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INTEGRATED MANAGEMENT CYBERNETICS AS A FOUNDATION FOR ORGANIZATIONAL RESILIENCE

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ABSTRACT. The *4th Industrial Revolution* introduced a highly automated and connected business environment. Nevertheless, many organizations are reeling in the wake of the speed and severity of the COVID-19 pandemic's impact, catching many unawares, and placing their sustainability in question. Given the connectedness promulgated by the *4th Industrial Revolution*, one might expect organizational resilience to be a given - only time will tell whether this was the case. This article considers the concept of cybernetics as contributing to systems-thinking, which may enable resilience strategies to come to fruition. Cybernetics is a goal-driven approach in which constant feedback is analyzed and applied in correcting the current course. We reflect on the roots and principles of the cybernetic concept, developing it into a management cybernetics concept. We take a *non-technological* approach in acknowledging organizations as systems. Management theories such as stakeholder and stewardship theories are systems components that can play a crucial role in effectively communicating management information within the cybernetic loop. We conclude that an integrative and cooperative relationship with legitimate stakeholders can play an essential role in an organization's preparedness.

Key terms: Business performance; management cybernetics; organizational sustainability; organizational resilience, turbulent events

Introduction

The outbreak of the 2020 COVID-19 pandemic is a peculiar case of a turbulent event characterized by its rapid emergence and its brutal impact on global economic conditions and socio-economic structures. This crisis has left many organizations questioning their ability to respond effectively to unanticipated turbulent events.

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Events such as these can create uncertainty within many organizations, especially when testing their resilience and jeopardizing long-term sustainability[2]. Organizational sustainability and resilience are critical capabilities to ensure business continuity[3]. The concept of sustainability is considered as being inclusive of strategies that meet the current corporate and stakeholder needs while protecting and sustaining resources for future generations[4]. Resilience is not about responding to and rebounding from a singular turbulent event but about continuously anticipating and adjusting in anticipation of such events[5].

Resilience can be defined as "the ability of the system to maintain its identity in the face of internal change and external shocks and disturbances"[6], which emphasizes the ability to manage encroaching risks effectively. The above quote highlights two concepts pertinent to effective management in context, i.e., a systems-thinking mindset and the ability to remain on course.

We argue that organizational resilience is of strategic importance and an essential requirement for sustainable organizations. Contemporary management philosophies such as *just-in-time* and *six sigma* have resulted in the fragmentation of business operations[7], resulting in (among other) interdependent value chains[8], resulting in higher risk exposure for many organizations. A typical organizational value chain will consist of upstream, operational, and downstream sub-chains, each with internal and external participants and role-players - all of whom can be affected by turbulent events. Acknowledging that resilience is time, space, and shock-specific affirms that the unpredictability of turbulent events will test resilience strategies' effectiveness. Adopting a multi-level, systems-based management philosophy will

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[8] Revilla, E. and Saenz, M., The Impact of Risk Management on the Frequency of Supply Chain Disruptions: A Configurational Approach, in *International Journal of Operations & Production Management,* 37(5)/2017, 557–76.

emphasize the links between various organizational components[9] [10]. Since organizations, as socio-economic systems, consist of multiple interrelated components functioning at different hierarchical levels, we argue that their resilience ambitions cannot be managed by focusing on simplistic managerial perspectives. The key to resilience is a mindset of not getting caught off-guard by unforeseen events. It does not, however, mean that all events are known beforehand. Instead, it means that the organization has some plan of action in store should an unforeseen event occur – a contingency plan, if you will, that strives to minimize possible adverse effects of such events. This, in turn, requires continuous and open communication between the organization and its stakeholders.

Problem definition and methodology

The fallout of unexpected turbulent events often reaches further and is more profound than anticipated. It often impacts areas within socio-economic (organizational) systems not typically expected, ranging from economic impact on the organization through to the employees' physical and psychological well-being.

