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Management Modelsvis-À-Vis the Challenge of a VUCA Environment and Wicked Problems

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Abstract- A reductionist approach assumes the existence of a stable, simple and clear environment, characterized by certainty. Under this approach, the forward-looking social and technological changes need to be planned as progressive and incremental, since they can then be anticipated sufficiently ahead in time to understand them and include them in the agenda, so as to prevent their impacts and correct any deviations. But the current environment where companies manage their businesses is quite far from this reality. Instead, the environment is volatile, uncertain, complex and ambiguous (the four words that characterize a VUCA environment), giving rise to wicked problems which are difficult to manage. This context will force companies to change their structures, practices and beliefs and, consequently, their management style. The purpose of this paper is to describe such changes and offer a proposal to better deal with the environment.

Keywords: *complexity, chaos, VUCA environments, wicked problems.*

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I. Introduction: Environments and their Distinctive Features

An environment includes a set of factors that impact companies, either directly or indirectly. This is the reason why the environment is relevant and needs to be considered, since it encompasses social changes, new technologies, resource availability, regulatory frameworks and dynamics.

II. Simple Environments: Evident, Obvious, Imaginable

In this type of environment, the causes behind effects are visible. They are evident and imaginable, and are easily discernible. They are just a few and well known, and emerge after a retrospective analysis based on academic knowledge or previous personal or professional experience. Organizations know what the cause is, what may happen, and what has already happened; they are also aware of its consequences and how to resolve such cause and prevent its recurrence. The cause-effect relationship in simple environments is evident, repeated and predictable (Snowden & Boone, 1999).

The potential measures to adopt respond to a context close to certainty or to measurable risk. Results will be as expected. This type of environment is defined by repetitive patterns. If there are changes, there will also be a way of identifying them quite ahead and take them into account to correct the action. The Strategy may be designed as a formal, mechanistic and deliberate act that will not take the company by surprise in terms of strategic control.

A simple environment (as a real or an assumed scenario) is based on the search for efficiency and incremental innovation, using technology, as well as existing products, services and business models. The purpose will be to introduce improvements to reduce failures and to make products and/or services cheaper, customized to the client's value requirement and more environmentally-friendly. If products and/or services experience a drop of demand or a declining lifecycle, the actions may consist in a revamping process.

Simple environments tend to narrow the cognitive frameworks shaped over time and in the recent or past history. Leaders usually screen their analyses based on these frameworks, and this may distort the decisions to be made in order to face a future that may eventually be different. A deep-rooted bias, a certain path-dependency, may lead to decisions that follow the players' line of thought rather than a useful answer to true requirements.

The perspective of a simple environment (self-built or assumed on many occasions) may curb the need of facing relevant changes that emerge from technological and/or social disruptions. Managerstend to follow the same path and repeat practices, processes, products, competitive advantages, business models, brands, targeting and marketing strategies and, sometimes, when there is an effective reaction, it may be too late. A VUCA environment requires a quicker reaction. The new disruptive entrants might settle in a market without being detected by the radar of established companies. Kodak could be a case in point because, despite being the company that discovered digital photography by the mid-70s, it could never become a digital photography enterprise. It lost its market share to new players and it filed for bankruptcy on January 20, 2012 (Scott, 2016).

III. Complicated Environments: More difficulties, not so evident

According to Asthana (2018), in complicated environments, the cause-effect relationship is not so

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evident. However, if the proper questions are made and there is sufficient experience and knowledge, the causes may come to the surface.

In complicated environments, as stated by Snowden & Boone (1999), the identification of causes tends to be relatively difficult and requires measurement, consultation to experts and action-taking, appealing to academic or corporate experience. The mechanisms of analysis and measurement will require useful tools and, sometimes, causes and their effects may be detached in terms of time and space, and a linkage between them may be needed for the analysis.

