



A Scale Development for Volatile-Uncertain-Complex-Ambiguous (VUCA) World Management

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Abstract

This article is an attempt to develop a questionnaire, which presently is unavailable in the literature, so that the Volatile-Uncertain-Complex-Ambiguous (VUCA) world can be understood and relatively measured by governments, companies, and institutions. The aim is to measure the dynamics of VUCA in the framework of the economic unit (region, country, economic sector) within the framework of a unique methodological approach. Ultimately the aim is not to approach statistical theory with a new methodology, but to present relevant material to the current approaches of statistical theory with a unique survey. By utilizing the survey created in this article, the potential to analyze many divergent scenarios about "the future readiness" becomes applicable, such as: The relationship between education levels, years of experience, the age of the company and VUCA awareness, and VUCA awareness between different sectors (ICT/Industry, Banking/Industry, Industry/Service), VUCA awareness between varying scale companies (small, medium-size and large-size companies), differences in levels of VUCA awareness in the same sector of different countries, differences in levels of VUCA awareness among the institutions whether they are achieving the Sustainable Development Goals or not, etc.

1. Introduction

Current life is a series of networks in an interdependent and interconnected world in which the conditions and environment frequently and rapidly change; however, irrationally in the present climate, the formulation of plans, strategies and policies is still based on fixed goals. This pattern of thinking requires a review of ideas and methods if successful preparation for an unknown and unpredictable future is to be achieved. Many believe they are credible prognosticators and attempt to formulate decisions according to expected future assumptions, and despite social sciences assuming that perfect prediction is not possible, procedures are available for improving the ability to prepare for a favourable outcome in an unknown future.

According to Persis, Venkatesh, Sreedharan, Shi and Sankaranarayanan (2021), organizations are starting to adopt emerging technologies such as the circular economy and the internet of things to manage their businesses in the VUCA world. In the research conducted by Troise, Corvello, Ghobadian and O'Regan (2022: 9), the importance of investing in digital technologies for organizations to be agile and develop in VUCA environments is stated. In addition, it is emphasized that the use of relevant technologies is not sufficient and digital technology capability should be developed and complemented with innovative capabilities. Persis, Venkatesh, Sreedharan, Shi, and Sankaranarayanan (2021: 9) state that the adoption of cloud-based services is important due to the uncertainty of information-sharing mechanisms in organizations.

The behaviors of complex systems are very difficult to gauge and predict by virtue of known elements such as chaotic behavior, self-organizing patterns, fat tail characteristics, and adaptive interactions, making the modelling of them almost impossible. Knowledge accumulation through gaining different perspectives and a wide range of practice is the most advantageous and best source of strength to possess, as economic theory, policy design and decision making at the individual or corporate level require a more realistic analysis of how real people decide and choose. Present models associated with modern mainstream economics assume that society makes decisions parallel to a mathematical maximizer in possession of renewed new theories that encompass behavioral aspects and complex dynamic external factors into the equation. The capacity for long-term perspective has not been established yet and the ability to deal with change and discontinuity is deficient.

The mechanical view does not lead us easily into exploring interrelationships, co-evolution, dynamic flow, values, unintended consequences, multiple perspectives, learning, the emergence of the totally unexpected, collapse, and the ways differing factors interact or consider the distant future or the role of the past (Boulton, Allen and Bowman, 2015).

Business and other human endeavors are systems which are bound by invisible fabrics of interrelated actions, which often take years to fully play out their effects on each other. It is doubly hard to see the whole pattern of change. Instead, organizations tend to focus on snapshots of isolated parts of the system. Systems thinking is a conceptual framework, a body of knowledge and tools that has been developed over the past fifty years, to make the full patterns clearer, and to help us see how to change reality effectively (Senge, 1994: 10).

In the research conducted by Kaivo-oja and Lauraeus (2018), it is stated that the main issues in modern VUCA management are agility in response to volatility, knowledge and information management in response to uncertainty, restructuring in response to complexity, and experimentation in response to ambiguity.

2. VUCA Literature Review

In an environment that enjoys stability as a normality, the approach of an organization is to rely on previous experiences and customary practices; however, the variability encountered in VUCA conditions drives an organization to become more attentive to associated

stakeholders and increase receptiveness in both education and innovation. The world's challenges contribute to the unpredictability of today's environment; therefore, more often than not, outdated information and methods are used, slower responses are consequential and risk avoidance orientation is affected.

