VUCA environments before the recession caused by Covid-19: a systematic literature review

Entornos VUCA antes de la recesión por la pandemia de Covid-19: una revisión sistemática de la literatura

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Abstract: The acronym VUCA as a description of a Volatile, Uncertain, Complex and Ambiguous environment, has been gaining increasing relevance as a noun to describe a reality that is complex and turbulent. Besides the healthcare challenges, the COVID-19 pandemic has also caused drastic changes in the management world. Through a systematic literature review of 137 articles published before the beginning of the COVID-19 pandemic (between 2009 and March 2020), we develop a conceptual framework that integrates complementary branches of theoretical and empirical research, with the VUCA environment as the central unit of analysis. Our objectives are to unravel how the main theories in this field address essential aspects of management and future study trends, we also propose a conceptualisation of VUCA as an essential element of the current environment and its relationship with the different disciplines in the business world.

Keywords: VUCA, turbulence, uncertainty, environment, covid-19.

Resumen: El acrónimo VUCA como descripción de un entorno Volátil, Incierto, Complejo y Ambiguo, ha ido ganando cada vez más relevancia como sustantivo para describir una realidad que es compleja y turbulenta. Además de los desafíos por la atención médica, la pandemia COVID-19 también ha provocado cambios drásticos en el mundo de la gestión empresarial. A través de una revisión sistemática de la literatura de 137 artículos publicados antes de la recesión por COVID-19 (entre 2009 y marzo del 2020), desarrollamos un marco conceptual que integra corrientes complementarias de investigación teórica y empírica, con el entorno VUCA como unidad central de análisis. Nuestros objetivos son desentrañar cómo las principales teorías en este campo abordan aspectos esenciales del management y las futuras tendencias de estudio, también proponemos una conceptualización de VUCA como elemento esencial del entorno actual y su relación con las diferentes disciplinas del mundo empresarial.

Palabras clave: VUCA, turbulencia, incertidumbre, entorno, covid-19.

1. Introduction

Over the last half a century, many articles have endeavoured to describe contemporary scenarios, their complexity and the difficulty in managing them due to turbulent environments.

The term turbulent was coined by Emery and Trist (1965), who characterised this type of environment by its rapid speed of change and the impossibility of predicting its evolution.

This definition has moved on and, nowadays, to define a turbulent environment, the acronym VUCA is applied to describe a Volatile, Uncertain, Complex and Ambiguous situation.

As defined by Gerras (2010, p.11), Volatility is related to an unstable environment, with a high rate of change, where even up-to-date information may not be sufficient to make the right decisions; Uncertainty is understood as the inability to know everything about a given situation and the difficulty of predicting the nature and effect of change; Complexity refers to the difficulty of understanding the interactions of the different parts that make up a system and the effects that may occur; and Ambiguity is the difficulty of interpreting the meaning of a given event in an objective way, when the context is diffuse and different opinions may coexist, with a high probability of error. The inclusion of these new variables that were not covered by the term turbulent has enabled the scientific community to study this type of environment using more specific premises.

In the following table the VUCA terminology is exemplified with some generic cases, and more specifically with a paradigmatic VUCA event, such as the COVID-19 pandemic:

Table 1: VUCA Definitions and examples.

	Definition	Example	Example in COVID-19 context
VOLATILITY	Continuous and unpredictable changes. Even with the most current data, we may not make the right decisions.	Stock market movements.	New coronavirus strains.
UNCERTAINTY	It is not possible to know everything about a situation or to predict the nature and effect of change.	Process of digitisation of society.	Origin of the pandemic, first infections in China. Economic impact of the pandemic.
COMPLEXITY	Many interconnected and interdependent elements, like a tangled web, without necessarily signifying change.	Industrial production systems. A car factory.	Contagions caused by the mobility of people.
AMBIGUITY	Difficulty in interpreting the meaning of a process when the context is blurred.	Butterfly effect.	Vaccination results.