IV. Complex Environments: Unknown Cause-Effect Relationships. Complex Systems

In this type of environment, the cause-effect relationship may only be known in retrospect. The questions whose answers might help identify the linkage are unknown. There is basic knowledge but experimentation is required (Asthana, 2018).

As stated by Cocho Gil (2017), the analysis of complexity focuses on the study of systems made up by a broad range of interacting components that give rise to interindependent behaviors.

Living systems - including social systems- tend to operate in complex environments. This is why most of the problems faced by organizations and involving people (employees, shareholders, clients, suppliers and the society at large) are present in this type of context (Snowden & Boone, 1999).

In complex environments, the cause-effect relationship is not easy to determine, not only because the relationship is difficult to find but also because it is not always the same. Social agents learn, modify their behavior, and show a variety of possible behaviors; in addition, there may be situations unseen in the past.

Complex systems have the capacity to learn, to adjust. In complex environments, experience (either academic or professional) may be insufficient to assess and understand the future. This turns strategy into a highly difficult exercise. For example, a company cannot be sure that any new product will be demanded and valued by clients in the near future. And it will also be impossible to assure that prospective competitors will be the same as the present competitors and that their competitive position will be the same as the current position.

Snowden & Boone (1999) relate complicated systems with machines. They argue that, if there were appropriate experience, there would be no difficulties to operate them. Instead, they relate a complex system with a rainforest, a system in constant flux. And, in this case, complex systems can only be managed by resorting to some degrees of freedom that may lead to learning, self-management, self-control and self-regulation. Some authors, such as Byrne & Callaghan (2013), argue that many social theories are being reinterpreted through the lens of complexity.

The rules of strategy conceived for simple and complicated environments leave little room for managing emergency as a quick reaction to changes in the environment. This reaction consists in collecting information, understanding it (from the client's paradigm) and turning it into actions. Montoya Restrepo & Montoya Restrepo (2015) define emergency as the appearance of new business attributes at the highest levels of the hierarchical structure that come from its lowest levels. For the authors, this approach is strongly related to the contributions made by biology and the systems theory. From this perspective, emergency and the ensuing complexity result from adaptations.

Another approach provided by these authors makes reference to Kauffman (2003, 1993, 1995), who suggests that the problem of emergency is related to a special quality of the organization, its system and components. From this standpoint, emergency comes from the interaction and connection of the components with reality.

V. Chaotic Environments: Small Changes, Big Alterations

Many ancient civilizations believed that life was a constant and unstable tension between chaos and order. For instance, in Chinese cosmology, there are two complementary principles: Yin is negative, dark and feminine, while Yang is positive, bright and masculine. Life was for them a constant search of equilibrium between Yin and Yang (Werner, 2017).

It is widely considered that the French mathematician Jules Henri Poincaré has laid the foundations of the modern Chaos Theory. He wrote a paper on celestial mechanics in 1890, where he states that a slight change in the initial conditions of a system may have a strong impact on a phenomenon. More recently, in the mid-20th century, the study of chaos may be found in places such as the Center for Nonlinear Studies, at Los Alamos National Laboratory.[1] Nevertheless, its formal approach started in 1961with Edward Lorenz at the MIT in the field of mathematics and meteorology.[2] This scientist observed the phenomenon anticipated by Poincaré as part of a process that, from the sphere of meteorological sciences, is known as the butterfly effect (Gleick, 1987).

[1] The place in the United States where, in the 1940s, the first atomic bomb launched against Hiroshima and Nagasaki was developed and made.

[2] He discovered, almost by chance, that a small roundup difference in the third decimal place of the oceans temperature in the input of his model led to important changes in the outcome. Consequently, he started to study how science understood flows in all types of fluids.