Due to the uncertainties experienced and the interconnectedness of the events and problems, it could be almost impossible for them to take ideal measures (Sinha and Sinha, 2020: 19).

With the emerging state of complexity, organizations have readily attempted to identify short term solutions to address opposing problems, which is known as short-termism. The passing of global uniformity has revealed that countries, organizations, companies, and individuals are now huge networks, with each agent of these systems being interconnected and interdependent in a variety of ways.

Whether responses from within the entanglement are sufficient or formulated decisions are adequate to fulfil desired situations is difficult to distinguish due to the big picture being obscured, and the measures taken could worsen situations.

The concept of VUCA was invented by the United States Military Academy and designed to understand the volatile, uncertain, complex, and ambiguous world that was observed after the end of the Cold War, with theories concerning the subject being frequently published in literature since 2002. The concept of VUCA aims to make quick decisions, reach unexpected moves and unpredictable results, as well as strategic leadership (Latha and Christopher, 2020: 743; Kaivo-oja and Lauracus, 2018: 38; Raghuramapatruni and Kosuri, 2017: 16), which defines the dynamic nature of our day and our world (Horney, 2009: 33). Waller, Lemoine, Mense, Garretson and Richardson (2019: 78) state that VUCA should be seen as a development and more of an opportunity for cooperation rather than a risk that needs to be mitigated. Perhaps an expansion of the present scientific world view which requires certainty, value neutrality and stability, is necessary, or perhaps it is more constructive for organizations to see and enjoy the unpredictability of this world when dealing with complex problems.

It can be stated that communication skills, social intelligence, higher-order thinking skills, self-management, a sense of responsibility, agility and flexibility are important to live in the VUCA world.

2.1. Volatility

There are different definitions of volatility in related literature. In the Merriam-Webster dictionary, it is defined as a tendency of one variable to change quickly and unpredictably (Merriam-Webster Dictionary, 10/12/2023).

The Cambridge dictionary defines volatility as “the quality or state of being likely to change suddenly, especially by becoming worse.” (Cambridge Dictionary, 10/12/2023)

In finance, volatility (usually denoted by σ) is the degree of variation of a trading price series over time, usually measured by the standard deviation of logarithmic returns. In related

literature, many researchers defined volatility from different perspectives. Some of them are as follows:

According to Sinha and Sinha (2020: 17-18), due to the increasing frequency of changes, it becomes difficult to correlate cause and effect between events in today's world. One of the best examples of understanding the idea of volatility is price fluctuation. Volatility is concerned with changes in the social environment as well as expressing the pace of change in the world in manufacturing, the services sector, and the market. Beabout (2012: 19) expresses volatility as unexpected in the intensity of the situations.

Lawrence (2013: 5) emphasized that volatility is turbulence, a phenomenon that occurs more frequently than in the past. As stated in Raghuramapatruni and Kosuri (2017: 18), VUCA quickly became a slogan. It is seen that the balance of many organizations that cannot adapt to the whims of the VUCA world, such as economic turbulence and rapid changes in business environments, has been disrupted.

In the formulation of our daily decisions, we generally use our hearts more than our minds. That is why in line with Rodriquez and Rodriquez (2015: 855) volatility is defined as the goals and values that form the basis of individual decisions. Volatility is referred to as the dynamic quality of decision making.

The measurements of the status of the facts in the information age are changing rapidly, and the definitions of the situation in the mind of the decision-maker are constantly changing due to the constantly updated data (Shaffer, 2011: 66).

Volatility refers to the rate of change in both the variable set and the information space in the values for each variable (Thoren and Vendel, 2019: 301).

Volatility describes the rate of change (usually rapid) and is the model of the dynamics observed in socio-environmental systems. To provide a comprehensive explanation of the causes of volatility, it requires long-term monitoring (Schick, Hobson and Ibsch, 2017: 7).

The research conducted by Bartscht (2015) emphasizes the development of capacities to create useful situational understanding in VUCA environments and the better positioning of organizations in dynamic environments. In the article written by Kaivo-oja and Lauraeus (2018), it is stated that one of the main issues in VUCA management is agility in response to volatility. In the same article it is also stated that the VUCA approach is the basic and the most fundamental conceptual solution for technological disruption as well. In separate important research conducted by Worley and Jules (2020), three inferences about practices related to agile and sustainable organizations in crisis environments have been identified as volatile, uncertain, complex, and ambiguous (VUCA). These are the difficulties in characterizing the situation, the lack of capacity of most organizations to respond, and the silence about socially structural inequality.