VUCA has its origin in the military field, and it was the work of Whiteman (1998) that first made an explicit reference to this type of environment. The term is currently used to describe the present reality in the economic and business fields. More than a decade ago, Bob Johansen, in his book Leaders Make the Future (Johansen, 2010), highlighted the need to develop a new leadership for times of extreme uncertainty. Other works also focused on this aspect (Coates,

2009; Lahl & Egan, 2012). Nowadays, management is no stranger to the problem of uncertainty, given the appearance of new elements that have a direct impact on traditional management systems. It is obvious that those who have to make business decisions in environments, yet lack comprehensive information about them, will be especially affected by this turbulent reality. As far back as the 1950s, Druker (1955) suggested that defining the situation and determining what is relevant, as well as the scope of our current knowledge of the environment, were essential elements in the decision-making process. These elements obviously become very complex in a reality such as that in which we currently find ourselves.

The aim of this study is to determine the current state of the art of academic knowledge on VUCA, the trends and fields of research, through a systematic review of the literature, in order to determine, based on the conclusions drawn, which are the most promising lines of research for the future and to establish some recommendations for business management in an environment with these characteristics.

The interest of the academic field in this VUCA is increasing in recent years, especially in the field of leadership, with the new challenges that managers have to face (Bennett & Lemoine, 2014), as well as its development and implementation (Elkington et al., 2017) or the need to acquire special skills in leadership (Hall & Rowland, 2016). Interest has also occurred in the field of management, as described by Kim et al (2018) in relation to the development of new products, or Maier et al. (2016), who describe the problem of managing future scenarios immersed in uncertain changes. The management of innovation policies in the development and execution of disruptive innovation (Pandit et al., 2018) has also been considered, and Saleh and Watson (2017) provided considerations on the management of excellence in VUCA environments. Nevertheless, other disciplines have not been forgotten, such as human resources, the retention of talent through the management of supervisors through motivation and the transfer of information (Deshpande & Gupta, 2019), or stressing the need for adaptation by human resources departments to this new environment (Srivastava, 2016), especially in greater flexibility and dynamism. Further studies have focused on the field of Organisational Development, how management problems can be studied in the VUCA environment from original perspectives (Busse, 2020; Khari & Sinha, 2018), or on the development of skills within the organisation that can promote agility, receptivity and innovation (Xing et al., 2020). However, perhaps the most salient study is that of Bennett and Lemoine (2014), which established a definition of each constituent element of the VUCA environment in relation to the social sciences and described how its effects can be counteracted through a focused approach in adapting management criteria to the specific handling of each of the constituent elements of this environment.

It is worth noting the increasing attention that aspects such as managerial training and adapting managers' needs to the new VUCA reality are currently attracting (Hall & Rowland, 2016; Tsui & Dragicevic, 2018). In short, the environment is no longer predictable and has become one m7ore element of uncertainty, especially affecting the core aspects of business leadership and management, the scenarios of change have always been present, but the pace of change, especially in what Huy & Mintzberg (2004) call "dramatic change", has become a constant today. Our intention is to carry out a systematic, comprehensive review of the academic literature on VUCA with the aim of determining the current state of the art and its possible future evolution. For this purpose, a search was made on the Web of Science and Scopus databases, considering the documents reviewed by peers in English, until the starting of COVID-19 Recession. We need

to acknowledge that some limitations may arise from these databases and the temporal scope of the articles reviewed. This review follows the procedure proposed by Edmondson & McManus (2007), through which research papers are classified by taking into account their degree of intrinsic evolution, distinguishing between nascent, intermediate and mature, and enabling this criterion to be used as a new element in identifying possible trends for future studies.

There are three research questions that we intend to answer in this work, these are: (Q1) What are the characteristics and trends of the most recent research on VUCA until COVID-19 Recession? (Q2) How can the published articles be classified in terms of maturity? And (Q3) What are the suggestions for future studies?

2. Methodology

The main objective of the process of the data collection was the construction of a general database to perform a "Systematic Literature Review" (SLR). Given the heterogeneity of the disciplines in which the term VUCA appears, only peer-reviewed articles from Web of Science and Scopus in which the term VUCA appeared in the tittle, in the abstract or in the keywords were considered. Articles from conferences or book chapters were excluded. This gave greater consistency to the results obtained due to their replicability, regardless of the database used.