Such uncertainty poses the question of possible ways to offer organizations the best opportunity to mitigate and minimize the fallout from such events. We hypothesize that organizational resilience provides such a viable way. The question, however, is how could *resilience* be attained? In the attempt to formulate strategies supportive of resilience, we consider a *4th Industrial Revolution* aspect that, among others, propagates the effective flow of goal-orientated information in an (organizational) systems context. That aspect is cybernetics.

In unpacking the components contributing to resilience, our reflective consideration will consider the following; Firstly, attention is given to the basic concept of cybernetics, inclusive of its contemporary roots and fundamental principles. Secondly, some focus is directed to developing a management cybernetics concept, which entails the importance of information communication between the organization and the role-players in its operational environment, followed by an integrative reflection on how cybernetics can enable resilience strategies. The paper is finalized with some concluding remarks.

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Cybernetics

The challenging times during World War II provided the backdrop for the evolution of disciplines such as artificial intelligence (AI) and cybernetics[11], which are often considered similar concepts. Nonetheless, the former's essence is found in making more intelligent, human-like computers, while the latter aims to develop goal-orientated systems that can navigate a dynamic environment[12]. Cybernetics is arguably more focused on goal attainment than on advanced technologies with superior processing capabilities.

3.1. Contemporary cybernetics' roots

Cybernetics' history arguably begins with Norbert Wiener's (a mathematics professor) World War II efforts to design an *anti-aircraft predictor machine* able to extrapolate an aircraft's flight trajectory. The goal hereof was to better the chances to shoot down enemy planes[13]. Although unsuccessful, Wiener's efforts to build a machine that can anticipate human behavior is important[14]. During this same era, a series of conferences supported by the *Josiah Macy, Jr. Foundation* focused on developing cybernetics as a scientific discipline[15] [16], spanning from the social sciences to the cognitive sciences. Furthermore, it is acknowledged that governance exists within complex social structures driven by (among other things) interactions between technology and people[17].

Therefore, one can deduce that the essence of the contemporary cybernetic concept speaks of a sophisticated, systems-based approach to optimize the interaction between people and technology. As such, it is essentially a cross-disciplinary and goal-driven scientific approach, targeting specific outcomes.

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[16] Anon. n.d., The 'Macy conferences': Background. http://www.asc-cybernetics.org/foundations/history2.htm**.** Date accessed March 29, 2020.

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3.2. Cybernetics' principles

Whereas the physical sciences are known as sciences of *knowable systems*, cybernetics can be considered as a science of *complex systems*[18]. Furthermore, cybernetics can also be seen as embracing the *Servo theory* principles of control, output, and feedback[19]. Figure 1 provides a conceptual illustration hereof.

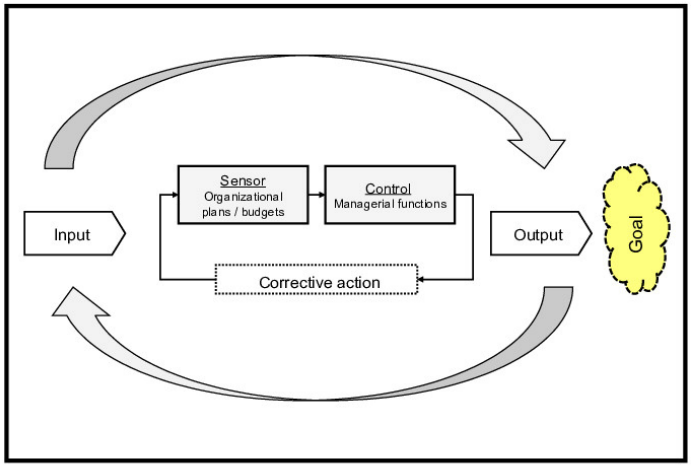

Figure 1: Cybernetic loop

Although simplistic, the above illustrates that specific outputs are required to attain the desired goal, which in turn needs particular inputs. Essential herein is the continuous monitoring and processing of pertinent information during the input-conversion activities. Fundamental to contemporary cybernetic theory is the concept of feedback[20], also referred to as the *cybernetic loop*. Feedback is a crucial enabler of potential corrective actions to be identified and applied, should some components within the system not contribute to attaining the desired goals[21].

