STAKEHOLDER ANALYSIS IN FACILITATING CURRICULUM TRANSFORMATION IN ENGINEERING HIGHER EDUCATIONAL INSTITUTIONS

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ABSTRACT

Curriculum transformation in Higher Educational Institutions (HEIs) is critical to ensure preparedness and responsiveness in an unpredictable world. The research exploring stakeholders' roles and responsibilities in curriculum transformation in HEIs, drew on data generated from a hybrid workshop with partners in an international project. The results highlight the diverse key stakeholders involved in curriculum transformation, and how critical it is to involve them in this complex and dynamic process. The participation of stakeholders is emphasised in several CDIO standards, and their intense engagement is important when considering curriculum transformation.

KEYWORDS

Curriculum transformation, Stakeholders, Engineering Education, CDIO Standards: 9, 12.

INTRODUCTION

Curriculum transformation in Higher Educational Institutions (HEIs) is essential for the construction of academic programmes that are relevant, proactive and responsive to the evolving needs of society, industry, and the global workforce (Walker & Bedford, 2017). This is particularly crucial in engineering education, where the curriculum must address the current state of the field and anticipate future challenges and innovations (Audunsson *et al.*, 2024). HEIs should therefore play a pivotal role in preparing graduates for a rapidly changing world (Lee, 2022; Moloi & Moloi, 2024).

Transformation may involve radical changes that impact the long-term sustainability of a programme or institution. Curriculum transformation in HEIs can take various forms and occur at different levels of intensity. It may be in response to formal reviews, accreditation requirements, or the evolving expectations of industry partners and governmental bodies (James *et al.,* 2025). It may also be informed by continuous or ongoing feedback from students and faculty members who make adjustments to integrate emerging trends and new content. A comprehensive stakeholder analysis is critical for meaningful curriculum transformation, which allows for a deeper understanding of the diverse perspectives and interests of those involved in curriculum alignment, relevance and impact (Belita *et al.,* 2020). Stakeholders' involvement is fundamental in the CDIO initiative and is formally addressed in some of the Standards. For example, stakeholders should review and validate the learning outcomes of the program (Standard 2) and they should receive feedback on the evaluation of the program with respect to the 12 standards (Standard 12) (CDIO Office, 2025). As expected, the involvement of stakeholders is reflected in several papers within the CDIO community (Matthíasdóttir *et al.*, 2014; Ormazabal *et al.*, 2022).

Engineering stakeholders' studies have been conducted over the years, e.g. with focus group discussions (Khoo, Zegwaard & Adam, 2020), surveys (Khoo *et al.*, 2020; May & Strong, 2006), graduates' self-assessment (Grant & Dickson, 2006), semi-structured interviews (Fuentes Del Burgo & Navarro Astor, 2016) and multi-stakeholder studies (Ormazabal *et al.,* 2022). Ormazabal *et al.* (2022) focused on comparing the CDIO syllabus with the results of their study with multi-stakeholders where it was clear that the graduates with degrees built on the CDIO curriculum framework were valued, although it was also noted that enhanced competence proficiency was needed.

Understanding the roles and concerns of stakeholders is key to reshaping the curriculum, supporting sustainable development and contributing to the future of engineering education. Stakeholders can be defined as "any group or individual who can affect or is affected by the achievement of the organisation's objectives" (Freeman, 1984: 46). Johnson *et al.* (2012) define stakeholders as "… those individuals or groups that depend on an organisation to fulfill their own goals and on whom, in turn, the organisation depends". We can draw on stakeholder theory to acknowledge the importance of considering the needs and interests of diverse stakeholders, and thus aim to provide value creation for those involved (Freeman, 1984). Cheng, Adekola and Sanfa (2022) consider stakeholders for university education studies to be HEIs, students, government and employers. The purpose of the research was twofold: to identify the key stakeholders involved in curriculum transformation and examine their respective roles in shaping the curriculum transformation process.

LITERATURE REVIEW

The curriculum within Higher Education (HE) and HEIs should be transformed to align with the rapidly changing demands of society, industry, and the global context (Opertti, 2023; Bakthavatchaalam, 2024). Traditionally, HEIs prioritised discipline-based knowledge and theoretical foundations, emphasising academic content over practical application. However, recent shifts in workforce requirements and societal expectations have driven HEIs to reassess their curricular frameworks, integrating skills and competencies that enhance graduates' adaptability and employability (Cheng *et al.,* 2022; Santos *et al.,* 2022; Mabungela & Mtiki, 2024).

Four perspectives may be used to understand curriculum transformation, especially in preparing graduates for the volatile, uncertain, complex and ambiguous (VUCA) context (Walker & Bedford, 2017). Firstly, HEIs incorporate interdisciplinary and more experiential learning opportunities in an effort to transform the curriculum. They are increasingly embracing programmes that blend multiple fields of study, enabling students to develop cross-disciplinary skills and innovative thinking. Such approaches, like those seen in STEM and STEAM (Science, Technology, Engineering, Arts, and Mathematics) initiatives, reflect an understanding that complex, real-world problems often require solutions beyond a single discipline. Furthermore, experiential learning, with internships, co-ops, and service-learning, offers students practical experience, bridging the gap between theory and practice to better prepare them for the job market and operational needs of their future professional activities.