Finally, a total of 137 articles published in journals from the beginning of the appearance of the term VUCA until 2020 were referenced. In 2020, with the starting of the pandemic, the number of papers in which the term VUCA appears has increased exponentially and are out of the scope of this study (in March 2020 there were 16 papers already published that are included in this review. Since March 2020 until October 2022 there are 145 articles more published in relation with VUCA). In those research articles that incorporate quantitative and/or qualitative analysis techniques, the variables proposed by Edmondson and McManus (2007) were also collected, as proposed in their analysis methodology, with the aim of classifying the status of a particular piece of research as incipient, intermediate or mature.

3. Literature analysis

In this section, we analysed the data obtained in the search and selection process described above from two viewpoints. On the one hand, we examined the information obtained from the first selection of articles on VUCA environments, which we used to adjust the current state of the art and other trends that may be detected in the future, in order to answer the first research question (Q1). On the other hand, we will determine the degree of maturity of each of the empirical studies carried out by the scientific community to date, applying the aforementioned Edmondson and McManus methodology to answer the second research question (Q2), and thus determine which research disciplines could be most useful to the scientific community.

3.1 Description

Regarding the number of articles published (Figure 1), although the first article is from 1992, the first that was released in a scientific journal is from 2009. The number of published articles remained practically constant until 2012, then grew from 2013 onwards. However, from 2020 onwards, there was a significant increase in the use of this term, coinciding with the beginning of the COVID-19 Recession.

The geographical origin of the first authors of the research is very diverse (Figure 2). The most prominent country is India, with 34 articles (24.8%); followed by the USA, with 28 articles (20.4%). The UK 16 articles (11.7 %), Australia 7 articles (5.1 %) and Germany 6 articles (4.4 %) are also prominent (the remaining countries have less than three publications).

Figure 1: Diachronic analysis of peer-reviewed publications.

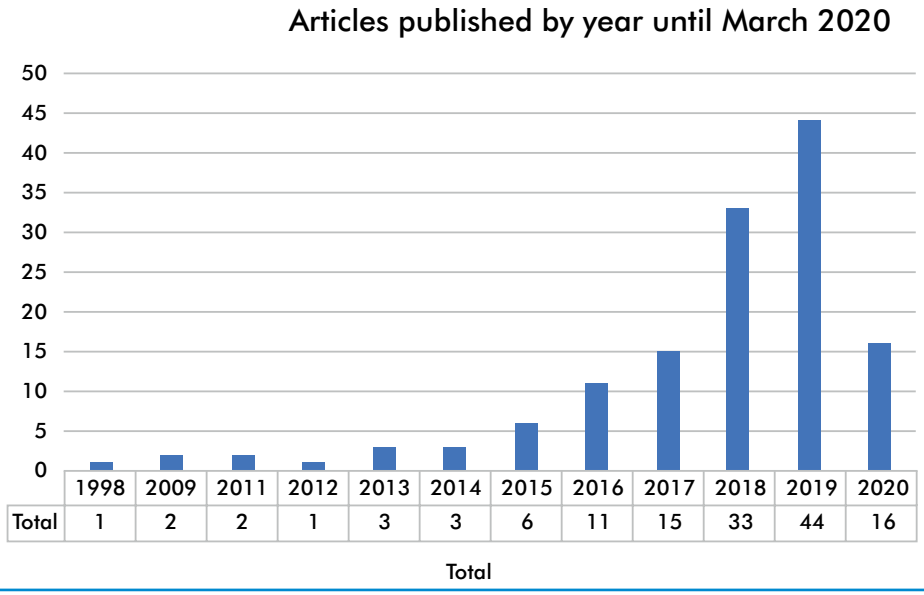
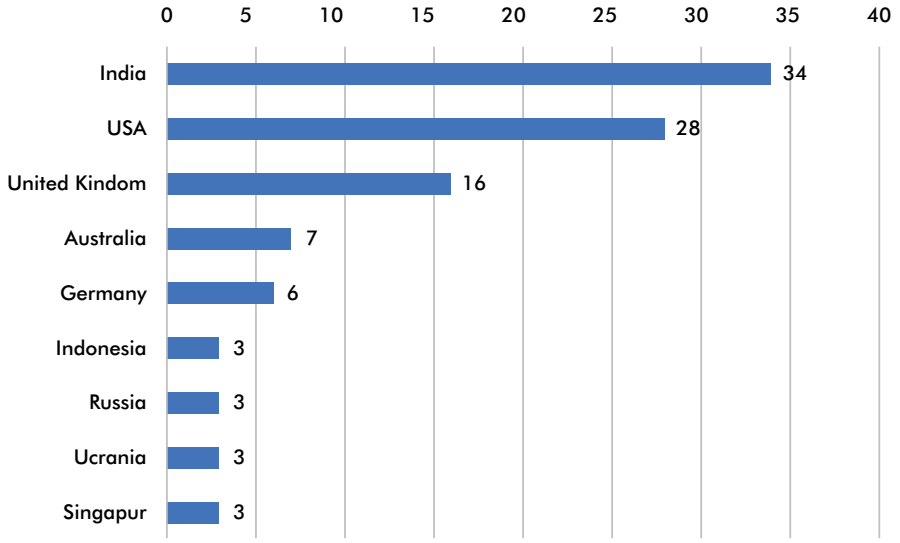