2.2. Uncertainty

In the Merriam-Webster dictionary, uncertainty is defined as "the lack of sureness about someone or something". Moreover, the dictionary says that uncertainty may range from

falling short of certainty to an almost complete lack of conviction or knowledge, especially about an outcome or result (Merriam-Webster Dictionary, 10/12/2023).

In the Collins dictionary, uncertainty is defined as a state of doubt about the future or about what is the right thing to do (Collins Dictionary, 10/12/2023).

In the field of economics, uncertainty is defined as the probability of the occurrence of expected results being unknown, whereas in contrast the probabilities of risk are known. There are many definitions and explanations on this subject in the literature as well. Some of them are shared below.

The concept of uncertainty is defined as the state of lack of information, which is not related to cause and effect but to whether a particular event is important enough to establish a meaningful cause. Uncertainty is not volatility (Bennett and Lemoine, 2014: 314). Uncertainty is characterized by a lack of predictability and the likely prospects for surprise. Uncertainty is the result of the multiple feedback loops and interactions that are inherent in complex systems. Uncertainties also arise due to the rapid interactions of several elements in complex systems. During such “surprises”, the system’s behaviour differs qualitatively from *a priori* expectations, which can pose risks to conservation objects as well as to the effectiveness of management actions (Schick, 2017: 7).

Today, past experiences are rapidly losing their importance in predicting how events will develop. It becomes difficult to make decisions about issues related to investment, growth, or development. There are many unknown variables, and the prediction of results has gone beyond just statistical tools or technologies (Sinha and Sinha, 2020: 18). Even though there are few predictions for the future, decision-makers often need to predict the possible consequences of their actions (Shaffer, 2011: 66). Since uncertainty is caused by the absence of sufficient information, it simply involves obtaining information. The investment here includes the methods of collecting, interpreting, and sharing information (Bennett and Lemoine, 2014: 314).

Waller et al. (2019) classified uncertainty into six types of scientific evidence depending on generic causation. These are concept uncertainty, measurement uncertainty, calculation uncertainty, sampling uncertainty, mathematical modelling uncertainty and causal uncertainty. Under all these uncertainties, it could be very difficult to talk about perfect modelling.

2.3. Complexity

There are many definitions and explanations on this subject in the literature as well. Some of them are shared below.

According to Beck and Plowman (2019), complex systems are made up of interdependent agents that interact, learn from each other, and adapt their behaviours accordingly. Butler and Allen (2008) emphasized the role of sensitivity to initial conditions, negative and positive feedback processes, disequilibrium and emergent order. Campbell (2007) said that complexity is made up of a very large number of autonomous elements that are dynamic, interactive, and governed by micro-rules that exhibit ‘butterfly effects’, are non-linear, and exhibit replicated patterns. In another study, Rahman-Bacchus and Wu (2011) highlight

spatial self-organization, non-linearities, the plurality of equilibria, and the importance of coevolutionary relationships.

“A new perspective on leadership and decision making based on the complexity of science appears to be the most fundamental requisite of today.”

The main reasons why even the results of controlled environments are beyond expectations are the non-linear relationships, interactions and dependencies between various parameters and variables. Complexity refers to the interdependence of multiple dimensions in a system (Sinha and Sinha, 2020: 18). Complexity refers to the complex and extensive network structure and dynamic paths that exist between the components of a system. It also implies that the state of a system is based on principles of chaos and subject to overflow points (Schick, Hobson and Ibsch, 2017: 8). Complexity can be defined as the number of variables related to a particular decision in the knowledge domain and the amount of interaction between these variables (Thoren and Vendel, 2019: 301).

2.4. Ambiguity

The most abstract element of VUCA is Ambiguity. It is related to the uncertainty of reality, the potential for misreading, the confused meanings of circumstances and the mixed consequences of actions (Schick, 2017: 8). There is a subtle difference between “Uncertainty” and “Ambiguity”. Uncertainty refers to a particular state of existence where relevant information is missing. Ambiguity, on the other hand, is expressed as the absence of a meaningful message caused by the stack of information, despite the availability of relevant information (Sinha and Sinha, 2020: 18). Too much data will naturally lead to a lack of clarity. Therefore, there will be a failure to address the larger root causes underlying the problems (Waller, 2019: 76). Ambiguity is often a by-product of information overload. It should be noted that there is a combination of uncertainty and ambiguity that prevails in our age (Sinha and Sinha, 2020: 18).