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The Chaos Theory has gone beyond the so-called hard sciences, like physics and mathematics, and is also found today in the so-called soft sciences, such as sociology, business, economics and management, among others. It seeks to understand the behavior of nonlinear dynamical systems, i.e. the systems where the internal parameters (the state variables) follow temporary rules that may change over time. They are the opposite of stable, linear and predictable systems. The Chaos Theory has replaced the reductionism and predictability of determinism which have characterized many business administration practices.[3]

Simple and complicated systems may be interpreted by means of linear equations, since they allow for analyzing and modeling systems where the consequences are proportional to the causes (proportionality), and when, there is more than one cause, the consequences are the result of their combinations (overlapping). The results can be seen in the initial conditions. Instead, chaotic and complex systems can only be analyzed or modeled on the basis of nonlinear systems. In this case, the results are not proportional to the causes; a slight change in the initial conditions results in a sizable modification in the output. In addition, the principle of overlapping does not apply either, and the combination of causes may trigger consequences not found in the sum of the initial conditions (Carrillo Trueba, 2012).

When environments are ruled by complexity and chaos, there may be unexpected structures and events, the attributes of which may be very different from the underlying attributes, resulting in abrupt changes, multiple states or an evolution towards unpredictable formats (Byrne & Callahan, 2013).

According to Asthana (2018), the cause-effect relationship of chaotic environments not only is unknown but also changes all the time. In turn, Gleick (1987) states that, in a chaotic behavior, the performance of the system is irregular, unstable and unpredictable, and it is usually associated with randomness (against the regular, stable and predictable performance that characterizes simple and complicated systems). The author admits that there are orderly systems that may tend to chaos, as there are also chaotic systems that may tend to order as from the so-called "triggering effects". In chaotic environments, managers cannot focus on the control of results (as is the case in simple and complicated systems) but only prevent any negative impacts or mitigate the consequences.

In unpredictable and a periodic situations of chaos, it is hard to find patterns to follow since, on many occasions, experiences emerge for the first time and known actions do not work. Actions should be focused on establishing some kind of order that may lead from a chaotic system to a complex system where it may be reasonably possible to control diversity and emergency. Chaotic contexts make it possible to develop a higher degree of innovation, driven at the beginning by the crisis itself and by the omission of some rules that would be undoubtedly respected in a simple or complicated context. One part of management should act to stop or mitigate the consequences while another part, less stressed by the context, should create an innovative situation (Snowden & Boone, 1999).

In chaotic environments (and also in complex contexts, a subclass of the former), reductionist, mechanistic and deterministic reactions are not efficient. Knowing the initial conditions does not allow to calculate an approximate behavior. The system lacks order and its internal parameters (state variables) follow temporary rules that change over time. Social agents learn and modify their behavior. There must be an organic nonlinear response. Strategy, as a formal and deliberate act, exhibits limitations. Testing in the market, collecting information and then reacting would seem to be an essential part of the process (Gleick, 1987).

VI. VUCA Environments: A New Paradigm for Strategy

The acronym VUCA (which stands for Volatile, Uncertain, Complex and Ambiguous) has become a metaphor of modern times.

Its origins date back to 1986 at the Army War College of the United States. Nevertheless, the public use of the acronym started with Herbert Barber, in 1991, who, while working for such institution and building on the work of Warren Bennis and Burton Naus, was seeking to develop leaders that may be able to operate in a different global context.[4] Barber presented his ideas in a conference held in February 1991, where professionals and scholars were convened to discuss about leadership in complex environments. By then, the participants of the event had already identified important turbulences and uncertainties derived from politics as well as social and technological changes (Baran, 2017). However, other sources attribute the origin of the acronym to General Maxwell R. Thurman, Vice Chief of Staff of the US Army and former Commander of the United States Army Training and Doctrine Command. Since then, many publications of the U.S. Army Heritage & Education Center at Carlisle Barracks have adopted the concept.[5]

Referring to this concept, authors such as Bennett & Lemoine (2014), argue that, in VUCA

[3] According to the dictionary of philosophy, determinism is the theory that serves to assess the necessary connection of all events and phenomena and their causal conditioning. http://www.filosofia.org/enc/ros/det.htm

[4] Bennis, W. & Naus, B. (1985). *Leaders: The Strategies for Taking Charge*. New York: Harpers & Row.

