

# A D-VUCAD Transitioning Analysis on Romanian Higher Education System in the Context of Artificial Intelligence. Challenges, Opportunities and Perspectives

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**Abstract.** *The significant global transformations in recent years have led to widespread disruption across numerous facets of society. Events such as the COVID-19 pandemic and other concurrent realities have had a tremendous impact on the global order, resulting in profound effects across various crucial dimensions in a D-VUCAD context.*

*Relevant studies highlight the fact that technology has redefined global higher education offering personalized learning but raising ethical concerns. Leadership must adapt to digital disruptions while addressing conflicts between traditional and modern approaches. In this context, the education system is rapidly changing due to technology and societal shifts, posing complex challenges for leaders. Enrollment fluctuations and workforce demands add to the volatility, requiring flexible responses. Furthermore, at EU level, European initiatives aim to improve education, but face practical hurdles in diverse contexts. Despite research common efforts, there's a need to bridge educational insights with real-world applications, navigating from uncertainty to clarity in an evolving digital era.*

*This paper aims to provide through the case study method, an original and unique D-VUCAD analysis on Romanian higher education system in the context of artificial intelligence to understand, on one hand, the realities, and the challenges it faces and on the other hand, to adapt the educational system to the new matrix, transitioning from old dimensions to the new ones: volatility to vision, uncertainty to unity, complexity to clarity, ambiguity to alignment, disruption to digitalization. While the first part of the case study identifies and illustrates with concrete examples and numbers the challenges Romanian higher education system is facing with, the second section of the research analyze the transition from traditional environment to the reinvented one, adding concrete initiatives, programs, and projects as examples to enrich the understanding of these manifests in the realm of higher leadership education perspectives.*

*Paper findings show that multiple initiatives and endeavors are ongoing to modernize the vocational education and training (VET) system, reforms and investments backed by the RRF are geared towards reducing the school dropout rates, enhancing the population's digital skills and creating lifelong learning opportunities. However, ensuring high-quality, skills-oriented education and alignment with the labor market, policy coordination, efficient legislative initiatives and a comprehensive strategic framework delineating the vision and targets for education remain significant challenges.*

**Keywords:** Higher education, D-VUCAD environment, digitization & AI, competences, and lifelong learning

## Introduction

The massive global changes from last years have caused extensive disruption across various aspects of society. The COVID-19 pandemic, the war in Ukraine, the energy crisis, and other contemporaneous realities have exerted a monumental influence on the global order, precipitating profound effects across a multitude of critical dimensions such as technological, socio-economic, political, environmental, cultural, and psychological (Bruns et al., 2020).

In this context, higher education in the digital era faces significant challenges and opportunities characterized by disruption, volatility, uncertainty, complexity, ambiguity, and diversity (D-VUCAD matrix). Navigating these dynamics requires innovative strategies, adaptive leadership, and a commitment to addressing the evolving needs of students and society. The question would be how we can adapt to a continuously changing environment, in order overcome current educational challenges and align with the European or even global vectors, targets and goals?

Withing this framework, this paper aims to provide through the case study, an original and unique D-VUCAD analysis on Romanian higher education system in the context of artificial intelligence to understand, on one hand, the realities, and the challenges it faces and on the other hand, to adapt the educational system to the new D-VUCAD matrix transitioning from old dimensions to the new ones: volatility to vision, uncertainty to unity, complexity to clarity, ambiguity to alignment, disruption to digitalization. through concrete actions, strategies and good practices.

## **Literature review**

We find ourselves immersed in a world that is becoming progressively transformed and the educational system is not immune to these challenges, especially in the post-COVID era (Rogayan and Dantic, 2021). It is evident that many leaders are not primarily burdened by workload, but rather by the task of navigating and comprehending their evolving work environments, which are becoming increasingly intricate. For some authors, the complexity of these environments exceeds their capacity to manage effectively (Petrie, 2015).

In another order of ideas, technological revolution has fundamentally reshaped global higher education, fostering a worldwide interconnectedness that has redefined socio-economic, educational, and cultural paradigms (Siu and Garcia, 2017). But even so, major problems have been identified over the years and through numerous studies in curriculum implementation and sustainability, resources allocation and educational infrastructure, functional leadership, training, and continuous learning in AI environment (Rafael et.al., 2020). Consequently, addressing institutional challenges may enable them to confront the current D-VUCAD environment instabilities affecting higher education institutions (ThankGod, 2021).

Traditional leadership education models have been disrupted by online learning platforms offering courses and certifications in leadership skills. Universities offering executive education programs face competition from online platforms like Coursera, edX, and LinkedIn Learning, which provide convenient and accessible options for leadership development.