Therefore, we can deduce that the cybernetic ontology is based on understanding the inter-dependent relationships between systems components and the availability of relevant information and supportive knowledge.

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Cybernetics and management

Although cybernetics' official history may have started in the 1940s, the foundational concepts can be traced to the Greek philosopher Plato[22]. In this ancient context, the Greek term κυβερνητική [*kybernētikḗ*], as the root for the term *cybernetics*, is translated as 'governance' or 'to steer'[23] [24], which speaks to a managerial aspect - considering it as a *science of effective organizations*. Management cybernetics can be defined as applying cybernetic principles to organizations and the interactions within[25]. It, therefore, stands to reason that cybernetics also has applicability in the management sciences.

4.1. Importance of information communication

The term cybernetics became widely accepted after Wiener's published his book *Cybernetics: Control and communication in the animal and machine* in 1948[26] [27] [28]. The title illustrates a fundamental concept of cybernetics: the importance of information and specifically the control and communication of information.

It is important to stress the role of sharing information between all parties committed to resilience[29]. Cybernetic practitioners utilize models of the organizational processes, feedback, goals, and information flow to understand the capabilities of the applicable system[30]. Therefore, the cybernetics components of information communication, performance control, and goal-driven are inherent components of effective management. To attain organizational goals, managers must realize and accept two things. Firstly, they require *information* to guide their initial managerial decision-making. Secondly, they need *feedback* (as another information dimension) to either confirm the current status quo or suggest alternatives to correct the status quo or to pre-empt potential risks resultant from the unknown.

Within this context, we acknowledge that organizational management is an integrative concept, encompassing both internal and external role-players to the organization. Furthermore, we recognize that the flow of information between these role-players is essential.

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[23] Fabrycky, B.
[24] Pangaro, P.
[25] Dekkers, R., Applied Systems Theory. Heidelberg: Springer International Publishing, 2015.
[26] Fabrycky, B.
[27] Pangaro, P.
[28] Pickering, A.
[29] Siagian, H. *et al.*
[30] Pickering, A.

4.2. Systems thinking in management

By seeing an organization as a system of multiple integrative components[31] [32], we acknowledge that resilient (and sustainable) organizations are not resultant from a single-minded pursuit of financial gain. Instead, it is (at least somewhat) dependent on their operating environs' economic, social, and political realities.

Cybernetics is founded on innovative adaptive engineering and brain science methods, which pushed its development into many social sciences areas[33]. As alluded to earlier, cybernetics has contributed substantially to *systems thinking* by emphasizing the concept of information flow (and the importance of feedback) as a systems component[34] [35]. A *management cybernetics* way to view resilience should be how various system components can support each other in achieving organizational goals. We argue that a critical element (or component) in resilience ambitions is the participants within the organizational context – especially when facing unforeseen turbulent events. We consider two related management concepts (or theories) as potentially pertinent to enabling resilience: stakeholders and stewardship.

4.2.1. Stakeholders

The concept of organizational stakeholders emphasizes the importance of certain groups to the success of organizations[36] [37]. Stakeholder theory postulates the belief that if an organization is sensitive to its stakeholders (not just its shareholders), it should function more effectively[38]. A feature of stakeholder theory is its focus on distinctive organizational aspects that promote its effective functioning. In essence, stakeholder theory considers organizations as *linked groups* (i.e., as systems components), each with its objectives. Therefore, the organization's success depends on bringing these groups and goals together to generate the optimum benefit.