[5] In http://usawc.libanswers.com/faq/84869

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environments, management is a difficult task since it is hard to understand the future. However, they recognize that volatility, uncertainty, complexity and ambiguity are features found in various environments with different degrees of intensity.

In turn, Berinato (2014) considers that, even in this type of environment, management requires a systemic assessment of the environment's features in order to make efficient decisions.

On the other hand, George (2017) states that traditional management methods are no longer sufficient to address the current volume of change. Business is no longer as usual. Leaders must deal with a different context where the classic techniques of management systems for decision-making and control (basedon prospective criteria) are not enabling companies to handle the huge information flow created by the environment.

Johansen (2017) underlines that volatility makes vision statements ineffective; uncertainty blurs understanding; complexity prevents a sharp eyesight and ambiguity is an obstacle for agility. He promotes the VUCA concept as a framework for decision-making, and suggests enlarging corporatevision to prevent the consequences of volatility, i.e. to be clear about where to go and have enough skills to scan the future, broaden the understanding of the context so as not to fall into uncertainty, improve insightfulness to combat complexity by avoiding unnecessary and confusing information, and develop agile reactions in the face of changing circumstances.

Other authors like Nandram & Blindlish (2017) consider that VUCA environments are challenging and this may help companies find new opportunities. They underline the need to attain a distributed leadership and instill a collective (and collaborative) awareness in managers. Likewise, the authors state that it is necessary to incorporate a systemic perspective in order to capture the opportunities emerging from this type of environment.

In turn, Taleb (2013) argues that some situations benefit from crises and even thrive when exposed to volatility, randomness and disorder. They seem to be comfortable when facing risks or uncertainty. According to Taleb, this is not resilience since, if it were, the system would return to the initial condition after the impact. In this case, there is an evolution, an improvement against the original status.

On the other hand, Chawla & Lenka (2018) consider that being prepared to face these environments is the role of leaders. They believe that this is not an easy task since it requires a management style defined as "resonant" by Goleman, Boyatzis & McKee (2015), to which they attribute some features such as self-knowledge and self-confidence, as well as genuineness, empathy and relationship management.

There are also authors such as Magellan Horth (2018) who propose to replace VUCA with the acronym RUPT (which stands for Rapid, Unpredictable, Paradoxical, and Tangled). Rapid because changes overlap and occur at an extremely accelerated pace. Unpredictable because strategies can only be analyzed and designed by introducing assumptions about the future, even though there may be unexpected events that force organizations to reframe thinking. Paradoxical because, sometimes, the emerging proposals may seem contradictory. And Tangled because of the multiple internal and external connections of the phenomena being tackled and analyzed.[6]

Cascio (2020), from the Institute For The Future (IFTF), Palo Alto (California), proposes a framework to analyze the environment under a context that he has defined using the acronym TUNA (Turbulent-Uncertain-Novel-Ambiguous).

In addition, research by Horst Rittel & Melvin Webber (1973), among others, quoted in Moore (2012), introduced the concept of wicked problems to refer to situations where intelligence is insufficient to quickly finda solution due to the fact that information is incomplete, contradictory and changing.

According to Wahl (2006), wicked problems are unique and their morphology is characterized by an unclear definition of boundaries and perimeters. They are multi-casual, multi-scalar and interdependent and respond to multiple stakeholders with conflicting agendas among them; and the options to approach them are blurred and ramified. The solution to this type of problem may demand a long time. Even worse, sometimes they are never completely solved or are solved in the realm of the best possible solution rather than the correct one.

A volatile environment is unstable, i.e. it can change suddenly and turn into a different environment at people, social, political and technological levels. When there is volatility, changes are violent, significant and sudden and it is impossible to determine when they may jump into a new condition (Barber, 1992).