Figure 2: Papers published by country.



3.2 Knowledge areas

We follow the methodology proposed by Tranfield et al. (2003) which has been followed by multiple studies (Nolan & Garavan, 2016; Wang et al., 2014) to determine the knowledge areas.

Each researcher carried out an independent reading of the 137 articles. In this reading, 5 major areas of knowledge were established. During the process, discrepancies were resolved through consensus, with the aim of reaching a single common list. Regarding the areas of knowledge covered in the articles collected in our research, strategic management and leadership are among those where most of the works are concentrated, in first place, with 41 articles from strategic management (29.9 %). There are different approaches, such as scenario evaluation (Maier et al., 2016; Sharif & Irani, 2017), excellence management (Saleh and Watson, 2017), disruptive innovation (Pandit et al., 2018) or strategy (Bereznoy, 2017; Giones et al., 2019; Kim et al., 2018; Thorén & Vendel, 2019). The citation numbers of the articles belonging to these knowledge areas are directly related to the difficulty of managing in turbulent environments such as VUCA. In the case of leadership, with 33 articles (24.1 %), many are related to innovation (Hall & Rowland, 2016; Schoemaker et al., 2018), within this field, the work of Bennett & Lemoine (2014) on the identification of VUCA variables and the establishment of recommendations with the aim of counteracting the effects of these variables on management stands out for its number of citations. Other topics present to a lesser extent are human resources (HR), organisational development, education and learning, innovation, sociology, raw materials and religion, though with a significantly lower number of publications.

A summary of the implications derived from the areas of knowledge discussed in the academic literature appears in Table 2. In this table we include a column with the references of the key articles in these areas (VUCA articles included in the revision are contributing to them).

The subjects related to business management, have been taken into account in order to propose, as a conclusion to the study, some recommendations for this field. In our case, the areas we took into account due to their obvious significance to the business environment were: leadership, strategic management, organisational development, HR and Education and Learning.

Leadership. A VUCA environment requires management control, supported by creativity and innovation. To achieve this, one of the most effective organisational structures is ambidexterity (Nadler & Tushman, 1990; Tushman & O'Reilly, 1996). Thus, management supervision exists (exploitation) yet the creative phase of exploration, which represents a significant improvement in the adaptive capacities of the company, is not neglected. Likewise the dynamic capabilities theory (Carnahan et al., 2010; Teece et al., 1997) constitutes an effective tool for leadership in a VUCA environment, as explained in the work by Schoemaker et al. (2018), where it is proposed that only through entrepreneurial leadership by Top Management Teams (TMT) can it be managed with guarantees in this turbulent environment. These authors indicate that only through strongly rooted dynamic capabilities will organisations be able to stay at the forefront through rapid innovation, given the specific skills that must be developed to undertake this function. Only with serious involvement on the part of the TMT can it be carried out.

Strategic Management. It is necessary to open up the traditional management-exploitation model to include leadership-exploration considerations (March, 1991). This will require simultaneous development. Forecasting and early warning models that can serve as management tools in the VUCA environment will have to be incorporated into management (Bartscht, 2015; Börjeson et al., 2006; Rowe, 2010), as well as the use of new procedures for managing future scenarios (Alexander et al., 2018; Sarkar & Osiyevskyy, 2018; Thorén & Vendel, 2019).

