

Co-Evolution and the Future of Higher Education: A Literature Review of Institutional Adaptation in 21st century

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ABSTRACT

Change in higher education is often attributed to developments in technology, the economy, and society, but explanations of how this adjustment occurs vary considerably. Existing research has largely approached this transformation through innovation, governance, and digitalization, with less attention directed toward co-evolutionary perspectives on adaptation. Competing accounts variously emphasize internal institutional change or external environmental pressures as the primary drivers of adaptation. Drawing on scholarship in co-evolution theory and higher education research, this literature review examines the relationships between universities and the broader systems in which they are embedded. The analysis shows that institutional adaptation is not adequately explained as a series of discrete organizational reforms. Rather, universities and their environments continuously shape one another through reciprocal processes of adjustment and learning. As institutions respond to shifting external conditions, they simultaneously influence the networks within which those conditions emerge. The review proposes a conceptual framework of the co-evolutionary university and identifies participation in adaptive networks as a central condition for sustaining institutional relevance. These findings support a view of higher education adaptation as a continuous and relational process in which responsiveness to environmental change depends on ongoing interaction with a broader ecosystem of actors and institutions.

Keywords: co-evolution, higher education, institutional adaptation, complexity theory, learning ecosystems, organizational change

1. INTRODUCTION

1.1 Background of the Study

Digital and networked infrastructures have become integral to higher education, altering how institutions are organized and function across space and organizational settings (Cheers, 2012). Learning, knowledge creation, and professional development occur across interactions among universities, learners, employers, professional communities, governments, and technological systems. From this perspective, educational systems can be viewed as complex adaptive systems in which multiple actors interact and adjust their behavior in response to changing conditions (Cheers, 2012; Mearman et al., 2026). This view suggests that universities are not isolated organizations but participants in broader networks of relationships and exchanges. Institutional adaptation is therefore better accounted for through relations between universities and external actors, rather than through internal reform alone (Leydesdorff, 2005).

1.2 Problem Statement

Research on higher education adaptation has examined diverse issues, including educational innovation (Leydesdorff, 2005), digital transformation (Ciampi et al., 2021; Nunes & Malagri, 2023), organizational change (Mearman et al., 2026), and workforce development (Prasetya & Suprpto, 2026). These studies have provided useful insights into specific aspects of institutional change. However, they have largely evolved as separate streams of research and offer limited understanding of how universities adapt within broader systems of interconnected actors and institutions.

Current approaches to higher education adaptation view change as a response to external pressures implemented through institutional reforms and strategic initiatives (Mearman et al., 2026). These perspectives have led to how universities respond to changing environmental conditions. However, adaptation does not occur solely within institutions. Universities interact continuously with learners, employers, knowledge communities, and technological systems, and these interactions may shape adaptation in important ways. Yet, relatively little attention has been given to adaptation as a process of reciprocal adjustment among these interconnected actors. As a result, there remains a need for a framework that explains higher education adaptation from a co-evolutionary perspective and captures the systemic relationships through which change occurs.

1.3 Research Question

This study addresses the following research question: To what extent does co-evolution provide a useful framework for understanding adaptation and institutional relevance in contemporary higher education?

1.4 Research Objectives

The objectives of this study are to:

1. Review the literature on co-evolution theory and complexity theory (Cheers, 2012).
2. Review the literature on higher education adaptation and institutional change.
3. Examine the relationship between co-evolution theory and higher education research.
4. Develop a conceptual framework for understanding higher education institutions as participants in co-evolutionary systems (Prasetya & Suprpto, 2026).

2. LITERATURE REVIEW

Literature has examined various technological, economic, social, and labor-market developments (Prasetiya & Suprpto, 2026) but these approaches demonstrate aspects of institutional adaptation, they often address change processes independently. As a result, the literature provides limited explanation of how universities adapt through ongoing interactions with learners, employers, knowledge communities, governments, and technological systems. This section addresses this gap through examining co-evolution as a framework for understanding adaptation in higher education. Rather than conceptualizing change as a series of discrete institutional responses to external pressures, a co-evolutionary perspective emphasizes reciprocal adjustment among interconnected actors and systems (Leydesdorff, 2005; Mearman et al., 2026).

