Multidisciplinary Sciences, Volume 16. (2026) No. 4, pp. 32–40. *https://doi.org/10.35925/j.multi.2026.4.3*

UNIVERSITIES AS LIGHTHOUSES IN THE AGE OF CHAOS: THE IMPORTANCE OF HUMAN-CENTRED SUSTAINABILITY

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Abstract. Universities in the regions rarely have to deal with pressures as intense and multidirectional as today. This situation makes it more difficult to find out what new strategies and tools are suitable to respond to this challenge and serve for this purpose. This paper attempts to answer this question through a qualitative case study of the University of Miskolc, Hungary, and its DigitALL project. The DigitALL project (RRF-2.1.2-21-2022-00001) is a digital transformation initiative funded by the EU's Recovery and Resilience Facility at approximately HUF 3.44 billion. Relying on the document analysis of the university's 2025–2030 institutional strategy and project documentation, this article demonstrates how the financial investment expressed itself practically. It took the form of curriculum renewal through ESCO-based labor market analysis, a structural shift towards cooperative project-based learning, predictive student analytics achieving 85-95% accuracy, and the deployment of nearly 2,800 digital devices. These results are discussed in the context of literature on human-centered sustainability, the third mission activity of regional universities, and EU recovery instruments. This article reframes the lighthouse metaphor and argues that regional universities are able to provide their wider neighborhood with an orientation and stabilization function that extends well beyond conventional institutional performance when institutional strategy, EU policy alignment, and human-centered digital innovation mutually reinforce one another – as in this case.

Keywords: human-centred sustainability, digital transformation, future-proof education and research, SDG 4 (Quality Education), regional university, cooperative learning.

1. Introduction

The present period is usually termed a global polycrisis. Morin and Kern [1] first used the phrase, and it was later defined by Lawrence et al. [2, p. 2] as "the causal entanglement of crises in multiple global systems in ways that significantly degrade humanity's prospects." Within this landscape of converging challenges, universities occupy a special place as knowledge and research generating institution, citizen educating organization, and long-term institutional memory preserving entity [3].

This paper argues that universities should be seen as lighthouses, providing orientation, warning, and illumination for the communities navigating turbulent times around them. The metaphor of agency and embeddedness is strongly emphasized. Similar to coastal lighthouses, regional universities gain significance through their specific geographic and social embedding; it is in this sense that makes them irreplaceable instead of just useful. The case is analyzed of the University of Miskolc, a regional university in north-eastern Hungary, that has adopted "human-centered sustainability" as the guiding principle of its institutional strategy for 2025-2030 [4]. This term refers to concerns beyond environmental ones, including economic viability, social

responsibility, digital inclusion, green energy and the well-being of people at the center of institutional processes. The empirical focus is the DigitALL project (RRF-2.1.2-21-2022-00001), financed through the EU's Recovery and Resilience Facility with a budget of approximately HUF 3.44 billion at 100% EU support intensity [5]. Including digital infrastructure, curriculum renewal, cooperative learning methodologies, and AI-based student analytics, this project showcases how EU-level policy instruments can lead to real institutional transformation rather than just funded activity.

The importance of the case-study program goes far beyond the Hungarian context. The RRF, set up by Regulation (EU) 2021/241, allocated about EUR 723 billion for recovery after the pandemic, with Hungary providing 29.8% of its national plan for digital transition, including the digitalization of higher education [6]. The University of Miskolc is situated in Northern Hungary, one of the EU's less developed regions, which has been hit by the earlier decline of heavy industry and has below-average GDP per capita. This is the context that is used to make the point. A lighthouse is most needed where the waters are most difficult to navigate; the capacity of the university to educate, do research, innovate, and keep talent has ramifications for the region that go far beyond its own institutional boundaries.