We can also notice that changes in workforce demands, and economic conditions have brought volatility in enrollment patterns for educational programs. Institutions offering educational programs may experience fluctuations in demand requiring agile responses to adapt curriculum offerings and delivery modes, according to some authors (Steward et al., 2016).

In another vein, there is some uncertainty regarding the future role of AI in education. While AI offers opportunities for personalized learning experiences and data-driven insights into professional development, questions arise about its ethical implications, impact on interpersonal skills development, and potential biases in AI-driven decision-making tools used in educational programs (Lam and Kare, 2016).

When talking about changes, leadership seems to be an important vector. Johansen considers it can be perceived as a process in which an individual or a group influences a collective to attain a shared objective (Johansen, 2012). In addition to that, it entails the articulation of a shared vision for change, which is collaboratively shaped and endorsed (Mincu, 2022).

In this context, school and university leadership can be seen as a process in which leaders influence teachers, other professionals, and students to fulfill the educational objectives, that holds significance as it fosters an environment conducive to effective teaching and learning (ETUCE, 2012).

Additionally, research conducted by Kornelsen in 2019 indicates that contemporary workplaces are confronting a leadership dilemma characterized by conflicts between senior organizational leaders and the millennial generation in the context of global digitization (Kornelsen, 2019).

According to the 2019 report from the McKinsey Global Institute, automation is anticipated to lead to the elimination of 800 million jobs by 2030, with many other professions undergoing varying degrees of transformation. The World Economic Forum further forecasts that by 2025, 85 million jobs will be assumed by robots, while 97 million positions will emerge through collaborative efforts among humans, robots, and algorithms (Masterson, 2022).

Furthermore, the 2023 Future of Jobs report by the World Economic Forum suggests that half of the workforce will necessitate retraining to acquire the essential skills required for future employment:

- Analytical thinking
- Creative thinking
- AI and big data
- Leadership and social influence
- Resilience, flexibility and agility
- Curiosity and lifelong learning
- Technological literacy
- Design and user experience
- Motivation and self-awareness
- Empathy and active listening

According to Eurostat data, in 2022, over 40% of individuals aged 25-34 in the EU had attained tertiary education completion.

At European level, the strategic framework of the European Education Area advocates for cooperation among European Union Member States and relevant stakeholders, facilitating the monitoring of progress toward realizing their shared vision (European Commission, 2021). By 2030, the initiative targets include (The Council of the European Union, 2021):

- The proportion of 25-34-year-olds with tertiary educational attainment should reach a minimum of 45%.
- At least 47% of individuals aged 25-64 should have engaged in adult learning within the preceding 12 months.

Collectively, all these studies highlight the evolving landscape of education, influenced by technological advancements and shifting societal paradigms, presents leaders with unprecedented challenges, who must navigate increasingly intricate work environments, where traditional models of leadership education are disrupted by online platforms offering convenient alternatives for skill development. Moreover, fluctuations in educational environment and workforce demands introduce volatility in enrolment patterns for educational programs, necessitating agile responses from institutions, as the realities from educational system like high dropout rates, socio-economic disparities, limited participation, lack of support, inequities and others are still present.

Looking ahead, while initiatives at the European level aim to promote cooperation and advance educational outcomes, there are practical challenges in implementing these policies across

diverse cultural, social, and economic contexts. Achieving targets related to tertiary educational attainment and adult learning participation requires coordinated efforts and investment in educational infrastructure and resources.

AI holds promise for personalized learning and data-driven insights, concerns about its ethical implications and impact on interpersonal skills persist. Leadership, in this context, plays a pivotal role in shaping educational outcomes and addressing contemporary educational dilemmas.

However, despite all this research, there is still a need to explore the topic and apply it to our contemporary realities, in a new dimension which involves a complex transition from present to future perspective, from Volatility to Vision, Uncertainty to Unity, Complexity to Clarity, Ambiguity to Alignment and finally, Disruption to Digitalization in a reinterpreted environment.

## **Methodology**

Qualitative research methodology was used in this study, namely case study approach and document analysis.

Document analysis involves systematically reviewing various document types to extract relevant information and identify recurring themes across texts. This method is crucial for delving deeper into the broader context of this study. Through extensive document scrutiny, the research established a robust foundation in existing knowledge while uncovering consistent perspectives.

Meanwhile, the case study method allowed for an in-depth exploration of a specific real-world scenario. Focused on the educational challenges for competence-oriented higher education in the context of the development of artificial intelligence systems and digital education transformation, this research study examines current realities and the possibility for changes in a new, updated, and reinvented D-VUCAD matrix through an original analysis of Romanian higher education system in the context of artificial intelligence.