2.1 Theoretical Framework

This study is informed primarily by co-evolution theory and complexity science. Originating in the biological sciences and later applied to organizational research, co-evolution theory describes processes through which interacting systems adapt in response to one another over time (Westman et al., 2022; Mearman et al., 2026). Within organizational settings, adaptation is understood as a product of reciprocal relationships between organizations and their environments rather than as a one-directional response to external conditions. Formal evolutionary models have also examined the relationship between universities and the wider systems in which they operate. These models suggest that the responsiveness and scientific capabilities of national university systems may influence the competitive performance of the industries they support (Fatas-Villafranca et al., 2008). Similar observations in complexity science view organizations as systems composed of multiple interacting actors whose collective behaviour cannot be fully explained through simple linear relationships (Cheers, 2012; Kinchin, 2023) and therefore, universities are participants in broader networks that include learners, employers, governments, professional communities, and technological systems rather than being isolated.

To situate this perspective within organizational scholarship, several established theories provide partial accounts of different dimensions of adaptation. Dynamic Capabilities theory examines how organizations respond to changing conditions (Ciampi et al., 2021), while Socio-Technical Systems Theory focuses on the interaction between social structures and technical components in processes of organizational change (Prasetiya & Suprpto, 2026). Institutional Theory directs attention to the influence of regulatory and normative pressures, and the Triple Helix model describes the interrelations between universities, industry, and government (Leydesdorff, 2005). Although these perspectives address distinct aspects of organizational adaptation, this paper will focus on the co-evolution theory as the primary framework for interpreting these dynamics.

2.2 Previous Studies

Studies of digital transformation in higher education have explored how institutions respond to changing technological conditions and shifts in educational delivery. Nunes and Malagri (2023) found that the COVID-19 pandemic accelerated technology adoption in higher education while exposing differences in institutional preparedness and digital capacity. Research has also examined the relationship between emerging technologies and learning processes. Sargsyan (2025) discussed the educational implications of agentic artificial intelligence, identifying both opportunities for personalized learning and challenges related to learner dependence and equitable access. The rapid emergence of generative AI further disrupts traditional models of institutional change; because it acts as an 'arrival technology' rather than a stable tool ready for broad adoption, it forces institutions to continuously renegotiate pedagogical goals through collective, local inquiry rather than top-down scaling (Perl-Nussbaum & Finkelstein, 2026). Similarly, Thorne (2024) examined the interaction between users and digital technologies, arguing that technologies and users shape one another through ongoing patterns of use and adaptation. Adding to this complexity, Watanabe, Naveed, and Neittaanmäki (2016) demonstrate that successful ICT integration relies heavily on a co-evolutionary dynamic between technology advancement and 'trust in teachers'. Their empirical research reveals that during the transition to blended learning, a lack of trust and a state of semi-disengagement can trigger an 'educational productivity paradox,' wherein increased technology use actually fails to improve, or even correlates with declining, educational outcomes. This dynamic is reinforced by recent literature highlighting that digitalization and organizational agility share a bidirectional, co-evolutionary relationship, where digital capabilities enhance organizational agility, but agility is simultaneously required to successfully integrate and exploit emerging technologies. (Ciampi et al., 2021; Meyer & Powell, 2020).

Some studies have examined how collaboration, shared learning, and collective action influence processes of institutional change (Westman et al., 2022) while other studies have approached adaptation from a co-evolutionary perspective and have examined the effects of feedback, reciprocal learning, and historical conditions on adaptation processes (Mearman et al., 2026). From a new institutionalist perspective, universities are shaped by - and actively shape - economic, political, and cultural subsystems, navigating pressures of institutional isomorphism while simultaneously exporting their own organizational models to society (Meyer & Powell, 2020). Increasing attention has also been given to the integration of technological and social dimensions in higher education, although patterns of interaction and collaboration appear to differ across contexts (Prasetya & Suprpto, 2026). This integration is best understood through a socio-technical-institutional model, which posits that sustainable transformation is only achieved when technological innovation, organizational restructuring, and human capital development co-evolve simultaneously (Prasetya & Suprpto, 2026).

Furthermore, viewing the university through a complex systems lens challenges the traditional notion of institutions as purely rational, "strategic actors." In this regard research indicated that universities function as "adaptive resilient organizations" embedded in volatile environments, relying on internal features like loose coupling, resource slack, and requisite variety to absorb external shocks and dynamically self-organize (Pinheiro & Young, 2017). Within these complex ecosystems, adaptation relies heavily on multi-helix network relationships. The traditional linear model of knowledge transfer has increasingly been replaced by the Triple Helix framework of university–industry–government relations, where institutional boundaries are less distinct and interactions occur through reciprocal exchanges among the three sectors (Leydesdorff & Meyer, 2003). Subsequent developments have extended this framework to include civil society and environmental considerations through the Quadruple and Quintuple Helix models (Carayannis & Campbell, 2011). Within these perspectives, universities are viewed as participants in broader regional systems and may assume different roles in processes of knowledge exchange and innovation (Amitrano & Bifulco, 2026).