2. Literature review

Clearly understanding what it means for a university to navigate polycrisis requires engaging with several bodies of literature that rarely interact directly. This review brings them into dialogue. Lawrence et al. [2] provide the most rigorous peer-reviewed account of polycrisis, identifying cascading effects, feedback loops, and tipping points as the causal mechanisms, which distinguish it from crises that merely coincide. For higher education, the condition is paradox: the disruptions constituting the polycrisis make universities' core missions more necessary, while simultaneously threatening their capacity to deliver them [7]. The VUCA framework - volatility, uncertainty, complexity, ambiguity - offers a complementary perspective at the organizational level, highlighting the institutional agility these conditions demand [8].

The sustainability literature has moved well beyond environmental management. The whole-institution approach [9, 10] insists that sustainability must be integrated across all institutional functions, rather than delegated to specialist units. This is extended through a human-centered model grounded in the Society 5.0 paradigm [11], placing human well-being, rather than systemic efficiency, at the center of institutional purpose. Trencher et al. [12] describe a co-creation function in which universities and communities jointly produce sustainability outcomes — a conception of the third mission that extends well beyond traditional knowledge transfer or public engagement.

Digital transformation is not an agenda separate but a site where these tensions are enacted in practice. Benavides et al. [13] established that digital transformation in higher education is genuine organizational and cultural shift, not an upgrade of equipment – a distinction with direct implications for how projects like DigitALL should be evaluated. This, Bygstad et al. [14] do through the introduction of a digital learning space, which arises not from infrastructure alone but from its interaction with educational practice. At the pedagogical level, cooperative learning is theoretically underpinned by social interdependence theory [15], while Zawacki-Richter et al. [16] provide a map of the landscape of AI applications in higher education – a field that has expanded considerably since their systematic review but which they helped establish as a legitimate area of scholarly inquiry.

The regional dimension has roots in a separate tradition. The Triple Helix model [17] proposed that interaction between university-industry-government is the engine of regional innovation. However, Thomas, Faccin, and Asheim [18] add nuance to this general rule by noting that in peripheral regions, where industry and government actors are fewer, the situation is often quite different, and the universities are left to take on an orchestrating role for which the model provides little guidance. This is in keeping with Goddard and Vallance's [19] description of the civic university, an institution that is based in and responsible for its place, rather than simply being located there. The tension between standardized metrics and the context-specific nature of third-mission work documented by Compagnucci and Spigarelli [20] is directly relevant to any assessment of what DigitALL achieved.

The EU policy environment covers both the funding architecture and much of the methodological scaffolding within which this study operates. According to the RRF [21], about EUR 723 billion was made available for the recovery after the pandemic, with at least 20% earmarked for digital transition; the plan of Hungary, which was

approved in December 2022, assigned 29.8% to this area [6]. The ESCO framework [22] and Skills-OVATE make it possible to translate EU-level labor market priorities into curricular tools; the latter is the framework of the European Commission [23] on smart specialization for aligning university activities with regional development strategy. All this is underpinned by a Hungarian governance context transformed by the "model change" that turned universities into public-interest trust foundations [24] – an institutional environment that any account of the University of Miskolc must acknowledge, even where its full implications remain contested.

3. Methodology

The study uses a qualitative single-case design according to Yin [25]. Two case characteristics need explicit mention. The DigitALL project has not been subjected to peer-reviewed analysis before, placing this as a revelatory case in Yin's terms – one that opens up a phenomenon on which there is no scholarship yet. At the same time, critical characteristics accompany the case: if the proposal holds in the genuinely hard context of a post-industrial Central European region – navigating EU recovery mechanisms and domestic governance reform at the same time – there should be good grounds to believe it would also hold under more favorable conditions elsewhere.

The research method used is document analysis [26]. The data corpus belongs to four categories: institutional strategy of the university [4], official documents of projects [5], milestone reports [27, 28], and internal project presentations covering subprojects, methodologies, and pedagogical approaches in detail. EU policy documents are used for contextual framing throughout. The study follows the path of analytical generalization rather than statistical generalization [25]. It aims to illuminate a theoretical proposition instead of making claims on the frequency of similar cases.