Baran (2017) states that the speed of change is impacted by disruptive technologies and by globalization. In his opinion, volatility is a sudden and violent change of condition. As a result, companies need to adapt in order to respond to such volatility.

Wright and Snell (1998), as quoted in García-Tenorio Ronda, Sánchez Quirós & Pérez Rodríguez (2014), consider that, in a stable and predictable environment, the company's adjustment to the environment (either real or assumed) can be solved easily by using human resources with a limited range of skills and behaviors. Instead, in a dynamic and

[6] This research paper has not delved into the RUPT metaphor because it has been considered that its description is covered by the description of the acronym VUCA.

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unpredictable environment, flexibility becomes more relevant and people with a wider and more varied range of skills and behaviors will be required.

When there is volatility, change is likely to occur but its magnitude and time of occurrence are unknown (Lemoine & Bennett, 2014).

George (2017) argues that, in volatile environments, companies need in-depth understanding of their capabilities and strategies to take advantage of rapidly changing circumstances in an extremely changing environment by playing to their strengths while minimizing their weaknesses. According to George, flexible tactics will be required for rapid adaptation to changing external circumstances without altering the strategic course.

In turn, Lemoine & Bennett (2014) consider that, in volatile environments, the information is available and the situation may be understandable and, certainly expected, but given their unpredictable nature, companies need to develop an agile reaction and count on flexible resources.

For authors such as Ferrari, Sparrer & von Kibed (2018), a company cannot reduce the environment's 'degree' of VUCA but it can increase its capabilities to deal with it. In this regard, Thomas & Ambrosini (2015) state that, in volatile contexts, strategies must include formal aspects, which are typical of management control, but also embrace a comprehensive and thorough vision that may contribute to capture the emergency.

In quantum mechanics, the uncertainty or indeterminacy principle was formulated by Werner K. Heisenberg and is related to the incapacity to simultaneously measure the position and linear movement of a subatomic particle. In social sciences, the uncertainty is determined by the conviction that "reality is not predictable" and that (…) "consequently (…) there will only be assumptions" and approximations (López Meléndez, 2013).

When there is uncertainty, boundaries are blurry and behaviors are unknown or unpredictable. There is neither certainty nor likelihood. There is no probability distribution on which companies can work. Christensen (2015) states that disruptive products and services are not those that emerge as continuity or evolution of an already existing product or service offered by the market but rather something new, inexistent or focused on a new and underserved segment of consumers. Amid uncertainty, it is difficult to create new- and particularly, disruptive- businesses and services since, at the time of assessing them, it is not possible to determine the value requirement of the demand (clients ignore the potential use of the new product or service), as well as the price and the amount (there is no market to be explored).

Liduena (2015) argues that, in an uncertain environment, some things are known- for example, that automobiles will be self-sufficient in terms of energy- but others are unknown- such as how this innovation will add value to consumers. The articulation between car manufacturers and Information and Communications Technology (ICT) companies to respond to this innovation is also unknown. For the author, borders among markets will be blurred and the barriers to entry will disappear over time. It is important to take into account that communication companies are already moving into the automobile market.

Lemoine & Bennett (2014) suggest that information is critical to reducing uncertainty, and firms will need to consider information from new perspectives. It has already been seen that social systems occur within complex environments, covering most of the issues being faced by organizations and their various stakeholders- employees, shareholders, clients, vendors and society at large.

In complex environments, the cause-effect relationship is difficult to predetermine. Social agents exhibit a broad range of possible behaviors and, additionally, they can learn because they have the capacity to adapt to new situations. Lemoine & Bennett (2014) argue that, in complex environments, there are many interconnected parts forming an elaborate network of information and procedures. Consequently, the analysis must be systemic rather than linear.