These studies suggest that adaptation involves relationships among multiple actors, institutions, and technologies. However, most research has focused on specific dimensions of change and has examined these relationships in relatively isolated contexts. As a result, limited attention has been given to how adaptation emerges through the mutual adjustment of interconnected systems or how these interactions may be understood within a broader conceptual framework. This study contributes to the literature by reviewing and integrating these perspectives through a co-evolutionary lens and by examining the implications of this framework for understanding contemporary higher education.

3. METHODOLOGY

3.1 Research Design

This study adopts an integrative literature review design to examine the applicability of co-evolution as a framework for understanding adaptation in higher education. An integrative review enables the synthesis of literature from multiple fields and supports the examination of relationships among concepts, theories, and research findings. This approach is appropriate for the present study because relevant scholarship is dispersed across higher education, organizational studies, complexity science, and innovation research. The review seeks to identify common themes and establish a foundation for interpreting higher education through a co-evolutionary lens.

3.2 Data Collection

Data were identified through a systematic literature review on co-evolution and higher education across four academic databases: Scopus, Web of Science, ERIC, and Google Scholar. The final database search was completed on June 1, 2026. A consistent search string was applied across all databases: (TITLE-ABS-KEY("co-evolution" OR "organizational co-evolution" OR "complexity theory") AND TITLE-ABS-KEY("higher education adaptation" OR "institutional change" OR "learning ecosystems" OR "university transformation")). To ensure inclusion of foundational works, the database search was supplemented through backward and forward citation chaining (snowballing) of all eligible studies. This iterative process enabled the identification of additional relevant publications not captured through the initial keyword search, particularly seminal theoretical contributions and widely cited empirical studies.

The search strategy combined primary and secondary keywords to capture literature aligned with the study's research focus. Core terms included "co-evolution," "organizational co-evolution," "complexity theory," "higher education adaptation," "institutional change," "learning ecosystems," and "university transformation." These keywords were systematically combined using Boolean operators to ensure comprehensive retrieval of studies examining co-evolutionary dynamics in relation to adaptation processes within higher education systems. Table 1 provides a summary of all keywords and search term combinations used in the review process.

Table 1. Keywords Used in the Literature Search

Parameter	Description
Databases Searched	Scopus, Web of Science, ERIC, Google Scholar
Primary Keywords	"co-evolution", "organizational co-evolution", "complexity theory"
Secondary Keywords	"higher education adaptation", "institutional change", "learning ecosystems", "university transformation"

Following the PRISMA 2020 protocol, the screening process occurred in multiple stages. Initially, 345 records were identified. After removing 14 duplicates, 331 records were screened by title and abstract, resulting in the exclusion of 250 records (primarily because they utilized 'co-evolution' in a strictly biological or software-development context). The remaining of the 81 full-text articles were assessed for eligibility and of these, 59 were excluded as they lacked a bi-directional systems perspective on isolated classroom technologies without organizational context. The final 21 core studies were subjected to a quality appraisal to evaluate their methodological rigor, theoretical clarity, and relevance to institutional co-evolution. This high exclusion rate was necessary to ensure the final corpus specifically addressed systemic, reciprocal adaptation in higher education. The inclusion and exclusion criteria were developed to ensure consistency in the selection of literature and to maintain alignment with the study's objectives. Table 2 summarizes the criteria used to guide the selection process.

Table 2. Inclusion and Exclusion Criteria for Literature Selection

Category	Inclusion Criteria	Exclusion Criteria
Source Type	Peer-reviewed journal articles; foundational theoretical works; academic books.	Non-peer-reviewed articles; opinion pieces; general websites; editorials.
Thematic Focus	Higher education adaptation; learning ecosystems; organizational change; complexity theory.	Studies lacking relevance to institutional co-evolution; isolated technological adoption without organizational context.
Context	Higher education institutions; complex adaptive systems; organizational studies.	Primary/secondary education (unless providing foundational systems theory); unrelated corporate sectors.

Applying these criteria resulted in a final selection of 21 core studies. This selected literature constituted the basis for the subsequent analysis and synthesis. Particular attention was given to studies examining adaptation, interdependence, network relationships, feedback processes, and interactions among higher education institutions and their broader environments. This approach enabled the review to identify recurring themes and conceptual connections across multiple fields of research.