Three limitations deserve acknowledgment. The institutional documents of the kind analyzed here are not neutral records; they are produced by active organizations with an interest in presenting their work favorably, and that possibility inflects the evidence base throughout. The project was also ongoing at the time of writing, so some outcomes remain provisional. Most significantly, the analysis has no access to participant perspectives – no interviews with students, faculty, or regional partners who experienced the transformation from within. Those voices would not simply supplement this account; they might complicate it in ways that document analysis cannot anticipate.

4. Results

The University of Miskolc's 2025-2030 strategy, entitled "Human-Centered Sustainability", comprises four interconnected goals. At its heart lies the aspiration to provide education and research ready for the future, targeting a 130% increase in research revenue and committing to biannual curriculum renewal. The academic renewal is aimed at greater international presence, with a specific objective of 1,000 international students at the university in 2030. Organizational efficiency is the driver that supports both – a 50% reduction in administrative time so that institutional resources are redirected toward the people that the university serves. The fourth goal is not so much a goal in itself as an indicator: it represents the extent to which the other three have been realized from the perspective of students, faculty, staff, and partners – a 30% improvement in stakeholder satisfaction. The University's strategic framework is presented in Figure 1 as an interactive visualization. The four strategic goals- future-proof education and research, enhanced international visibility, organizational and process efficiency, and stakeholder satisfaction- are structured around the overarching principle of human-centered sustainability, with each goal contributing to the institution's long-term financial, social, and environmental resilience.



Figure 1. *Strategic goals of the UoM* [University of Miskolc]

The strategy makes explicit the integration of human-centered sustainability with all the goals, putting particular emphasis on human skills vis-a-vis technical competences and defining sustainability in the wider context of finance, economics, sociology, and organization.

The DigitALL project started in June 2022 for 47 months to implement the strategy through two parallel streams. The major part of the budget, HUF 2.26 billion accounting for 65.6% of the total funding, was allocated to C-activities concerning digital infrastructure and AI analytics, while D-activities on curriculum and pedagogical innovation received HUF 1.15 billion (33.3%). Smart specialization received a further HUF 36 million (1.1%). By the third milestone, not only all the quantitative targets were met but exceeded: 2,787 devices were deployed against a target of 2,757; skills development reached 10,299 participants against a target of 10,000; and smart specialization training served 705 participants against a target of 600 [27].

Curriculum renewal was the driver of the D/1 subproject, which had its foundations in the ESCO framework and Skills-OVATE for competence-level labor market analysis, supported by technology trend monitoring and direct regional employer engagement through forums organized with Borsod-Abaúj-Zemplén Chamber of Commerce (BOKIK). Methodology transfer from PricewaterhouseCoopers was provided through a three-phase decreasing-support model explicitly designed for the development of institutional self-sufficiency rather than dependency. An expert group of associate deans was trained to operate the methodology independently, ensuring that the capacity would outlast the project itself. Pedagogically, the project introduced cooperative project methodology, organizing students into heterogeneous groups of four to six. The design is based on positive interdependence: each student has an individual sub-task that he/she must do and teach his/her peers and is collectively responsible for the group's output. Crucially, the presentation format requires members to report on each other's sub-tasks rather than their own — a mechanism that makes real knowledge sharing a structural need, not just hope [15, 29]. As a result, this is an actual institutional shift from teaching-focused to a learning-focused paradigm, where soft skills go hand in hand with technical competences.

Besides these pedagogical innovations, the project applied predictive analytics on a scale hardly ever witnessed before in Hungarian higher education. Data on more than 25,000 students described by 82 attributes were used for the construction of an initial model. This model achieved approximately 85% accuracy (71.4% specificity, 90.8% sensitivity). Subsequent fine-tuning, which included short-term outcome variables like credit progression rates, pushed the accuracy to about 95% [28]. Throughout, the CLEMSTAT platform was used with explicit intentions to develop actionable early warning interventions for at-risk students — not mere statistical classifications. A

student-facing application that complemented this system took the same approach down to the individual level, supporting integration and orientation and thus exemplifying the dual character of the human-centered approach: institutional intelligence in the service of individual empowerment.