Given the objectives of this paper, the chosen research methodologies and approaches are well-suited for the paper's purpose, with limitations regarding its subjective style, risk of bias and further applications.

## **Results and discussions**

### ***A traditional D-VUCAD analysis on Romanian higher education system in the context of artificial intelligence and the related challenges***

The educational system in Romania has been impacted by the changes generated by the COVID-19 pandemic, which accelerated the transition from in-person to online or hybrid education formats.

However, this transition from traditional education models to alternative systems has been accompanied by problems and challenges, which we will identify in the following through a traditional D-VUCAD analysis on Romanian higher education system in the context of artificial intelligence and the challenges it faces. Each of the 6 dimensions (disruption, volatility, uncertainty, complexity, ambiguity, and diversity) was particularly explained, illustrated, and framed within the Romanian high education context, pointing out the related obstacles and barriers, as we can see in the author's table below.

**Table 1. A D-VUCAD analysis on Romanian higher education system in the context of artificial intelligence and the challenges it faces**

| Dimension          | Context                                                                                                                                                                                                                                                                                                                                      | Romanian Education System's realities and challenges                                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Disruption</b>  | Traditional higher education models disrupted by digital technologies, online learning platforms, and alternative credentialing systems. Acceleration of online learning due to COVID-19, challenging traditional instruction and campus-based education.                                                                                    | Educational obstacles during COVID-19 pandemic in the context of AI systems orientation.                                                                                                              |
| <b>Volatility</b>  | Rapid changes in student demographics, funding sources, and geopolitical dynamics contribute to unpredictable shifts in enrollment patterns and financial sustainability. Technological advancements and evolving student preferences also contribute to volatility in the higher education landscape.                                       | Low tertiary education attainment rate among young people high dropout rates, socio-economic disparities, limited participation, migration.                                                           |
| <b>Uncertainty</b> | Prevailing uncertainty regarding the long-term impact of digitalization on education quality, student engagement, and learning outcomes. Economic uncertainties, including rising tuition costs and fluctuating funding sources, add to the uncertainty surrounding higher education.                                                        | Significant challenges in digital skill proficiency among its population, with a substantial portion lacking basic and advanced digital competencies, especially among young people aged 16-24.       |
| <b>Complexity</b>  | Higher education institutions must navigate complex regulatory environments, accreditation standards, and compliance requirements amid digital transformation. Balancing diverse stakeholder needs and expectations, including students, faculty, administrators, employers, and policymakers, adds complexity to decision-making processes. | Low utilization of work-based learning opportunities and low employment rate among Vocational Education and Training (VET) graduates; mismatches between VET training and labour market demands.      |
| <b>Ambiguity</b>   | Ongoing debates and research in educational pedagogy regarding the effectiveness of online learning methodologies compared to traditional instruction. Ambiguity surrounding institutional priorities and educational outcomes in preparing students for a digital and globalized workforce.                                                 | Romania ranks poorly compared to other EU countries in terms of participation rate in education and training among individuals aged 25-64.                                                            |
| <b>Diversity</b>   | Higher education institutions serve diverse student populations, necessitating inclusive and culturally responsive teaching and support services. Digitalization offers opportunities to expand access to higher education for underserved communities while highlighting disparities in digital infrastructure and technological literacy.  | Persistent inequalities in higher education access across socio-economic groups, disparities in educational quality and language barriers; inequitable opportunities in Romania's educational system. |

Source: Author's own analysis.