3.3 Data Analysis

The analytical process unfolds in three stages. First, the selected studies are grouped according to their primary theoretical orientation, spanning co-evolution theory, complexity science, organizational adaptation, higher education transformation, and socio-technical perspectives. Second, key concepts and findings are drawn from each study and arranged into preliminary thematic categories. Third, these categories are set against one another across the literature in order to trace patterns of convergence and divergence and to assess whether they can be interpreted through a co-evolutionary lens.

This process yields four recurring themes: (1) Interdependence and complex systems are consistently framed as central to co-evolutionary dynamics, where higher education institutions are embedded in tightly coupled ecological, technological, and institutional environments. (2) Continuous mutual adaptation is reflected in ongoing reciprocal adjustment between institutions and their environments, with change occurring as an iterative and sustained process. (3) Network relations and distributed agency are evident in the dispersion of influence across actors, partnerships, and governance structures shaping institutional trajectories. (4) Systemic and non-linear change is characterized by feedback effects, thresholds, and emergent outcomes that disrupt linear assumptions of institutional development. These themes appear across distinct strands of literature, cutting across disciplinary boundaries and empirical contexts. Table 3 summarizes the thematic categories that emerge from the analysis.

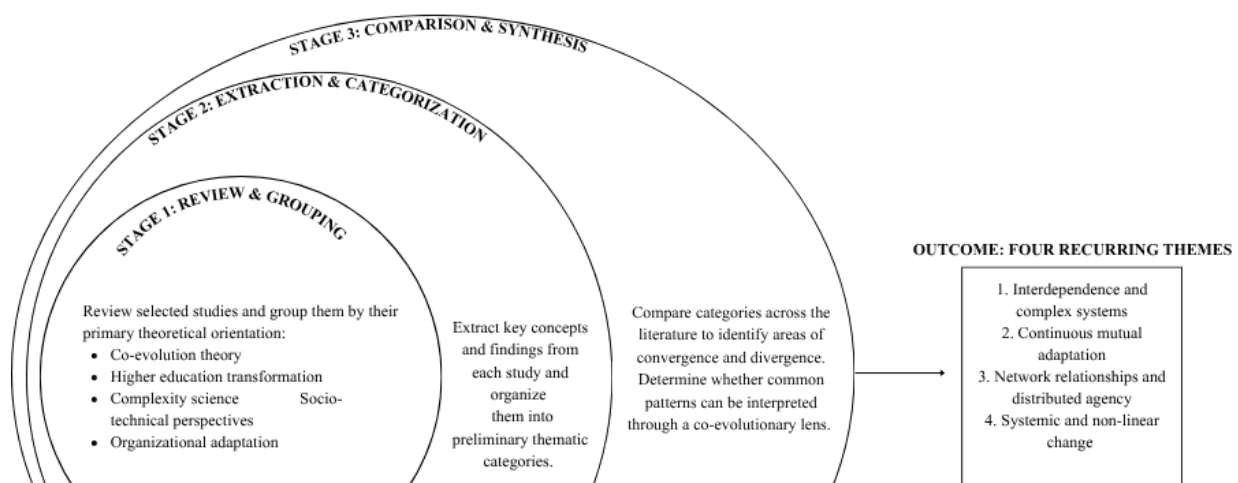


Figure 1. The analytical process of LR

The synthesis revealed several common observations. First, higher education institutions are frequently described as operating within interconnected systems rather than as isolated organizations. Second, adaptation is commonly represented as an ongoing process shaped by

interactions among multiple actors, including learners, employers, governments, professional communities, and technological systems. Third, change is often distributed across networks rather than driven solely through institutional planning. Finally, many studies describe adaptation as non-linear, with feedback processes generating outcomes that extend beyond the original scope of institutional interventions.