The infrastructure dimension of the project involved procuring special laboratory equipment, NMR spectrometers, hematology analyzers, and 400 notebooks and 350 desktops, and VR headsets and smart boards as well as three content creation studios to be invested deliberately in faculty capacity to produce digital content. Network infrastructure and Coursegarden LMS, the digital environment, were added later along with plagiarism detection software. The project delivered 2,947 devices against a target of 2,757 by the third milestone, thus having a 6.9% surplus.

5. Discussion

The case of the University of Miskolc provides empirical support for all dimensions of the lighthouse metaphor. The source of Orientation is explained by the systematic tuning of curricula to the requirements of the labor market, first through European frameworks and then directly to regional employers. The source of Illumination is different: the AI-based analytics infrastructure makes visible regularities that no single human actor could discern unaided and thus supports proactive intervention prior to the irremediable condition of an at-risk student. The same holds for the university's third mission activity. Warning is in a longer term, tracking potentially disruptive technology developments and their probable impact on the knowledge that graduates will actually need. These three functions are unified by embeddedness – the labor market forums with BOKIK and the corporate professionals who are integrated as guest lecturers – thus making the lighthouse visible as a local institution rather than an external authority. In an era of growing institutional weakness, the capacity to build trust, which results from guidance that is transparent and evidence-based, is a kind of public service in and of itself—perhaps even more so in peripheral regions, where the university is often the most prominent knowledge institution and one of the few sources of stability for communities that are trying to find their way through economic restructuring.

The RRF was more than just a funding stream. It facilitated the scale of institution-wide transformation that no conventional grant could have supported, all while conditioning the funds on measures that ensured results-based accountability throughout. The constant overperformance against targets – 2,787 devices against 2,757, 10,299 skills development participants against 10,000, 705 smart specialization participants against 600 – indicates not only institutional capacity but also the incentive structures that have been created through milestone-based disbursement [27]. Perhaps more important in the long run is how much EU frameworks like ESCO became part of operational methodology rather than mere reference for compliance, a type of deep Europeanization that far exceeds what the European Commission [23] calls regulatory alignment. But the focus on numbers makes the focus on quality – changes in the pedagogical culture, shifts in the faculty's conception of their role – only partial. The 47-month implementation period creates a sense of urgency but, as has been said, 'urgency has to be managed' because it could also lead to risks: the same pressure that facilitates delivery could also support a superficial uptake where real transformation is required.

What makes this case different from many initiatives of digital transformation is the consistency between sustainability and digitalization, two agendas that most institutions often separately pursue. Here, they are genuinely integrated. Cooperative methodology does not become an add-on to digitized curriculum but the pedagogical expression of human-centeredness. AI analytics do not serve institutional surveillance but support early intervention in ways that place the student, not the classification, at the center. Infrastructure diversity - NMR spectrometers and VR headsets, content creation studios and standard computing provision - reflects disciplinary responsiveness, not the imposition of uniform technological template. Of these, the investment in content creation studios should be of particular note: it equips faculty to "hold on" to their own digital content and thus the academic project, precisely at the moment of its greatest erosion by digital transition. Institutional practice of the features gives concrete operational substance to the conceptual model proposed by Pasaribu et al. [11] and demonstrates the co-creation function that Trencher et al. [12] articulate at a theoretical level.