➤ **Disruption:**

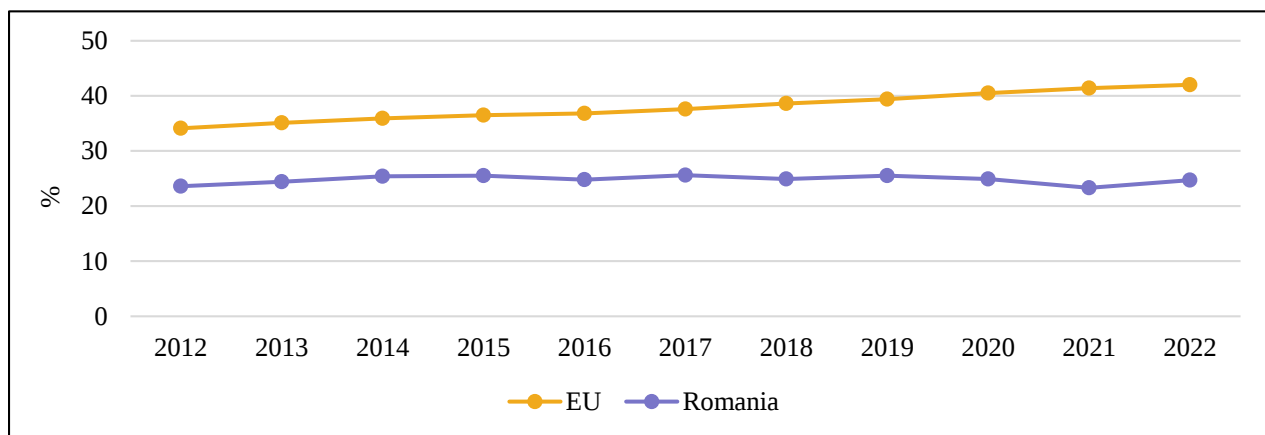
A survey conducted among students during the period of remote learning sheds light on students' satisfaction regarding the quality of higher education and the repercussions of the COVID-19 pandemic (UEFICS DI, 2022a). The results indicate that most of respondents felt universities effectively addressed pandemic-induced challenges. Nonetheless, over a quarter of Bachelor students faced educational obstacles due to inadequate devices and poor internet connections. While access to educational resources notably improved, further investments are deemed necessary. In another order of ideas, approximately 60% of respondents affirmed that their

university provides conducive conditions for personal growth, with a similar proportion feeling a sense of belonging to the university community and acknowledging the impact of students' assessments on teaching staff (UEFICS DI, 2022b). Although more than 64% of Bachelor students consider their study subjects relevant for professional development, slightly less than half expressed satisfaction with their level of active involvement in class and the effectiveness of teaching techniques in facilitating the learning process ((UEFICS DI, 2022c).

➤ **Volatility:**

According to Eurostat data, Romania's tertiary educational attainment rate is below the EU average of 40%, with only 24.7% of individuals aged 25-34 holding tertiary education degrees in 2022 (Council of the European Union, 2023). In the last decade, this indicator has varied from 23% in 2012 to 26% in 2017, registering a slight decrease during the pandemic to 23 percentage points, as indicated in the figure below (Eurostat, 2023). Factors contributing to these low results include high dropout rates due to inequality of opportunity, socio-economic limitations, low participation in higher education and partially, emigration. These trends underscore the significant challenges facing Romania's higher education system and the need for targeted interventions to improve access and completion rates.

**Figure 1. Tertiary education attainment rate (age 25-34), 2012-2022**



Source: Eurostat, LFS, [edat\_lfse\_03].

➤ **Uncertainty:**

A study conducted by BRIO & Uipath Foundation in 2023 reveals that only 50% of persons aged 16-19 possess basic digital skills, contrasting with the EU average of 69%. Conversely, just 10% of Romanians exhibit advanced digital skills (compared to the EU average of 33%), with 43% having low proficiency (versus the EU average of 28%). Moreover, 56% of young people aged 16-24 possess basic digital competencies, compared to the EU average of 80% (BRIO and Uipath Foundation, 2023).

➤ **Complexity:**

While over half of Romania's upper secondary education students are enrolled in vocational programs (61.7% in 2021), surpassing the EU average (52.1%), the proportion of recent VET (Vocational Education and Training) graduates benefiting from work-based learning remains below 10% (8.4% in 2022), the lowest rate in the EU (60.1% at the EU level), according to EACEA dates

(EACEA, 2023). Moreover, the diminishing employment rate of recent VET graduates (57.7% compared to 79.7% in the EU in 2022) further underscores the mismatch with labor market demands.

➤ **Ambiguity:**

In Romania, the percentage of individuals aged 25-64 engaging in education and training rose from 1.0% in 2020 to 5.4% in 2022, though it remains notably lower than the EU average of 11.9% (OECD, 2023). As per the European Skills Index, Romania ranks poorly among EU nations in terms of skills development and activation. Less than a third of the adult population possess basic or advanced digital skills, in contrast to the EU average of 54%. Furthermore, labour shortages persist across various sectors of the economy, including critical occupations relevant to the green transition such as construction workers.

➤ **Diversity:**

Despite improvements, access to higher education in Romania remains unequal across socio-economic groups, rural and urban areas, and minority communities. Certain demographic groups, including Roma students and individuals from marginalized communities, continue to be underrepresented in higher education. Moreover, disparities in the quality of education and resources among institutions affect the academic experience and outcomes for students from diverse backgrounds. Besides that, language barriers, particularly for minority groups pose challenges for accessing higher education opportunities conducted in Romanian. (Euridice, 2022).