Table 3. Thematic Categories Identified in the Literature Review

Core Theme	Key Concepts & Patterns Identified in the Literature	Representative Sources
Interdependence & Complex Systems	Educational environments function as complex adaptive systems. Institutions, agents, and technologies are not autonomous but interact, anticipate behaviors, and share a "natural history" within an ecosystem. Universities function as "adaptive resilient organizations" embedded in volatile environments.	Cheers (2012); Mearman et al. (2026); Pinheiro & Young (2017)
Continuous Mutual Adaptation	Adaptation is an ongoing, reciprocal process rather than a periodic intervention. Organizational agility and dynamic capabilities co-evolve continuously with digital and environmental pressures.	Ciampi et al. (2021); Westman et al. (2022)
Network Relationships & Distributed Agency	Agency and change are distributed across multiple spheres, including human networks, technological artifacts (e.g., GenAI), industry, and government. Transformation relies on collaborative norm-construction. Knowledge transfer has evolved into multi-helix networks (Triple/Quadruple/Quintuple Helix), requiring universities to dynamically shift roles to drive regional innovation.	Carayannis & Campbell (2011); Lee et al. (2026); Leydesdorff (2005); Leydesdorff & Meyer (2003); Westman et al. (2022)
Systemic & Non-linear Change	Institutional change is emergent, recursive, and driven by dynamic feedback loops. Actions generate non-proportional, unpredictable outcomes that reshape the entire educational ecosystem.	Cheers (2012); Mearman et al. (2026)

Comparison across the literature also revealed important differences in how adaptation is conceptualized. Studies of digital transformation and educational technology tend to focus on organizational responses to technological change, while co-evolutionary and complexity-oriented perspectives emphasize reciprocal interactions between institutions and their environments. Yet both strands of literature converge on the view that institutional change emerges through ongoing relations among multiple actors and systems.

The synthesis identifies a set of shared concepts linking higher education research with broader theories of co-evolution and organizational adaptation. These concepts point to universities as embedded within interconnected systems shaped by mutual influence, continuous adaptation, and dynamic feedback processes.

4. FINDINGS & DISCUSSION

4.1 Overview of Findings

The literature synthesis identifies four recurring themes that characterize adaptation in contemporary higher education. Universities are situated within tightly interwoven systems in which institutional outcomes emerge through continuous interaction among multiple actors and levels of organization. Adaptation, in this view, is not readily captured by linear models that assume planned responses to external pressures, but instead reflects ongoing processes of reciprocal influence and adjustment across the system.

4.2 Interdependence and Complex Systems

The first theme concerns the interconnected nature of higher education systems. In this regard, universities are embedded within wider networks of interacting actors and systems. What processes determine whether system-level educational and innovation outcomes emerge in a coordinated or fragmented form is the distribution of resources, constraints, and functional capabilities across heterogeneous actors. Learners, employers, governments, professional communities, research institutions, and technological infrastructures each occupy distinct “ecological niches” within these arrangements, contributing partially overlapping yet non-identical repertoires of knowledge, expectations, material resources, and institutional practices (Cheers, 2012; Leydesdorff, 2005; Mearman et al., 2026). These elements are coupled through continuous exchanges; flows of information, credentialing expectations, funding and labor, and stabilized routines of coordination. Through such ongoing interactions, patterns of alignment and influence gradually emerge that are not reducible to the intentions or capacities of any single actor. Instead, system-level regularities are produced as a collective outcome of distributed interdependencies, where redundancy and complementarity between actors’ roles structure the overall dynamics and shape emergent outcomes at the level of the system as a whole.

Where this interdependence is not properly accounted for, systemic mismatches tend to happen. These mismatches reflect the underlying structure of the networks in which higher education is embedded, in which coordination failures emerge between institutional activity and external demands. Potapova (2025), for instance, reports a persistent disconnect between the training of engineering specialists and the structural modernization requirements of high-tech industries, despite ongoing institutional reform efforts. This demonstrates that universities cannot effectively adapt or provide relevant human capital without closely co-evolving with regional economic structures. Accordingly, complexity-oriented research characterizes higher education as a complex adaptive system in which institutional behavior emerges from interactions among multiple agents rather than from centralized control (Cheers, 2012). From this perspective,

universities cannot be understood as autonomous organizations operating independently of their environments. Instead, they are embedded within systems of interdependence where changes in one part of the system generate consequences for other actors.

This finding aligns closely with co-evolution theory, which assumes that adaptation occurs through reciprocal relationships among interconnected entities. The literature therefore suggests that institutional change cannot be fully explained through internal governance structures or strategic planning alone. Understanding adaptation requires attention to the broader networks within which universities operate, therefore, the higher education system requires a fundamental shift from viewing universities as autonomous entities reacting to their environments, to analyzing the broader, interconnected networks within which they continuously co-evolve.