In terms of the complexity of the environment, George (2017) states that today's business leaders need the ability to see through chaos in order to have a clear and open-minded perspective of their companies. The proposals based on order and control and emerging from the theories and practices of Business Administration- designed for the mechanistic systems conceived after the Industrial Revolution- are not efficient enough to address the complexity of the environment and solve wicked problems. A useful approach requires organic responses and an in-depth understanding of the operation of sociotechnical systems.

Ambiguous environments create confusion and may involve different interpretations, which can all, some or none be correct. Kail (2011) emphasizes two emerging factors in ambiguous environments: firstly, the inability to accurately conceptualize threats and opportunities ahead and, secondly, the feeling of frustration. Kail proposes to develop a capacity to listen attentively and to be determined to act on the basis of incremental results so as to move forward and find the way.

Lemoine & Bennett (2014) state that, in ambiguous environments, the basic rules of the game are unknown; the cause and effect relationship is not understood and there is no precedent for making predictions as to what to expect. Rules have changed; they are no longer the same.

Ambiguity has led to an increasing use of innovation methods based on prototyping such as

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design thinking, Ux Ui Design, or agile methodologies like scrum. The lack of information and/or the failure to understand it -typical of ambiguous environments- may lead to symptoms of management paralysis, i.e. not knowing how to deal with decisions or trying to avoid or delay decision-making (Moses & Lyness, 1990).

Dima (2015) proposes some practices to work in ambiguous environments: (1) Accept fewer amount of data to prevent paralysis or avoidance, since it is not possible to work in ambiguous contexts as if they were environments of certainty; (2) Understand the objective before making a decision since elections must be clearer in ambiguous environments; (3) Avoid making questions whose answers do not contribute to the decision because data in excess increases ambiguity rather than reducing it.

VII. Specific Characteristics of Organizations

Hierarchical (also known as vertical) organizations are built on the principle that power may and should be divided unequally among their members. Power asymmetry is a special feature of these organizations. Power is delegated by the administrators to the governance bodies (owners, management boards, boards of directors) and, in turn, they vest this power in their subordinates. In general, power is scarcely delegated to workers (Terlato, 2022).

When Burn & Stalker (1950)- quoted in Solórzano García & Navío Marco (2016)- were developing some studies about companies, they observed that organizations needed various types of structures in line with the environments where they operated. Within the paradigm of the so-called Contingency Theory, they found two types of organizations: mechanistic and organic. Companies with a mechanistic structure tend to operate adequately in simple and moderately stable environments, while those with an organic structure fit well with unstable and changing environments, characterized by some degree of uncertainty. The higher the mechanistic structure, the more predetermined and focused the answer on the application of practices, with a limited degree of freedom and endeavor.

In hierarchical, mechanistic, procedure-dependent and bureaucratic organizations, reaction tends to be slow, so slow in fact that companies cannot react in the face of social and technological changes. On the other hand, these companies operate on the basis of the information available to make plans and models and, eventually, take on risk positions. These firms do not feel at ease with incomplete and ambiguous information and are not prepared to deal with wicked problems. They hardly use collective intelligence and do not develop multidisciplinary high-performing work teams (Terlato, 2020).

Collective intelligence is not a new concept since it was defined by Wechsler a long time ago. While studying adults, he stated that it was "the global ability of an individual to act purposeful, to think reasonably and to effectively deal with its environment" (Wechsler, 1964). In turn, Szoniecky & Bouhaï (2017) consider that it is a process that leverages the capacities of a group aligned behind a shared reflection principle to adopt a course of action that cannot be resolved by only one person. According to the authors, this process requires to relinquish selfish interests in search of the common good. On the other hand, Malone & Bernstein (2015) compare collective intelligence with market mechanisms that may help make decisions in times of crisis, while Engelbart (2004) considers that a community's collective intelligence represents its capability for dealing with complex and urgent problems.

On the other hand, universities and business schools have been largely engaged in training managers on the basis of previous and known situations and, on these premises, then imagine the future ahead. But this may lead to difficulties whenever action is needed in a constantly changing context (Luksha et al, 2017).