***A reinterpreted D-VUCAD analysis on Romanian higher education system in the context of artificial intelligence and the related challenges***

After describing in the first part of this study the Romanian higher educational system in the traditional D-VUCAD environment, identifying the current realities supported by statistics and numbers and analyzing the challenges that impact this educational framework, the second section of the research brings to our attention an original approach, focusing on analyzing how Romania and its education system transition from Volatility to Vision, Uncertainty to Unity, Complexity to Clarity, Ambiguity to Alignment and Disruption to Digitalization. These new dimensions open different horizons for analysis, aligning us with future perspectives.

Adding concrete initiatives, programs, or projects as examples would further enrich the understanding of how these manifests in the realm of higher leadership education.

**Table 2. A D-VUCAD reinterpreted and updated analysis on Romanian higher education system in the context of artificial intelligence, transition to the new vectors and good practices implementation**

| Transitioning to New Dimension | Vector Description                                                                                                        | Strategies and Good Practices                                                                                                                                                                                      |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Volatility to Vision</b>    | Establish national plan in Education Initiative with clear objectives, funding mechanisms, and implementation strategies. | Romania is focusing on increasing access to higher education for vulnerable students and improving retention rates.                                                                                                |
| <b>Uncertainty to Unity</b>    | Foster industry-academia partnerships; joint research projects, internship programs, and curriculum development.          | The updated legislative framework in higher education is designed to enhance the relevance to the labour market, improve quality standards, and promote internationalization efforts by organizing the dual route. |

| Transitioning to New Dimension      | Vector Description                                                                                                          | Strategies and Good Practices                                                                                                                                                        |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Complexity to Clarity</b>        | Provide professional development; workshops, online courses, resource libraries for AI literacy and skills.                 | Efforts are ongoing to modernize the vocational education and training (VET) system.                                                                                                 |
| <b>Ambiguity to Alignment</b>       | Establish AI Ethics Committee; review policies, address ethical dilemmas in research and teaching.                          | Romania aims to refine lifelong learning legislation and enhance adult education initiatives, supported by EU funds, though facing challenges in policy coordination and governance. |
| <b>Disruption to Digitalization</b> | Implement AI-powered learning management systems, adaptive platforms, virtual laboratories to enhance learning experiences. | Reforms and investments backed by the RRF are geared towards enhancing the digital skills of teachers and students while bolstering digital education initiatives.                   |

Source: Author's own work.

### ➤ Transitioning from Volatility to Vision

The new higher education law introduces a national program to reduce university drop-out rates and enhance equity, that includes actions such as supporting the transition process to higher education, establishing counseling and orientation centers, and offering second chances to drop-outs (UEFISCDI, 2022d). Special places are reserved for Roma students, high-school graduates from rural areas, children under the social protection system, and students with disabilities (UEFISCDI, 2021). Furthermore, a minimum scholarship amount has been established, corresponding to 10% of the gross minimum wage, while students in science, technology, engineering, and mathematics (STEM) fields have a higher threshold of 33% (European Commission, 2023). Additionally, investments funded by the Recovery and Resilience Funds (RRF) from Romanian Recovery and Resilience Plan (PNRR) are currently in progress to upgrade and enlarge recreational areas, canteens, and student dormitories, ensuring that a minimum of 40% of spaces are allocated for students from underprivileged backgrounds (Romanian Government, 2022).

### ➤ Transitioning Uncertainty to Unity

The updated higher education law introduces several key actions aimed at enhancing academic standards and promoting internationalization. Among these is the continuation of the recently implemented option of dual education within universities, fostering partnerships with companies, short-cycle university programs and double specialization programs to broaden students' academic opportunities. Moreover, the legislation includes a national initiative to bolster the study of STEM subjects, reinforcing the importance of these fields in the educational landscape (STEAMonEDU, 2021). Strengthened regulations mandate the alignment of curricula with qualifications and make ethics and academic integrity courses compulsory, underscoring the commitment to fostering ethical behavior and scholarly rigor (Mirea et al., 2021). Furthermore, to facilitate internationalization efforts, the national 'Study in Romania' program was established and the development of joint-degree programs with universities within the European Higher Education Area (Romanian Government, 2023).

➤ **Transitioning to Complexity to Clarity**

Romania has devised an extensive national implementation strategy in line with the 2020 Council Recommendation on Vocational Education and Training (VET) and the Osnabrück Declaration, directing efforts toward VET modernization (Cedefop, 2019). A skill forecasting mechanism, crucial for aligning VET provision with economic needs, is being developed through the ESF-funded ReConnect project and is slated to be operational in early 2024 (Cedefop, 2019a).