Waller (2019: 76) defines ambiguity as the lack of clarity surrounding an event and its meaning, or the reasons behind things that are difficult to understand. Bennett and Lemoine (2014: 27) also state that there is a lack of understanding about causal relationships. Causal relationships are unclear in Ambiguity. Shaffer (2011: 66) mentions that ambiguity refers to the unknown importance of one or more factors in a situation.

3. The Development of the VUCA Questionnaire

A separate literature study was conducted for each of the 4 conditions that make up the VUCA acronym, and 12 question statements were created for each word by the authors of the article, based on more cited studies in this area, by the brainstorming method. The possible questions that can be used to understand the VUCA World awareness of institutions

are formulated as follows. Through this way companies (institutions and governments) will understand to what extent they are prepared for an uncertain future. A Likert scale is a popular and widely used rating scale to measure attitudes, feelings, or opinions that cause variations in behaviour.

Likert scales are most useful when you are measuring unobservable individual characteristics, or characteristics that have no concrete, objective measurement. These can be elements like attitudes, feelings, or opinions that cause variations in behaviour. Some of the most common types of items include:

- **Agreement:** Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree.
- **Quality:** Very Poor, Poor, Fair, Good, Excellent.
- **Likelihood:** Extremely Unlikely, Somewhat Unlikely, Likely, Somewhat Likely, Extremely Likely.
- **Experience:** Very Negative, Somewhat Negative, Neutral, Somewhat Positive, Very Positive (Bhandari and Nikolopoulou, 2024).

The format of the survey that is developed here could be a five-level Likert and could be evaluated as follows; 1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree and 5. Strongly agree.

The questionnaire developed includes twelve questions under each word and they are as follows:

Volatility

- High volatility causes the failure of strategic plans of institutions.
- Volatility can be measured.
- In our institution, planning is made beforehand anticipating probable future volatile periods.
- In our institution higher volatility is regarded as an opportunity.
- Volatility is among the key components of change management.
- Volatility requires micro level financial analysis for institutions.
- Volatility requires a macro level business cycle analysis for institutions.
- In our institution strategic planning includes projected volatility analysis.
- In our institution volatility is known as a forward looking metric and is measured periodically.
- Volatility provides a profit opportunity.
- Long-term survival requires higher adaptability.
- Since discontinuous changes cannot be foreseen, it requires new management tools and new thinking methods.

Uncertainty

- Radical uncertainty is not well captured by probabilistic reasoning.
- The difference between risk and uncertainty should be made explicit.
- In our institution we prepare contingency plans for unexpected future events before they occur.
- The higher the uncertainty, the more difficult the decision-making is.
- When uncertainty is high, institutions should use new management tools rather than traditional ones.
- Uncertainty requires agility and flexibility.
- Imperfect and incomplete information are the main factors behind higher uncertainty.
- Visionary leadership is required to deal with uncertainty in a better way.
- Participatory and collaborative leadership are necessary skills to deal with uncertainty.
- Detailed Internal Analysis will not have a significant impact on decreasing the degree of uncertainty.
- Multidimensional External Analysis will help institutions decrease the level of uncertainty.
- Inclusion of all stakeholders in the decision-making process may increase the degree of uncertainty.

Complexity

- The future will be increasingly non-linear and complex.
- The emphasis on complexity, networks and patterns of organization is getting more important.
- Our institution is aware of the difference between complex and complicated domains.
- Management of interrelated and interconnected systems requires new ways of leadership.
- Increased complexity leads to competition.
- Networks of interdependencies are taken into consideration while forming the strategic planning of our institution.
- In our institution, rather than a reductionist view, a holistic view is preferred in the decision-making process.
- Complexity is about overcoming the unclear and enormous amount of information.
- Complex domains represent the unknowns.
- In a complex domain, there are no right answers.
- In a complex domain, because the cause-and-effect relationship is unclear, the wisdom of crowds could be a necessity.
- Simplicity in the design of decision making and an organizational table may help to deal with complexity.