One of the critical aspects of the stakeholder theory is to define who the stakeholders are – to which there are various ways of categorization. One way is to group stakeholders into primary and secondary stakeholders, in which the former

[31] Dekkers, R.
[32] Fabrycky, B.
[33] Pickering, A.
[34] Fabrycky, B.
[35] Pangaro, P.
[36] Alaoma, A. and Voulvoulis, N.
[37] Fischer, D., Brettel, M. & Mauer, R., The three dimensions of sustainability: a delicate balancing act for entrepreneurs made more complex by stakeholder expectations, in *Journal of Business Ethics*, 163(1)/2020, 87-106.
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is essential for organizational success, while not necessarily the case for secondary stakeholders. Another way is to classify stakeholders based on their interests[39], which leads to *internal* versus *connected* versus *external* stakeholders. In this manner, the internal and connected stakeholders have a more direct relationship with the organization - the former are typically employees, while the latter generally are supply-chain-related stakeholders such as financiers, suppliers, and customers. The external stakeholders have indirect influence over the organization and usually include governmental and regulatory agencies.

In terms of resilience, one must be cognisant of all *legitimate* stakeholders, i.e., stakeholders with a vested interest in the operations and consequences of the business activities[40] [41] [42] [43], and identifying such stakeholders early on is essential.

4.2.2. Stewardship

Stewardship is seen as a caring and loyal devotion to an organization, institution, or social group[44]. It is also seen as inclusive of non-economic interests, encouraging organizations to pursue broader cooperative behavior[45]. Stewardship theory may be considered as proposing a model of behavior driven by the organization's intrinsic values[46] [47]. Furthermore, stewardship theory also contends that *stewards* work towards the betterment of the organizational stakeholders[48] [49]. It can explain settings where managers serve the greater good of the organization's objectives and stakeholders and suggest that goals can be attained through collaboration.

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[41] Kessler, E.H.

[42] Tillema, S. and Ter Bogh, H.J., Does an agency-type of audit model fit a stewardship context? Evidence from performance auditing in Dutch municipalities, in *Financial Accountability and Management,* 32(2)/ 2016, 135-156.

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[49] Menyah, T., Stewardship theory and shareholder, in *Australian Journal of Management*, 9(1)/ 2013, 5-22.

Since stewardship also has non-economic interests at heart, it causes the organization to pursue broader cooperative behaviors for the greater good of multiple stakeholders[50] [51]. We share the opinions of [52] and [53] by considering stewardship theory as complementing stakeholder theory but argue that organizational sustainability goes beyond purely economic value creation motivations. Therefore, it can be argued that stewardship theory suggests that organizational goals can be attained through collaboration. Hence again, the importance of pertinent information, and the sharing thereof, is seen.

Reflection

In an era of uncertainties and complexities, the management of risks to the organization is essential. Conventional risk management approaches often rely on operational and financial criteria. The concepts of *resilience* and *risk management* may be considered complementary terms[54], with resilience being assessed as *enhanced risk management*[55]. Conceptually illustrated below, resilience builds on risk management principles, but by exploiting various *adaptive capabilities*, resilience minimizes the potential negative impact of turbulent events.