➤ **Transitioning to Ambiguity to Alignment**

Romania endeavors to enhance its legislative framework for lifelong learning, aiming for improved regulations regarding the certification of learning outcomes from non-formal, informal education, and micro-credentials. Under the ESF+ 2021-2027 programs, the EU is committed to assisting Romania in upskilling its populace, emphasizing equitable digital and ecological transitions (European Commission, 2022). Supported initiatives include refining quality assurance in adult vocational training (EUR 12 million), establishing adult career guidance systems (EUR 45 million), implementing the national second chance program for upper secondary school students, piloting individual learning accounts, and reskilling over 32,000 individuals impacted by the transition to a climate-neutral economy.

In addition to that, from 2025, Romania mandates a newly established teacher competence framework to steer teacher education, career progression, and certification, emphasizing on-the-job competency evaluation through personal portfolios (OECD, 2020).

➤ **Transitioning Disruption to Digitalization**

In order to advance the proficiency of educators in digital skills, Romania has incorporated the European Framework for the Digital Competence of Educators (DigComEdu) into its national legislation (Punie and Redecker, 2017). With the backing of the RRF, most of the teachers across the country are slated to undergo training in digital pedagogy. Additionally, Romania is actively implementing the installation of digital equipment and smart labs in schools that have not received such investments over the past decade. In parallel, digitalization grants have been disbursed to 61 universities in higher education (Dumitrescu, 2023). These grants are intended to enhance digital infrastructure, elevate the digital competencies of both academic staff and students, and facilitate the revision of curricular frameworks.

## Conclusion

Amid the COVID-19 pandemic, the reality was swiftly adjusted to school closures, transitioning to remote and blended teaching methods to ensure continued effective learning. In this context, policymakers, school leaders, educators, including teachers, trainers and even young people have a pivotal position in delivering high-quality education.

The involvement and commitment of all these stakeholders are imperative for the success of any educational reform. They are instrumental in nurturing and implementing innovative curricula and teaching methodologies that equip learners with the essential competencies required to thrive in Europe's sustainable digital economy of tomorrow.

However, as illustrated in the case study, the shortages regarding Romanian educational system and the related trials are still vehemently present. Significant challenges such as low tertiary education attainment rate among young people, high dropout rates, socio-economic disparities, lack of basic and advanced digital competencies, low utilization of work-based learning opportunities and low employment rate among young generation, consequently followed by mismatches between VET

training and labour market demands highlight the gaps and the incoherences between current infrastructure and the educational development in a new D-VUCAD environment.

The presented qualitative research also has some limitations such the limited scope of this specific Romanian real-world scenario, which may not be applicable to other domains or aspects of artificial intelligence. In addition, the findings of this case study may not be easily generalizable to other contexts or populations, limiting their broader applicability. Moreover, there might be a risk of bias inherent in both the case study approach and document analysis, possibly influenced by the researcher's assumptions.

Romania ranks poorly compared to other EU countries in terms of participation rate in education and training among individuals aged 25-64, posing a significant risk to the provision of high-quality, inclusive, and innovative education. In addition, socio-economic status notably influences student achievement, constraining education's potential as an equalizer of opportunities. Considering the educational impact of COVID-19, the transition to remote learning poses a risk of exacerbating pre-existing inequalities.

Addressing this challenge requires the revaluation of current policies, implementation of new effective legislative frameworks, commitment of funds and best practices to support the acquirement of new skills adjusted to the labour market and lifelong learning.

While participation in adult learning in Romania and access to educational resources shows signs of improvement, additional measures are required to tackle significant skills shortages and mismatches, particularly considering the green and digital transition.

Continuous support for young people, students and educators throughout their careers is essential to enhance their competencies, alongside opportunities for collaboration and knowledge exchange with peers through cross-border projects and networks.

Endeavors are ongoing to modernize the vocational education and training (VET) system, reforms and investments backed by the RRF are geared towards enhancing the population's digital skills.

Despite numerous initiatives, there remains a necessity to enhance the digital proficiency of educators, instructors, and learners while also enhancing schools with appropriate digital resources. In the light of the foregoing, ensuring quality and alignment with the labor market, policy coordination and governance due to fragmented responsibilities across ministries and the need of a comprehensive strategic framework delineating the vision, policy responses, and targets for education remain significant challenges, which may be subject to further research and can be explored by the author in the following.