4.3 Continuous Mutual Adaptation

A second theme concerns the nature of adaptation itself. Across the reviewed literature, adaptation is rarely described as a discrete event or periodic reform process. Instead, adaptation is conceptualized as a continuously unfolding dynamic arising from sustained coupling between institutional systems and the environments in which they are embedded. In this framing, institutional organization is not treated as a static structure, but as a system maintained through ongoing regulatory feedback, in which actors such as students, faculty, and administrators participate in iterative exchanges that continuously modulate system state. Mearman et al. (2026) illustrate this process through evidence that institutional change is generated through recurrent feedback loops, wherein informational and behavioral signals are transmitted across hierarchical components and progressively reshape outcomes over successive cycles rather than through discrete, pre-specified interventions.

As a result, each adjustment operates simultaneously as a localized response to preceding system states and as an active determinant of subsequent system configurations, such that present modifications are carried forward as structural constraints on future dynamics. Similarly, organizational scholarship characterizes institutional systems and their environments as mutually constituted through recurrent cycles of action and response, generating coupled trajectories of change rather than separable analytical domains (Westman et al., 2022). In this framing, adaptation is the product of persistent bidirectional interaction in which structural configurations and environmental conditions continuously co-create one another over time. Thus, successive rounds of institutional adjustment are accumulated in a manner analogous to evolutionary processes, wherein system-level properties are incrementally reorganized through ongoing perturbation, redundancy, and stabilization not through discrete or independently directed transformations. This logic of co-adjustment is not limited to organizational practices alone but also extends into the material and digital infrastructures that structure university life. As Patel (2022) highlights, maintaining institutional relevance requires the continuous alignment and

co-evolution of pedagogical practices with physical learning spaces, rather than treating campus design as a static, one-off event.

This observation represents one of the strongest connections between higher education research and co-evolution theory. In both literatures, adaptation is understood as a process of mutual adjustment and universities respond to environmental pressures as well as they influence the conditions to which they later respond. This reciprocal relationship challenges conventional approaches that separate institutions from their environments and instead supports a co-evolutionary understanding of change. Consequently, understanding adaptation in contemporary higher education means recognizing that long-term institutional relevance is achieved through this ongoing, mutual adjustment rather than through periodic, isolated institutional reforms.

4.4 Network Relationships and Distributed Agency

The third theme concerns the distribution of agency across educational systems. The literature consistently indicates that institutional change is not driven exclusively by university leaders, policymakers, or individual educators. Instead, change emerges through interactions among multiple actors operating within networks. In this regard, the Triple Helix literature conceptualizes universities, governments, and industry as interdependent institutional spheres, jointly implicated in the production and circulation of knowledge and innovation (Leydesdorff, 2005). Within this configuration, innovation processes are not located within any single actor, but are distributed across a coupled system of institutional relations in which boundaries between sectors are functionally permeable rather than strictly delineated. Organizational adaptation research similarly foregrounds the role of coordinated learning processes, shared routines, and collective action in the emergence of stable institutional outcomes (Westman et al., 2022). In this sense, agency is not treated as an attribute of isolated organizations, but as an emergent property of structured interaction across multiple institutional levels. This distributed configuration of agency is further illustrated by processes of institutional shaping, wherein emerging industrial sectors engage in sustained lobbying, negotiation, and collaboration with universities to realign research agendas and training structures with evolving technological regimes (Fatas-Villafranca et al., 2008). Over time, such interactions produce recursive alignment dynamics, in which institutional priorities and sectoral demands become mutually constitutive through repeated cycles of coordination and adjustment.

Research on educational technologies provides additional evidence of distributed agency. Rather than functioning as neutral artefacts, technologies participate actively in the structuring of organizational practice, while simultaneously being configured through institutional logics, patterned user behaviour, and regulatory constraint. In this sense, technological systems are not externally applied instruments, but components of socio-technical assemblages in which

functional properties and organizational routines are continuously co-produced through iterative interaction across multiple levels of analysis. These observations imply that agency is distributed across heterogeneous human and non-human actants, rather than being localised within a single organisational locus.

From a co-evolutionary perspective, inter-organizational network structures operate as conduits through which adaptive dynamics are transmitted and stabilised. In this framing, relational ties do not merely facilitate exchange, but constitute the medium through which variation, selection, and retention processes are enacted across interconnected systems. The ability of universities to participate in and learn from these networks may therefore be an important determinant of institutional adaptability. This distribution of agency demonstrates that understanding adaptation in contemporary higher education necessitates moving beyond traditional, top-down administrative models to instead embrace collaborative, network-driven processes of change.

