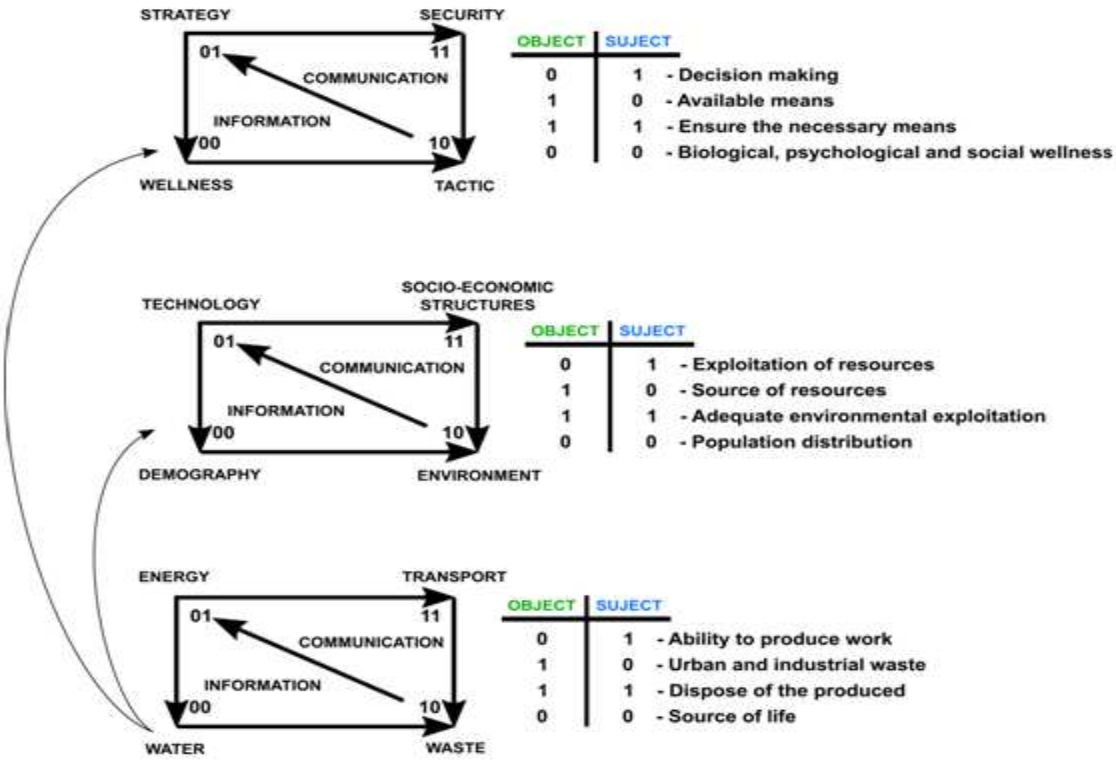
On the other hand, energy is necessary to distribute drinking water (pumping station) or obtain water for irrigation (irrigation engine), a fundamental element in the demographic distribution and the welfare and health of the population. The purification of water also produces waste (sludge from purification and water treatment plants) that can be used, in turn, to produce energy, although as we have seen, it is a pollutant.

5.2 THE RISKS

The risks that arise from these critical infrastructures can be called "innate or connatural" since they are inherent to each of the aspects they contemplate (energy, transport, waste, and water) and not added by third parties or their irresponsible management, what already implies a systemic risk. For example, water pollution due to poor waste management, as a result of a poor policy for the preservation of the environment.

According to Figure 4 we can say that there is a kind of 'backbone' that supports the factors on which, reducing risks has its best results: 'Water - Demography - Wellbeing', which as we see, has a common element: people's lives, which is where all duly implemented policies should aim.

Fig. 4. PAU of risk



If we look closely at the previous graph, we can see that each of the PAU is divided into two levels, which we could call: superficial, controlled by communication between the aspects that define it, and deep, controlled by information. The tremendous impact of the fact that, since the middle of the last century, what is known as the 'Information Society' will emerge quickly. Since by handling with greater precision and adjustments the elements that make up or define the level deep, finally determine how the surface level behaves, where, if an adequate tuning of the communication channels is achieved, it would reduce the risks present in each level.

Only in this way can we think about the possibility of diminishing, overall, the risks derived from any human activity.

6.0 THE INFRANOMIC AS A NEW APPROACH

The study of risks has been on the rise since the relatively recent creation of the International Risk Governance Council (IRGC, 2005). A disciplinary field under construction has emerged in the last years: Infranomics (Gheorghe et al., 2014). It is considered that it also represents a new approach that allows thinking about the conditions for risk management and criticality in innovative infrastructures. The term infranomics is a neologism that arises from the need to provide more complex responses from a non-traditional theoretical framework that helps the decision-making process in socio-technological systems of high complexity. The chosen term refers to "Infra" (for infrastructure) and "Nomic" (for the Greek root of gnosis, law or knowledge).