Table 2: Areas of knowledge

Knowledge Areas	Main contributions to	VUCA related constructs	Implications
Leadership	Tushman & O'Reilly (1996) Teece et al. (1997) Grobman (2005) Lichtenstein et al. (2006) Hall & Rowland (2016) Antonacopoulou & Bento (2018) Castillo & Trinh (2019) Schoemaker et al. (2018)	-The dynamic capabilities are shown as the most effective tools for leadership in the VUCA environment. -Ambidexterity, leadership in exploration. -Leadership in a complex environment. -Leadership supported by continuous learning.	-Development of leadership in the VUCA environment through the learning of specific skills. -Proactivity, search for opportunities. -Need for strong adaptability.
Strategic Management	March (1991) Börjeson et al. (2006) Rowe (2010) Bartsch (2015) Maier et al. (2016) Bereznoy (2017) Alexander et al. (2018) Thorén & Vendel (2018)	-Opening from management-exploitation to leadership-exploration. -Joint development of leadership and management. -Development of scenarios for better management. -CYNEFIN model applied. -Corporate early warning forecasts. -Backcasting as an alternative tool to forecasting.	-Paradigm changes in the modelling of future scenarios. -Implications of leadership traits in management. -Greater degree of exploration required. -Development of early warning systems, agile management.
Human Resources (HR)	Johansen (2007) Shaffer & Zalewski (2011) Shukla et al. (2015) Sing & Sorum (2018)	-Development of specific skills adapted to the VUCA environment (ICT, Talent Management, Management, Training) -VUCA Prime application in HR for management of the VUCA environment. -Introduction of the concept of Human Capital in HR management of VUCA.	-Development of leadership through HR management. -New skills, adaptability and resilience prevail. -Need for oriented professional development.
Organisational development	Desai (2010) Baltaci & Balcı (2017) Du & Chen (2018) Pasmore (2018) Rao & Thakur (2019) Pangaribuan et al. (2020)	-Transfer of knowledge. -Complex adaptive systems. -Co-creative learning. -Organisational skills. -Knowledge workers.	-Development of organisational ambidexterity relying on knowledge workers. -Promotion of transparent transfer of information between departments. -Promotion of value generation by organisational commitment.
Education and Learning	Tsui & Dragicevic (2018) Seow et al. (2019) Sathya (2020)	-New experiential teaching methods for VUCA environments. -Teaching method based on the Triarchic Theory by Sterneberj. -Continuous learning.	-Need for a paradigm shift in teaching to face the VUCA challenges. -Reconsider teaching in the field of business and related disciplines.

Human Resources. The development of new attributes in the field of leadership requires new management of human resources, which enhance the ability to adapt by enabling new skills (Johansen, 2007) and by the empowerment of what has come to be called human capital (Shaffer & Zalewski, 2011), emphasising areas such as innovation, which has now acquired special relevance (Sing & Sorum, 2018).

Organisational Development. New models have recently emerged, based on the development of organisational ambidexterity as a response to a VUCA environment (Du & Chen, 2018), based on knowledge workers (Rao & Thakur, 2019), promoting maximum transparency in knowledge transfer (Pangaribuan et al., 2020).

Education and Learning. Last but not least, training must be included in this summary. New strategies are needed that can effectively address learning in a VUCA reality, through innovative models (Sathya, 2020; Seow et al., 2019), or based on continuous learning (Tsui & Dragicevic, 2018) and dynamic capabilities (Teece, 2011).

3.3 Future VUCA research with regards to knowledge areas

In this section we include new opportunities of research with regards to the different knowledge areas introduced previously.

Leadership. It is necessary to develop skills related to the management of scenarios, where uncertainty and turbulence are elements of special relevance. A redefinition of the qualities of a leader is required. Skills such as vision, which have been very important up until now, are less relevant in a VUCA environment, given the difficulty of drawing up a future perspective based on current information. The ability to adapt (Schoemaker et al., 2018) appears as an essential element of study. The appearance of adaptive leadership is a highly consistent element of study.