Ambiguity

- Business-as-usual models cannot be used under ambiguity.
- To equip staff with 21st century skills may help deal with ambiguity.
- When the “Cause and Effect” relationship cannot be seen clearly, we may use learning by experience.
- A holistic view is the key to deal with ambiguous situations.
- “Critical Thinking” could be helpful to deal with the difficulties of ambiguity.
- Emotional Quotient (EQ) is as important a skill as IQ when dealing with uncertainty.
- The use of Information Communication Systems may effectively help to decrease the degree of ambiguity.
- “Pattern Recognition Skill” of leaders is of vital importance in dealing with ambiguity.
- Providing clear communication to staff, customers or the media clarifies ambiguity.
- “Creative Thinking” could be helpful in dealing with the difficulties of ambiguity.
- Using “Collective Intelligence” and “Encouraging Staff” could be a driving force for motivating managers.
- Dealing with ambiguity requires agility, resilience and anti-fragility depending on experience.

4. Conclusion and Recommendations

The 21st century has been labelled as a post-normal time characterized by the complexity and chaos that exist in the world today. The interdependencies and interconnectedness of countries, companies and individuals are making management and governance exceptionally challenging.

Managers of today require advanced skills, new fashioned ways of thinking and up-to-date values. The VUCA world is a reality of the 21st century and awareness of this fact must be taken into consideration in the management of companies and in the formulation of their strategic plans.

The life span of many companies is shortening as the degree of volatility increases and as uncertainty, complexity, and ambiguity become evident in the world markets. The survey created in this study will allow us to understand or measure the VUCA awareness of different actors in different companies. An inadequate level of awareness should impress upon managers that they should establish an understanding of VUCA to formulate superior and more effective decisions.

A new perspective on leadership and decision-making based on the complexity of science appears to be the most fundamental requisite of today. A new emphasis on complexity, networks, and patterns of organization has emerged. The new conception of life involves a new kind of thinking—thinking in terms of relationships, patterns, and context.

In science, this way of thinking is known as “systemic thinking” or “systems thinking”. A unified systemic vision includes and integrates life’s biological, cognitive, social, and ecological dimensions, in addition to including the philosophical, spiritual, and political implications.

The development of the VUCA questionnaire may help decision makers understand the implications of this unified vision for a broad range of professions, from economics, management, and politics to medicine, psychology, and law. This perspective is essential for overseeing the existing global ecological crisis and protecting the continuation and flourishing of life on earth.

It could be described as a shift of metaphors, a change from seeing the world as a machine to understanding it as a network.

Cybernetics is the result of a multidisciplinary collaboration between mathematicians, neuroscientists, social scientists and engineers, a group that has become known collectively as cyberneticists. To efficiently resolve our problems, an optimum solution is to encourage scientific disciplines to work collaboratively on post-normal formulas. Our endeavour is an attempt to develop one more tool that may help decision makers understand the level of their VUCA awareness and in turn may allow them to understand the complexities of the 21st century.

Although perfect prediction is not possible, especially when we are dealing with ill-defined problems, managers of today can prepare their institutions in an improved manner against the uncharted unknowns of the VUCA world which is one of the most important actualities of today and has evolved from globalization, the extensive use of information and communication technologies, the never-ending emergence of new technologies, the irrationality of agents and lots of cognitive biases.

We hope that the VUCA questionnaire we have tried to develop here will guide today’s managers and academics working in this field who must deal with all these problems.

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Bibliography

1. Jan Bartscht, (2015) *Why Systems Must Explore the Unknown to Survive in VUCA Environments*. *Kybernetes*, 44(2), 253-270.
2. Beabout, B. R. (2012) *Turbulence, Perturbation, And Educational Change. Complicity: An International Journal of Complexity and Education*, 9(2), 15-29.
3. Beck, T. and Plowman, D. A. (2014) Temporary, Emergent Interorganizational Collaboration in Unexpected Circumstances: A Study of The Columbia Space Shuttle Response Effort. *Organization Science*, 25(4), 1234-1252.
4. Bennett, N. and Lemoine, G. J. (2014) What A Difference A Word Makes: Understanding Threats to Performance in A VUCA World. *Business Horizons*, 57, 311-317.
5. Bhandari,P and Nikolopoulou, K *What is a Likert Scale*, <https://www.scribbr.com/methodology/likert-scale/> (accessed: 19/01/2024).