Infranomics is, then, a discipline of disciplines. The research led to 2014 a second article plus a book entitled "Infranomics Sustainability, Engineering Design, and Governance," which collects the materials of several authors with what is achieved to have a clearer idea of this new epistemic field, to understand. According to the authors of this article, one of the most promising and dynamic of recent years.

In this book, the three editors (Gheorghe et al., 2014), who forged the concept, allow us to see how the idea initially prospered on the terrain of the simulation models and then towards the metamodels. The body of this discipline defines itself as a system of systems, which without reaching the final leaves of the tree of the taxonomy that it planted could have done so if the end user needs it. This is also intuitive and recursive so that it understands the initial nodes of the tree, recursively applying this idea, we reached the level of detail that is needed.

At the beginning of the analysis, two plans were proposed in which the benefits of the infrastructure should flourish to meet its ultimate purpose, which is to cover the explicit and implicit needs of infrastructures.

In the first years of the Infranomics in the EU, the transfer dimension was the clearest. During this period, most authors who produced research and tangible transfers came from the field of technologies and to a lesser degree from the economy. In the second stage, the areas of technologies began to be overwhelmed by the complexity, and the discussions and debates had resulted much closer to the satisfactory solutions of real problems. In many cases, it was possible to build specific models and tools to make decisions about them, but there was still a lack of input from other disciplines to give completeness to the concept.

The issues that arise, and that in the future could be analyzed more deeply from the TL method. Among others, are the following: infrastructure and sustainability; integrated approaches for the strategic management of strategic assets; risks and safety, renewable energy, and management; optimal policy designs for the area affected by disasters; risks to the energy consumption of transport and energy security; the risks of lack of equity and ethical problems due to lack of access to infrastructure; the risk and the new alternative urban technology for future cities with low carbon emissions. Issues of modeling and simulation, issues of governance in complex scenarios with multiple actors of divergent interests; infrastructures trained to face risks and uncertainties associated with climate change, among others.

In short, how problems such as those of the new structures are addressed, no longer have the artifact or technological design as the goal. Instead, we resort to what is provided by various

particular disciplines, but in a comprehensive vision, which includes the social and even cultural dimensions of the approach to emerging problems in the 21st century.

7.0 CONCLUSIONS

The risk is the threat of something that is not yet clearly perceived, but that is under a potential presence in the environment. The reason for its irruption can be varied: failures (punctual or massive) in these technological systems, terrorist attacks, human errors, biological problems, natural disasters that generate consequences, etc. Furthermore, systemic risks appear in the globalized and interdependent world, which, due to their impact on society, may even develop a global contagion.

It is not a minor issue. So, it is not surprising that risks and the uncertainty associated with it, are a subject of study from various disciplines: sociology, economics, political science, and others. Under numerous interpretive frameworks: decision theories, complex systems, to name a few. Therefore, it is a challenge to offer readers a synthesis of some of the main perspectives about risks.

On the other hand, the question of risks and uncertainty is not only a topic of academic interest. On the contrary, their analysis offers the possibility of understanding the ways of attenuating them, of preventing them, and of cushioning their undesired effects. This work is desirable both for an organization and for a country. A scientific understanding of risks provides models applicable to the management of certain specific issues.

It is considered that this article has presented the dimensions that allow evaluating the issue of risks (existing or potential) that can spread and affect critical infrastructures. Since they are events that can have a profound and rapid impact on the welfare and functioning of a community, at different scales of action, its management through risk governance becomes a critical aspect for modern societies.

What is the advantage of TL as a research method?

The TL allows, as we have seen through of this article, not only observe the many facts posed by reality but also, go beyond the simple appearance to find the "unit" or "pattern" (PAU) that Underlies all phenomena.

In this way, you can acquire a general view of all the processes that determine the real event under investigation or study. The application of TL as a complement to the traditional scientific method is a much more rigorous way of approaching an investigation by observing any topic. On the other hand, it gives the observer (researcher or scientist) the ability to avoid the frequent and confusing "transcendental contemplation" with which they face a multitude of apparently different phenomena, but, respond in their dynamics to a single and straightforward universal pattern.

The PAUs, as foundations of our subjective reality, serves as a frame of reference for the general aspects that structure the objective reality that science defends. They would be the equivalents of a "mathematical formula" (in fact they are an algebraic structure), that govern the vision that the subject has of his subjective world. Also, from the physical sphere extracting from it, order through the apparent chaos that presses it. True laws that govern both the behavior and conduct of a human being, at the same time as the macrocosm.

Unlike Plato's "Ideas," they are not "truths" of logic, from which the grammatical subject and its predicate derive their meaning, but rather, like them, fundamental aspects that overcome the entities and laws of thought logical, inspired by human subjectivity.

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