4.5 Systemic and Non-Linear Change

The final theme concerns the non-linear character of institutional change. Across the literature, adaptation is frequently shown to generate outcomes that are not readily decomposable into singular causal pathways, nor predictable from initial conditions alone. Complexity theory frames these dynamics in terms of multi-actor interaction systems in which recursive feedback loops emerge, shaping subsequent behaviour while simultaneously altering the structural conditions under which future actions occur (Cheers, 2012).

In parallel, Mearman et al. (2026) conceptualise institutional change as a recursive process in which interventions not only alter observed outcomes, but simultaneously reconfigure the underlying decision environments through which subsequent rounds of institutional choice are generated and structured. This perspective complicates traditional planning-oriented models that conceptualise institutional change as a linear sequence of design, implementation, and evaluation and adaptation emerges from interconnected interaction systems, in which outcomes are contingent upon evolving relational configurations rather than pre-specified strategic pathways. Institutional trajectories therefore appear as emergent properties of ongoing systemic interaction, rather than as the direct expression of centrally directed reform agendas.

Consequently, the primary challenge for higher education institutions may lie less in the execution of discrete reform programmes than in the cultivation of adaptive capacities that sustain continuous learning, responsiveness, and participation within co-evolving institutional networks. From this perspective, recognising the non-linear character of institutional change becomes essential for understanding contemporary higher education systems, insofar as durable transformation is generated through dynamic ecosystem-level interactions rather than through linear, plan-driven models of institutional design.

4.6 Discussion

The four themes identified in the literature support a co-evolutionary interpretation of higher education adaptation. Accordingly, universities are not isolated institutions, nor are they passive recipients of external change as they operate in systems of interdependence in which adaptation happens through reciprocal influence, distributed agency, and continuous interaction among multiple actors.

Hence, this synthesis indicates that institutional relevance is conditioned by both internal organisational capabilities and the structure of relationships connecting universities to various stakeholders, systems and communities. Co-evolution is therefore not an additional explanatory layer, but a reframing of institutional adaptation in which change is generated through relational processes embedded in ongoing interaction.

The findings suggest that adaptation in higher education is most appropriately understood as a systemic process of mutual adjustment among interconnected actors. This interpretation provides a conceptual basis for analysing contemporary institutional change and a framework for future research on higher education adaptation. From a theoretical standpoint, this research shifts analysis from linear models of reactive change toward continuous co-evolutionary dynamics, integrating complexity theory with institutional perspectives to account for how universities and their environments adapt in tandem. In practice, it implies that institutional governance depends on sustained engagement within multi-actor networks, ongoing alignment of educational and organisational practices, and distributed forms of agency, rather than reliance on isolated, top-down reform interventions.

5. CONCLUSION

This study reviewed literature across higher education research, organizational studies, complexity science, and co-evolution theory to develop a systemic framework for institutional adaptation. The research indicates that universities do not adapt through isolated or linear reforms, but through continuous reciprocal adjustment with their socio-technical and economic environments. A co-evolutionary perspective therefore integrates insights across disciplines and emphasises feedback processes and relational networks as central to institutional relevance, with adaptation emerging from ongoing interaction rather than centrally directed intervention.

Several limitations should be noted. This study is based on secondary literature and does not include primary empirical data. The scope of the reviewed work spans heterogeneous institutional and national contexts, limiting the generalisability of any single adaptive model. In addition, co-evolutionary processes are inherently difficult to observe and measure directly, which constrains empirical validation.

Future research should empirically examine how co-evolutionary dynamics operate within higher education systems and their surrounding environments. Comparative and longitudinal studies are needed to identify the conditions under which reciprocal adaptation is enabled or constrained. Methodological development is also required to better capture interdependence and feedback effects, including formal modelling approaches such as evolutionary and population dynamics frameworks for analysing bidirectional institutional–environment interactions (Fatas-Villafranca et al., 2008). As higher education becomes increasingly embedded in interconnected systems, a central question remains: whether institutions can maintain relevance while retaining largely self-contained organisational structures in the presence of persistent co-evolutionary pressures.

6. DECLARATIONS

This study is an integrative literature review and did not involve human subjects; therefore, ethics committee approval was not required. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Generative AI was utilized solely for language editing, formatting assistance, and literature retrieval during the drafting of this manuscript. The authors take full responsibility for the content, analysis, and synthesis provided.