Strategic management. Within the literature on ambidexterity, it is necessary a good balance among exploration and exploitation strategies. The elements of adaptation and forecasting, in the face of an uncertain reality, acquire much greater importance (O'Reilly & Tushman, 2008). The agility of responses should be considered as a core element, with a clear influence on both human resources (HR) and the organisational development of the company. Higher doses of intuition are required (Robinson et al., 2017), since the value of the information obtained from the environment is more relative. Proper risk management, at organisational, group and individual levels, must be considered (Cheese, 2016; Getele et al., 2019), as well as adaptability and flexibility (Sushil, 2017). Identifying the precursors of a VUCA element in a company is a particularly relevant aspect in order to be able to tackle them as quickly as possible and minimise their effects (Codreanu, 2016; Heinonen et al., 2017). In this VUCA reality, one of the elements to which the company's management must pay the greatest attention is organisational development, as the correct evolution of the company will depend on this.

Human Resources. Due to the characteristics of the current environment, issues such as the selection of personnel are particularly relevant at present. Their criteria must be considered through a VUCA lens, as the ability to adapt to changes in the environment is essential. Although elements such as commitment and the ability to work as a team must always be taken into account, given the special characteristics of the environment, they now become fundamental.

Adequate and transparent management of the transmission of knowledge between departments is a crucial factor to be able to provide company managers with good decision-making tools. In this nascent reality, new skills are needed that must be implemented by the HR department, based on efficiency and flexibility. Within this field, there is a close relationship between the characteristics of the environment and its development and efficiency, making the appropriate dynamic modelling of a work team highly relevant to anticipate needs (Mathieu et al., 2014). In the same way, new jobs require new profiles, which is a challenge for human resource departments (Reichel & Mayrhofer, 2009). They also involve the development of individual competencies, as an element of change in the company, given that these are key resources to create dynamic capabilities (Kamprath & Mietzner, 2015). Accordingly, the development of appropriate tools to facilitate the work of management teams in addressing VUCA challenges is of special interest.

Organisational development. The speed of response to a turbulent and changing environment, based on precision and agility, is essential. Correct management of the company's own expertise, and transferring it to all the departments involved, must be carefully considered the role that the HR department must play to enhance these skills in the organisation is crucial. The transmission of what the organisation needs to achieve its objectives and being able to make an adequate response to the environment are of vital importance. All this must be actively supported by those responsible for the company's management.

Education and learning. A new environment requires new knowledge, and executive training is a field which is constantly evolving. There is an urgent need to acquire specific skills to manage such an environment, in which uncertainty and turbulence take on a particularly salient role. Given this reality, new teaching concepts are emerging with the aim of filling these gaps: the curricular development of the new generation of TMT components and the adaptation of VUCA teaching, in order to provide tailored tools to educational entities, so they can work effectively on the new problems arising today. Among the new leadership skills, creativity and innovation, focused on both leadership and management, appear as fundamental elements.

From this point of view, there are many relevant fields that could be the object of study in the short term. These include innovation and entrepreneurship, which have long been conditioned by this changing environment, as they have a direct relationship with innovation and the improvement of performance in companies experiencing a turbulent environment (Hult et al., 2004; Kraus et al., 2012; Yasir et al., 2017). Last but not least, training in all its areas is a very interesting field for management and leadership (Chambers et al., 2010; Orphanos & Orr, 2014; Rowland & Hall, 2014).

We can also comment on other areas of knowledge which, although they are relevant, have been subject to a significant lack of research, such as the changes in B2B and market relations that are taking place with the emergence of new technologies, as well as the implications for e-commerce (Iyer et al., 2009; Iyer et al., 2004). The development of control and management systems for customer relationships are core factors in the proper management of companies (Bonnemaizon et al., 2007; Wilson et al., 2007)

A special field is that of public administrations and their performance in the VUCA environment, together with the evolution of citizen participation in a more dynamic environment and its implications (Stivers et al., 2018) and the area of complexity management (Klijn, 2008).

3.4. Maturity level of VUCA research

Of the total 137 documents studied, there were 85 conceptual documents (62.0%), 21 pure qualitative documents (15.3%), 22 pure quantitative documents (16.1%) and 9 mixed qualitative/quantitative documents (6.6%). The high number of conceptual documents (85) compared to the rest (52 in total) highlights the nascent character of the VUCA research environment, which is currently taking off in the scientific community (Edmondson & McManus, 2007).