6. Butler, M. J. R. and Allen, P. M. (2008) Understanding Policy Implementation Processes as Self-Organizing Systems. *Public Management Review*, 10, 421-440.
7. Boulton, J. G., Allen, P. M. and Bowman, C. (2015) Embracing Complexity, Strategic Perspectives for an Age of Turbulence, England: Oxford University Press.
8. Cambridge Dictionary, <https://dictionary.cambridge.org/dictionary/english/volatility>, (accessed: 10/12/2023).
9. Campbell-Hunt, C. (2007) Complexity in Practice. *Human Relations*, 60(5), 793-823.
10. Collins Dictionary, <https://www.collinsdictionary.com/dictionary/english/uncertainty>, (accessed: 10/12/2023).
11. He, Z., Rayman-Bacchus, L. and Wu, Y. (2011) Self-Organization of Industrial Clustering in A Transition Economy: A Proposed Framework and Case Study Evidence from China. *Research Policy*, 40, 1280-1294.
12. Horney, N., Pasmore, B. and O'Shea, T. (2009) Leadership Agility: A Business Imperative for A VUCA World. *People & Strategy*, 33(4), 33-38.
13. Kaivo-oja, J. R. L. and Lauraeus, I. T. (2018) The VUCA Approach as A Solution Concept to Corporate Foresight Challenges and Global Technological Disruption. *Foresight*, 20(1), 27-49.
14. Latha, A. and Christopher, P. (2020) Vuca in Engineering Education: Enhancement of Faculty Competency for Capacity Building. 9th World Engineering Education Forum, *Procedia Computer Science*, 172, 741-747.
15. Lawrence, K. (2013) Developing Leaders in a VUCA Environment, Colorado: UNC Executive Development, UNC Kenan-Flagler Business School.
16. Merriam-Webster Dictionary, <https://www.merriam-webster.com/dictionary/volatility>; <https://www.merriam-webster.com/dictionary/uncertainty> (accessed: 10/12/2023).
17. Persis, D. J., Venkatesh, V. G., Sreedharan, V. R., Shi, Y. and Sankaranarayanan, B. (2021) Modelling and Analysing the Impact of Circular Economy; Internet of Things and Ethical Business Practices in The VUCA World: Evidence from The Food Processing Industry. *Journal of Cleaner Production*, 301, 1-13.
18. Senge, P. M. (1994) *The Fifth Discipline: The Art and Practice of the Learning Organization*, USA: Random House.
19. Raghuramapatrani, R. and Kosuri, S. R. (2017) The Straits of Success in A VUCA World. *Journal of Business and Management*, 19, 16-22.
20. Rodriguez, A. and Rodriguez, Y. (2015) Metaphors for Today's Leadership: VUCA World, Millennial And 'Cloud Leaders'. *Journal of Management Development*, 34(7), 854-866.
21. Schick, A., Hobson, P. R. and Ibisch, P. L. (2017) Conservation and Sustainable Development in A VUCA World: The Need for A Systemic and Ecosystem-Based Approach. *Ecosystem Health and Sustainability*, 3(4), 1-12.
22. Shaffer, L. S. (2011) Career Advising in A VUCA Environment. *NACADA Journal*, 31(1), 64-74.
23. Sinha, D. and Sinha, S. (2020) Managing in A VUCA World: Possibilities and Pitfalls. *Journal of Technology Management for Growing Economies*, 11(1), 17-21.
24. Stensaker, B., Frølich, N., Huisman, J., Waagene, E., Scordato, L. and Pimentel Bótas, P. (2014) Factors Affecting Strategic Change in Higher Education. *Journal of Strategy and Management*, 7(2), 193-207.
25. Thorén, K. and Vendel, M. (2019) Backcasting as A Strategic Management Tool for Meeting VUCA Challenges. *Journal of Strategy and Management*, 12(2), 298-312.
26. Troise, C., Corvello, V., Ghobadian, A. and O'Regan, N. (2022) How Can SMEs Successfully Navigate VUCA Environment: The Role of Agility in The Digital Transformation Era. *Technological Forecasting & Social Change*, 174, 1-12.
27. Waller, R. E., Lemoine, P. A., Mense, E. G., Garretson, C. J. and Richardson, M. D. (2019) Global Higher Education in A VUCA World: Concerns and Projections. *Journal of Education and Development*, 3(2), 73-83.
28. Worley, C. G. and Jules, C. (2020) COVID-19's Uncomfortable Revelations About Agile and Sustainable Organizations in A VUCA World. *The Journal of Applied Behavioral Science*, 56(3), 1-5.