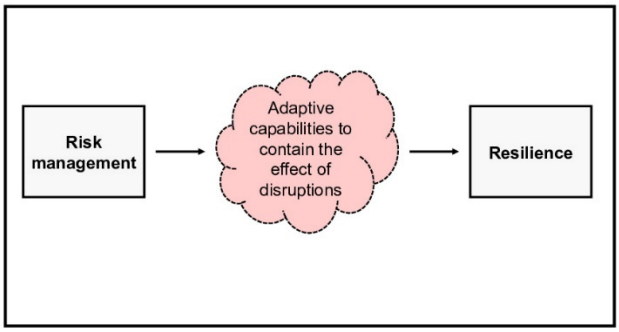

Figure 2: Resilience versus Risk management

[50] Kessler, E.H.
[51] Tillema, S and Ter Boght, H.J.
[52] Kessler, E,H,
[53] Tillema, S and Ter Boght, H.J.
[54] Vanelle, R.M., Lucato, W.C., Ganga, G.M.D. and Alves Filho, A.G., Risk management in the automotive supply chain: An exploratory study in Brazil, in *International journal of production research,* 58(3)/2020, 783-799, https://doi.org/10.1080/00207543.2019.1600762**.**
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A systems-thinking approach seeks sustainability, encourages stakeholder-driven (participatory) methods, and aims to ensure resilience[56]. We thus argue that one such critical *adaptive capability* is the embracing of a systems-thinking mindset. In doing so, managers will not only realize that their organization does not exist in a vacuum but that stakeholders play an essential role in its continued existence. Such realization, however, goes further than mere stakeholder acknowledgment. In attaining resilience, reciprocal and constructive relationships with legitimate stakeholders become imperative. This mindset will, in turn, acknowledge the key in all good relationships – effective communication of pertinent information. In a management cybernetics context, such effective communication will enable the pragmatic functioning of a cybernetic feedback loop between the organization and its stakeholders.

In formulating comprehensive resilience strategies,[57] suggest a three-dimensional approach. Firstly a *readiness* dimension will emphasize situational awareness and visibility. Secondly, a *response* dimension will emphasize agility, flexibility, and collaboration, and thirdly a *recovery* dimension will emphasize contingency planning and market position. In support hereof,[58] suggests similarly themed resilience stages in which *proactive* capabilities are required for before the event, *adaptive* capabilities for during the event, and *reactive* capabilities for after the event. As a *4th Industrial Revolution* concept, cybernetics can enable the mentioned resilience dimensions. It was alluded to earlier that cybernetics is a goal-orientated concept. Sustainability is a specific organizational goal, which by default means that resilience, as a significant contributing factor to sustainability, is also such a goal. In being resilient (in reaching its goals), the organization must be ready for anything, have an existing response plan when the inevitable happens, and have a recovery plan to get back on track.

Legitimate stakeholders may have access to pertinent information from areas that fall outside the regular reach of the organization. Relationships that enable sharing relevant information will contribute to mutual goal attainment, thus enhancing the organization's resilience capabilities. It must be noted that such understanding is not limited to the environment external to the organization. It most definitely is also inwardly focused. Furthermore, although resilience strategies fall typically within the senior management domain, the feedback and information flow cuts across all hierarchical levels. This will make significant contributions to the mentioned readiness dimension. Similarly, the goodwill of legitimate stakeholders is also required in ensuring that both the response and recovery plans have any chance of success.

[56] Alaoma, A. and Voulvoulis, N.

[57] Han Y., Woon Kian C. and Dong, L., A systematic literature review of the capabilities and performance metrics of supply chain resilience, in *International Journal of Production Research*, 2020, published online.

[58] Corrales-Estrada, A.M., *et al.*

Therefore, we acknowledge that stakeholder theory attempts to balance all legitimate stakeholders' objectives, while stewardship theory is complementary to having a serving interest. The cybernetic concepts of feedback, control, and goal-driven imply that stakeholder feedback needs to be analyzed within a stewardship mindset. This may result in current organizational strategies and operational activities being altered, thus enabling resilience in the advent of turbulent events.

Final thoughts

Contemporary times are characterized by much uncertainty on many societal levels. There are constant economic and social upheavals. The fallout of the global COVID-19 pandemic in itself illustrates society's vulnerability on so many levels. One can reasonably assume that modern civilization balances on a knife's edge. The question becomes what one can do to be ready when the inevitable happens.

A limitation of many reflective studies is that definite answers to problems are often not found. This, however, is not the reason why such reflections should be undertaken. Instead, it could contextualize contemporary issues in a *big picture* setting and get at least some debate going. Therefore, in answering the question of how resilience can be attained in an era rive with turbulent events, the basic answer is to be prepared. No one knows what the next turbulent event might entail. Still, by constantly communicating with legitimate (and perhaps like-minded) stakeholders and utilizing their feedback to adjust one's course, one may be able to better weather the next storm.