Aiming to answer the second research question, we organised the published articles according to the criteria of Edmondson and McManus (2007). This methodology will only be carried out on empirical articles, which in our case are 52 and a summary table[1] was drawn. According to these criteria, from a total of 52 articles, 21 articles (40.4%) were nascent, 9 articles (17.3%) were intermediate, and 22 articles (42.3%) were mature.

- **Nascent articles.** These contain empirical research of a qualitative nature, collected through observations, working documents and/or in-depth interviews with a content-oriented theme. The development of new constructs is intended, with the aim of offering an original response to the how and why of the research questions proposed on a subject of interest. Some examples of these articles include Hall and Rowland (2016), in leadership (Giones et al., 2019), or in decision making in VUCA environments.
- **Intermediate articles.** These works incorporate a qualitative and quantitative analysis, in order to identify the relationships between new and existing constructs. Examples include Oliva & Kotabe (2018) in which the main problems that start-ups can encounter in high turbulence environments (VUCA) are raised through a combination of interviews with experts and quantitative analysis; and that of Seow et al. (2019), which investigated the results of the implementation of an experimental pedagogy at the University of Singapore adapted to VUCA environments, through a study based on quasi-experiments and a quantitative analysis of the findings obtained.
- **Mature articles.** These articles study a specific concept from a quantitative perspective, with models already existing in the literature. In this case, they were empirically validated through statistical methods. Examples include Geysi et al. (2019), comparing corporate values in VUCA environments, and that of Niblock & Harrison (2013), who study the behaviour of the carbon market.

The research gaps observed in the reviewed literature, which are summarised in Table 3 confirm the initial research phase in this field: there are few articles that rely on consolidated management theories. This is a relevant aspect, since one of the critical characteristics of performance in a VUCA environment is management and leadership. It is especially significant that the dynamic capabilities theory is only used as a reference in five articles (Jari & Lauraéus, 2019; Pandit et al., 2018; Schoemaker et al., 2018). Accordingly, this implies that there is a lack of articles that focus on implementing management systems in VUCA environments. There are no quantitative studies in quality publications (first and second quartiles) that provide us with field information on how the VUCA reality is perceived, and how solutions are being implemented through management and leadership, which makes it difficult to identify the most suitable solutions to address this environment. In addition, there are no comparative studies between theory and the actual practice

1 *The table has not been included for reasons of space, in case of interest it is available, upon request to the authors.*

of business management. According to Ashby's law (Ashby, 1957, p. 206), "Only variety can absorb variety." From this, we can derive that the management of a complex environment requires complexity. It would therefore be very relevant to systematically investigate management aspects that could serve as an empirical reference of good practices. New skills which take this situation into account (Johansen, 2010) will be necessary for these new times, which will especially affect team management and the training of executives, especially when the environment is subjected to those circumstances of dynamism and uncertainty that are so relevant.

Table 3:
Perceived gaps

Reference concept	Observed gaps	Additional information
Theoretical perspectives	References to the dynamic capabilities' view are missing.	This theory is only used in five articles, despite being considered as the most suitable theory for turbulent environments (Schoemaker et al., 2018).
Research content	Articles are missing on the implementation of management systems in the VUCA environment.	The complexity of the VUCA reality requires theoretical developments that facilitate management and leadership tasks.
	Lack of articles describing the reality of management/leadership in the VUCA environment.	There are no field visions (qualitative analyses) of the VUCA reality and how management and leadership are being implemented in companies that do it successfully.
	Few articles with references to confronting the gap between management/real leadership, from ideal to theoretical in VUCA. Application of the Resource- and Capability- theories.	As with the previous point, it would be interesting to have comparative studies between theoretical and real leadership practices in companies, which would serve as a reference.
	Very few empirical articles	This is a derivative of the novelty of this problem. In any case it would be an interesting gap to cover from the perspective of management and leadership by developing empirical studies that centre on these two elements.
	Shortage of articles on team management	Proper management of work teams is especially relevant.
	Few articles on education and training	This is a support element for both management and leadership.