## References

- BRIO and Uipath Foundation (2023). Predictors of the digital literacy level of Romanian students report. <https://uipathfoundation.com/wp-content/uploads/2023/02/State-of-the-Nation-2-Alfabetizarea-Digitala-in-Romania-20230222-EN.docx.pdf>
- Bruns, D. P., Kraguljac, N. V., & Bruns, T. R. (2020). COVID-19: facts, cultural considerations, and risk of stigmatization. *Journal of Transcultural Nursing*, 31(4), 326-332. <https://doi.org/10.1177/1043659620917724>
- Cedefop (2019). Vocational education and training in Romania: short description. Luxembourg: Publications Office. <http://data.europa.eu/doi/10.2801/256780>
- Cedefop (2019). Vocational education and training in Europe. <https://www.cedefop.europa.eu/en/tools/vet-in-europe/systems/romania-2019>

- Comisia Europeană/EACEA/Eurydice, 2022. Către echitate și incluziune în învățământul superior din Europa. Raport Eurydice. Luxemburg: Oficiul pentru Publicații al Uniunii Europene.
- Council Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond (2021-2030) 2021/C 66/01 (OJ C, C/66, 26.02.2021, p. 1, CELEX: [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021G0226\(01\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021G0226(01))).
- Council of the European Union (2023), COUNCIL RECOMMENDATION on the 2023 National Reform Programme of Romania and delivering a Council opinion on the 2023 Convergence Programme of Romania <https://data.consilium.europa.eu/doc/document/ST-9849-2023-REV-1/en/pdf>.
- Dumitrescu, R. (2023). Tech company sets up first PNRR-funded SmartLab in western Romania. Romania Insider, Bucharest, 2023, <https://www.romania-insider.com/tech-company-sets-first-pnrr-funded-smartlab-oradea>.
- EACEA (2023). Eurydice. Romanian national reforms in vocational education and training and adult learning. <https://eurydice.eacea.ec.europa.eu/national-education-systems/romania/national-reforms-vocational-education-and-training-and-adult>
- ETUCE (2012). School Leadership Survey: School Leadership in Europe: issues, challenges and opportunities <https://www.csee-etuce.org/images/attachments/SchoolLeadershipsurveyEN.pdf>
- European Commission (2021). Strategic framework. European Education Area. (n.d.). <https://education.ec.europa.eu/about-eea/strategic-framework>
- European Commission (2022). European Social Funds. <https://european-social-fund-plus.ec.europa.eu/en/news/romania-partnership-2021-2027-adopted>
- European Commission (2023). Romania's recovery and resilience plan. [https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/romania-s-recovery-and-resilience-plan\\_en](https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/romania-s-recovery-and-resilience-plan_en).
- European Parliament (2021). Education and youth in post-COVID-19 Europe – crisis effects and policy recommendations. [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.europarl.europa.eu/RegData/etudes/STUD/2021/690872/IPOL\\_STU\(2021\)690872\\_EN.pdf](chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.europarl.europa.eu/RegData/etudes/STUD/2021/690872/IPOL_STU(2021)690872_EN.pdf)
- Eurostat (2023). "Education Attainment Statistics" EducationData.org, October 15, 2023, <https://educationdata.org/education-attainment-statistics>
- Johansen R. (2012). Leaders make the future : ten new leadership skills for an uncertain world (2<sup>nd</sup> ed. rev.expanded). Berrett-Koehler.
- Lam, H., Khare, A. (2016). Addressing Volatility, Uncertainty, Complexity & Ambiguity (VUCA) Through Insourcing and Backshoring. In: Mack, O., Khare, A., Krämer, A., Burgartz, T. (eds) Managing in a VUCA World. Springer, Cham. [https://doi.org/10.1007/978-3-319-16889-0\\_9.x](https://doi.org/10.1007/978-3-319-16889-0_9.x)
- Kornelsen, J. (2019). The quest to lead (with) millennials in a VUCA-world: bridging the gap between generations. In: Kok J., van den Heuvel S. (eds) Leading in a VUCA World. Contributions to Management Science. Springer, Cham. [https://doi.org/10.1007/978-3-319-98884-9\\_2](https://doi.org/10.1007/978-3-319-98884-9_2).
- Masterson, V. (2022). From medicine drones to coral cleaners: 3 'jobs of the future' that are already here. World Economic Forum, [online] Available at: <https://www.weforum.org/agenda/2022/05/robots-help-humans-future-jobs/> [Accessed 5 February 2024].