REFERENCES

- Amitrano, C. C., & Bifulco, F. (2026). The co-evolution of ecosystem and university's roles: A focus on the integration of technologies and cultural heritage. *The Journal of Technology Transfer*, 51(1), 535-553.
- Carayannis, E. G., & Campbell, D. F. (2011). Open innovation diplomacy and a 21st century fractal research, education and innovation (FREIE) ecosystem: building on the quadruple and quintuple helix innovation concepts and the "mode 3" knowledge production system. *Journal of the Knowledge Economy*, 2(3), 327-372.
- Cheers, C. J. (2012). Evolution of a higher ed curriculum based ecosystem. In M. Brown, M. Hartnett, & T. Stewart (Eds.), *Future challenges, sustainable futures: Proceedings ascilite Wellington 2012* (pp. 182–186). <https://doi.org/10.14742/apubs.2012.1655>
- Ciampi, F., Faraoni, M., Ballerini, J., & Meli, F. (2021). The co-evolutionary relationship between digitalization and organizational agility: Ongoing debates, theoretical developments and future research perspectives. *Technological Forecasting and Social Change*, 176, 121383.
- Fatas-Villafranca, F., Sanchez-Choliz, J., & Jarne, G. (2008). Modeling the co-evolution of national industries and institutions. *Industrial and Corporate Change*, 17(1), 65–108. <https://doi.org/10.1093/icc/dtm039>
- Kinchin, I. M. (2023). Five moves towards an ecological university. *Teaching in Higher Education*, 28(5), 918–932. <https://doi.org/10.1080/13562517.2023.2197108>
- Lee, J. H., Hwang, Y., & Lee, S. (2026). GenAI-mediated activity theory (GMAT) for L2 teachers. *Language Learning & Technology*, 30(1), 1–21. <https://doi.org/10.64152/10125/73675>
- Leydesdorff, L. (2005). Triple Helix of university-industry-government relations. In *Encyclopedia of creativity, invention, innovation and entrepreneurship* (pp. 2356-2364). Cham: Springer International Publishing.
- Leydesdorff, L., & Meyer, M. (2003). The Triple Helix of university-industry-government relations. *Scientometrics*, 58(2), 191-203.
- Mearman, A., Peasland, E., & Tallontire, A. (2026). "How did you get the change to stick?"—Exploring a change process in a UK university via co-evolution. *Innovative Higher Education*. Advance online publication. <https://doi.org/10.1007/s10755-026-09890-9>
- Meyer, H. D., & Powell, J. J. (2020). New institutionalism in higher education. 9781473942912.
- Nunes, M. P., & Malagri, C. A. N. (2023). The digital transformation in blended education: What are we doing in Latin America? *SciELO Preprints*. <https://doi.org/10.1590/SciELOPreprints.7301>

Patel, H. (2022, February). The co-evolution of pedagogy and learning spaces for a better student experience [Briefing paper]. SUMS Consulting. <https://sums.org.uk/app/uploads/2022/02/SUMS-Briefing-Paper-The-Co-Evolution-of-Pedagogy-and-Learning-Spaces-February-2022.pdf>

Perl-Nussbaum, D., & Finkelstein, N. D. (2026). A Framework for institutional change in the age of AI. arXiv preprint arXiv:2605.12757.

Pinheiro, R., & Young, M. (2017). The university as an adaptive resilient organization: A complex systems perspective.

Potapova, I. R. (2025, May). Co-evolution of structural changes in high-tech industries in the EAEU countries with reforms in higher education [Conference presentation abstract]. Scientific Conference "Co-evolution of economic, social, cultural and political systems in countries and regions of the world", Moscow, Russia.

Prasetya, B., & Suprpto, F. (2026). Evolution of Higher Education Research in Developing Countries: A Scopus-Based Bibliometric Study. *Immortalis Journal of Interdisciplinary Studies*, 2(1), 261-284.

Sargsyan, L. (2025). Integrating agentic AI in higher education: Balancing opportunities, challenges, and ethical imperatives. *Foreign Languages in Higher Education*, 29(1), 88–100.

Thorne, S. L. (2024). Generative artificial intelligence, co-evolution, and language education. *The Modern Language Journal*, 108(2), 567–572. <https://doi.org/10.1111/modl.12932>

Watanabe, C., Naveed, K., & Neittaanmäki, P. (2016). Co-evolution between trust in teachers and higher education enabled by ICT advancement: a suggestion to ICT growing economies. *Journal of Technology Management for Growing Economies*, (2).

Westman, L., Luederitz, C., Kundurpi, A., Mercado, A. J., & Burch, S. L. (2022). Market transformations as collaborative change: Institutional co-evolution through small business entrepreneurship. *Business Strategy and the Environment*, 32(2), 936–957. <https://doi.org/10.1002/bse.3083>