These threads do not resolve into a neat set of recommendations but do point in a clear direction. Above all, the case of Miskolc suggests that more than any single part, coherence matters: the DigitALL project

institutionalized because it belonged to a framework – "Human-Centered Sustainability" – that could absorb and make sense of external funding rather than simply receive it. This coherence reached outward to the EU policy level, where strategic engagement with tools like the RRF and ESCO brought methodological resources that magnified what the university could do in its region – resources that a national funding environment on its own could not have provided. It reached inward to the classroom: infrastructure investment was accompanied by real pedagogical change rather than taken as enough on its own – an empirical vindication of the argument made by Bygstad et al. [14]. It also dissolved a boundary that institutions often struggle to cross: between the core educational mission and regional engagement, between what happens inside the curriculum and what the region actually needs. Whether the coherence documented here will survive the end of the funding cycle is the question that longitudinal research will need to answer, and it is the most consequential one this case leaves open.

6. Conclusion

This paper presents the first peer-reviewed analysis of the DigitALL project and, in doing so, advances understanding of how human-centered sustainability can be put into practice through digital transformation at a regional university. The lighthouse metaphor has proved analytically productive: it captures the functions that universities can perform in the polycrisis era in a way that neither the disruption narrative nor the civic university framework fully conveys. It shows that this function is achievable when the necessary conditions are deliberately created, not as an aspiration but as a documented institutional reality.

This paper makes four contributions which build on one another. Its empirical foundation is the first peer-reviewed account of an RRF-funded higher education transformation in Central Europe – a record valuable, regardless of theoretical interpretation. This record also supports a conceptual claim: human-centered sustainability is not just a strategic slogan but can be operationalized and traced in specific decisions on curriculum, pedagogy, and student support. The argument then moves to the policy level – the case shows how EU instruments can expand what a regional university can do within its territory. Finally, the lighthouse metaphor is not decorative; it gives an analytical vocabulary that can highlight agency, embeddedness, and trust in a literature inclined towards disruption and competition.

Several questions remain open and point towards a necessary research agenda. Longitudinal follow-up is necessary to determine if the pedagogical culture shifts and the AI analytics infrastructure will endure after EU funding concludes. Another question is what is specific to the Miskolc context from what is transferable. A comparative analysis of RRF-funded projects across European universities would allow researchers to distinguish the two. The perspectives of students, faculty, and regional partners, absent from this document-based study, are indispensable for any fuller account of what the transformation has actually meant to those inside it.

Human-centered sustainability provides an excellent normative orientation for this program. It articulates that all technological investments should eventually lead to the development of human capacities. These capacities include critical thinking, ethical reasoning, creativity in collaboration, and communication with empathy. In particular, the experience of the University of Miskolc is relevant to the Eurasian academic community. The author states that the European instruments play a role in bridging the European policy instruments with human-centered institutional philosophy. It is also a meeting point between EU digital frameworks and the Society 5.0 paradigm. He claims that this is not just a local experiment but a confluence of intellectual traditions with application across a much broader space. He hopes that the coming decade will see such initiatives turn into actual transformations and not just well-documented episodes – lighthouses whose beams continue to illuminate long after the initial investment has been made.

7. Implications

The case of the University of Miskolc has lessons that go far beyond its regional context for all peripheral higher education institutions under the pressures of global polycrisis. The core issue is that of institutional identity. It proved in Miskolc that a clear strategic framework – in this case, "Human-Centered Sustainability" – was much more than mere branding. It was through this framework that the project could create connectivity and turn all externally funded projects into cumulative institutional development. This is because, as a general rule, regional

universities with their dependence on rather volatile project-based funding are structurally very vulnerable to fragmentation – every new grant pulls in a different direction and, in the absence of a stable core narrative, the institution ends up accumulating activities rather than building capacity. DigitALL was partly successful because it had such a clear place within this framework.

A related implication has to do with the architecture of innovation. The Triple Helix model [17] describes the university-industry-government dynamics as the engine of regional innovation, but this case suggests that the framework needs a fourth dimension. It was also the alignment with European instruments – the RRF, ESCO, Smart Specialization – that provided not just funding but structural leverage and methodological resources which no domestic triangle of actors could have supplied. For universities at the periphery that aspire to orchestrate local innovation ecosystems, engagement with EU-level policy is not an optional supplement but a strategic necessity.

