Review of: "[Commentary] Service Sector Work Under Pressure From New Technologies and Artificial Intelligence – Lessons From a Number of Foresight Studies"

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Potential competing interests: No potential competing interests to declare.

The submitted paper presents an interesting topic. However, there are some weaknesses that should be addressed before considering it for publication. They are discussed below.

The literature review is rather poor. There are 8 references, and 7 out of 8 are those where the submitting author is either the first author or a collaborative author. It means that there is really an inappropriate referencing of own publications. The literature review has to be significantly expanded given that there are numerous publications on the topic.

The focus in the paper seems too narrow. It should consider some other aspects discussed below.

The understanding of undesirable events changed for one main reason: the nature of its contributory factors, including AI. The main source of risk today is the organization itself. Indeed, one can notice that many industrial accidents have essentially organizational components, such as company's culture, safety culture, communication between groups, decision-making by people in authority, centralization and decentralization, organizational clarity, and several other attributes which are more a matter of collective than individual work. These new characteristics are consequences of the evolution of two things: a) the type of barriers which ensure a safe environment, and b) the new interrelations and interdependencies between entities that were previously isolated and considered practically independent.

Barriers enabling safety of the operational activities evolved with both the complexity of the tasks and the increased number of involved persons. The main consequence is the change of the redundant barriers into interdependent and interrelated ones. It makes it difficult to anticipate weaknesses in these barriers, leading to failures. This trajectory is well pictured by the metaphor of the slices of cheese, where degradation propagates through holes in lines of defense. This picture is still adequate, but a sequential display of such an event is not so representative of the underlying reality anymore; lines of defense have no more the same redundancy. A more appropriate model would rather present the situation as a degradation of margins, which locally would be individually acceptable but which, collectively, has important consequences that could not be anticipated by a local analysis. It also means that the aggregate effect of individual consequences is superior to their simple sum. This would seem to suggest a need to understand "linchpins" within organizations – good and/or bad.

This particularity leads to certain characteristics of complexity. The complexity of the operational and business

environment asks for an organizational answer adapted to face new stakes and challenges.

NEW STAKES AND CHALLENGES: COMPLEX INTERFACES

Enterprises are designed, operated, and managed to provide optimal performance, reliable operation, and functional safety. Meanwhile, the technological evolution (including the advent of AI) and modern operational and business environments bring an important source of complexity. Some authors speak of “structural complexity,” introduced through the heterogeneity of system components across different technological domains due to the increased integration among various systems, and the “dynamic complexity,” which is manifested through the emergence of (even unexpected) system behavior in response to local changes in environmental and operational conditions.

For example, the automation of several processes conveys more opacity in the system, with numerous control rules and new information technologies involved. Furthermore, internal and external pressures, as well as high performance and competitiveness requirements, continuously increase (*“do-more-and-better-with-less”* paradigm), creating a stressful environment for both managers and workers and causing reduced performance and concentration down the path.

Consequently, contemporary organizations rather become complex socio-technological-economic entities involving many interacting and interdependent elements with hardly predictable long-term behavior at micro and macro levels. The connections between their constituent elements are of different strengths and types such as physical, informational, geospatial, functional, procedural, financial, market, societal, etc. Therefore, the management of those organizations also turns out to be more challenging due to significant uncertainties created through complexity.

Furthermore, complexity is associated with the strength of linkages between several autonomous constituent elements of a system that yield interactions difficult to grasp and anticipate. As discussed above, it creates emergent system behavior which is influenced by uncertain cause-and-effect relationships and unscheduled discontinuities.

One of the consequences of this complex context of modern organization is the necessity of increasing the technical training for the operator. This training is taken for granted during the commissioning phase but invariably undergoes a dilution in time, the in-service training being reduced to certain aspects more critical to health and safety.

Maintenance is another domain where training is often neglected. It is usually believed that the procedures of maintenance prove the quality of the tasks' output. Such a hypothesis is not unreasonable at the beginning of the operation of new equipment or a system. However, experience shows that a degradation of conformity is observed with time, the staff developing local adjustments and the management taking certain liberties about the maintenance schedule. One slowly deviates from the manufacturer’s requirements without providing a new technical basis for changes. Indeed, a decrease in maintenance does not necessarily cause an immediate decline in performance. These deviations are tolerated and even sometimes reinforced because of their short-term advantage. Here, one can see a rapid degradation of the safety margin, causing a “drift to danger” or a “drift to failure/system breakdown.”

In the context of the complexity and the functional opaqueness of the system, it is difficult for the workers to anticipate its

global behavior based on the behavior of its components in interaction. As complexity is a matter of interactions between simple interdependent components/systems, humans, IT, etc., it brings unexpected reactions of the whole, often amplified by operators' actions erroneously adapted to those situations. The emergent system behavior that occurs is influenced by uncertain cause-and-effect relationships and unscheduled discontinuities. Those interactions create both significant uncertainties and overall opaqueness in the system, which consequently makes the operator dependent on indirect information, reducing his capacity for immediate analysis and ulterior action. Consequently, the safety margin is reduced, and the system becomes more vulnerable to accidents.

These peculiarities highlight the importance of organized situational awareness, which can be described as the capacity to estimate in the short term the anticipated effects following actions and to at least ensure that obvious anomalies are quickly detected and corrected. Many studies mention the importance of observing and carefully analyzing "warning flags" or "precursors" in order to prevent major accidents from happening.

An organization operating in a complex and strongly coupled operational environment must pay attention to the centralization and decentralization of the decision-making process. Considering the unique and irreversible character of event initiators, some decision-making in the field cannot allow delays. The chain of authority has to be modified to allow a timely reaction, reflecting a global direction already known by the organization members (system behavior is too complex to enable centralized real-time control). Thus, organizations should have enough flexibility to be applicable in many different and unanticipated situations. Such "on-the-spot" decision-making must be supported by transverse (cross-functional) functions. The latter involves a participation of several ad hoc specialized units which can act in unison to realize an analysis by considering all the relevant aspects while facing an unforeseen situation.