- Mincu M. (2022). Why is school leadership key to transforming education? Structural and cultural assumptions for quality education in diverse contexts. *Prospects* (Paris). 2022;52(3-4):231-242. doi: 10.1007/s11125-022-09625-6. Epub 2022 Oct 31. PMID: 36339494; PMCID: PMC9628287.
- Ministerul Investițiilor și Proiectelor Europene (2022). PLANUL NAȚIONAL DE REDRESARE ȘI REZILIENȚĂ (PNRR). <https://mfe.gov.ro/pnrr/>
- Mirea, N., Robescu, D. F., FlorinBogdea, C., & Carutasu, G. (2021). Facts and Figures about STEM Education in Romania. *Managment Knowledge Learning International Conference*, 96.<https://www.toknowpress.net/ISBN/978-961-6914-27-7.pdf>.
- OECD (2020), Improving the teaching profession in Romania [https://www.oecd-ilibrary.org/education/improving-the-teaching-profession-in-romania\\_3b23e2c9-en](https://www.oecd-ilibrary.org/education/improving-the-teaching-profession-in-romania_3b23e2c9-en)
- OECD (2023). Education at a Glance. Key indicators. <https://www.oecd-ilibrary.org/deliver/e13bef63-en.pdf?itemId=/content/publication/e13bef63-en&mimeType=pdf>
- Petrie, N. (2015). Vertical leadership development–Part 1 Developing leaders for a complex world. Center for Creative Leadership. Retrieved from <https://www.ccl.org/wpcontent/uploads/2015/04/VerticalLeadersPart1.pdf>.
- Punie, Y., editor(s), Redecker, C., European Framework for the Digital Competence of Educators: DigCompEdu , EUR 28775 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73718-3 (print),978-92-79-73494-6 (pdf), doi:10.2760/178382 (print),10.2760/159770 (online), JRC107466.
- Rafael, V. F., Rafael, E. L., Villaruz, G. B., Cuyugan, V. P. (2020). Business Process Reengineering in a Volatility, Uncertainty, Complexity, Ambiguity, and Disruptive (VUCAD) Landscape. *International Journal of Recent Technology and Engineering (IJRTE)* ISSN: 2277-3878, Volume-8 Issue-5, January 2020. <https://doi.org/10.35940/ijrte.E4561.018520>
- Rogayan Jr., D. V., & Dantic, M. J. P. (2021). Backliners: Roles of Science Educators in the Post-COVID Milieu. *Aquademia*, 5(2), ep21010. <https://doi.org/10.21601/aquademia/11053>
- Romanian Government (2023). Study in Romania Program. <https://studyinromania.gov.ro/>
- Siu, K. W. M., & García, G. J. C. (2017). Disruptive technologies and education: Is there any disruption after all?. In *Educational leadership and administration: Concepts, methodologies, tools, and applications* (pp. 745-780), PA: IGI Global.
- STEAMonEDU (2021). STE(A)M educational practices in Romania. <https://steamonedu.eu/news/steam-educational-practices-in-romania/>
- Stewart, B., Khare, A., and Schatz, R. (2016). “Volatility, uncertainty, complexity and ambiguity in higher education” in *Managing in a VUCA world*. eds. O. Mack, A. Khare, A. Krämer and T. Burgartz (Cham: Springer International Publishing), 241–250.- [https://doi.org/10.1007/978-3-319-16889-0\\_16](https://doi.org/10.1007/978-3-319-16889-0_16)
- Thankgod A.M. (2021). Leadership Competencies for the Volatile, Uncertain, Complex and Ambiguous (Vuca) Environment: Challenges to Higher Education. *European Journal of Humanities and Educational Advancements*, vol. 2, no. 5, 2021, pp. 119-138, doi:10.17605/OSF.IO/DAC3Q.
- UEFISCDI (2021), Accesul în învățământul superior: o analiză cantitativă, Analiză a tranziției generației școlare 2017/2018 în primul an universitar 2018/2019. <https://uefiscdi.gov.ro/Publicatii-1>.
- UEFISCDI (2022a), Cadru de politică publică privind îmbunătățirea accesului, a participării și a absolvirii în învățământul superior din România. <https://uefiscdi.gov.ro/Publicatii-1>.

- UEFISCDI (2022b), Studiu privind angajabilitatea absolvenților de învățământ superior din România. <https://uefiscdi.gov.ro/Publicatii-1>.
- UEFISCDI (2022c), Studiu privind gradul de satisfacție a studenților cu privire la calitatea învățământului superior (2019-2020). <https://uefiscdi.gov.ro/Publicatii-1>.
- UEFISCDI (2022d), Abandonul în învățământul superior românesc. <https://uefiscdi.gov.ro/Publicatii-1>.
- World Economic Forum, (2023). Future of Jobs Report 2023, [online] Available at: [https://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2023.pdf](https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf).