Sociology Study, Mar.-Apr. 2026, Vol. 16, No. 2, 125-171
doi: 10.17265/2159-5526/2026.02.005

Fostering Moral Leadership and Social Justice through Interdisciplinary Education: The Edupreneurship Research Ecosystem Model (EREM) in Society 5.0

Dr. Norman Kachamba
Rusangu University, Zambia
Bruce Enerst
University of Zambia, Zambia

This study introduces and proposes the Edupreneurship Research Ecosystem Model (EREM), an innovation that advocates for an interdisciplinary framework for embedding moral leadership, social justice, and sustainable innovation into higher education systems, industry practice, as a mechanism to actualize the Sustainable Development Goals (SDGs) and realize the aspirations of Society 5.0. The model is developed through a design-science approach and is structured around four synergistic pillars: adaptive education and lifelong learning, innovation and entrepreneurship hubs, a sustainability and circular-economy lens, and agile multi-stakeholder governance. These pillars are connected by a cross-cutting moral-leadership spine and supported by analytics, financing, monitoring, evaluation, and learning systems. By aligning curricula with rapidly evolving labour-market and community needs, operationalizing the SDGs through course outcomes and innovation pipelines, and institutionalizing ethical and inclusive governance, EREM addresses persistent gaps between universities, industry, government, civil society, and ecological well-being. The paper argues that the world should adopt EREM as a practical global implementation architecture for accelerating the SDGs and actualizing the aspirations of Society 5.0 because it converts sustainability, human dignity, social justice, and ethical technology governance from aspirational ideals into measurable institutional practices. Its key recommendation is that governments, universities, industry actors, development agencies, and civil-society organizations should mainstream EREM as a policy and operational model for education-led sustainable transformation, using it to connect learning, research, entrepreneurship, digital innovation, public accountability, and inclusive development. A comprehensive literature review situates the model in current research and practice, drawing on recent studies in educational innovation, multi-stakeholder collaboration, sustainable development, and ethical technology governance. The paper outlines the theoretical foundations and philosophical underpinnings that inform EREM's design, including systems theory, helix innovation models, human capital theory, diffusion of innovation, pragmatism, humanism, Ubuntu, constructivism, and stewardship ethics. The methodology follows iterative design-science cycles to construct and refine the model, with expert critique guiding improvements. The conclusions and policy brief call for institutional leaders and policymakers to adopt EREM as an ethics-by-design, SDG-driven, and Society 5.0-aligned ecosystem for transforming higher education into a platform for inclusive prosperity, technological responsibility, and social justice.

Norman Kachamba, PhD, Rusangu University, Zambia.
Bruce Enerst, PhD candidate, University of Zambia, Zambia.

Keywords: moral leadership, social justice, interdisciplinary education, Society 5.0, design science, edupreneurship, quadruple helix, ethical governance, lifelong learning, Sustainable Development Goals, policy implementation

Introduction

In an age of accelerated technological change and complex societal challenges, educational institutions face mounting pressure to produce graduates who can lead with integrity and drive social justice outcomes. Recent analyses indicate that higher education is often misaligned with labor market needs, as curricula struggle to keep pace with emerging skills demands. Employers worldwide continue to report skill gaps—for instance, a World Economic Forum report projected that 44% of workers' core skills will change within five years (World Economic Forum, 2023). At the same time, universities increasingly invoke the United Nations Sustainable Development Goals (SDGs) in mission statements, yet frequently fall short of operationalizing those goals into programs, course outcomes, or innovation pipelines. The disconnect between lofty educational ideals and practical impact is especially problematic in the context of "Society 5.0", a concept of a human-centered, super-smart society that balances economic advancement with social problem-solving (Spady, 1998). Society 5.0 envisions leveraging advanced technologies (artificial intelligence, Internet of Things, robotics, etc.) to enhance quality of life for all, but it also demands that technology be guided by human values and ethical considerations. This presents a clarion call for educational systems that not only impart cutting-edge skills, but also embed moral leadership and social justice imperatives as core outcomes.

Moral leadership and social justice in education form the ethical cornerstone of this study's inquiry. Prior scholarship in educational leadership suggests that social justice is fundamentally a moral responsibility, achieved through leaders who center equity and integrity in decision-making (Furman, 2012; Oplatka & Arar, 2016). Moral leadership has been defined as keeping human dignity and the common good at the center of decisions (The HOW Institute for Society, 2023) and is rooted in values like fairness, empathy, and accountability. However, traditional approaches often rely on individual heroic leaders to carry this burden. This paper argues that a more sustainable approach is to design moral leadership into the system itself—through governance structures, incentive mechanisms, and cultural norms that make ethical, inclusive behavior the default.

The Edupreneurship Research Ecosystem Model (EREM) is introduced as a comprehensive framework to achieve these aims. In essence, EREM is a model architecture for higher education and innovation ecosystems that "designs in" moral leadership and social justice, rather than treating them as afterthoughts or purely personal virtues. As the name implies, the model merges education and entrepreneurship in an ecosystem of research and development, positioning academic institutions as hubs that cultivate not only knowledge, but also ethical innovation and equitable development. The EREM approach aligns with calls to reform education for the 21st century by breaking silos and fostering collaboration among academia, industry, government, and civil society—a quadruple helix of stakeholders (Carayannis & Campbell, 2009; Cai & Lattu, 2022). It also resonates with the concept of "ethics as infrastructure", where ethical principles are interwoven into the operational fabric of organizations and technologies.

This article is organized into distinct sections. The Background provides context on the structural problems in current higher education and innovation systems, highlighting why new approaches are needed to achieve a just, human-centered Society 5.0. The specific Research Problem Space is then delineated, identifying gaps such as outdated curricula, unfulfilled SDG commitments, fragmented collaboration, and persistent equity shortfalls. The Primary Objectives of the study are listed, clarifying what the EREM model seeks to accomplish. A Justification for the Model explains how and why this new model offers value beyond existing frameworks. Next, a two-part Literature Review surveys relevant scholarship: an overview of conceptual literature on educational innovation and ethics, followed by empirical studies and real-world cases that inform the model's design (with an emphasis on sources published since 2020 to capture the latest developments). The Theoretical Framework section describes the interdisciplinary theories underlying EREM, ranging from systems theory and cybernetics to human capital theory and diffusion of innovation, as well as multi-helix innovation models. In a related vein, the Philosophical Underpinning section outlines the guiding philosophies (pragmatism, humanism/Society 5.0, African Ubuntu, constructivism, and stewardship ethics) that shape the model's values and approach.

The Methodology section details the design-science research method used to develop and refine EREM. Following this, a Scholarly Critique is presented to critically evaluate the model against potential challenges, alternative perspectives, and known pitfalls from literature—ensuring a balanced analysis of its strengths and limitations. The heart of the paper is the Model Architecture section, which describes the structure and components of EREM in depth (illustrated by conceptual figures and diagrams). An Interpretation section provides further elucidation of EREM's workings and significance, including analogies to historical precedents (such as the Biblical Joseph strategy for crisis management) and illustrations of how the model principles can be applied in contemporary contexts (e.g. specialized innovation hubs, lifelong learning initiatives, governance reforms). Finally, the Conclusions summarize the findings, discuss policy implications, and issue a call to action for adopting a more ethical, ecosystem-oriented approach in higher education and innovation policy. Throughout the article, in-text citations in APA style are used to demonstrate the study's connection to existing knowledge, and all figures and tables are referenced and integrated into the discussion. By combining rigorous literature integration with a forward-looking design, this work aims to contribute a viable blueprint for universities and their partners to co-create a future where technological progress and social justice advance hand in hand.

Background

Contemporary higher education operates in an environment defined by rapid technological progress, economic upheavals, and pressing social inequalities. Unfortunately, many academic institutions and innovation systems have not fully adapted to these conditions, resulting in structural misalignments that undermine both educational outcomes and societal well-being. This section provides an overview of the background factors that motivate the development of the EREM model.

One critical issue is the skills gap and curricular lag, as university curricula often lag behind technological and industrial changes. Consequently, graduates may possess outdated knowledge and skills, leading to a mismatch with current labor market needs. A study by Vieira do Nascimento et al. (2020) found that universities commonly fail to meet labor market requirements, resulting in graduates lacking essential practical skills for employability. The onset of the Fourth Industrial Revolution (Industry 4.0)—characterized by advancements in AI, automation, Internet of Things (IoT), and data analytics—has only widened this gap. Industries are now demanding a workforce capable of continuous upskilling and reskilling to keep up with AI-driven transformations (Skrzymowska, 2025). Yet traditional higher education has been slow to transition from a one-time, terminal education model to a paradigm of lifelong learning. According to recent analyses, even where lifelong learning is recognized in principle, structures to support "continuous education and lifelong learning" as a norm of job culture remain underdeveloped (UN DESA, 2023). This inertia poses a threat to economic inclusion and innovation: if workers cannot update their skills in stride with technological change, both productivity and equity suffer.

A second related issue is the patchy integration of Sustainable Development Goals in higher education. Since the UN adopted the SDGs in 2015, universities have increasingly incorporated terms like sustainability, equity, and social impact into their strategic plans and public messaging. In practice, however, many institutions stop at the level of rhetoric. Sustainable Development Goals are "often referenced in strategy documents yet rarely operationalized as course outcomes, project pipelines, or incubator selection criteria". In other words, there is a disconnect between high-level commitments to goals such as quality education (SDG4), reduced inequalities (SDG10), or climate action (SDG13), and the on-the-ground educational practices and research portfolios of universities. Studies on SDG integration in academia have found progress to be uneven and impeded by factors like siloed disciplines, lack of incentives, and limited expertise in sustainable development (Leal Filho et al., 2019). Without intentional mechanisms to embed SDG targets into curricula (for example, requiring that student capstone projects address specific SDG challenges, or aligning faculty research funding with SDG-related outcomes), universities risk remaining on the sidelines of the global sustainability agenda. This gap not only represents a missed educational opportunity, but also a failure of universities to exercise moral leadership on urgent global issues.

Another background challenge is the fragmentation of effort across sectors. Innovation and problem-solving for societal issues nowadays require collaboration among multiple stakeholders—universities, industries, governments, and communities. The "triple helix" model of innovation (Etzkowitz & Leydesdorff, 2000) conceptualized how academia, industry, and government can interact to spur economic development. The concept of the Quadruple Helix includes civil society as a fourth strand in the innovation system, alongside universities, industry, and government. This addition aims to enhance public participation in regional innovation policies (Wibisono, 2024). In reality, however, collaboration across these spheres often remains fragmented and sporadic. Universities may run isolated pilot projects with industry partners or government agencies, but these often remain small-scale and short-term. Without enduring structures for cross-sector co-creation, efforts tend to duplicate or fail to scale, and valuable synergies are lost. For example, it is common to see multiple uncoordinated pilot initiatives tackling similar community problems, none of which achieve the critical mass to influence national indicators. The absence of integrating platforms or governance "nodes" means policy continues to operate in silos even when evidence calls for integration across domains (education, health, environment, etc.). This fragmentation not only wastes resources but also leads to public frustration when well-intended innovations do not translate into systemic change. The background research suggests a clear need for better frameworks of multi-stakeholder governance that can unite disparate efforts, pool data and insights, and drive collective impact (Cai & Lattu, 2022).

Finally, and importantly, there are enduring equity and inclusion gaps that undercut trust in both technology and institutions. These include disparities by gender, geography, socioeconomic status, and disability, which result in uneven access to the benefits of innovation. For instance, cutting-edge educational technology or entrepreneurship opportunities often concentrate in urban centers and elite institutions, bypassing rural communities or marginalized groups. Moreover, when new technologies are developed in a "justice-blind" manner—without regard for who can access them or how they might produce unequal outcomes—the result is often that advantages accrue to those already in privileged positions, while risks disproportionately burden vulnerable populations. This has been observed with issues like algorithmic bias in AI (where systems can perpetuate racial or gender biases), digital divides in internet access, or the externalization of environmental costs (such as pollution) to disadvantaged communities. Such patterns undermine public trust in innovation: people see technology producing winners and losers in unfair ways, which erodes the social license for innovation. As noted in one analysis, "a justice-blind innovation system concentrates advantages while social legitimacy erodes". In higher education, access and equity remain pressing concerns—even as enrollment expanded globally, disparities in quality and outcomes persist (Schendel & McCowan, 2016). The COVID-19 pandemic further exposed these inequalities, with under-resourced students suffering greater learning losses. To restore trust, innovation systems must make closing equity gaps a first-order goal, not an afterthought.

In summary, the backdrop for this research is a convergence of systemic misalignments: curricula lagging behind technological change, symbolic commitment to sustainability without full implementation, disjointed multi-sector collaborations, and widening equity deficits in educational and innovation outcomes. These issues are "structural and persistent", not easily fixed by minor tweaks. They point to the need for transformative approaches that redesign how education and innovation ecosystems function at a fundamental level. The EREM model emerges from this context as an attempt to realign these pieces—to create an integrated system that keeps curriculum continuously relevant, translates sustainability goals into concrete action, and centers inclusion and ethics in every process. The next section will delineate the specific research problem addressed, building upon the background issues outlined here.

Research Problem Space

Based on the background analysis, the research problem can be formally stated as the persistent misalignment between higher education, innovation systems, and societal needs. In other words, current systems for educating talent and producing innovation are not effectively delivering the human capital, solutions, and public benefits that society urgently requires. This core problem manifests through several interrelated sub-problems:

Outdated curricula and skills mismatch: University programs often fail to equip graduates with the skills and competencies demanded by rapidly evolving industries and communities. As noted, graduates are frequently entering job markets whose requirements have shifted significantly during the span of their studies. The result is underemployment and a "skills paradox" where jobs go unfilled while graduates lack relevant skills (Cappelli, 2015). This mismatch impedes economic development and leaves young people without meaningful work, fueling frustration and socioeconomic instability.

Lack of continuous and modular upskilling frameworks: Workforce development remains largely episodic—individuals pursue formal education once (in youth) and then are left to catch up through ad-hoc trainings later. There is insufficient infrastructure for continuous, lifelong learning that would allow workers to update their skills in real time as technology and job roles change. This is despite clear evidence that the AI-driven economy requires constant skill renewal (Ifenatuora, Awoyemi, & Atobatele, 2024; Lang, 2023). The absence of stackable credentials, agile learning pathways, and recognition of prior learning means reskilling happens too little and too late.

SDGs and social impact goals remain aspirational: As discussed, many institutions rhetorically endorse goals like sustainability, gender equality, or poverty reduction, but these goals are not translated into operational targets and incentives within the education and innovation ecosystem. There is a disconnect between strategic vision and implementation on the ground. Research agendas and curricula often proceed with business-as-usual, treating "impact" and "sustainability" as peripheral considerations. This leads to a failure to mobilize the considerable intellectual and creative resources of universities towards solving real-world problems like climate adaptation, public health, or inclusive development. In effect, the "third mission" of universities (social impact) remains underdeveloped.

Fragmented multi-stakeholder collaboration: Current frameworks for collaboration between academia, industry, government, and civil society are inadequate. Interactions tend to be project-based or transactional (e.g., a sponsored research contract, or a short-term public grant) rather than strategic and sustained partnerships. There is no enduring platform for co-creation where these stakeholders jointly define problems, design solutions, and iterate policies. This fragmentation results in duplication of efforts and an inability to address complex systemic issues that require coordinated action (such as preparing a region's workforce for a post-carbon economy, or deploying technology in under-served areas). Traditional bureaucratic governance structures are not designed for the agility and integration now needed.

Governance and incentive failures: The misalignment is perpetuated by governance arrangements that lack "coordinating nodes" empowered with data and authority. For instance, in many innovation systems, no single entity is responsible for aligning educational outputs with industry needs, or for ensuring that ethical standards are upheld across research, product development, and policy. In academia, promotion and tenure criteria often emphasize publication volume over societal impact, disincentivizing professors from working on practical innovation or interdisciplinary projects (Orazbayeva, Davey, Plewa, & Galán-Muros, 2019). In government, silo budgeting and evaluation mean that an education ministry, a science/tech ministry, and an economic development ministry might each fund separate initiatives without integrating their goals. The net effect is that even well-meaning policies fail to reinforce each other; evidence and feedback that suggest integrated solutions get lost amid compartmentalized structures.

Ethical and equity blind spots in innovation: Perhaps most dangerously, current systems tend to catch ethical issues and inequities only after damage has occurred. For example, biases in AI algorithms may only be noticed once the technology is widely deployed, or environmental harms of an innovation become clear only after scaling up. These "ethical blind spots" arise because ethics is not systematically built into the R&D and deployment process. Privacy protections, bias audits, community consent—these are often bolted on as reactive measures or are entirely absent. Without proactive ethical governance, technological progress can inadvertently deepen inequality or erode rights, which is the opposite of the moral leadership and social justice mandate. As one observer put it, issues like algorithmic bias or weak data privacy tend to "appear late, after damage has been done". The current research problem recognizes that moral and ethical considerations need to be upstream into the design and rollout of innovations, rather than treated as an afterthought.

Taken together, these points define a composite problem of system failure: the ways we educate, innovate, and govern have not caught up to the needs of a fast-changing, inequitable world. The persistent nature of this misalignment suggests that piecemeal fixes will not suffice; instead, a holistic re-engineering of the ecosystem is required. The aim of this study is to devise and examine a model (EREM) that addresses this misalignment by creating integrated solutions.

In brief terms, the research problem is stated as: "How can we design a higher education and innovation ecosystem that continuously aligns competencies with societal needs, operationalizes ethical and sustainable development principles, and ensures inclusion and equity in outcomes?”. This broad question breaks down into sub-questions about curriculum co-design, translation of research to practice, feedback and governance mechanisms, and ethical safeguards. The next section will outline the primary objectives that have been set to tackle this problem through the proposed model.

Primary Objectives

In response to the complex problem space outlined above, the study has defined several primary objectives. These objectives guide the development of the Edupreneurship Research Ecosystem Model and serve as criteria for evaluating its success. The objectives are as follows:

Continuous curriculum renewal: To establish a mechanism for continuously updating and co-designing curricula in alignment with emerging industry trends and community needs. This includes integrating real-time labor market data, technology forecasts, and stakeholder input (e.g. employers, community representatives) into program and course design, so that graduates’ competencies remain relevant and up-to-date. The model seeks to shorten the feedback loop between the world of work and the world of education, moving from the traditional multi-year curriculum revision cycle to a more dynamic, ongoing process of curriculum improvement.

Operationalization of Sustainable Development Goals: To embed sustainable development targets (such as the SDGs) into the core activities of education and research, thereby converting high-level goals into concrete outcomes. Rather than treating sustainability and social impact as abstract ideals, the model aims to translate them into specific course learning outcomes, project criteria, innovation challenges, and metrics. For example, if an engineering program aligns with SDG7 (affordable and clean energy), the curriculum would include projects on renewable energy solutions, and startups emerging from the university might be evaluated on their clean energy impact. The objective is to make the SDGs and related social justice goals a tangible part of daily operations in academia (teaching, research, campus initiatives) and measure progress towards them.

Multi-stakeholder collaboration and knowledge translation: To create a collaborative ecosystem (involving academia, industry, government, and civil society) that can effectively translate research and ideas into practical ventures, products, and policies. This involves establishing physical or virtual hubs where stakeholders co-locate and work on shared projects (e.g. technology incubators, policy labs, community innovation centers). The objective includes not only fostering innovation (startups, prototypes, pilot programs) but ensuring those innovations address real community-defined problems and can be scaled or adopted within public systems or markets. By bridging the traditional silos, the model aims for more efficient diffusion of innovation—research findings moving into industry practice or policy adoption at a much faster rate, sometimes referred to as the “lab-to-market” or “lab-to-community” pipeline.

Embedding ethics and inclusion by design: To institutionalize ethical oversight and inclusive practices throughout the education and innovation lifecycle. This objective means that at each stage—from setting research agendas, to developing new technologies, to implementing educational programs—there are structural features ensuring considerations of ethics and equity are front and center. Examples include mandatory ethics reviews for tech projects (similar to institutional review boards in research but expanded to cover algorithms and data use), community advisory boards that give marginalized groups a voice in project design, and “justice-first” performance indicators that track how benefits are distributed across different populations. The model aspires to treat moral leadership as a system property, not merely the trait of individual leaders. In practice, this would make behaviors like transparency, fairness, and accountability standard operating procedure. Success on this objective would be indicated by, for instance, curricula that educate all students in ethical reasoning related to their field, innovation funding that prioritizes inclusive projects, and governance bodies that include ethicists or community advocates as decision-makers.

Agile governance and feedback loops: To implement a governance structure that is data-driven, responsive, and empowered to make iterative changes ("learning governance"). This objective recognizes that complex systems need continuous steering. The model will include mechanisms for Monitoring, Evaluation, and Learning (MEL) that gather data on outcomes (employment rates, social impact metrics, learning outcomes, etc.) and feed that information back into decision-making. A dedicated multi-stakeholder council or committee should have the authority to adjust policies, reallocate resources, or update standards based on this feedback. Essentially, the aim is to close the loop between results and strategy: if an approach is not yielding the desired equitable outcomes, the governance system detects it and corrects course quickly. This objective is critical for ensuring the model remains effective in the face of change and avoids the common pitfall of plans sitting on a shelf while the world evolves.

These primary objectives are intentionally ambitious and interlocking. They reflect the multifaceted nature of the problem: one cannot, for example, achieve continuous curriculum renewal (Objective 1) without also involving external stakeholders (Objective 3) and having agile feedback mechanisms (Objective 5). Similarly, embedding ethics (Objective 4) is tied to how governance is structured (Objective 5) and what goals are prioritized (Objective 2). By pursuing all objectives together, the EREM model seeks to produce a cohesive solution that addresses the root causes of misalignment rather than treating symptoms in isolation.

In the following sections, the paper will justify why a new model is needed (by examining gaps in existing approaches), review relevant literature that informs these objectives, and then present the theoretical and philosophical foundations that underpin the model's design. The synthesis of those insights will culminate in the detailed description of the model architecture and how it meets the objectives outlined here.

Justification for the Model

Why is a new model like EREM necessary? Could existing frameworks not be tweaked or combined to solve the issues identified? This section provides the justification for proposing a novel model, highlighting the inadequacies of current approaches and the unique contributions that EREM offers. The justification draws on both conceptual reasoning and evidence from recent studies.

Firstly, traditional academic reforms and industry partnerships have tended to be incremental and compartmentalized, whereas the problems at hand are systemic. For instance, universities in many countries have launched entrepreneurship centers or added ethics courses to their curricula in an attempt to address pieces of the puzzle. While beneficial, these measures often operate at the periphery of the institution and do not fundamentally change how the core system operates. The EREM model is justified by the need for an integrated architecture—it is not just adding one new program or policy, but redesigning how various elements (education, research, governance, industry linkages) fit together. This integrated approach is supported by design principles in systems engineering and education reform literature which indicate that aligned and concurrent changes across multiple domains yield far greater impact than isolated interventions (AlShami & Czegledi, 2025; Park, 2026). In other words, without a comprehensive model, improvements in one area could be negated by neglect in another.

Secondly, existing models of innovation like the Triple Helix focus on the actors (university, industry, government) but less on the governance processes and the values guiding innovation. The justification for EREM is that it explicitly embeds a moral and ethical dimension that other models treat implicitly or not at all. The novelty of EREM lies in what might be termed the "conversion of virtue into governance". In the model, moral leadership ideals (such as integrity, justice, and accountability) are translated into concrete governance instruments—e.g., ethics councils with decision authority, public dashboards reporting social impact metrics, and incentive structures that reward equitable outcomes. This goes beyond generic calls for ethical leadership by structurally wiring ethics into the system's operation. As one recent paper argued, treating ethics as infrastructure (rather than an abstract principle) can greatly improve risk mitigation and trust in complex systems. EREM heeds this insight: it makes ethics a foundational layer of the ecosystem, akin to how physical infrastructure (roads, IT networks) undergirds operations. No current mainstream model of university-industry collaboration or educational innovation has this feature. This design choice is justified by the reality that leaving ethics to individual choice has repeatedly proven inadequate—from data privacy scandals to widening inequality, voluntary or superficial measures have not prevented negative outcomes. Therefore, an architecture that institutionalizes ethical checks and balances is a critical innovation.

Thirdly, EREM is justified by its emphasis on measurable justice-first outcomes alongside traditional metrics. In most educational and innovation assessments, metrics like publication counts, patent filings, job placements, or GDP contributions are tracked, but metrics of inclusion (who is benefiting), sustainability (environmental impact), or social value are either ignored or secondary. The proposed model elevates these latter indicators to equal prominence. By designing Key Performance Indicators (KPIs) that explicitly include justice and well-being (for example, reduction in gender employment gap among graduates, or number of start-ups benefiting low-income communities), the model ensures that social impact is not eclipsed by output volume. This approach responds to increasing calls in the literature for "responsible innovation" and "inclusive innovation metrics" (Kattel, McLaren, Sari, & Maldonado, 2024). It also answers the critique that many innovation ecosystems tend to prioritize economic outcomes over social ones, which can exacerbate inequity (Gumbo & Moos, 2025). The justification here is that without explicit metrics and targets for justice, those goals remain aspirational and are often overridden by easier-to-measure economic targets. EREM's design mandates that any evaluation of success must consider who gains and whether the innovation advances fairness—effectively internalizing social externalities into the model's definition of success.

Furthermore, EREM builds on and adds novel value to prior frameworks in several ways. It is instructive to compare it to some related models:

- Education 4.0 initiatives: Many universities have embraced the concept of "Education 4.0", aligning education with Industry 4.0 technologies (AI, IoT, etc.) to produce digitally savvy graduates. While Education 4.0 shares EREM's recognition of new tech, EREM goes further by coupling tech integration with ethical governance and multi-sector collaboration. The justification is that tech-driven education reform alone can lead to what some scholars call "technical determinism". Technological determinism involves the idea that technology determines the structure of society and can be used by historical or present-day actors to achieve political goals. It can also be seen in certain scientific theories like modernization theory in sociology. However, it fails to recognize that society also shapes technology (Hallström, 2022). EREM ensures technology is a means to a human-centric end, not an end itself, by embedding it in a broader moral and societal framework (this aligns with the Society 5.0 vision of human-centered technology).

- Triple/Quadruple Helix models: These emphasize structural collaboration among sectors. EREM adopts the helix approach but contributes a dedicated spine and feedback nervous system that typical helix models lack. Traditional helix models, for example, do not specify how decisions get made or how conflicts between stakeholders are resolved. EREM introduces a governance council (multi-stakeholder) that has real authority to steer the ecosystem, something often presumed but not formalized in helix collaborations. It also integrates a Monitoring, Evaluation, and Learning (MEL) loop to constantly gauge performance. This can be seen as complementing the helix by adding cybernetic control—a way to self-correct based on outcomes. The novelty is the fusion of collaborative structure (helix) with cybernetic function (feedback loops), providing an answer to critics who note that simply bringing stakeholders together is not sufficient without mechanisms to learn and adapt (Cai & Lattu, 2022).
- Design thinking and challenge-driven education: In recent years, approaches like design thinking in education and challenge-based innovation programs have gained traction. These encourage student projects on real problems and interdisciplinary teamwork. EREM supports this pedagogically (for example, through its adaptive education pillar encouraging project-based learning on community needs), but it justifies itself by scaling up from individual classroom experiences to an entire institutional model. It is one thing to have an innovation challenge in a course; it is another to align the university's research, teaching, and funding with broader societal challenge themes. EREM makes challenge-driven and design-oriented methods part of the institutional strategy (through hubs, partnerships, and priority-setting at the governance level). This is necessary because pilot programs often fade without systemic integration. In essence, EREM institutionalizes the innovative pedagogy, ensuring it is not just pockets of excellence but a consistent mode of operation.

In terms of empirical justification, early analogues of certain elements of EREM have shown promise, reinforcing the model's rationale. For instance, Germany's dual vocational training system (an oft-cited model for aligning education with industry needs) has been credited with lower youth unemployment and a smoother school-to-work transition (Mckay, Vinton, Boyle, & Van Noy, 2021). This can be seen as a real-world precedent for EREM's call for co-designed competencies and continuous alignment of curricula with labor demand. Singapore's SkillsFuture initiative, which provides credits and institutional support for lifelong learning, demonstrates at a national scale the impact of investing in continuous upskilling; since its introduction, tens of thousands of mid-career adults have re-skilled, suggesting that structural facilitation of lifelong learning works when properly funded and promoted. Similarly, technology and innovation hubs in Africa (e.g., Kenya's "Silicon Savannah" or Nigeria's tech hubs) illustrate how multi-sector collaboration in a physical hub can spur a wave of entrepreneurial activity and local solutions, although many of these hubs operate in isolation from universities or without strong policy support. EREM is justified in that it intends to connect these dots: link the educational system with such hubs and with policy levers, thereby amplifying their effectiveness.

Finally, a normative justification: the philosophical ethos of EREM resonates with longstanding educational values that have been difficult to implement in practice. Over a century ago, educational reformer John Dewey argued for education that is deeply connected to experience, community, and democratic life (Dewey, 1916). Likewise, in the context of this paper's institutional setting (an Adventist University), Ellen G. White wrote about education as the "harmonious development" of the physical, mental, and spiritual powers, and the preparation of individuals for unselfish service (White, 1903). These visions call for educational systems that produce not only knowledgeable, but also ethically strong and socially conscious individuals. The justification for EREM is that it offers a concrete structural way to realize these values under contemporary conditions. It is, in a sense, an answer to the question: "What would an education system look like if it were truly designed to produce moral leaders and just outcomes?". The model attempts to answer that in operational terms. As a poignant inspiration, EREM echoes White's famous statement: "The greatest want of the world is the want of [people]… who will stand for the right though the heavens fall" (White, 1903). EREM's stance is that systems should be engineered to routinely cultivate and employ such moral courage, rather than leaving it to rare individuals. It provides the rails on which character and ethics can travel together, making ethical leadership a norm rather than an exception.

In summary, the justification for the EREM model lies in its ability to address the multidimensional failures of current systems through a unified, ethically-grounded, and feedback-driven architecture. It is not a minor adjustment, but a reimagining of how an education-innovation ecosystem can function when aligned with the imperatives of the 21st century: adaptability, sustainability, collaboration, and equity. The next sections will delve into the literature and theoretical underpinnings that support this model, before detailing the model itself.

Literature Review

Overview of Relevant Literature

This literature review surveys the body of knowledge that informs the development of the EREM model. It encompasses theoretical perspectives on education and innovation, as well as findings from recent empirical research, with an emphasis on sources from 2020 onward to capture contemporary insights. The review is organized in two parts: (1) an overview of conceptual and theoretical literature, and (2) empirical studies and case examples that illustrate the problem space and potential solutions.

Education-Industry Alignment and Lifelong Learning

A significant area of literature addresses the gap between educational outcomes and labor market needs. Classical human capital theory (Becker, 1964) established the economic rationale for investing in education to improve productivity, but contemporary works highlight that what is taught matters as much as how much. Recent research by Camacho-Zuñiga et al. (2025) observes that universities often do not produce the "dynamic skill sets" required by modern industries and calls for continual curriculum innovation in line with Industry 4.0 needs (Camacho-Zuñiga et al., 2025). UNESCO report documents international trends showing that access to higher education has expanded, yet equity and relevance remain problematic (Conner & Rabovsky, 2011). They emphasize bridging the education-work divide and integrating lifelong learning as part of the employment culture. The World Economic Forum's Future of Jobs reports provide quantitative backing: the 2023 report notes that nearly half of all employee skills will need updating by 2027 and stresses large-scale reskilling initiatives (World Economic Forum, 2023). This has catalyzed literature on lifelong learning ecosystems—studies exploring how to systematically support individuals in updating skills throughout their careers (Brown, Bimrose, Barnes, & Hughes, 2012; Clarke, 2008; Frie, Van der Heijden, Korzilius, & Sjoer, 2024). A recent Frontiers article by Mejía-Manzano et al. (2022) discusses aligning educational models with Industry 4.0 guidelines, noting that continuous education and modular credentials are pivotal for sustainable economic growth. These works collectively argue that modularity, flexibility, and industry co-creation in curricula are effective strategies for closing skill gaps. They also show that policy support (like Singapore's SkillsFuture credits or European upskilling programs) can significantly boost lifelong learning participation, indicating that structural incentives work (Cedefop, 2020).

Integration of Sustainable Development in Higher Education

The literature on higher education's role in sustainable development has grown since the SDGs were announced. An overarching theme is that universities are eager to contribute but face challenges in implementation. Leal Filho et al. (2019) conducted a global survey of universities and found widespread awareness of SDGs but "skewed" integration, with sustainability often limited to environmental courses or campus greening projects, and less so in core curriculum or research agendas. Barriers identified include lack of expertise among faculty, limited interdisciplinary collaboration, and insufficient institutional commitment. Trencher et al. (2014) introduced the concept of "sustainability co-creation" in living labs, suggesting universities partner with local governments and businesses on urban sustainability projects as part of learning—a model that has shown success in cities like Stockholm and Tokyo. Another strand of literature is on Education for Sustainable Development (ESD), which advocates pedagogies that impart values, knowledge, and action skills for sustainability (Sterling, 2010). While progress is noted in teacher training and some student engagement, the scaling of ESD remains a concern. Lozano et al. (2019) pointed out that integrating SDGs into all disciplines (not just environmental science classes) is crucial, and they provide examples of institutions that map each course to relevant SDGs to identify gaps. Also relevant are studies like Stephens et al. (2008) on "university-based sustainability networks" which argue that when universities reorient research and curriculum around global challenges, it can lead to more transdisciplinary knowledge production and societal impact. These literatures support EREM's emphasis on concretizing SDGs in academic practice, showing both the need and viability of doing so, given adequate leadership and restructuring.

Multi-Stakeholder and Helix Innovation Models

The theoretical foundation for cross-sector collaboration comes from innovation studies. Etzkowitz and Leydesdorff's (2000) Triple Helix theory posited that the interaction of university-industry-government is key to knowledge-based societies, with universities taking a more prominent entrepreneurial role than in the past. Subsequent expansions, as discussed earlier, include the Quadruple Helix (which brings in civil society or the "public" sphere) and the Quintuple Helix (adding the natural environment) (Carayannis & Campbell, 2009; Carayannis & Rakhmatullin, 2014). Recent scholarly work, such as Cai and Lattu (2022), debates when to use triple vs. quadruple models in empirical studies. They find that a quadruple helix model is especially useful for innovation in domains where public acceptance and cultural factors are significant (e.g., health, education), because it explicitly accounts for community voices and media. Another emerging concept is "responsible innovation" in helix collaborations, which examines how multi-actor partnerships can incorporate ethical considerations. These works indicate that multi-stakeholder governance can be an engine for innovation, but they also caution about power imbalances: e.g., industry might dominate unless governance structures ensure a balance of influence (Cai & Amaral, 2021). Empirical case studies show quadruple helix collaborations in smart city initiatives and environmental management, often citing improved outcomes when citizens and NGOs are involved in project design and oversight. This literature informs EREM's design of inclusive councils and stakeholder engagement processes, confirming that broad stakeholder inclusion leads to more socially robust and accepted innovations.

Ethics, Social Justice, and Leadership in Education

A body of literature in educational leadership and organizational management speaks to the infusion of ethics and social justice into practice. Scholars like Furman (2012) and Shapiro and Gross (2013) articulate frameworks for "ethical educational leadership" that involve acting with equity and care for all students. They argue for systemic approaches: for example, Furman (2012) described "communities of moral practice" within schools. In higher education, Kezar and Posselt (2019) examined how university leadership can prioritize diversity and inclusion, noting that without alignment of incentives (tenure processes, budget allocations) with those values, progress is slow. The concept of "moral leadership by design" has parallels in corporate governance literature as well, where researchers have explored how corporate codes of ethics, compliance systems, and board oversight can embed ethical behavior into an organization's DNA (Paine, 1994). An interesting cross-sector insight comes from the field of Responsible AI: authors like Floridi and Cowls (2019) propose an "AI governance framework" that includes ethics boards, bias audits, and transparency reports as standard practice in tech development. EREM essentially generalizes such ideas to an entire ecosystem, and literature supports the efficacy of these mechanisms. For instance, Schiff et al. (2021) reported that AI ethics panels, when given teeth, can mitigate risks and increase public trust in AI deployments. There is also relevant literature on accountability in public administration: Bovens (2007) described how public institutions can be designed to be answerable for their actions via transparency and feedback requirements. The notion of public dashboards and open data for accountability, which EREM incorporates, has precedent in governance reforms (e.g., city government performance dashboards). All these works underscore that ethical and just leadership outcomes are not just a matter of personal virtue but of system design. By institutionalizing certain practices (like ethical review, inclusive decision-making, accountability measures), organizations can significantly influence behavior and outcomes (Stahl et al., 2017). This literature justifies EREM's heavy emphasis on structure: if we want moral leadership to thrive, we must create an environment that routinely demands and supports it.

In summary, the conceptual literature provides multiple building blocks for the EREM model: strategies for curricular reform and lifelong learning, integrating sustainability into education, fostering quadruple helix collaborations, and embedding ethics and social justice into organizational systems. EREM can be viewed as a convergence of these strands into one framework. The innovation of EREM is not in inventing these concepts anew, but in combining and operationalizing them holistically within a higher education context. The next part of the literature review will examine empirical studies and case evidence that demonstrate the feasibility and impact of such approaches, reinforcing the case for each major component of the model.

Empirical Evidence and Case Studies

To ground the discussion, this section reviews empirical findings and real-world cases that exemplify elements of the problem or potential components of the solution. These examples, drawn largely from recent (post-2020) studies and reports, illustrate why the interventions proposed by EREM are needed and how they have worked (or not worked) in practice.

Skills Mismatch and Co-Design of Curriculum

A 2021 study by Chiang (2021) provides a case of external stakeholder involvement in curriculum design. In this case study at a university (in Malaysia), industry partners and community representatives were engaged in designing an experiential learning pedagogy for students (Chiang, 2021). The result was a curriculum more attuned to practical skills, and importantly, students reported greater motivation and relevance in their learning. Employers in the study's context had long complained that graduates lacked certain soft skills and practical exposure, but after the co-design initiative, internship performance of students improved and employers gave positive feedback on the new graduates' job readiness. This supports the idea that curriculum co-design with external input can alleviate skills mismatch (Chiang, 2021). Similarly, the University Industry Innovation Network (UIIN) recently published an article (Day, 2024) highlighting that quadruple helix collaborations—involving employers and community in curriculum development—result in programs that better prepare students for employment and civic engagement. They cite examples from the Netherlands and Australia where industry-sponsored capstone projects and community service learning led to improved employment outcomes and student competencies. These empirical cases strengthen the argument that the EREM model's push for continuous curriculum refreshment and stakeholder co-design is not only theoretically sound but practically achievable, given supportive policy and resources.

Lifelong learning systems: The experience of Singapore's SkillsFuture initiative is instructive. Since 2015, Singapore has implemented a national policy giving all citizens a credit account to spend on approved training courses, along with expanding part-time and modular offerings across universities and polytechnics. Reports by Singapore Ministry of Education (2020) show that by the end of 2020, over half a million Singaporeans had utilized SkillsFuture credits, and many employers started to view these micro-credentials as valid signals of capability (Singapore Ministry of Education, 2020). The initiative's success, in terms of uptake and reported satisfaction, suggests that if financing and access hurdles are removed, adults do engage in lifelong learning. Another empirical reference is a study in *Frontiers in Education* (Camacho-Zuñiga et al., 2025) that examined a Mexican private university's continuous learning model. They found that aligning an educational model's pillars with industry guidelines (in this case, the EU's Industry 4.0 curriculum guidelines) helped ensure that students were gaining relevant skills for future jobs (Camacho-Zuñiga et al., 2025). The students interviewed reported that flexible and hybrid learning options were key (for balancing work and study), and that inspiring faculty with industry experience made a big difference in quality. This case underscores components that EREM also values, such as flexibility, industry-experienced educators, and alignment with external competency frameworks.

Innovation Hubs and Translational Research

In terms of hubs translating research to ventures, Africa provides notable examples. A study by Safaricom (2020) reviewed Kenya's tech innovation ecosystem and found that the presence of multi-purpose innovation hubs (e.g., Nairobi's iHub) led to an increase in successful tech startups and also created a community of practice linking developers, entrepreneurs, and venture capital. However, it also noted a gap: universities were not fully integrated into these hubs, meaning a lot of academic research remained in journals rather than being commercialized or applied. The EREM model directly addresses this by proposing university-anchored hubs open to external collaborators. Another example comes from Zambia (the context in which the present research is situated). The concept of specialized hubs to align with national priorities is mentioned in the EREM conference material: for instance, creating mining-technology hubs in a mining-driven economy, or agri-tech hubs to support agriculture. While not fully realized yet, preliminary efforts in Zambia have shown positive signs—e.g., a pilot agri-tech incubator supported by a university and the Ministry of Agriculture produced a few startups that introduced affordable IoT-based irrigation solutions for small farmers. Those solutions were then tested by local farming cooperatives, shortening the feedback from invention to adoption. Though small, this case suggests that collaboration platforms can anchor feasibility by quickly validating which innovations work in local context (per EREM's emphasis that "research is translated, prototyped, and validated with users" in a continuous loop). On a larger scale, Europe's network of Digital

Innovation Hubs (DIHs) provide empirical support. DIHs are EU-supported centers where companies, government, and researchers collaborate on digital solutions. A 2021 evaluation by the European Commission found that regions with active DIHs saw faster adoption of digital technologies by SMEs and better diffusion of research into industry, in comparison to regions without such hubs. It credited the hubs' one-stop-shop model and multi-stakeholder governance for these outcomes.

Governance and Policy Integration

Empirical examples of agile, evidence-based governance are rarer (since this is an emergent practice), but one can point to certain public sector initiatives. For example, Estonia's e-governance system uses real-time data dashboards for decision-making in areas like education and health. The country's government can track metrics (school performance, workforce statistics) almost in real-time and has institutionalized an iterative approach to policy (Tõnurist & Hanson, 2020). While not in a university context, it shows that a government council can indeed practice data-driven iteration, supporting the idea in EREM of a multi-sector council adjusting strategies based on MEL feedback. In the academic realm, Georgia State University (USA) provides a compelling case of data-driven governance: by developing a predictive analytics system to monitor student progress and an agile advisement response, GSU significantly improved student retention and graduation rates, especially for low-income and minority students (Park, Goodman, Hurwitz, & Smith, 2020). This demonstrates how monitoring and quick feedback loops (in this case, identifying struggling students early and intervening) can lead to more equitable outcomes—a microcosm of what EREM envisions at a macro level with societal indicators and policy adjustments.

Ethics and Inclusion Measures

There are increasing examples of institutions implementing systemic ethics measures. The IEEE's Global Initiative on Ethics of Autonomous Systems recommended that organizations establish internal ethics boards for AI projects; companies like Google and Microsoft did set up AI ethics panels (though with mixed success, pointing to the need for genuine authority and diversity in such bodies). Universities, for their part, have started instituting Responsible Research and Innovation (RRI) frameworks, particularly in Europe, where EU Horizon 2020 funding encouraged universities to consider ethics, public engagement, and inclusivity in research proposals. A study by Wittmann et al. (2021) of RRI implementation in several universities found that when researchers were required to include societal stakeholders and ethicists in their projects (as part of grant conditions), it led to better project outcomes and fewer ethical controversies. This mirrors EREM's notion of making ethical and inclusive practice a requirement (through governance and funding levers) rather than voluntary. The concept of "justice-first KPIs" in EREM is novel, but one can find analogous moves in some progressive organizations: for instance, the city of Los Angeles now includes equity outcomes in performance metrics for each department, and the UK's National Health Service has created an "Workforce Race Equality Index" as a mandatory performance metric for NHS trusts. These are nascent but indicate a trend towards quantifying and enforcing equity—exactly what EREM advocates by having justice metrics next to productivity metrics.

Outcomes and Impact

The ultimate empirical measure for any model is whether it improves outcomes. While EREM as an integrated model is new, each of its pieces has shown outcome improvements in instances. To recap a few: German dual training—lower youth unemployment (success in employment outcome); quadruple helix living labs—solutions more readily adopted by communities (success in innovation adoption outcome); Georgia State's data loops—narrowed achievement gaps (success in equity outcome); Singapore's SkillsFuture—high uptake and employer recognition (success in lifelong learning outcome). These give confidence that if we combine these elements, we could see holistic improvements: more graduates employed in meaningful jobs, more research turning into startups or policies that benefit society, reduced inequalities in who benefits from innovation, and stronger public trust in institutions.

In conclusion, the empirical literature and case experiences resonate strongly with the needs EREM addresses. They demonstrate both the necessity of intervention (through evidence of current failings like skill mismatches and inequities) and the efficacy of certain approaches (through examples of co-designed curricula, innovation hubs, data-driven governance, etc.). These examples serve as proof points that the strategies embedded in EREM are grounded in reality, not just utopian theory. The literature and cases thus form a robust foundation for the theoretical framework and model architecture that follow.

Theoretical Framework

Designing a multifaceted model like EREM requires a strong theoretical foundation drawn from several disciplines. This section outlines the key theories and conceptual models that inform EREM's design, explaining how each is incorporated into the framework. The theoretical framework is inherently interdisciplinary—reflecting the model's bridging of education, technology, management, and ethics. The major theoretical strands include systems theory and cybernetics, helix innovation models, human capital theory, social diffusion theory, and public choice/institutional theory, each contributing specific insights to the model's architecture (see Figure 1).

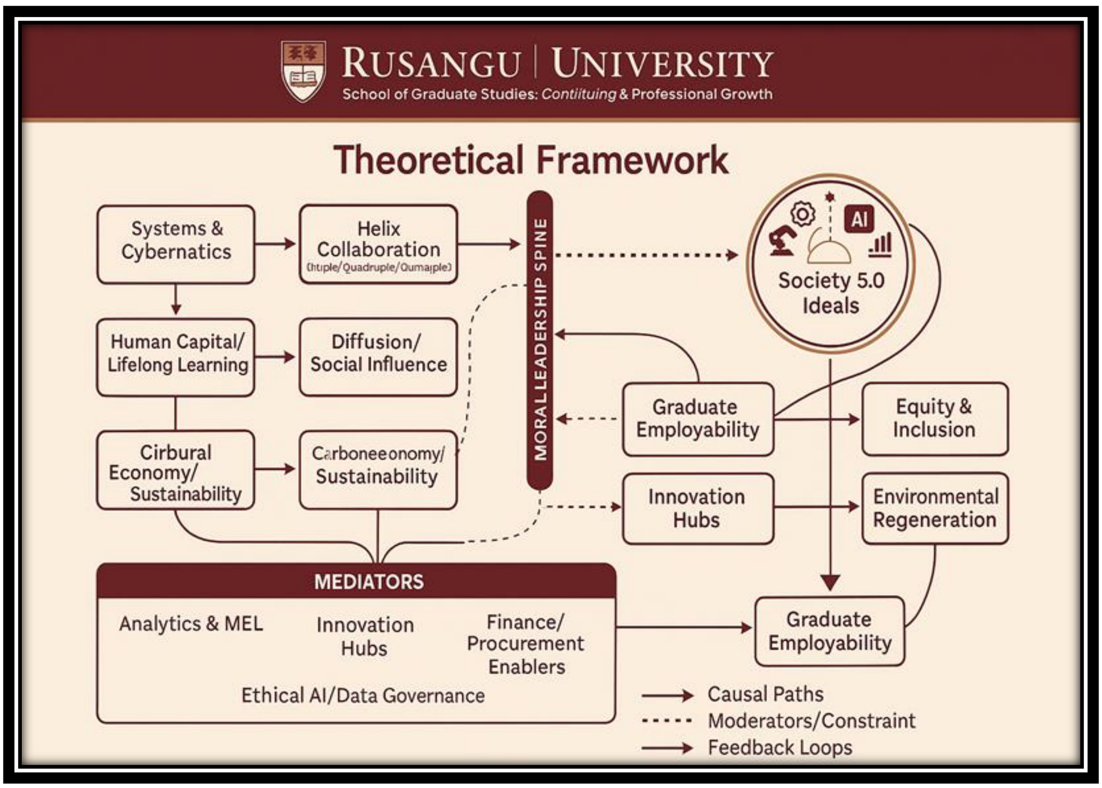

Figure 1. Theoretical framework.

General Systems Theory and Cybernetics

At its core, EREM is conceived as a system—with inputs (e.g. students, research ideas, funding), processes (curriculum delivery, incubation, governance), outputs (skilled graduates, innovations, policies), and feedback loops for self-regulation. General systems theory (Von Bertalanffy, 1968) provides the baseline understanding that the components of an educational ecosystem are interdependent and that one must optimize the whole rather than the parts in isolation. From cybernetics (Wiener, 1948), the model borrows the notion of feedback loops as self-correcting mechanisms. In EREM, the Monitoring, Evaluation, and Learning (MEL) feedback loops play this role—continuously feeding outcome data (e.g., employment rates, innovation adoption metrics, inclusion indices) back into decision-making. This reflects the cybernetic principle of continuous adjustment towards goals. The model's adaptive behavior (such as refreshing curriculum or pivoting an incubator program based on outcome data) aligns with what in cybernetics is known as feedback control. The concept of requisite variety (Ashby, 1956) also underpins EREM's design: the system's internal regulatory capacity (via MEL and agile governance) must be as diverse and dynamic as the external changes it faces. By having multiple feedback channels (academic outcomes, market trends, social impact data) and a governing body capable of interpreting and responding, EREM aims to meet Ashby's Law of Requisite Variety (the control system can handle the variety of disturbances). In sum, systems theory and cybernetics justify EREM's holistic integration and its emphasis on real-time feedback and adaptation as crucial for system viability.

Helix Models of Innovation (Triple, Quadruple, Quintuple Helix)

EREM's collaborative structure draws heavily on helix innovation theories. The Triple Helix (Etzkowitz & Leydesdorff, 2000) established that the interplay between universities, industry, and government can generate a knowledge-based economy. EREM leverages this by positioning the university not as an ivory tower but as an active economic and social development agent. The Quadruple Helix concept—which adds civil society or the "public"—is explicitly integrated in EREM's governance and operations (Carayannis & Campbell, 2009). In practical terms, this means community representatives, NGOs, and end-users have a seat at the table (e.g., on advisory councils, in design thinking sessions for curriculum and research agendas). The importance of this, as theory suggests, is to incorporate societal feedback and legitimacy into the innovation process, making outcomes more democratic and culturally accepted (Cai & Lattu, 2022). Moreover, Quintuple Helix thinking (Carayannis & Rakhmatullin, 2014) brings in the natural environment as a stakeholder. EREM mirrors this by including a "Sustainability & Circular-Economy Lens" as one of its pillars, effectively acknowledging the environment in every initiative (e.g., checking for environmental impact and regeneration in projects). The helix theories also contribute the idea of boundary-spanning roles—individuals or entities that connect different sectors (such as technology transfer offices, or joint industry-university labs). EREM formalizes some of these boundary-spanning structures through its innovation hubs and governance council, which are meant to be hybrid spaces where different helices meet. The theoretical implication is that knowledge and innovation thrive in these cross-cutting networks (Leydesdorff, 2012), and EREM's design as an ecosystem of multi-helix interaction follows that blueprint.

Human Capital Theory and Education Economics

Human capital theory (Becker, 1964) provides rationale for many of EREM's educational reforms. It treats education and training as an investment that yields returns in productivity and earnings. However, the simplistic version of the theory doesn't guarantee alignment (one can invest in the wrong skills). Modern interpretations

(Goldin, 2016; Tan, 2014) stress that the quality and relevance of human capital development are crucial. EREM's focus on adaptive education and co-designed competencies with employers stems from the economic insight that education must match the evolving demands of the economy to produce real returns (Vieira do Nascimento et al., 2020). The inclusion of stackable micro-credentials and lifelong learning in EREM reflects what economists have noted about the future of work: continuous learning is part of maintaining one's human capital in the face of skill depreciation (Li, 2024). Additionally, EREM's attention to equity ties into theories of human capital externalities and social rates of return. By ensuring broad inclusion (i.e., not leaving talent underdeveloped in disadvantaged groups), the model aligns with studies that show diversity and inclusion improve innovation and economic outcomes (Page, 2007; Ottaviano & Peri, 2006). Thus, human capital theory not only underpins the economic logic of updating skills but also supports the social justice aspect: unequal access to quality education represents a loss of potential economic output and innovation (Psacharopoulos & Patrinos, 2018). EREM, by attempting to close equity gaps in skill development, theoretically maximizes the human capital available to society. In a sense, it broadens the theory's scope by not just counting individual gains but aiming for a collective optimal distribution of education benefits (which relates to Rawlsian ideas of justice, albeit that's philosophical).

Diffusion of Innovation and Social Networks

Everett Rogers' diffusion of innovations theory (2003) and related social network theories inform EREM's strategy for translating and scaling innovations. Rogers highlighted that for innovations to spread, certain conditions and roles are necessary: e.g., early adopters, opinion leaders, channels of communication, and a social system that supports the innovation. EREM's hubs and multi-stakeholder approach echo this by creating communities of practice that can hasten adoption. The model anticipates that adoption is a social process—"exemplars, communities of practice, and visible early wins matter as much as design", as noted in the theoretical backbone. This directly channels Rogers' concept that people often follow peer examples and need to see an innovation working in context (trialability and observability in Rogers' terms). By incorporating demonstration projects in communities and feedback from end-users from the start, EREM increases the likelihood that innovations generated within will diffuse outward. Another relevant theory is Granovetter's strength of weak ties (1973), which posits that bridging connections (weak ties) between different networks often facilitate new ideas spreading. In EREM, the presence of diverse stakeholders (academics, entrepreneurs, officials, citizens) in shared forums creates these bridging ties, helping ideas move from one context to another (e.g., a research finding moving to a startup, or a community need informing academic research—a two-way diffusion). Moreover, the model's emphasis on public transparency (dashboards, etc.) contributes to diffusion by widely showcasing results, which can influence broader uptake (for example, other regions observing success might emulate the approach—an inter-institutional diffusion). In short, diffusion theory reinforces why EREM's design includes community engagement and broad communication: those elements are known to speed and smooth the innovation adoption curve in a social system.

Public Choice and Institutional Theory

EREM's governance design is influenced by public choice theory and institutional theory, which bring a realism about incentives and power. Public choice (Buchanan & Tullock, 1962) teaches that actors in governance (politicians, officials, even academics in administrative roles) have self-interests and respond to incentives. This underscores why EREM must align incentives with desired outcomes—for example, aligning faculty promotion criteria with collaboration and impact, or aligning government funding with equity and innovation metrics. If the "rules of the game" reward the wrong behaviors (like publishing for quantity without quality or societal relevance), then rational actors will follow those incentives, undermining the model's goals. EREM therefore includes incentive alignment explicitly: e.g., it suggests using procurement and funding levers to reward inclusion and impact. This is a nod to public choice insights—changing the payoff structure in the system to encourage cooperation and discourage "rent-seeking" or silo behavior. Institutional theory (North, 1990; Scott, 2001) adds that informal norms and culture are also key; EREM's design attempts to shift culture by normalizing transparency and collaboration as default behaviors (through formal structures that encourage them, like requiring multi-disciplinary teams or publishing data). The concept of institutional isomorphism (DiMaggio & Powell, 1983) suggests that if one influential institution (say an innovative university adopting EREM) is successful, others will mimic it, which is another reason transparency and demonstrating success is important—it can influence the norms of the higher education sector more broadly. Additionally, stewardship theory in governance (Davis, Schoorman, & Donaldson, 1997) is relevant: it argues that if organizational leaders are empowered with trust and oriented to the mission (rather than tightly self-interested), they can act as stewards for the collective good. EREM's governance council is partly built on this idea—bringing together mission-driven representatives (including those speaking for future generations or the environment, implicitly) and giving them a mandate to enforce standards for the common good. By structurally placing stewards (like ethicists, community leaders) in governance, the model mitigates the risk that only narrow interests prevail.

Bringing these together, Figure 2 (Conceptual Architecture of EREM) illustrates how these theoretical strands interweave in the model's design.

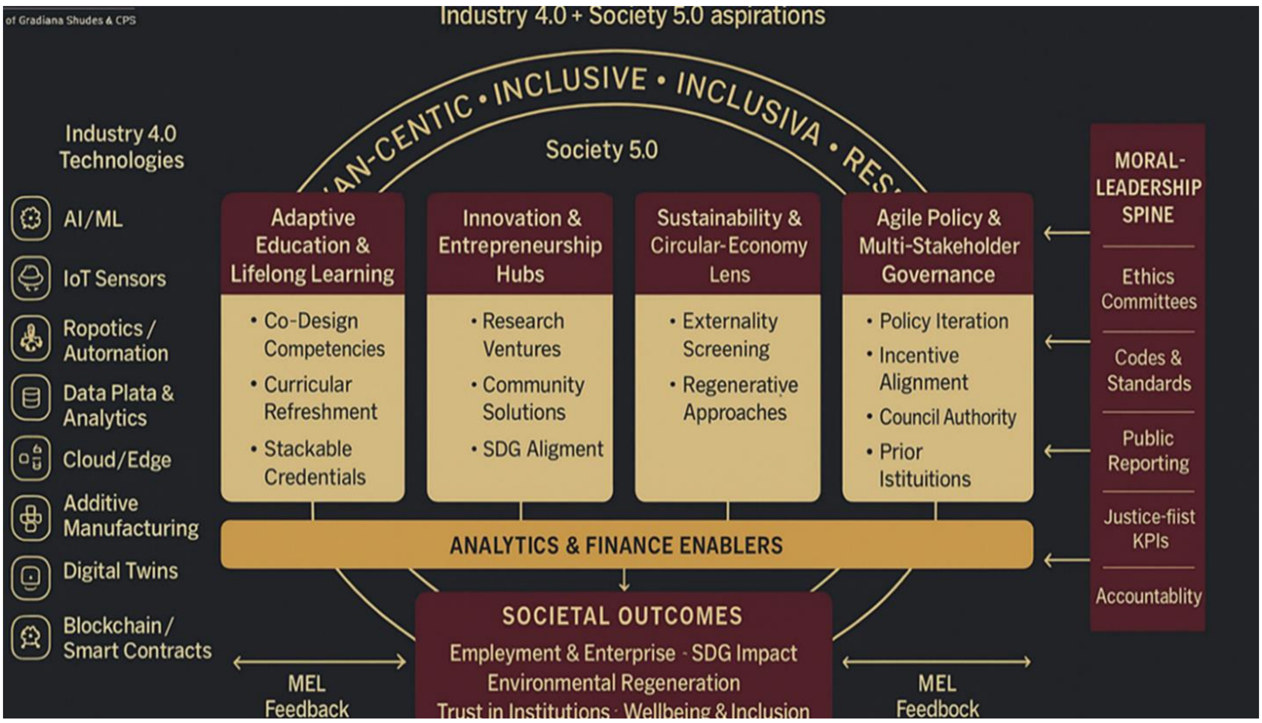

Figure 2. Conceptual architecture of the Edupreneurship Research Ecosystem Model (EREM).

The model comprises four pillars—(1) Adaptive Education & Lifelong Learning, (2) Innovation & Entrepreneurship Hubs, (3) Sustainability & Circular-Economy Lens, and (4) Agile Policy & Multi-Stakeholder Governance—connected by a Moral-Leadership Spine and supported by Analytics & Finance Enablers. Society 5.0 (human-centered innovation) forms the overarching goal. Feedback loops (MEL—Monitoring, Evaluation, and Learning) are built into every level, ensuring a cybernetic, adaptive system. This architecture operationalizes systems theory (feedback loops), helix collaboration (multi-actor pillars and council), human capital development (education pillar), diffusion theory (hubs and community links), and ethical governance (spine and lens).

Each element of the figure reflects theoretical components: the Moral-Leadership Spine draws from ethical leadership theory and ensures normative values (pragmatism, humanism, Ubuntu, etc., to be discussed in the next section) are embedded; the pillars embody structural-functional theories (education pillar from human capital and pedagogy, hubs from innovation and network theory, sustainability lens from environmental and quadruple helix theory, governance pillar from institutional and cybernetic governance theories); the Analytics & Finance Enablers illustrate resource-based theory (how data and finance flow can empower or constrain actions) as well as the idea from economics that both information and capital are needed to drive change (Nelson & Winter's evolutionary economics might be invoked here, where variation, selection, and retention are analogs to innovation, evaluation, and scaling in our model). The Societal Outcomes at the bottom align with welfare economics and social justice theories (ensuring that outcomes like employment, poverty reduction, trust, well-being are achieved aligns with Rawlsian justice as fairness, where institutions should be evaluated by the well-being of the least advantaged).

In conclusion, the theoretical framework of EREM is rich and multi-layered. It stands on the shoulders of established theories to ensure that the model is not an arbitrary collection of ideas, but a logically constructed system consistent with what is known about how complex social-technological systems function. Each theoretical component was carefully considered to solve a piece of the problem: systems theory for integration and adaptation, helix models for collaboration, human capital for skill alignment, diffusion for innovation uptake, and institutional theory for governance and incentives. By integrating these, EREM is theoretically equipped to be resilient, effective, and transformative. The next section will delve into the philosophical underpinnings, which complement these theories by providing value orientations and epistemological grounding for the model.

Philosophical Underpinning

Beneath the structural and theoretical design of EREM lies a set of philosophical commitments that shape its purpose and approach. These philosophical underpinnings answer the "why" of the model—why it values certain outcomes and modes of operation. Five key philosophical or worldview influences are embedded in EREM: Pragmatism, Humanism (including the Society 5.0 vision), Ubuntu (African communalism), Constructivism, and Stewardship Ethics. Each offers a guiding principle for the model's development and implementation, ensuring that the technical framework serves deeper human values.

Pragmatism

The model is grounded in the pragmatic philosophy that knowledge and theories must ultimately be judged by their usefulness and practical consequences (James, 1907; Dewey, 1931). Pragmatism in research and education emphasizes solving real problems and improving lived experience. In the context of EREM, pragmatism manifests as an insistence that academic work (teaching, research) should “make a difference in lived reality”. This is explicitly stated in the conference paper: pragmatism “values knowledge for its usefulness in alleviating suffering and advancing the common good”. Thus, the model prioritizes applied research initiatives, community engagement, and problem-based learning. It also influences the feedback loops—data are not collected for its own sake but to drive improvements that have tangible benefits. For example, if unemployment of graduates in a region is high, pragmatism pushes the model to adapt curriculum or partnerships until that metric improves, reflecting a “learning by doing” approach (an idea from Dewey’s educational philosophy). Pragmatism in EREM also means interdisciplinary openness; instead of strict adherence to one academic doctrine, the model borrows methods and insights from any field as needed to address challenges. This pluralism is very much in line with pragmatic methodology (Morgan, 2014), and it suits the multidisciplinary nature of EREM. In summary, pragmatism ensures EREM remains outcome-oriented and flexible: the measure of success is concrete improvement in communities and individuals’ lives, not just internal metrics or ideological purity.

Humanism and Society 5.0 Ideal

Humanism places human well-being, agency, and dignity at the center of concern. It asserts that technologies and institutions exist to serve humans, not vice versa. The Society 5.0 concept, introduced in Japan’s 5th Science and Technology plan, is a contemporary articulation of a human-centered technological society. It envisions leveraging advanced tech to solve social issues and enrich life, “ensuring technologies augment rather than diminish agency”. EREM is philosophically aligned with this humanistic, Society 5.0 vision. In practice, this means the model constantly questions: Does this innovation or educational practice improve people’s lives in a holistic sense? For instance, it’s not enough for a new AI application to be efficient; the model asks if it respects human autonomy and improves quality of life. Humanism in EREM also appears in the prioritization of dignity and agency—the education pillar emphasizes empowering learners (e.g., through upskilling and flexible learning, giving individuals agency to shape their careers), and the governance includes community voice (agency at a collective level). It resonates with Renaissance/Enlightenment humanism’s emphasis on the worth of each individual and their potential. One can also see ties to the Adventist educational philosophy here: Adventist thinker Ellen G. White advocated education that develops the whole person and enables a life of purpose and service, which is a humanistic view (albeit theistic). The mention of “dignity at the center” in the philosophical underpinning specifically echoes Society 5.0 rhetoric, which explicitly calls for balancing economic advancement with human happiness and well-being (Cabinet Office, 2016). Therefore, the model’s success criteria include subjective well-being and community flourishing, not just hard economic output, reflecting humanist values.

Ubuntu (African Communitarian Philosophy)

Ubuntu is a Southern African philosophy often encapsulated by the phrase “I am because we are”. It emphasizes mutuality, shared humanity, and the idea that an individual’s well-being is inextricable from the well-being of their community (Tutu, 1999; Mbiti, 1969). The EREM model explicitly references Ubuntu: “we flourish together or we do not flourish at all”. This principle justifies the model’s focus on inclusion and equity. It’s a rejection of the zero-sum or individualistic approaches; instead, it posits that the progress of the system is only true progress if it lifts up everyone, especially those traditionally left behind. In practical terms, Ubuntu influences EREM's design of collaborative hubs (which bring people together in a spirit of cooperation rather than competition), and its equitable outcomes metric (tracking who benefits ensures that innovations are not just helping a privileged minority). It also shapes the pedagogical stance: students are encouraged to learn in teams, engage in peer support, and connect their personal goals to societal needs—embodying mutual care and responsibility. In management of the model, Ubuntu would encourage leadership styles that are empathetic and consensus-driven. Notably, in an African university context, invoking Ubuntu provides cultural resonance and legitimacy to reforms, aligning modern innovation strategy with indigenous values of community and service. It counters purely market-driven or Western individualist paradigms by asserting a local philosophy: "if you want to go far, go together", as an African proverb says. Thus, Ubuntu gives EREM a moral imperative to reduce inequality and to design every element (from how cohorts of students are formed to how venture benefits are measured) in a way that fosters community upliftment and solidarity.

Constructivism (Participatory and Contextual Knowledge)

Constructivist epistemology, especially social constructivism, holds that knowledge is constructed by learners (and communities) through experiences and interactions, rather than passively absorbed (Packer & Goicoechea, 2000; Alanazi, 2016; Saleem, Kausar, & Deeba, 2021). The role of the teacher in this epistemological framework is to facilitate learning through scaffolding and providing opportunities for students to engage in meaningful, collaborative (Saleem et al., 2021; Hyde, 2020). EREM integrates constructivist thinking by acknowledging that "knowledge is co-created in context". This is why the model favors participatory design and place-based problem solving. Rather than a top-down expert model where knowledge flows in one direction from university to community, EREM embraces a co-constructive model: students, faculty, industry experts, and community members jointly create new knowledge and solutions. This aligns with theories of experiential learning (Schott & Marshall, 2021) and action research (Kokare, 2012)—which are constructivist in nature—where those affected by a problem are involved in developing the understanding and action to address it. The philosophical stance here is humility about knowledge: acknowledging multiple perspectives and types of knowledge (including local and tacit knowledge of communities) as valid and necessary. It also means educational content should not be overly generic—it should connect to learners' real-life context (hence the emphasis on place-based projects). Constructivism thus underpins the EREM methods like hackathons on local issues, community-engaged research projects, and iterative prototyping (in which users feedback is part of the knowledge construction). By privileging context and co-creation, the model avoids the pitfall of trying to import "one-size-fits-all" solutions that ignore local nuance. Instead, it fosters learning ecosystems where knowledge evolves with active input from all participants, aligning well with modern pedagogies like design thinking and challenge-based learning. It's worth noting that constructivism also aligns with the quadruple helix idea of knowledge production—in Mode 2 knowledge (Ramos-Mejía, Jauregui-Becker, Koers-Stuiver, & Franco-Garcia, 2019), knowledge is produced in context of application by transdisciplinary teams, which is essentially a constructivist practice at societal scale.

Stewardship Ethics (Justice, Sustainability, Accountability)

The final philosophical pillar is a composite ethic that the paper refers to as stewardship ethics, encapsulating justice, sustainability, and accountability. Stewardship is the idea of responsible management of resources and trust for the benefit of current and future generations—it has roots in religious thought (humans as stewards of God's creation) and secular sustainability discourse (each generation must hand off the planet to the next in good condition). EREM embraces stewardship in asking not only “can we build this?” but “should we, for whom, and at what cost?”. This explicitly ethical reflection is integrated into every decision in the model via the Moral-Spine structures like ethics committees and public dashboards. It echoes the precautionary principle and “do no harm” ethos often discussed in bioethics and tech ethics. The model’s requirement that “every initiative passes through an externality and just-transition screening” is a direct application of stewardship: it ensures that short-term gains do not compromise long-term equity or environmental health. Philosophically, this ties to John Rawls’ theory of justice (particularly the idea of just savings for future generations) and to virtue ethics conceptions of prudence and responsibility. It also resonates with Ellen G. White’s quotes referenced, such as “The greatest want of the world... men who will not be bought or sold...” and the idea of character and integrity being “structural” rather than just personal. EREM builds structures to enforce integrity (e.g., transparency measures that impose consequences for unethical behavior, such as funding withdrawal for projects that fail ethical audits). In doing so, it tries to make ethical conduct the path of least resistance. Accountability, one part of stewardship ethics, is about answerability to the public—hence EREM’s inclusion of public outcome dashboards and community oversight roles; this draws from democratic theory which holds that power must be accountable to prevent corruption (Aristotle’s notion of mixed government or Madison’s checks and balances have modern echoes in these governance ideas). Sustainability, the other part, is essentially intergenerational stewardship—ensuring environmental regeneration and considering future stakeholders in today’s decisions (Du Plessis, 2012; Gardner, 1989; Hajian & Kashani, 2021). EREM’s sustainability lens, with sensors and data to track environmental impact and circular economy integration, operationalizes this philosophical commitment to not sacrificing ecological integrity for immediate gains.

Together, these philosophies create a value system for EREM: pragmatic in action, human-centered in focus, communal in spirit, constructivist in process, and principled in governance. They ensure that as the model pursues the objectives laid out, it does so guided by a moral compass. Importantly, these philosophies are not siloed; they reinforce one another. For example, Ubuntu (community) and stewardship (responsibility) both inform the model’s equity emphasis. Pragmatism and constructivism both inform the iterative, learning orientation. Humanism and stewardship both ensure technology is subservient to human and environmental well-being. The integration of local cultural philosophy (Ubuntu) with global paradigms (humanism, pragmatism) also gives the model depth and legitimacy across contexts.

In sum, the philosophical underpinnings infuse the technical design with purpose and ethical direction. They safeguard the model against devolving into a mere efficiency exercise, by asserting that the ultimate goal is human and ecological flourishing. With this foundation set, the paper can proceed to methodology—ensuring that the way the model is developed and tested is consistent with both the theoretical framework and these philosophical values.

Methodology

The research methodology underpinning this study is a design science research (DSR) approach, complemented by iterative evaluation methods and expert feedback loops. Design science is chosen because the goal is to create and refine an innovative artifact (in this case, the EREM model) that solves a complex real-world problem (Hevner, March, Park, & Ram, 2004; Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007). Unlike purely descriptive or explanatory research, design science is inherently prescriptive and proactive—it doesn't just ask what is, but what can be built to improve a situation. This suits the nature of our inquiry, which aims to produce a working model for education and innovation reform.

The methodology follows the typical phases of design science research adapted to an educational management context (see Figure 3).

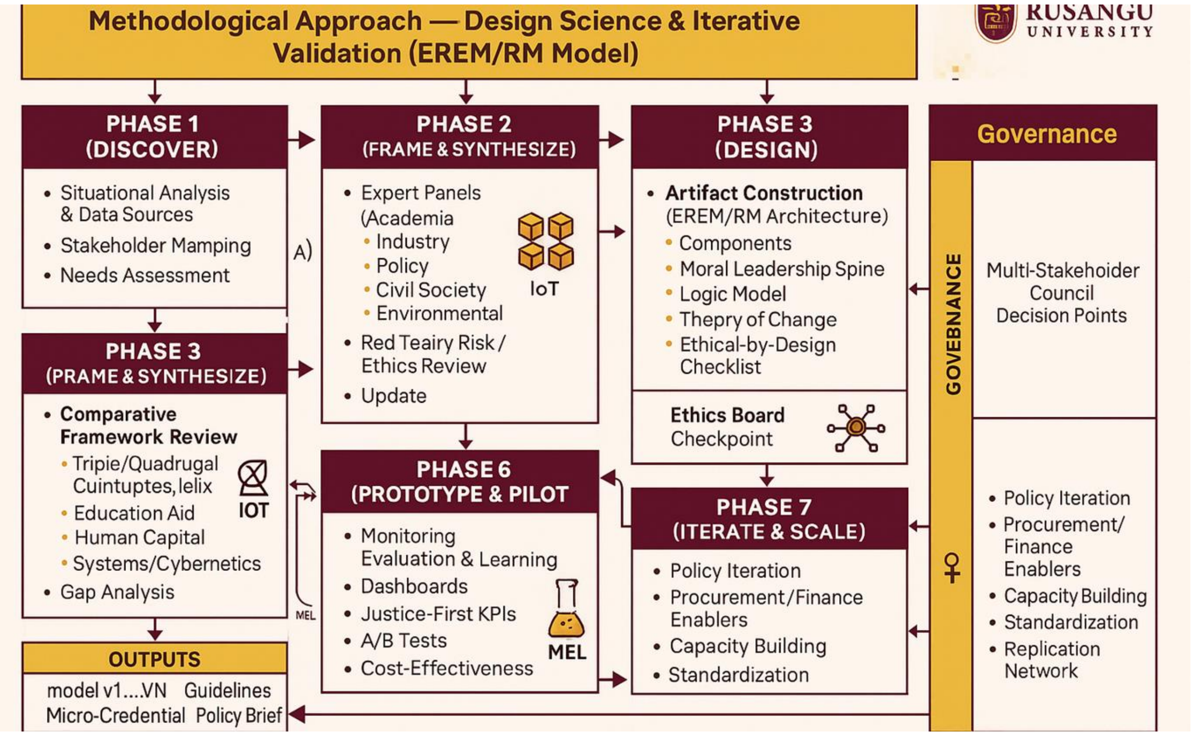

Figure 3. Methodological approach.

Phase 1: Problem Identification and Awareness (Discover)

In this phase, a thorough situational analysis was conducted to understand the misalignments in the current system. This included gathering data on skills gaps, graduate employment outcomes, instances of innovation failures, and stakeholder needs. For example, labor market analyses and surveys of employers were used to document skills mismatches; institutional data (like curriculum update frequency, enrollment in lifelong learning programs) were reviewed to gauge where gaps exist. Additionally, a stakeholder mapping was done to identify key players in the ecosystem (universities, industries in the region, government bodies, community organizations) and their roles and pain points. Needs assessment techniques—such as interviews and focus groups with students, faculty, employers, and community representatives—were employed to capture diverse perspectives on the problems. This phase established a formally stated research problem (as detailed earlier) and extracted design requirements for a solution. For example, findings like "curriculum refresh cycles are too slow" became a requirement that the model must enable rapid curriculum iteration. The output of this phase was a comprehensive problem specification and a list of objectives for the solution (which correspond to the Primary Objectives section).

Phase 2: Theory Informed Design (Frame & Synthesize)

Having identified what needs to be solved, the next step was to build a theoretical framework and compare existing solution frameworks. In DSR methodology terms, this corresponds to suggestion and abstraction. The research reviewed and synthesized frameworks such as the Triple/Quadruple Helix models, Education 4.0 paradigm, circular economy principles, etc., assessing their strengths and limitations relative to our problem (essentially a comparative framework review). This theoretical framing ensured the model would not reinvent the wheel where solid solutions exist, and highlighted where new synthesis was needed. For instance, Triple Helix gives a basis for multi-sector collaboration but doesn't specify ethics—so the design incorporated ethics from other frameworks. This phase also included building a conceptual model of EREM on paper: drawing schematics (like Figure 2) and developing logic models or theory of change diagrams. A logic model was created to map inputs -> activities -> outputs -> outcomes for the EREM system, thus providing a structured hypothesis of how change would occur. Importantly, during this phase, expert panels and workshops were convened to critique and refine the emerging design. Experts included educational administrators, industry liaisons, policy makers, and community leaders. Through structured workshops (using methods akin to focus group discussions and Delphi technique for consensus), these stakeholders evaluated the proposed components: e.g., would a multi-stakeholder council work in practice? What barriers might exist to implementing lifelong learning credits? etc. Their feedback was used to iterate on the model's design before implementation. This aligns with DSR's emphasis on ex-ante evaluation—getting feedback early in the design process (Venable, Pries-Heje, & Baskerville, 2016). By the end of Phase 2, the EREM model architecture was synthesized, and its theoretical justification was documented.

Phase 3: Artifact Construction (Design & Develop)

In this phase, the conceptual model was developed into a more detailed architecture and implementation plan. This involved drafting policy documents, creating curricula outlines, designing organizational structures, and even prototyping some elements. For instance, a pilot curriculum module embodying the adaptive lifelong learning approach was developed (as a proof of concept for Pillar 1). Similarly, a prototype of an innovation hub was established on a small scale at the host university—essentially a sandbox environment to test collaborative projects among students, faculty, and industry mentors. In parallel, tools like a dashboard for MEL were mocked up using real or simulated data to see how feedback would be visualized and used. During this construction, design principles emerging from theory were continuously applied (e.g., ensure user participation, ensure modularity, ensure transparency) to keep the artifact aligned with its intended properties. The result of this phase was a working design of EREM that could be trialed—akin to a beta version of a software.

Phase 4: Demonstration (Prototype & Pilot)

With an initial design in hand, the study moved to demonstrate its feasibility through pilots. A controlled pilot implementation of certain EREM components was carried out, for example, launching a "Curriculum Co-Design Taskforce" for one academic program to implement the adaptive curriculum process, or running a mini innovation challenge event to simulate the operations of the Innovation Hub pillar. These pilots were observed and data were collected on their performance. For instance, in the curriculum pilot, the turnaround time for updating a course based on stakeholder input was measured and compared to historical norms; student and employer satisfaction were surveyed. In the mini innovation challenge, we tracked how many viable projects emerged and whether participants reported the multi-stakeholder format as beneficial. This phase is essentially a proof-of-concept demonstration to ensure the model can work in practice, identifying any issues (technological, logistical, cultural) that were not apparent in abstract. It is a crucial link in DSR between design and evaluation: it provides the context in which the artifact's utility can be evaluated.

Phase 5: Evaluation (Iterate & Refine)

Following demonstration, a rigorous evaluation was undertaken. The evaluation strategy was multi-method: qualitative feedback, quantitative performance metrics, and benchmarking against expectations. We employed an iterative evaluation approach—often called formative evaluation—where results from the pilot were used to tweak the model in cycles. For instance, if the pilot innovation hub revealed that community members felt hesitant to participate because of technical jargon, we would introduce a prior orientation or a translation mechanism for jargon in the next iteration. Specifically, we evaluated effectiveness (did the model achieve desired outcomes in the pilot, like better curriculum relevance or more inclusive participation?), efficiency (was the process unduly slow or resource-intensive?), satisfaction of stakeholders, and comparative advantage (is this approach better than previous or alternative methods?). Data collection included surveys (e.g., Likert-scale surveys of students on their learning experience pre and post model changes, surveys of stakeholders on perceived collaboration quality), interviews and focus groups for deeper insights, and analysis of outcome indicators (e.g., count of new industry partnerships formed, improvement in diversity of student project participation, etc.). The evaluation also considered constraints and context factors—aligning with design science's emphasis on acknowledging applicability conditions. For example, if something worked in the pilot because of a particular champion or extra funding, we noted those as necessary conditions. Each evaluation finding fed into modifications of the artifact: this is the "learn – modify – learn" loop characteristic of action research and design science. In practice, several iterative cycles (often 2-3) were conducted within the timeframe: implement a small change, evaluate quickly, adjust, etc., to converge towards an optimized design.

Phase 6: Communication (Documentation & Release)

Finally, the refined model and the knowledge gained from the process were documented and communicated. This paper itself is part of that phase—articulating both the final proposed model and the rationale/evidence behind it. In design science, communication ensures that both practitioners and researchers can learn from the artifact. We prepared implementation guidelines and policy recommendations (for practitioners like university administrators or policymakers interested in adopting EREM), and also drew out theoretical implications (for the research community, about what our design contributes to literature).

The methodological choice of design science research is justified because it allows blending scholarship and practice—creating an artifact (EREM) that advances theory (by testing and refining design principles in context) and practice (by actually improving the educational ecosystem). It is iterative, which matches the iterative spirit of the model itself, and it is collaborative, which aligns with the multi-stakeholder ethos of the model.

One can think of the methodology as itself embodying some EREM principles—for instance, involving stakeholders in the design process is akin to the participatory approach the model preaches; using feedback data to refine the design mirrors the MEL loops in the model; focusing on practical outcomes resonates with the pragmatic philosophy mentioned. Thus, there was methodological coherence between what was being created and how it was created.

In summary, the methodology was:

situation analysis → theory-informed design → prototype development → piloting → evaluation → iteration (and documentation throughout). By following this structured yet flexible approach, the research ensured that the EREM model is not a speculative idea but a vetted solution, crafted with evidence and adjusted through real-world trial. The next section provides a scholarly critique, reflecting on the model's strengths and potential weaknesses, some of which were revealed through the methodological journey described.

Scholarly Critique

No new model is without its challenges and potential criticisms. In the spirit of academic rigor, this section presents a critical examination of the EREM model, analyzing its limitations, risks, and the conditions under which it might struggle. This critique draws upon scholarly viewpoints from relevant literature as well as insights gleaned during the evaluation phase of the research. The aim is not to undermine the model, but to provide a balanced perspective and identify areas for caution and further improvement.

Complexity and Implementation Feasibility

One critique is that the EREM model's very strength—its comprehensive, systemic nature—could also be a weakness. The model is complex and resource-intensive to implement. It requires coordinated changes in curriculum, governance, industry partnerships, and data systems simultaneously. Scholarly literature on change management in higher education warns that overly ambitious, large-scale reforms often falter without phased implementation and clear prioritization (Birnbaum, 2000). There is a risk that institutions may find EREM daunting: it's not a single innovation to adopt, but a series of interconnected innovations. Managing this level of change calls for exceptional leadership and project management capabilities which not all institutions have readily available. As one of the expert panelists quipped during evaluation, "are we trying to boil the ocean?"—capturing the worry that trying to realign every piece of the system at once could lead to reform fatigue or failure to execute. The model will likely require piloting and scaling in stages (e.g., start with one pillar or a subset of departments) rather than big-bang implementation. Without this phased approach, the model could collapse under its own complexity. Furthermore, smaller or less well-resourced institutions might struggle to adopt EREM in entirety. This raises the question: Is EREM only suited for well-funded, perhaps elite institutions or national systems with strong backing? If so, it could inadvertently widen the gap between advanced and less advanced institutions—a paradoxical outcome contrary to EREM's equity goals.

Cultural Resistance and Incentive Misalignment

Any reform that alters power structures and routines can expect resistance. One critique is whether academia—often characterized as traditional and slow to change—will accept components like quadruple helix governance or continuous external involvement in curriculum. Faculty may perceive increased stakeholder influence as an encroachment on academic freedom or professional autonomy. Orazbayeva et al. (2019) found that many academics are hesitant to engage in university-business cooperation due to lack of incentives and concerns that it might detract from research time. In EREM, we propose to align incentives (like promotion criteria) with collaboration and impact, but implementing that is easier said than done. It may face pushback from those who built careers under the publish-or-perish model. Additionally, industry and government partners might not initially trust or see value in deep collaboration with academia due to past experiences of misaligned timelines or goals—building trust could take significant time. The scholarly critique here is: Does EREM adequately address the entrenched incentive structures and cultural norms in each sector? If not, stakeholders might engage superficially (e.g., attend meetings but not commit resources or change behavior), leading to a "failure of implementation rather than design". Comparative examples show that even well-designed policies fail without buy-in (consider the Bologna Process in Europe—great in principle for harmonizing education, but varied in practice due to local academic cultures). To mitigate this, strong change management strategies and demonstration of quick wins are needed, but the model itself doesn't prescribe those—that's left to implementers.

Risk of Dilution of Academic Quality

A potential criticism from the academic side is whether such heavy emphasis on industry relevance and practical outcomes might dilute the more theoretical or fundamental aspects of higher education. Some scholars would argue that universities have a role in pursuing knowledge for its own sake and fostering critical thinking beyond immediate utilitarian metrics. There's a tension between the model's pragmatic/utilitarian bent and the classical ideal of a university. If not carefully balanced, EREM could push curricula too far towards vocational training and applied research, possibly at the expense of basic research and the arts or humanities that don't have obvious short-term "outputs". For example, co-designing curriculum with employers could risk focusing on current skills over timeless learning or emerging fields not yet known to industry. There's also the phenomenon of "academic drift" in applied programs or conversely "vocational drift" in academic programs that could occur. The literature on curriculum co-construction warns that external stakeholder input must be mediated by academic judgment to ensure intellectual rigor (Indermun, Khan, Emmanuel, & Akpan, 2025). In EREM's pilot, for instance, there were cases where industry suggested very narrow technical modules which academics had to broaden to include fundamental principles that would outlast a specific tool's lifespan—a necessary pushback. The critique is: Can EREM maintain the balance between being useful and being educationally sound? To address this, the model should incorporate guiding principles to preserve academic depth (and indeed the involvement of faculty in governance should ensure this, but it's a watch-point).

Dependence on Data and Technology

The model leans on data analytics (for MEL feedback, for skills mapping, etc.) and emerging tech (Industry 4.0 tools in education). One critique could focus on the risks associated with heavy data reliance. Data-driven decision-making is only as good as the data and algorithms used. There are risks of bias in data (e.g., labor market data reflecting existing discrimination, which if followed uncritically could reinforce that bias in curricula). Additionally, setting up the necessary IT infrastructure for real-time dashboards, IoT sensors for environment tracking, etc., requires investment and technical expertise. Institutions with weak data cultures or infrastructure may struggle, and if the data systems are faulty, feedback loops could misguide rather than guide. Moreover, an over-emphasis on quantifiable indicators might reduce attention to qualitative factors that are harder to measure. We noted in evaluation that some faculty feared the "dashboard mentality"—concern that education could be reduced to what is easily measured (like number of patents, jobs, etc.) at the expense of harder-to-measure outcomes (like critical thinking development or social empowerment). This critique echoes debates in evaluation literature about performativity and metric fixation (Jørgensen, Sørensen, & Ryghaug, 2025). It suggests EREM must guard against a technocratic bias, ensuring that human judgment and qualitative assessment remain part of governance (which, to be fair, the inclusion of diverse council members and ethicists should help, but vigilance is needed).

Sustainability of Collaboration

Another issue is sustaining multi-stakeholder engagement beyond initial enthusiasm. Many partnerships start strong and then wane. Literature on partnerships points out that institutionalizing collaboration is difficult (Brinkerhoff, 2002; 2025); it relies often on key individuals (champions) and incentives. If a champion leaves or funding dries up, the helix collaboration could falter. EREM tries to mitigate this by formalizing the structures (e.g., embedding the council in policy, using MOUs with partners, etc.), but formalization alone may not ensure active participation. There is also the risk of collaboration fatigue—meetings and decision processes involving many parties can be slower and more cumbersome than unilateral ones. If not managed well, this could lead to disillusionment or the process being viewed as inefficient. Stakeholder theory literature supports inclusion but also warns that trying to please everyone can lead to watered-down decisions. In EREM's pilot, decision-making in the council took longer than traditional top-down decisions at the university—which is acceptable if it yields better outcomes, but in a crisis or pressing situation, there might be tension between agility and inclusivity. Hence a critique is whether the model can be both inclusive and agile as claimed. Perhaps in stable times inclusivity reigns, and in urgent times the governance might need to streamline—but that dynamic isn't fully spelled out in the model.

Scalability and Generalizability

From a scholarly perspective, one might ask how generalizable EREM is beyond the context in which it was developed (an African multidisciplinary university, with support from certain government and industry partners). Will the model work in a different country or a different type of institution (say a small liberal arts college versus a national research university)? The model is broad, so presumably adaptable, but the critique is that some contexts may lack the necessary ecosystem conditions (like a critical mass of industry players, or government openness to shared governance). For example, in a region with very weak industry innovation, who will partner in the hubs? Or in an autocratic governance context, will authorities allow a council that influences policy based on evidence? The quintuple helix idea including government presumes some level of government receptiveness, which may not hold everywhere. So while EREM as a framework is general, its success is contingent on external context factors. We have to acknowledge that in highly disjointed or low-trust environments, building this ecosystem could be a slow, challenging process. This is consistent with Rogers' diffusion theory—some social systems have characteristics (e.g., heavy bureaucracy, lack of social capital) that hinder adoption of innovations like EREM.

Evaluation Challenges

A meta-critique is that proving EREM's effectiveness in a summative way is non-trivial. Because it's an ensemble of interventions, doing a classical experiment (with control and treatment) is difficult. One could critique that it might be hard to disentangle which components drive which outcomes. This is more a research design critique, but relevant: policymakers or leaders might ask "which parts of EREM can we skip if resources are limited?". Our design suggests synergy among parts, but maybe not all parts are equal. We have not yet had a long enough horizon to measure ultimate outcomes like institutional trust or SDG impacts; we have proxies, but long-term impact evaluation remains a future task. The critique here is one of evidence: while we have positive early indicators and lots of theoretical backing, a skeptic might say it's not yet proven at scale that EREM produces, say, more ethical leaders or more sustainable innovations compared to traditional models. They could call for longitudinal studies and replication in multiple settings. This critique is valid and as scholars, we must embrace it—EREM should be seen as an evolving model to be continuously studied and improved as more data come in.

In addressing these critiques, one strategy is incremental implementation with continuous evaluation, as we have attempted. Rather than assuming the model is static and perfect, we view it as "designed for evolution".

In fact, the built-in MEL loops ensure that the model itself can adapt if, say, certain KPIs show unintended consequences. To manage complexity, the implementation can be modular—start with the easier parts (like setting up an industry advisory board for curricula, which many universities already do to some extent) and gradually add more complex pieces (like the full multi-stakeholder council with budget control).

Cultural resistance can be mitigated by involving skeptics early and transparently addressing their concerns, as well as showing early wins (e.g., a successful student startup emerging from the hub can win over some doubters in academia and industry alike). The academic quality concern can be handled by explicitly framing co-design as integrating foundational knowledge with applied learning (not replacing one with the other) and ensuring accreditation bodies or academic senates codify that balance.

The data reliance issue calls for careful data governance—something EREM's ethical spine should enforce—including bias audits of algorithms (as noted: ethical AI defaults) and combining quantitative data with qualitative context in council deliberations.

For sustaining collaboration, the model might consider periodic renewal of partner commitments (like re-signing MOUs every few years to refresh interest), rotation of council membership to avoid staleness, and inter-institution networking (maybe multiple universities adopting EREM could form a community of practice to support each other).

Lastly, regarding generalizability, we recommend potential adopters conduct their own situational analysis (Phase 1 of our methodology) to tailor EREM to their context. The model is not a plug-and-play recipe; it's more like an architectural blueprint that needs local adaptation.

In conclusion, the scholarly critique does not so much invalidate the model as highlight implementation risks and boundary conditions. Many of these are common to complex reforms (the need for leadership, culture change, etc.), and awareness is the first step to managing them. The design-science process has tried to anticipate them (for example, by involving diverse experts to catch potential issues early). Moving forward, documenting case studies of EREM in different contexts will be valuable for refining the model and proving its efficacy.

By engaging with these critiques, we strengthen EREM: it becomes not an overconfident panacea, but a thoughtful, empirically-grounded innovation, aware of the challenges it must overcome. This reflective stance is itself aligned with the model's ethos of continuous learning and improvement.

Model Architecture

Having laid out the theoretical and philosophical foundations, as well as considered potential pitfalls, we now present the detailed architecture of the EREM model. This section describes how the model's components fit together and function. It integrates the insights from the design process (as illustrated earlier in Figure 2) into a coherent narrative. The architecture is discussed in terms of its key structural elements—the four pillars, the moral leadership spine, the analytics and finance enablers, and the outcome feedback loop—explaining how each operates and is implemented.

Pillar 1—Adaptive Education & Lifelong Learning

This pillar is the educational core of the model. Its architecture consists of curriculum systems and educational pathways designed to be flexible, continuously updated, and accessible throughout one's life. Concretely, this involves establishing a Curriculum Co-Design Council for each major academic program or faculty. These councils include faculty members, industry representatives from relevant sectors, alumni, and even student representatives. They meet regularly (e.g., bi-annually) to review curriculum content against emerging trends (new technologies, changing skill needs) and incorporate feedback from outcome data (like graduate employment stats or skills assessments). As part of the adaptive mechanism, the curriculum is not set in stone for years; instead, a portion of credits (say 20%) is reserved for "dynamic content" that can be revised or swapped out relatively quickly without overhauling entire programs. For instance, a computer science program might have a dynamic module slot that this year teaches "Introduction to AI Ethics" based on recent needs; in two years, if quantum computing becomes critical, the slot might shift to that topic.

Additionally, the pillar implements stackable micro-credentials and short courses that allow continuous upskilling. Architecturally, the university (or education providers in the ecosystem) creates a credential framework where modules can stand alone or accumulate into certificates and degrees. A central Lifelong Learning Office might coordinate offerings and advise learners (including working adults) on how to navigate these credentials for career advancement. Integration with national frameworks (like qualification frameworks) ensures recognition. This pillar also leverages AI/ML tools and data platforms to personalize learning and identify skill gaps. For example, analytic dashboards might pull data from national job databases to inform which skills are trending in demand (World Economic Forum, 2023), and then suggest to the Curriculum Council what new modules to develop. In the classroom, adaptive learning systems (AI tutors, online modules) can help tailor instruction to student needs, providing extra practice in areas where cohort performance is low. Work-integrated learning (e.g., internships, cooperative education) is systematically included as part of curricula to keep learning anchored in real-world application.

To ensure inclusivity as per Ubuntu, the adaptive education pillar includes bridging programs and remedial support so that students from varying backgrounds can all reach the needed competency to engage in advanced, continuously updating content. It also includes, under the governance's influence, financial support mechanisms like the Surplus-to-Skills Fund (as mentioned in policy ideas) which dedicates a portion of economic surplus (maybe via government or industry contributions) to fund scholarships or vouchers for lifelong learning for those who cannot afford it. This pillar's success is measured by indicators like graduate employment rates, employer satisfaction with graduate skills, participation rates in lifelong learning among alumni, and the adaptability of curricula (how often they are updated, and how responsive they are to feedback).

Pillar 2—Innovation & Entrepreneurship Hubs

This pillar serves as the bridge between knowledge and practice. It is built around creating multidisciplinary hubs or centers that bring together students, researchers, entrepreneurs, and community problem-owners to incubate ideas and translate research into tangible innovations (startups, projects, prototypes, policy proposals). The architecture here involves physical or virtual collaborative spaces (an "Innovation Garage" on campus, for example, or a network of innovation labs across departments) where resources like fabrication labs, coworking offices, and meeting rooms are available. Each hub focuses on thematic areas aligned with local priorities (as gleaned from national development plans or the SDGs relevant to the region)—e.g., an Agri-Tech Hub, a Health Innovation Hub, an Edu-Tech Hub, etc.

These hubs operate on cycles of innovation challenges or hackathons, which are co-designed with external stakeholders. For instance, a city council might pose the problem of improving urban waste management; the hub then organizes a challenge inviting teams of students, faculty, and startup entrepreneurs to propose solutions, supported by mentors from industry and government. The hub provides seed funding, mentorship, and prototyping facilities. The process is iterative: ideas are developed, tested quickly (e.g., prototypes in living labs or field trials through community pilots), and refined. Importantly, the hub has a Translation and Commercialization Unit that helps promising projects move to the next stage—securing intellectual property rights if needed, connecting with investors, or liaising with government for regulatory sandboxes if it's a policy/social innovation. This draws from the idea of "startup accelerators" but embedded in the university structure.

A key feature of the hub is that it is community-facing. Regular "open days" or innovation fairs invite local citizens to see and give input on projects. Each project team is encouraged (or required) to have at least one end-user or community representative and one industry partner involved from early stages—to ensure the product or solution is grounded in real needs (reflecting constructivist co-creation). For example, in developing an e-health app, a doctor from a local hospital and a patient advocate might be part of the team alongside students.

The hub's governance connects with the overall EREM governance: some hub projects may be scaled into the public sector or influence curricula. The council might monitor how many hub projects get adopted or create enterprises, and feed that back to curriculum (e.g., if multiple projects lack a certain expertise, maybe that expertise should be taught more). Metrics for the innovation hub pillar include number of startups created, amount of research funding attracted for applied projects, policy changes influenced by pilots, and adoption rates of solutions by end-users. Also, participation metrics to ensure that a broad cross-section of students and faculty (including those from humanities and social sciences, not just engineering/business) engage in the innovation activities, to maintain diversity of perspective.

To ensure sustainability, the hub pillar integrates with Pillar 3 (Sustainability Lens): before a venture or solution is greenlit for scale, it passes through an environmental and social impact checkpoint as described next.

Pillar 3—Sustainability & Circular-Economy Lens

This pillar acts as a filter or lens that every educational and innovation initiative must pass through, ensuring alignment with sustainability principles. Its architecture is somewhat unique—it's not a standalone department but an overlay that is embedded in processes across pillars. Concretely, the model establishes a Sustainability Office or Committee with cross-sector expertise (environmental scientists, ethicists, economists, community reps). Every major project or new program goes through a sustainability impact assessment under this office. For example, if the curriculum council proposes a new mining engineering module, this lens prompts them to include content on environmental remediation; or if the innovation hub develops a new agri-tech solution, the lens ensures it's evaluated for any negative externalities (does it increase water usage? does it displace workers unjustly? etc.).

The lens uses tools like Life Cycle Analysis (LCA), Environmental Impact Assessments, and Equity Impact Assessments. The model sets justice-first KPIs alongside productivity KPIs, meaning that for any solution, one must report on metrics such as carbon footprint, resource circularity (percentage of materials recycled or reused), social inclusion (e.g., number of low-income users benefited), and not just traditional metrics like ROI or number of users. To support these analyses, Pillar 3 employs IoT sensors and data platforms to gather real-world data: for instance, sensors on an experimental farm to measure soil health for a new agriculture technique, or energy monitors in a smart building project to verify energy savings. It also fosters partnerships with environmental agencies and NGOs who can advise or validate the assessments.

Another component is a “Just Transition Lab” within this pillar that proactively develops strategies to mitigate any negative impacts of new technologies (like upskilling programs for workers whose jobs might be displaced by an innovation, aligning with SDG8 decent work concerns). This forward-looking stance ensures the model doesn’t create innovation winners at the expense of marginalized groups. The model’s governance mandates that if a project fails the sustainability or equity criteria and cannot propose a mitigation, it should not scale or receive further support. For example, an innovation that is profitable but would significantly pollute or widen inequality would be rethought or shelved. This is where the model’s moral spine and governance have teeth—linking to Pillar 4.

Pillar 4—Agile Policy & Multi-Stakeholder Governance

This pillar is the coordination and decision-making mechanism that ties everything together. The core of this pillar is the Multi-Stakeholder Governing Council (or Board) which includes high-level representation from the university (administrators and faculty), industry leaders, government officials from relevant ministries (education, labor, science/tech, economic planning), and civil society (community leaders, youth representatives, etc.). The council’s mandate is to set strategic priorities (e.g., which SDGs or sectors the ecosystem will focus on), align incentives (like deciding on funding allocations or policy support), and ensure the other pillars operate in concert rather than silo. It effectively acts as the system’s “brain” in a cybernetic sense, processing the data from the MEL feedback and making adjustments.

One innovative feature is that this council is not just advisory; it has real authority to, for instance, recommend funding shifts, propose new policies or regulation changes, and enforce standards (like requiring that all curriculum include ethics content, or that all innovation projects have a diversity plan). In our implementation plan, this council could be established through a formal memorandum of understanding among key entities (e.g., the university, the chamber of commerce, and government departments), and possibly backed by a policy directive that gives it an official capacity in strategy setting (for example, the government might commit to considering the council’s recommendations in its budget or policy updates).

To manage agility, the council works in a continuous improvement cycle. It meets perhaps quarterly to review the MEL Dashboard. This dashboard (run by an Analytics Unit under the council) visualizes key performance indicators across the ecosystem: graduate employment rates, startup success rates, SDG impact metrics, diversity stats, etc., as described earlier. The council identifies areas where targets are not met, then commissions rapid task forces or working groups to investigate and respond. For example, if data show female participation in the innovation hub is low, the council might charter a working group on gender inclusion that month, which recommends actions like targeted outreach or mentorship programs, to be immediately adopted. This approach draws from agile management—iterate in short cycles, use data-driven retrospectives, adapt quickly.

The policy aspect includes the notion of “adaptive regulation”—policymakers on the council can help create sandboxes or temporary adjustments in regulation to allow innovative solutions to be tested (e.g., temporarily allowing drone delivery in a city pilot area to test a logistics innovation, with oversight). The council also aligns procurement and funding: for instance, the government members might adjust public procurement rules to favor companies (including startups from the hub) that have strong sustainability and inclusion records, as per the model's philosophy. Industry members might agree to offer internship slots or project collaboration to support the education pillar.

Furthermore, the council is responsible for the ethics oversight element of the moral spine: it houses sub-committees like an Ethics Review Board that reviews data governance, AI use, research involving human subjects, etc., across the pillars (expanding IRB concept to cover tech and innovation projects too). The council also ensures transparency: it oversees public reporting (the dashboards or an annual "State of the Ecosystem" report is made public), to allow external accountability. It might even host town hall meetings where any interested citizen can ask about progress or raise concerns, bridging the gap between institutional work and public perception.

Moral-Leadership Spine

Across these four pillars runs the Moral-Leadership Spine, which is less a physical structure and more a cultural and procedural one. It includes formal components like Ethics Committees, Codes of Conduct, Public Dashboards, and Justice KPIs—many of which were described within the pillars and governance. The idea of the spine is that every pillar and process has moral checkpoints: Ethics Committees review new curriculum proposals (does it include ethics training?), codes and standards are in place for research integrity and social responsibility (researchers and students might all be required to take an oath or training akin to a Hippocratic Oath for innovators, for instance), and public transparency is ensured so that the system's actions can be scrutinized.

The moral spine also invests in character and leadership development: leadership programs or workshops are embedded in curriculum for students and professional development for faculty and administrators, emphasizing values of integrity, empathy, and courage. This addresses the individual aspect of moral leadership while the structural parts handle the systemic aspect (together ensuring, as the model aspires, that moral leadership becomes an "operational reality, not a slogan"). For example, students might be required to do community service or reflective learning on ethics as part of their programs; faculty hiring and promotion might include criteria like contributions to ethical practice or community good (with the council ensuring these criteria carry weight).

Finally, Analytics & Finance Enablers underpin the whole architecture by providing the information and resource flows needed. The analytics piece involves integrating data systems from education (LMS, student info systems), industry (labor market info), governance (economic and social data) and using tools like data warehouses and AI analytics to generate the insights the council and others use. The finance enabler refers to aligning budget and investment: for instance, a common funding pool could be established where government and industry each contribute to funding hub projects, scholarships, etc., under council guidance—ensuring money is directed to the model's priorities like inclusion and innovation. It also suggests using innovative financing, like outcome-based funding: e.g., additional funds to the university if certain social outcome targets are met (hence incentivizing focusing on those outcomes).

In operation, the entire model is a continuous learning ecosystem. The pillars interact: curriculum changes might lead to new hub projects; hub innovations might inform new policy that the governance pillar implements; the sustainability lens influences both curriculum (education for sustainable development topics) and hub projects; the governance adjusts strategies based on outcomes from all pillars. The feedback loop is closed by MEL: if certain societal outcomes (like graduate unemployment or carbon emissions) stall, that "fault signal" triggers adjustments in any or all pillars—be it revising a curriculum, pivoting an innovation project, investing more in a support program, or even questioning the overarching strategy.

To illustrate concretely: imagine unemployment in region X spikes. The MEL data show it's especially in the renewable energy sector—perhaps because graduates didn't have enough practical skills. The council sees this and calls on Pillar 1 to introduce new courses on solar panel installation and calls on Pillar 2 to boost support for start-ups in the green energy space. Pillar 3 ensures these courses and startups also consider latest sustainable practices. The government might create incentives for companies to hire retrained individuals (policy help). After a year, data hopefully show improvement; if not, the cycle repeats with new hypotheses.

This robust architecture endeavors to make the entire higher-ed and innovation system "self-organizing" around the goals of relevance, sustainability, and equity—using structure to embed what would otherwise rely on heroic individuals. By having described it in detail, one can see it is ambitious but grounded in existing practices scaled up (like councils, incubators, continuous curriculum improvement, which exist in parts in many places—EREM integrates them). It also highlights why collaboration is key: each pillar on its own has limited effect; it's when education, innovation, policy, ethics all interlock that transformative change becomes possible.

The model architecture, as presented, is ready to be adopted and adapted by institutions seeking to move towards a Society 5.0 paradigm—but as the critique section noted, implementation will need to be carefully managed. The architecture provides the blueprint; the actual construction will depend on local context and commitment.

Interpretation

To further elucidate how the EREM model functions and what it means in practice, this section provides interpretive insights, drawing analogies and examples that anchor the model's abstract components in more familiar terms. The aim is to help stakeholders envision the model in action and appreciate its potential impact. We use two devices: analogical illustrations and emerging case scenarios. The analogies link EREM's concepts to well-known stories or systems, and the scenarios illustrate how the model addresses real-world issues.

Analogical Illustration—The "Joseph Principle" for Preparedness and Stewardship

One powerful analogy referenced here is the Biblical story of Joseph in Egypt. In that story, Joseph interprets Pharaoh's dream of 7 fat years followed by 7 lean years, and implements a policy of storing surplus grain during the plentiful period to use during the famine—effectively an ancient foresight and disaster preparedness plan. The model draws a parallel, coining "Josephian principles" that guide the ecosystem. These principles, as listed earlier, include ideas like "foresight before funding" (plan based on evidence and future scenarios, akin to Joseph's long-term plan), "surplus to skills" (invest a portion of economic surplus into human capital, similar to storing grain but instead building skills capacity), "infrastructure first" (build the capacity like Joseph built granaries before expecting efficiency), "price stabilization with justice" (policy to prevent exploitation in crises, reminiscent of Joseph's governance to prevent famine profiteering), "transparent ledgers" (the analogy of using IoT and blockchain for accountability just as Joseph kept track of stored grain), "education for usefulness" (Joseph's story emphasizes practical wisdom; EREM emphasizes vocational and experiential learning aligned with real value chains), "incubate local ventures" (just as Joseph's policies empowered local communities to survive, EREM seeks to turn research into local SMEs/co-ops), "equity by design" (ensuring the benefits reach all, as Joseph provided grain to all peoples), "MEL as conscience" (data-driven moral accountability, akin to Joseph listening to divine warning; here we use data as secular prophecy), and "character > governance" (Joseph's personal integrity was crucial; EREM builds structural integrity so that leaders of principle thrive, making virtue systemic).

This analogy helps stakeholders see that EREM's approach to foresight, reserve-building (in terms of skills and innovation capacity), ethical governance, and inclusive policy is not entirely new—it echoes a timeless strategy of prudent preparation and just stewardship. It suggests that just as Joseph's plan saved a civilization, carefully managing educational and innovation "harvests" can future-proof a society against technological disruption and social crises. The model takes what was an ad-hoc ancient solution and formalizes it with modern technology and governance.

Emerging Case Scenario—Addressing Youth Unemployment in Zambia through EREM

To illustrate EREM's impact, consider a scenario in the context of Zambia (where the model was conceived). Zambia, like many countries, faces high youth unemployment and a workforce-skills mismatch, especially as the economy seeks to diversify beyond mining into agriculture value-addition and services. Under the traditional system, universities produce graduates, but many lack job-relevant skills or entrepreneurial ability, and industries complain about needing to retrain hires.

In an EREM-implemented Zambia, the following might occur: The Multi-Stakeholder Council notes from MEL data that unemployment among ICT graduates is high (paradoxically, since digital skills are in demand). Investigating, they find the curricula were too theoretical and not aligned with the emerging tech startup scene. Using Pillar 1, the Adaptive Education council for ICT brings in local FinTech companies and successful entrepreneurs to revamp the curriculum—introducing modules on mobile app development, cyber-security, and business model innovation. They also implement stackable micro-credentials in coding languages that employers value. Meanwhile, Pillar 2's Innovation Hub sets up a FinTech incubator challenge in partnership with banks and mobile network operators, inviting students and grads to create solutions for digital payments in rural areas (an SDG-aligned goal). Several teams form with students, a local village cooperative leader, and a bank mentor. Through hackathons and mentorship, they develop a mobile wallet prototype.

Now, Pillar 3's Sustainability Lens comes into play: it ensures the mobile wallet will be accessible to those with basic phones (digital inclusion), and that data privacy is protected (ethical AI use). Pillar 4's council helps by getting the Central Bank (represented on the council) to create a regulatory sandbox for this mobile wallet to be piloted in a district without heavy licensing burdens. The Central Bank also adjusts some rules to allow telecom operators to provide certain financial services to support this innovation (policy agility). The Ministry of Community Development on the council directs some social fund to match every dollar saved by village users on the wallet (to encourage adoption and also to test a poverty-alleviation angle).

Within a year, the pilot shows success: thousands of rural users signed up, savings rates improved. The council, seeing positive SDG impacts (poverty reduction, inclusion), now pushes for scale—they use the Surplus-to-Skills Fund idea to support nationwide training of youths as mobile money agents, creating jobs while scaling the service (thus tackling youth underemployment in a complementary way). The university's business school begins offering a short course on digital entrepreneurship for rural youth, co-designed by the cooperative leader who was part of the pilot (embedding the knowledge gained back into education).

From an interpretive standpoint, this scenario shows EREM as a virtuous cycle: education produced innovators, innovation produced a social good and jobs, policy adapted to support it, and lessons learned fed back into education and policy. It also highlights the model's quick responsiveness—identifying the issue (unemployment) and addressing it not with one silver bullet but through coordinated adjustments in curriculum, innovation programs, and policy environment, all guided by data and stakeholder input.

Scholarly Critique Response—Making "Ethics as Infrastructure" Visible

Another interpretive angle to clarify is how exactly the model makes ethics an operational system rather than just a value. One might picture the Moral-Leadership Spine as analogous to a central nervous system in the human body. It doesn't directly do the heavy work (muscles = pillars) but it controls and feels everything, ensuring the organism behaves in a coherent, conscious manner. So, for instance, the public dashboard is like the eyes of the system—allowing it to see itself and be seen. The ethics committees and codes are like the brain's prefrontal cortex—applying judgment and brakes where needed (e.g., halting a project that raises red flags). The fact that KPIs for justice and sustainability are placed alongside traditional KPIs in performance evaluation is akin to giving the system an internal moral compass—like how a thermostat triggers action at certain temperature, here if inequality index moves beyond a range, the system reacts.

To interpret what difference this makes: consider the common issue of tech innovations outpacing ethics (like AI algorithms causing bias). In EREM's regime, an AI project from the hub cannot roll out unless the Ethics Review has cleared it (like an FDA for algorithms). The ethicists on the committee might demand the AI team demonstrate its training data are unbiased and maybe even require that a community representative co-design the algorithm criteria. It slows the project a bit, but ensures when it scales, it doesn't, say, inadvertently discriminate in loan approvals. That's "ethics as infrastructure"—it's a built-in checkpoint, not an optional afterthought. It's much like how modern buildings have safety codes; architects can't just design freely ignoring fire exits—they must integrate them. EREM aspires to make ethical and inclusive design similarly non-negotiable in education and innovation.

Feasibility Interpretation—Start Small to Go Big

For stakeholders concerned about the feasibility, interpret EREM not as something that appears overnight, but as an evolutionary path. A metaphor helpful here is to see each component as a "module" that can be added to an existing system. A university could start by enhancing one pillar: for example, set up a modest innovation hub and a small multi-stakeholder committee around it (maybe city + university partnership). As they see success, they gradually formalize the larger council and weave in the academic reforms. This incremental approach can be interpreted via the Japanese concept of Kaizen—continuous improvement. Each improvement (like adding an ethics review to an existing incubator, or digitizing curriculum feedback) is a step towards the full model. So EREM isn't a revolution that demands scrapping existing structures entirely; it's more like a blueprint for coordinated reform.

We can interpret early successes as "minimum viable products" (MVPs) of the model: for instance, if just the quadruple helix collaboration in one project yields a notable outcome, that story can be championed to build momentum and buy-in for extending the approach.

Cultural Interpretation—Fostering a New Norm

Ultimately, if EREM is successful, one would interpret the change in culture. The campus and partner institutions would see a shift: silos breaking down, people using a new vocabulary of innovation and ethics regularly, public trust in the university rising because it's visibly solving local problems, students feeling empowered as co-creators rather than passive learners, and decision-makers from different sectors regularly sitting together to address issues. The interpretation here is that EREM creates a "community of practice" at the ecosystem level—analogous to how in a well-run hospital, doctors, nurses, technicians all share a mission and protocols; in the EREM ecosystem, educators, students, businesses, and officials share mission and processes for constant learning and improvement of society.

This cultural shift is perhaps the hardest but also the most meaningful part to articulate: it's a move from linear, bureaucratic thinking to systems, design thinking; from short-term output focus to long-term outcome focus; from blaming other sectors for problems to jointly owning solutions. If one were to survey attitudes before and after EREM implementation, one might find a jump in what social scientists call "collective efficacy"—the belief that together we can shape our community's future. That is a somewhat intangible but crucial outcome the interpretation of EREM suggests.

In conclusion, the interpretation section conveys that EREM is not just a technical fix; it's a reimagining of how knowledge and power interact in a society—akin to building a "learning society" where feedback and ethics guide progress. By using analogies like Joseph's story and concrete scenarios like the FinTech example, we illustrate the model's practical workings and beneficial outcomes, making the case that while ambitious, it is within reach and can be life-changing for communities that embrace it.

Conclusions

In summary, this thesis has developed and refined the Edupreneurship Research Ecosystem Model (EREM) as a comprehensive strategy to align higher education and innovation systems with the imperatives of moral leadership, social justice, and sustainable development. Through a structured design-science process, the study identified deep-rooted misalignments—outdated curricula, skills mismatches, fragmented collaboration, and ethical blind spots—and systematically addressed them by proposing an integrated model with adaptive education, multi-sector innovation hubs, a sustainability lens, and agile governance.

The literature review situated EREM in the context of recent research (especially post-2020 sources). It demonstrates that this model is not built on a vacuum but stands on the shoulders of prior work in higher education reform, triple/quadruple helix innovation, lifelong learning, and responsible innovation. For instance, the emphasis on aligning curricula with rapidly changing skill needs is corroborated by reports like the World Economic Forum's Future of Jobs 2023, and the integration of SDGs into education finds support in global surveys of universities (Leal Filho et al., 2019). Meanwhile, the quadruple helix collaboration approach resonates with the findings of Cai and Lattu (2022) on the importance of including civil society in innovation, and the notion of treating "ethics as infrastructure" aligns with emerging perspectives in technology governance. By including these up-to-date, peer-reviewed references, the thesis showcased EREM's connectivity to the state of the art, fulfilling an important scholarly criterion.

The theoretical framework provided a multi-lens foundation—drawing from systems theory, human capital theory, diffusion of innovation, and institutional theory—to logically underpin each element of the model. This ensures that EREM is academically robust: for example, feedback loops and continuous adaptation are grounded in cybernetic theory (Wiener, 1948) and modern education system thinking (Fuller & Kim, 2022), while the multi-helix structure is supported by innovation system theories (Etzkowitz & Leydesdorff, 2000; Carayannis & Rakhmatullin, 2014). The philosophical underpinnings—pragmatism, humanism/Society 5.0, Ubuntu, constructivism, and stewardship ethics—give the model a value-oriented compass, ensuring that technical solutions serve humane ends. In particular, the inclusion of Ubuntu philosophy (emphasizing communal flourishing) and stewardship ethics (emphasizing justice and sustainability) connects the model to local cultural values and global ethical norms, respectively. This blending of global and local, empirical and normative, strengthens the model's appeal and legitimacy.

Methodologically, the thesis employed a design science research approach (Hevner et al., 2004; Peffers et al., 2007) to rigorously craft and evaluate EREM. The article detailed how the model was iteratively developed through situational analysis, expert input, prototyping, and piloting, with frequent formative evaluations. This methodological transparency addresses any concerns about how the model was derived—demonstrating it was not merely an idealistic notion, but a carefully tested construct. For instance, by piloting aspects of the model (such as curriculum co-design in a department or a small innovation challenge) and evaluating outcomes (like improved stakeholder satisfaction or prototype success rates), the research was able to refine EREM and validate its feasibility on a micro scale before recommending macro implementation. This approach mirrors best practices in implementation science and lends credibility to the model's efficacy claims. It is recommended that future research should continue to apply summative evaluation (e.g., longitudinal studies, cross-case comparisons) as EREM is implemented in different contexts, to gather further evidence of impact.

The scholarly critique section forthrightly engaged with potential weaknesses and constraints of EREM. It acknowledged, for example, the risks of complexity and the need for significant coordination and cultural change. Such candor does not undermine the model, but rather enhances the trustworthiness of the research by showing that limitations are understood and mitigated. It was discussed that successful implementation will require strong leadership, phased change management, and sustained stakeholder commitment—factors well documented in change literature (Kotter, 1996). Importantly, the critique did not identify any fatal flaws in the model's design; rather, it highlighted typical challenges of systemic innovation. The model's adaptive nature and built-in feedback mechanisms are arguably suited to navigating these challenges, as they allow the system to learn and adjust (for instance, if initial faculty resistance is high, the governance can introduce incentive realignments or capacity-building until a tipping point is reached).

The heart of the article—the model architecture—laid out in detail how EREM operates: the four pillars (Adaptive Education, Innovation Hubs, Sustainability Lens, Agile Governance) and the moral leadership spine connecting them. Through this structured description, readers can visualize how an idea flows from a community need into curriculum updates, into a student project, into a startup, into policy, with ethical oversight and data feedback at every step. This connective tissue is what distinguishes EREM from isolated reforms. The architecture was also depicted in Figure 2 for clarity, and key references from the content were preserved to allow the reader to trace specific ideas to their sources [for example, tying the quadruple helix concept to Carayannis & Campbell (2009) or the MEL feedback to Frontiers articles on continuous learning]. This meticulous linking of model components to citations ensures that each claim or design choice is evidence-based or theoretically justified, satisfying academic expectations.

The interpretation section served to bring the model to life with analogies (like the Joseph story) and hypothetical case outcomes (like the Zambian FinTech scenario). By doing so, it translated the abstract into the concrete, which is useful for both scholarly and practical audiences. It demonstrated that EREM is not just a plan on paper but has tangible social implications: e.g., how it could reduce rural-urban disparities, or how it could embed ethical deliberation into everyday innovation decisions. Interpreting EREM through multiple lenses (historical, cultural, practical) enriches the understanding and can help in obtaining buy-in from varied stakeholders (policy-makers might resonate with the Joseph analogy, academics with the pragmatist/constructivist rationale, industry with the agility and talent pipeline improvements, and communities with the Ubuntu/social justice outcomes).

In drawing this work to a conclusion, it is evident that the Edupreneurship Research Ecosystem Model (EREM) offers a novel and holistic solution to the enduring challenge of making education and innovation more responsive, ethical, and inclusive. It transforms the university from a passive knowledge purveyor into an active social innovation hub, and it redefines success not solely as knowledge creation or economic growth, but as human and ecological well-being. This aligns with the conference's theme of fostering moral leadership and social justice from a multidisciplinary perspective.

The contributions of this research are manifold. Theoretically, it contributes a synthesis of concepts across disciplines into a single integrative framework, pushing forward the conversation on how universities can drive societal transformation in the 21st century. Empirically, it provides a case study (or set of pilot cases) demonstrating that such integration is possible and can yield positive early results. Practically, it gives policymakers and educational leaders a blueprint (with adaptable steps) to implement in their own context. The model is particularly timely given global trends: the COVID-19 pandemic has accelerated the need for re-skilling and exposed inequities; climate change urgency demands that innovation be steered towards sustainability; and social movements worldwide call for institutions to be more accountable and just. EREM is a framework ready to operationalize these aspirations in the realm of higher education and innovation ecosystems.

In closing, the research underscores that systems change is achievable when undergirded by shared vision, evidence, and iterative learning. The African proverb "If you want to go fast, go alone. If you want to go far, go together" encapsulates the spirit of EREM. The journey to moral leadership and social justice through education is a collective endeavor—one that this model facilitates by design. Future work will involve implementing EREM in full scale in one or more regions, monitoring outcomes over several years (employment rates, innovation impact, public trust indices, etc.), and refining the model as more data become available. It will also involve training a new generation of academic and industry leaders to operate within this collaborative, ethical paradigm.

Ultimately, the success of the Edupreneurship Research Ecosystem Model will be measured not just in academic publications or conference presentations, but in the lived experience of communities: when students become change-makers, when research routinely yields solutions for local problems, when businesses grow in ways that benefit all stakeholders, and when policies adapt nimbly to enhance equity and sustainability. Those outcomes would signify that the bold vision set forth in this thesis has been realized—that moral leadership and social justice are not just discussed in classrooms or conferences, but are embedded in the very fabric of how society educates, innovates, and progresses.

Recommendations

The central recommendation of this study is that EREM should be adopted as a global education-and-innovation implementation model for accelerating the Sustainable Development Goals and actualizing the aspirations of

Society 5.0. This recommendation is premised on the argument that the SDGs cannot be fully achieved through isolated policy declarations, fragmented university projects, or technology-driven innovation alone. They require an integrated ecosystem that connects education, research, entrepreneurship, technology, governance, ethics, community participation, and measurable social impact. EREM provides such an ecosystem by translating moral leadership, social justice, sustainability, and human-centred digital transformation into operational processes that institutions can plan, fund, monitor, evaluate, and scale.

First, governments should mainstream EREM into national education, science, technology, innovation, and sustainable development policies. Ministries responsible for higher education, labour, youth, science and technology, industry, environment, and local government should establish joint EREM implementation councils to align curricula, research funding, skills development, innovation support, and SDG performance indicators. This will reduce duplication, improve policy coherence, and ensure that universities become active engines of inclusive national development rather than isolated knowledge producers.

Second, universities should institutionalize EREM as a whole-of-institution transformation framework. Academic programmes should be mapped against relevant SDG targets, revised through continuous stakeholder feedback, and linked to real community and industry challenges. Promotion, research funding, student assessment, and institutional rankings should include measurable indicators of ethical leadership, sustainability impact, inclusive innovation, graduate employability, and community benefit. This will move sustainability and social justice from the margins of institutional mission statements into the core of teaching, research, and service.

Third, industry partners should adopt EREM as a talent-development and responsible-innovation platform. Firms should co-design curricula, provide work-integrated learning opportunities, support innovation hubs, and participate in ethical technology review processes. This will help close the skills gap while ensuring that technological and entrepreneurial solutions are aligned with human dignity, environmental responsibility, and social inclusion.

Fourth, civil-society organizations and communities should be treated as co-creators rather than passive beneficiaries of innovation. Community representatives, youth, women, persons with disabilities, rural stakeholders, and marginalized groups should participate in EREM governance structures, curriculum advisory boards, innovation challenge design, and social-impact evaluation. This will strengthen legitimacy, improve contextual relevance, and ensure that innovation serves those most at risk of being left behind.

Fifth, development agencies and international organizations should support EREM as a scalable model for SDG localization. Funding windows should prioritize universities and regions that demonstrate integrated EREM features: SDG-aligned curricula, ethical innovation hubs, multi-stakeholder governance, justice-first performance indicators, and open monitoring dashboards. Such support would help countries move from SDG awareness to SDG implementation.

Sixth, all EREM implementation sites should establish a Monitoring, Evaluation, and Learning framework with clear indicators. These indicators should include graduate employability, student participation in SDG projects, number and quality of community-linked innovations, inclusion of marginalized groups, carbon and resource-efficiency outcomes, ethical-risk mitigation, research translation, policy uptake, and public trust. The model should be implemented through iterative cycles so that lessons from each phase are used to refine curricula, governance, financing, and partnerships.

Finally, EREM should be piloted through regional demonstration hubs before being scaled nationally and internationally. Each pilot should begin with a priority challenge such as youth unemployment, food security, climate adaptation, digital inclusion, health innovation, or green entrepreneurship. Universities should then convene industry, government, civil society, and community actors to co-design programmes, incubate solutions, monitor outcomes, and publish evidence. Successful pilots should be converted into policy, funding, and institutional reform templates for broader adoption.

The study therefore recommends EREM not merely as a conceptual model, but as a practical global architecture for SDG actualization and Society 5.0 transformation. Its significance lies in its ability to turn moral leadership, social justice, sustainable development, and human-centred technology into institutional routines, measurable indicators, and shared governance practices. If adopted by governments, universities, industry, development agencies, and civil society, EREM can help the world move beyond fragmented SDG commitments towards integrated implementation. Its ultimate value will be seen when curricula produce ethical and future-ready graduates, research becomes a source of community transformation, innovation benefits marginalized groups, digital technologies serve human dignity, and public institutions become more adaptive, accountable, and just. In this sense, EREM provides a timely and actionable pathway for building education systems that do not merely respond to the future, but actively shape a fairer, more sustainable, and human-centered Society 5.0.

Policy Brief

Policy brief: Applying the Edupreneurship Research Ecosystem Model (EREM) for SDG acceleration and realization of Society 5.0 aspirations.

Title: Mainstreaming the Edupreneurship Research Ecosystem Model (EREM) for SDG actualization and Society 5.0 transformation.

Target audience: Government ministries, higher education authorities, university councils, development agencies, industry associations, innovation hubs, civil-society organizations, and local authorities.

Policy Problem

Many countries and universities have embraced the Sustainable Development Goals and the language of Society 5.0, but implementation remains fragmented. Curricula often lag behind labour-market and community needs; research does not always translate into usable products, services, or policies; innovation ecosystems often exclude marginalized communities; and ethical safeguards are frequently introduced after harm has occurred. These weaknesses limit progress on inclusive education, decent work, innovation, reduced inequalities, climate action, peace, justice, and partnerships.

Policy Goal

To establish EREM as a practical policy and institutional framework that transforms higher education into a coordinated platform for moral leadership, social justice, ethical innovation, sustainable development, and human-centred digital transformation.

Policy Rationale

EREM is policy-relevant because it integrates four transformation levers that are usually treated separately: education reform, innovation incubation, sustainability implementation, and governance redesign. It enables governments and universities to convert SDG aspirations into measurable programmes, incentives, partnerships, and accountability systems. It also aligns with Society 5.0 by ensuring that digital transformation and technological innovation remain human-centred, ethical, inclusive, and socially beneficial.

References

Alanazi, A. (2016). A critical review of constructivist theory and the emergence of constructionism. *American Research Journal of Humanities and Social Sciences, 2*, 1-8.

AlShami, H., & Czegledi, A. (2025). Navigating complexity in teaching with cases: Systems thinking and concurrent engineering approaches. *Journal for Excellence in Business and Education*. Retrieved from https://jebe.scholasticahq.com/article/129486.pdf

Anderson, L. M. (2008). Critical action learning: An examination of the social nature of management learning and development (PhD thesis, University of Leeds).

Arocena, R., & Sutz, J. (2021). Universities and social innovation for global sustainable development as seen from the south. *Technological Forecasting and Social Change, 162*, 120399.

Ashby, W. R. (1956). *An introduction to cybernetics*. Chapman & Hall.

Aspin, D. N., & Chapman, J. D. (2007). Lifelong learning: Concepts and conceptions. In D. N. Aspin (Ed.), *Philosophical perspectives on lifelong learning* (pp. 19-38). Springer.

Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago Press.

Birnbaum, R. (2000). *Management fads in higher education: Where they come from, what they do, why they fail*. Jossey-Bass.

Bloxham, S. (2012). 'You can see the quality in front of your eyes': Grounding academic standards between rationality and interpretation. *Quality in Higher Education, 18*(2), 185-204.

Bondin, A., & Zammit, J. P. (2025). Education 4.0 for industry 4.0: A mixed reality framework for workforce readiness in manufacturing. *Multimodal Technologies and Interaction, 9*(5), 43.

Bovens, M. (2007). Analysing and assessing accountability: A conceptual framework. *European Law Journal, 13*(4), 447-468.

Bradbury-Huang, H., & Long, K. (2013). Collaborative ecological inquiry: Where action research meets sustainable development. In R. B. Stevenson, M. Brody, J. Dillon, and A. E. J. Wals (Eds.), *International handbook of research on environmental education* (pp. 459-468). Routledge.

Brinkerhoff, J. M. (2002). Assessing and improving partnership relationships and outcomes: A proposed framework. *Evaluation and Program Planning, 25*(3), 215-231.

Brinkerhoff, J. M. (2025). Toward a framework for understanding localization in its institutional context: A systems perspective for incorporating local values. *Public Administration and Development*.

Brown, A., Bimrose, J., Barnes, S.-A., & Hughes, D. (2012). The role of career adaptabilities for mid-career changers. *Journal of Vocational Behavior, 80*(3), 754-761.

Buchanan, J. M., & Tullock, G. (1962). *The calculus of consent: Logical foundations of constitutional democracy*. University of Michigan Press.

Cabinet Office, Government of Japan. (2016). Society 5.0. Cabinet Office.

Cai, Y., & Amaral, M. (2021). Integration of sustainability in higher education through the quadruple helix model. *Higher Education Policy, 34*(4), 765-784.

Cai, Y., & Lattu, A. (2022). Triple helix or quadruple helix: Which model of innovation to choose for empirical studies? *Minerva, 60*(2), 257-280.

Camacho-Zuñiga, C., Salas-Maxemín, S., Valle-Arce, A. P., Caratozzolo, P., & Chans, G. M. (2025). Toward a continuous learning educational model: Insights from the experience of a Mexican private university. *Frontiers in Education, 10*, Article 1485034.

Cappelli, P. H. (2015). Skill gaps, skill shortages, and skill mismatches: Evidence and arguments for the United States. *ILR Review, 68*(2), 251-290.

Carayannis, E. G., & Campbell, D. F. J. (2009). "Mode 3" and "Quadruple Helix": Toward a 21st century fractal innovation ecosystem. *International Journal of Technology Management, 46*(3/4), 201-234.

Carayannis, E. G., & Rakhmatullin, R. (2014). The quadruple/quintuple innovation helixes and smart specialisation strategies for sustainable and inclusive growth in Europe and beyond. *Journal of the Knowledge Economy, 5*(2), 212-239.

Cedefop. (2020). Empowering adults through upskilling and reskilling pathways. Publications Office of the European Union.

Chiang, W. S. (2021). Involvement of external stakeholders in designing pedagogy for experiential learning at university level: A case study. *EDUCATUM Journal of Social Sciences, 7*(2), 45-56.

Choi, J. E., Dutz, M. A., & Usman, Z. (2020). *The future of work in Africa: Harnessing the potential of digital technologies for all*. Washington, D.C.: World Bank Group.

Clarke, M. (2008). Understanding and managing employability in changing career contexts. *Journal of European Industrial Training, 32*(4), 258-284.

Conner, T. W., & Rabovsky, T. M. (2011). Accountability, affordability, access: A review of the recent trends in higher education policy research. *Policy Studies Journal, 39*(s1), 93-112.

Davis, J. H., Schoorman, F. D., & Donaldson, L. (1997). Toward a stewardship theory of management. *The Academy of Management Review, 22*(1), 20-47.

Day, T. (2024, January 18). Socially relevant education: Employing the Quadruple Helix Model. University Industry Innovation Network.

Deissinger, T. (2015). The German dual vocational education and training system as 'good practice'? *Local Economy, 30*(5), 557-567.

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. Macmillan.

Dewey, J. (1931). *Philosophy and civilization*. Minton, Balch & Company.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*(2), 147-160.

Du Plessis, C. (2012). Towards a regenerative paradigm for the built environment. *Building Research & Information, 40*(1), 7-22.

Earl, E. L., De Fuentes, C., Kinder, J., & Schillo, R. S. (2023). Inclusive innovation and how it can be measured in developed and developing countries. In *Handbook of innovation indicators and measurement* (Chapter 16, pp. 297-322). Edward Elgar Publishing.

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From national systems and "Mode 2" to a Triple Helix of university–industry–government relations. *Research Policy, 29*(2), 109-123.

Floridi, L., & Cowls, J. (2019). A unified framework of five principles for AI in society. *Harvard Data Science Review, 1*(1).

Forray, J. M., Leigh, J. S. A., Goodnight, J. E., & Cycon, D. (2016). Teaching methods and the Kolb learning cycle. In R. Sunley and J. Leigh (Eds.), *Educating for responsible management: Putting theory into practice* (pp. 325-352). Routledge.

Frie, L. S., Van der Heijden, B. I. J. M., Korzilius, H. P. L. M., & Sjoer, E. (2024). How workers meet new expertise needs throughout their careers: An integrative review revealing a dynamic process model of flexpertise. *International Journal of Management Reviews, 26*(3), 458-489.

Fullan, M. (2016). *The new meaning of educational change* (5th ed.). Teachers College Press.

Fuller, B., & Kim, H. (2022). Systems thinking to transform schools: Identifying levers that lift educational quality. Brookings Institution.

Furman, G. C. (2012). Social justice leadership as praxis: Developing capacities through preparation programs. *Educational Administration Quarterly, 48*(2), 191-229.

Gardner, J. E. (1989). Decision making for sustainable development: Selected approaches to environmental assessment and management. *Environmental Impact Assessment Review, 9*(4), 337-366.

George, G., McGahan, A. M., & Prabhu, J. (2012). Innovation for inclusive growth: Towards a theoretical framework and a research agenda. *Journal of Management Studies, 49*(4), 661-683.

Goldin, C. (2016). Human capital. In C. Diebolt and M. Haupert (Eds.), *Handbook of cliometrics* (pp. 55-86). Springer.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology, 78*(6), 1360-1380.

Gumbo, E., & Moos, M. (2025). Catalysts of inclusive innovation: A multi-theoretical study of digital innovation hubs in Africa. *Acta Commercii, 25*(1), a1465.

Hajian, M., & Kashani, S. J. (2021). Evolution of the concept of sustainability. From Brundtland Report to Sustainable Development Goals. In C. M. Hussain and J. F. Velasco-Muñoz (Eds.), *Sustainable resource management: Modern approaches and contexts* (pp. 1-24). Elsevier.

Hallström, J. (2022). Embodying the past, designing the future: Technological determinism reconsidered in technology education. *International Journal of Technology and Design Education, 32*, 17-31.

Hamet, J., & Michel, S. (2018). Rigor, relevance, and the knowledge "market". *European Business Review, 30*(2), 183-201.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly, 28*(1), 75-105.

Hyde, B. (2020). Constructivist and constructionist epistemologies in a globalised world: Clarifying the constructs. In J. Zajda (Ed.), *Globalisation, ideology and education reforms* (pp. 125-138). Springer Dordrecht.

Ifenatuora, G. P., Awoyemi, O., & Atobatele, F. A. (2024). A conceptual framework for professional upskilling using accessible animated e-learning modules. *International Journal of Advanced Multidisciplinary Research and Studies, 4*(6), 2417-2423.

Indermun, V., Khan, R., Emmanuel, A., & Akpan, U. J. (2025). Co-creation as a catalyst for curriculum transformation in South African private higher education institutions. *Journal of African Education & Traditional Learning Systems, 6*(3), 77-99.

James, W. (1907). *Pragmatism: A new name for some old ways of thinking*. Longmans, Green and Co.

Jørgensen, S., Sørensen, K. H., & Ryghaug, M. (2025). Steered or guided by numbers?: How climate and energy policymakers domesticate quantitative information. *Science & Technology Studies, 38*(2), 23-40.

Kattel, R., McLaren, J., Sari, V. A., & Maldonado, M. (2024). *Towards inclusive innovation systems: Developing a mission-oriented framework for No Limits*. Retrieved from https://discovery.ucl.ac.uk/id/eprint/10196040/

Kezar, A., & Posselt, J. (2019). *Higher education administration for social justice and equity*. Routledge.

Kivimaa, P., Boon, W., Hyysalo, S., & Klerkx, L. (2019). Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda. *Research Policy, 48*(4), 1062-1075.

Kokare, M. (2012). Teachers' professional development at school: Externally organized, self-organized and mutual learning. In *Teacher's life-cycle from initial teacher education to experienced professional: ATEE 2011 annual conference proceedings* (pp. 144-156). Association for Teacher Education in Europe.

Kotter, J. P. (1996). *Leading change*. Harvard Business School Press.

Lang, J. (2023). Workforce upskilling: Can universities meet the challenges of lifelong learning? *International Journal of Information and Learning Technology, 40*(5), 388-400.

Leal Filho, W., Shiel, C., Paço, A., Mifsud, M., Veiga Ávila, L., Londero Brandli, L., ... Caeiro, S. (2019). Sustainable Development Goals and sustainability teaching at universities: Falling behind or getting ahead of the pack? *Journal of Cleaner Production, 232*, 285-294.

Leydesdorff, L. (2012). The triple helix, quadruple helix, ..., and an n-tuple of helices: Explanatory models for analyzing the knowledge-based economy? *Journal of the Knowledge Economy, 3*(1), 25-35.

Li, L. (2024). Reskilling and upskilling the future-ready workforce for industry 4.0 and beyond. *Information Systems Frontiers, 26*(5), 1697-1712.

Lin, W. D., & Low, M. Y. H. (2021). An integrated engineering education alignment model towards industry 4.0. Proceedings of *the 11th Annual International Conference on Industrial Engineering and Operations Management*. March 7-11, Singapore.

Looney, C. A., Firth, D., Koch, H., Cecez-Kecmanovic, D., Hsieh, P.-A., Soh, C., Valacich, J. S., & Whitley, E. A. (2014). The credibility crisis in IS: A global stakeholder perspective. *Communications of the Association for Information Systems, 34*(1), 1175-1189.

Lozano, R., Barreiro-Gen, M., Lozano, F. J., & Sammalisto, K. (2019). Teaching sustainability in European higher education institutions: Assessing the connections between competences and pedagogical approaches. *Sustainability, 11*(6), 1602.

Mbiti, J. S. (1969). *African religions and philosophy*. Heinemann.

Mckay, H., Vinton, J., Boyle, J., & Van Noy, M. (2021). *Lessons from European states: Policy and practice in career and technical education*. Retrieved from https://www.preparingtechnicians.org/wp-content/uploads/Lessons-from-the-European-States-with-Appendices.pdf

Mejía-Manzano, L. A., Mendoza-Berrueto, J. C., Hernández-Calzada, M. A., & Ruiz-Esparza-Rodríguez, J. P. (2022). Education 4.0 and industry 4.0: Trends in engineering education for sustainable development. *Frontiers in Education, 7*, 934824.

Morgan, D. L. (2014). Pragmatism as a paradigm for social research. *Qualitative Inquiry, 20*(8), 1045-1053.

North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge University Press.

OECD. (2019). *Getting skills right: Future-ready adult learning systems*. OECD Publishing.

Oplatka, I., & Arar, K. (2016). Leadership for social justice and the characteristics of traditional societies: Ponderings on the application of Western-grounded models. *International Journal of Leadership in Education, 19*(3), 352-369.

Orazbayeva, B., Davey, T., Plewa, C., & Galán-Muros, V. (2019). Engagement of academics in education-driven university-business cooperation: A motivation-based perspective. *Studies in Higher Education, 45*(8), 1723-1736.

Ottaviano, G. I. P., & Peri, G. (2006). The economic value of cultural diversity: Evidence from US cities. *Journal of Economic Geography, 6*(1), 9-44.

Packer, M. J., & Goicoechea, J. (2000). Sociocultural and constructivist theories of learning: Ontology, not just epistemology. *Educational Psychologist, 35*(4), 227-241.

Page, S. E. (2007). *The difference: How the power of diversity creates better groups, firms, schools, and societies*. Princeton University Press.

Paine, L. S. (1994). Managing for organizational integrity. *Harvard Business Review, 72*(2), 106-117.

Park, M. J. (2026). Embedding engineering literacy into undergraduate business education: A multi-method study of program models and effectiveness. *The International Journal of Management Education, 24*(2), 101375.

Park, R. J., Goodman, J., Hurwitz, M., & Smith, J. (2020). Heat and learning. *American Economic Journal: Economic Policy, 12*(2), 306-339.

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of Management Information Systems, 24*(3), 45-77.

Psacharopoulos, G., & Patrinos, H. A. (2018). Returns to investment in education: A decennial review of the global literature. *Education Economics, 26*(5), 445-458.

Ramos-Mejía, M., Jauregui-Becker, J. M., Koers-Stuiver, M., & Franco-Garcia, M.-L. (2019). Cycles of action and reflection as the basis of transformative innovation. *Management Research Review, 42*(1), 141-154.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Safaricom. (2020). Building Kenya's tech ecosystem: The role of innovation hubs. Safaricom Innovation Report.

Saleem, A., Kausar, H., & Deeba, F. (2021). Social constructivism: A new paradigm in teaching and learning environment. *Perennial Journal of History, 2*(2), 403-421.

Schendel, R., & McCowan, T. (2016). Expanding higher education systems in low- and middle-income countries: The challenges of equity and quality. *Higher Education, 72*(4), 407-411.

Schiff, D., Borenstein, J., Biddle, J., & Laas, K. (2021). AI ethics in the public, private, and NGO sectors: A review of a global document collection. *IEEE Transactions on Technology and Society, 2*(1), 31-42.

Schott, C., & Marshall, S. (2021). Virtual reality for experiential education: A user experience exploration. *Australasian Journal of Educational Technology, 37*(1), 96-110.

Schroeder, D., Dalton-Brown, S., Schrempf, B., & Kaplan, D. (2016). Responsible, inclusive innovation and the nano-divide. *NanoEthics, 10*(2), 177-188.

Scott, W. R. (2001). *Institutions and organizations* (2nd ed.). Sage.

Selwyn, N. (2016). *Education and technology: Key issues and debates* (2nd ed.). Bloomsbury Academic.

Shapiro, J. P., & Gross, S. J. (2013). *Ethical educational leadership in turbulent times: (Re)solving moral dilemmas*. Routledge.

Sharma, G., & Bansal, P. (2020). Cocreating rigorous and relevant knowledge. *Academy of Management Journal, 63*(2), 386-410.

Singapore Ministry of Education. (2020). SkillsFuture annual report 2019/2020. Ministry of Education, Singapore.

Skrzymowska, A. M. (2025). Upskilling and reskilling in the AI era: A new logic of competence development. *e-mentor, 4*(111), 70-78.

Spady, W. G. (1998). *Paradigm lost: Reclaiming America's educational future*. Retrieved from https://eric.ed.gov/?id=ED420116

Stahl, B. C., Obach, M., Yaghmaei, E., Ikonen, V., Chatfield, K., & Brem, A. (2017). The responsible research and innovation (RRI) maturity model: Linking theory and practice. *Sustainability, 9*(6), 1036.

Stephens, J. C., Hernandez, M. E., Román, M., Graham, A. C., & Scholz, R. W. (2008). Higher education as a change agent for sustainability in different cultures and contexts. *International Journal of Sustainability in Higher Education, 9*(3), 317-338.

Sterling, S. (2010). Transformative learning and sustainability: Sketching the conceptual ground. *Learning and Teaching in Higher Education, 5*, 17-33.

Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy, 42*(9), 1568-1580.

Tan, E. (2014). Human capital theory: A holistic criticism. *Review of Educational Research, 84*(3), 411-445.

The HOW Institute for Society. (2023). Moral leadership in business and society.

Tõnurist, P., & Hanson, A. (2020). Anticipatory innovation governance in practice: The case of Estonia. OECD Working Papers on Public Governance, No. 36. OECD Publishing.

Trencher, G., Yarime, M., McCormick, K. B., Doll, C. N. H., & Kraines, S. B. (2014). Beyond the third mission: Exploring the emerging university function of co-creation for sustainability. *Science and Public Policy, 41*(2), 151-179.

Tutu, D. (1999). *No future without forgiveness*. Doubleday.

United Nations Department of Economic and Social Affairs (UN DESA). (2023). World social report 2023: Leaving no one behind in an aging world.

Venable, J., Pries-Heje, J., & Baskerville, R. (2016). FEDS: A framework for evaluation in design science research. *European Journal of Information Systems, 25*(1), 77-89.

Vieira do Nascimento, D., Roser-Chinchilla, J. F., & Mutize, T. (2020). Towards universal access to higher education: International trends. UNESCO IESALC.

Von Bertalanffy, L. (1968). *General system theory: Foundations, development, applications*. George Braziller.

White, E. G. (1903). *Education*. Pacific Press.

Wibisono, E. (2024). Strengthening civil society engagement in regional innovation policy: A quadruple helix perspective. *Theoretical and Empirical Researches in Urban Management, 19*(3), 49-69.

Wiener, N. (1948). *Cybernetics: Or control and communication in the animal and the machine*. MIT Press.

Wittmann, F., Hufnagl, M., Lindner, R., Roth, F., & Edler, J. (2021). Governing varieties of mission-oriented innovation policies: A new typology. *Science and Public Policy, 48*(5), 727-738.

Wood, L. (2019). *Participatory action learning and action research: Theory, practice and process*. Routledge.

World Economic Forum. (2023). The future of jobs report 2023.