The change and innovation mechanics created by VUCA environments forces organizations to ensure and accelerate the collection of bottom-up vertical information. For this purpose, frontline employees should be willing to identify new value requirements and be interested in proposing changes to their superiors. This will not be possible, of course, in highly vertical hierarchical companies with many lines of authority and in disempowering management systems (Terlato, 2020).

VIII. Conclusions

In a context of simplicity (either real or self-built), mechanistic companies- subject to stringent rules and regulations- tend to work in excess on the pillar of efficiency and incremental innovation. They commonly use technology as well as existing products, services and business models; their purpose is to introduce improvements to reduce failures and to make products and/or services cheaper, customized to the client's value requirement and more environmentally-friendly. Social and technological changes may be anticipated (or companies will believe that they have anticipated them). Consequently, there is time to understand them, take them into account, make corrections and prevent deviations. Strategy may be designed as a formal, mechanistic and deliberate act that will neither take the company by surprise in the strategic control nor entail implementation difficulties.

In the current context, mechanistic companies organized under the paradigm of simplicity may lose flexibility and capability for innovation. Simple environments tend to narrow the cognitive frameworks.

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Managers may feel tempted to continue following the same path and repeat practices, processes, products, competitive advantages, business models, targeting and marketing strategies, and their reaction may be delayed or nonexistent. The new disruptive entrants might settle in a market without being detected by the radar of established companies and lead enterprises and businesses to their demise.

But, as mentioned above, the characteristics of the environment where business is developed at present are far away from a simple environment. Consequently, some competitive models are becoming obsolete, and new tools, concepts and reference frameworks are now required.

Organic companies seem to adjust better to a VUCA environment. Their structures are mainly based on shared interests. They develop a higher sense of belongingness, and have fewer regulations and flatter hierarchical structures. For this reason, they are quicker to react and collect more bottom-up vertical information. Complex systems and sociotechnical structures need to be managed with a higher degree of freedom to enable learning, self-management, self-control and self-regulation. They will require empowered people with a wider range of skills and behaviors.

In a volatile environment, the magnitude of change and the time when it will occur are unknown. Companies need to develop in-depth understanding of their capabilities (by playing on their strengths while minimizing their weaknesses) and comprehend their strategies in order to benefit from the conditions provided by this environment. Firms will also need to develop flexible tactics for a rapid adaptation to new circumstances, without altering the strategic course. The degree of volatility is impossible to change but the company may improve its skills to handle it.

Companies will need to understand that uncertainty means that reality is nearly unpredictable and, therefore, only assumptions and approximations can be offered. Boundaries are blurry and behaviors are unknown. Information is critical to reducing uncertainty, and firms will need to consider it from new perspectives, even though sometimes it may be more efficient to go to market, measure, improve insightfulness and make adjustments as the company moves forward.

When there is ambiguity, the rules of the game are unknown. Therefore, it is impossible to adequately conceptualize the threats and opportunities ahead. For some authors, facing ambiguity requires to develop a capacity to listen attentively and to be determined to act on the basis of incremental results so as to move forward and find the way. They suggest reducing the amount of data, so as not to fall into paralysis or avoidance, and also to have a clear strategic course. When there is ambiguity, elections must be clearer and making questions whose answers do not contribute to the decision should be avoided. Data in excess increases ambiguity rather than reducing it.

Leadership will be critical to face this type of environment and will require self-knowledge and self-confidence, genuineness, empathy in relationship management as well as the capacity to instill a collective (and collaborative) awareness.

High-performing multidisciplinary teams whose members engage in collective intelligence and are reciprocally empathetic will have reached the condition of evolutionary learning communities and will be better prepared to face wicked problems, since they can contribute an increasingly systemic perspective.

Companies and universities alike will need to work to develop prospective capabilities since looking back is hardly useful in a VUCA environment.

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