The case also reframes the actual needs of digital transformation. The risk with large infrastructure investments is that procurement becomes a proxy for progress: device counts and network upgrades are measurable, while pedagogical culture change is not, and institutional attention tends to follow what can be reported. Miskolc's experience suggests that hardware without cooperative methodology and faculty development results in impressive inventories but limited educational value. The content creation studios are a telling detail – they are infrastructure, but infrastructure that invests in faculty agency rather than substituting for it.

In terms of regional engagement, the case presents a reframing of the third mission. Rather than taking community engagement as an activity that runs parallel to the core educational function, DigitALL placed regional actors directly in the curriculum: BOKIK forums informed programmed design, corporate professionals came into the classroom as lecturers, and labor market intelligence shaped what students were taught. In this model, the boundary between educational innovation and regional development largely dissolves.

These institutional lessons are embedded within a broader and more contested policy discussion. Digitalization at peripheral universities raises a structural question that cannot be answered by the Miskolc case but perhaps illuminated: does such investment accelerate regional convergence or widen existing disparities? This is what could be referred to as a digital paradox risk- well-resourced central institutions apply advanced instruments to draw in specialists from the surrounding regions, thereby accelerating the very brain drain that peripheral universities aim to counter. The 100% support intensity of the RRF model applied at Miskolc is a conscious remedy for this process, injecting substantial resources directly into a post-industrial region instead of allowing market rationality to concentrate it somewhere else. Whether this remedy will persist after the funding cycle is a more difficult issue.

The real challenge of EU-funded projects comes for the transition from structural funding to operational sustainability. The decreasing-support model is three-phase, and it is led by PwC to an independently operating internal expert group of associate deans. This is one way to answer the challenge. By design, this model treats external expertise as a temporary scaffold rather than a permanent dependency. It locates institutional knowledge where it has to be, to survive: inside the organisation. Whether this blueprint can prevent the "funding cliff" that has ended so many otherwise successful EU projects is another matter, but as a structural approach to capacity transfer, it is one of the more transferable lessons this case offers.

Author Contributions. Conceptualization, P.Sz., Z.H.; methodology, P.Sz., Z.H., B.M.Sz.K., N.H.; investigation, P.Sz., Z.H., B.M.Sz.K., N.H.; writing, original draft preparation, P.Sz., Z.H., B.M.Sz.K., N.H.; writing, review and editing, B.M.Sz.K., N.H.; visualization, P.Sz., Z.H., B.M.Sz.K., N.H.; supervision, P.Sz., Z.H., B.M.Sz.K., N.H. All authors have read and agreed to the published version of the manuscript.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

AI Use Statement. During the preparation of this manuscript, the authors used Scopus AI (Elsevier) to support the identification and collection of relevant literature, and Claude (Anthropic) for English-language proofreading. All AI-assisted output was carefully reviewed, revised, and verified by the authors. The authors take full responsibility for the accuracy and integrity of the manuscript.

Abbreviations

The following abbreviations are used in this manuscript:

Abbreviation	Explanation
AI	Artificial Intelligence
BOKIK	Borsod-Abaúj-Zemplén County Chamber of Commerce and Industry
ESCO	European Skills, Competences, Qualifications and Occupations
EU	European Union
GDP	Gross Domestic Product
HUF	Hungarian Forint
LMS	Learning Management System
NMR	Nuclear Magnetic Resonance
PwC	PricewaterhouseCoopers
RRF	Recovery and Resilience Facility
SDG	Sustainable Development Goal
Skills-OVATE	Skills Online Vacancy Analysis Tool for Europe
UoM	University of Miskolc
VR	Virtual Reality
VUCA	Volatility, Uncertainty, Complexity, Ambiguity

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