4. Conclusions and limitations

The main contribution of this study is to identify trends in the study of VUCA environments until the explosion of the used of this term with COVID-19 Recession. We classify and compare these trends, with studying the most relevant characteristics of the articles, such as the context of the research, the country of the first author and its content, as well as the intrinsic maturity of the articles studied according to the classification provided by Edmondson and McManus (2007). Based on this analysis, the main trends and gaps in the most relevant research disciplines have been identified, noting a particular significant absence of works on the VUCA environment from the perspective of the Dynamic Capabilities view, which we consider to be particularly useful in this field, and which would be an interesting element for future research.

The VUCA context is a determining factor of reality in general and of the company environment in particular. Strategic management, leadership, human resources and education and learning are the areas where it is particularly gaining in prominence. Companies need to reactively address this new reality with greater guarantees. Accordingly, this represents an opportunity for the field of knowledge to better understand where the world of business management is heading.

In terms of the most relevant areas of knowledge, based on the articles collected in the literature review, we consider the use of the dynamic capabilities view to be especially relevant for the construction of new knowledge, based on the first observed gap related to theoretical perspectives. This view transcends the concept of traditional strategy. According to its criteria, dynamic capabilities could guide the company, making the most of the new opportunities offered by the environment (Schoemaker et al., 2018). Dynamic capabilities can help companies to adapt more quickly to the VUCA reality through the use of internal and external competences with the objective to quickly adjust to changes in the environment (Schriber & Löwstedt, 2020; Teece et al., 1997). Likewise, dynamic capabilities take into consideration strategic alliances and the development of new products that enable the creation of value (Eisenhardt & Martin, 2000). Despite the fact that there are no guarantees of being able to successfully address the VUCA reality, companies with dynamic capabilities will deal with these challenges (Winter, 2003).

Following the study carried out in this work, several aspects have been confirmed:

1) The state of the art of VUCA publications is very incipient, though the term is not new, and despite the findings that the environment is increasingly influenced by this reality.

2) The articles included in this investigation are mostly in a nascent state of research (Edmondson & McManus, 2007). Accordingly, the development of new conceptual and empirical works would be of great interest to the scientific community.

3) There is a notable lack of works focused on the dynamic capabilities' prism, which is one of the most appropriate theories for the study.

The reality is that the increasingly dynamic and turbulent VUCA environment requires new methods to confront it with new tools, which although they obviously cannot guarantee success, can at least minimise or counteract the disastrous effects that this environment can create in the face of inadequate management or leadership.

Initial confusion about the term is giving way to increasingly complex knowledge, with valuable contributions now being made. However, there is still a need for a theoretical construct that establishes and corroborates the management theories which best fit this model which, by its very nature, could be supported by the dynamic capability view. If appropriate, it would be useful to develop elements that satisfy the known theoretical assumptions or pose new challenges that need to be demonstrated.

In terms of the implications for managers, this review of the literature has shown the need to rethink certain aspects related to leadership and innovation in its various facets. Leadership in a VUCA environment must be underpinned by the company's great capacity to adapt. In this sense, HR departments should focus on reinforcing the continuous learning of new skills related to adaptation to the environment and flexibility in the use of resources. Additionally, much more flexible and adaptive structures should also be put in place to facilitate organisational learning. Paying special attention to the need to promote innovation as a basic element of company survival

in a VUCA environment, and it is necessary to try to keep ahead of it. Regarding extrinsic factors, an agile and precise observation of reality can make it possible to anticipate possible future scenarios of uncertainty and even, if necessary, to establish a systematisation of the observation of the environment as another activity of business management, in order to detect the "precursors" of VUCA environments as early as possible. Individual competencies need to be developed, fostering transversal knowledge transfer, flexibility and adaptation. Here again, the involvement of the HR department is highly relevant.

Finally, this study is not free of limitations. This revision is until the disruption caused by the emergence of the pandemic caused by COVID-19, future studies can take into account the papers published since the COVID-19 Recession onwards. In addition, limitations may arise from the databases used for the selection of the articles: Web of Science and Scopus. Finally, this study is an overview of the VUCA literature; future meta-analysis combining data are also welcome.

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