Secondly, digital transformation has significantly influenced curriculum content, structure and outcomes. As technology advances, HEIs are integrating digital skills, data literacy, and online learning components across disciplines. Courses include modules on digital tools, remote collaboration, and data analytics, reflecting the demands of modern workplaces. The rise of online learning platforms and Massive Open Online Courses (MOOCs) has expanded access to education, prompting traditional institutions to offer more flexible, hybrid learning options. The recent advances of generative Artificial Intelligence (AI) is also a key driver.

Thirdly, soft skills and global competencies, such as critical thinking, cultural awareness, and ethical reasoning, are focused on. HEIs recognise that successful graduates must not only be knowledgeable in their fields, but also be capable of adapting to diverse and multicultural contexts, which is also typified as VUCA.

Lastly, accreditation frameworks (e.g., ABET in the US, ENAEE in the EU, EA in Australia, SASEE in South Africa, or ASEAN Quality Assurance Network (AQAN)) provide some reference and orientation to guide programme leaders in their quality assurance and continuous curriculum improvements, most often based on self-evaluations complemented by on-site visits. These are external to the quality assurance system of an institution (Patil & Gray, 2009).

More internally for continuous improvements, the CDIO framework provides a flexible opportunity with non-prescriptive standards and tools to align with needs and enhance engineering curricula once its vision is shared (cf. CDIO Standard 1). For each of the 12 CDIO standards, at its higher maturity in the self-evaluation rubric, "evidence related to the standard is regularly reviewed and used to make improvements" (Georgsson, Bennedsen & Kontio, 2016). Stakeholder theory helps us understand how interconnected the various stakeholders are, and how considering stakeholder needs in decision-making can be beneficial in the long run (Freeman, 1984). As required in CDIO rubrics, key stakeholders, including students, faculty, programme leaders, alumni and working life representatives, should be involved, for example, in formal training programme committees. This stakeholder constellation, though, should be clearly identified in the various processes of curriculum

transformation, and should be well trained and skilled for driving and managing curriculum renewal, even in unforeseen conditions. The CDIO Standard 9 on Faculty Competence emphasises that engineering and managerial skills be seen as a system and a whole, with curriculum operating products and their services to learning students. The CDIO Standard 12 on program evaluation guides continuous improvement processes with maturity scaling in which providing feedback to various stakeholders is included in the processes, hearing their voices in evaluation groups being of importance (Lassudrie, Kontio & Rouvrais, 2013).

RESEARCH METHODOLOGY

A constructivist paradigm and qualitative approach were adopted to identify the key stakeholders involved in curriculum transformation and to examine their roles in the curriculum development process within HEIs. An online workshop was held with 27 participants from the DECART project (Designing Higher Education Curricula for Agility, Resilience, and Transformation), funded by the European Union, as well as staff from the partner institutions. Mentimer and *'rich picture'* responses were produced by the participants. These responses informed subsequent discussions in groups, to answer the research questions. Jamboard was also used to generate data.

Using Mentimeter as an innovative digital tool allowed for real-time engagement and interaction with the participants, facilitating a sense of connection, given the hybrid workshop. It was also valuable for participants to see first-hand the multiple, diverse responses that came in through the word clouds, facilitating rich discussions. In the first part of the workshop, using Mentimeter, participants responded to the questions: "*Who are the stakeholders who are currently involved in curriculum transformation in HEIs?*", and "*How are the stakeholders involved in curriculum transformation in HEIs?*". Participants could add up to three responses in Mentimeter for each question.

In the second part of the workshop, participants were then asked to draw a '*rich picture*' using Jamboard. A rich picture is a system thinking tool used to depict a real-world, complex situation and, as argued by Marnewick *et al.* (2024), produce original data. Furthermore, rich pictures are considered standard action research methods, which can give diverse stakeholders a voice (Walker *et al.,* 2014). Participants can gain a shared understanding of the complexities of the situation and better understand the relationships of the stakeholders, as well as their concerns and interests. This study adopted a reflective practice strategy. Data were analysed using thematic content analysis (Anderson, 2007).

STUDY BACKGROUND

The study background is in the context of a European-funded project (DECART: Designing Higher Education Curricula for Agility, Resilience, and Transformation, 2022-25). It involves six HEI partners from member states of the European Union, Indonesia, and South Africa. There are three work packages in the project. Work package one addresses the challenges facing engineering curricula in an increasingly uncertain world and suggests methods and tools for the collaborative conception (C) and design (D) of curricula. The second package analyses the properties of resilient curricula, such as testing them against triggering events that could affect their operating environment (O). The properties of curricula that can increase resiliency are, among others, flexibility, adaptability and redundancy (Waldeck *et al.,* 2024).

Once implemented (I), curriculum operation (O) is dependent on the context, and requires monitoring external and internal changes on a semester or an annual basis, if not over longer accreditation cycles. Change at a low pace means that the curriculum has to be reworked and realigned on this temporal basis. However, the need for change can be more rapid in the face of the pressures of new needs and rapidly disruptive events, as is the case with sudden crises. The current paper is part of the third work package of the project, which deals specifically with the transformation (T) of a curriculum to better cope with change and align stakeholders around a common vision. Transformation involves engineering moving from one curriculum (current state) to another (future state), whether revised, adapted, recasted, reformed or completely renewed. Transformation entails several degrees, depending on the gap analysis. Transformation involves a significant managerial dimension underpinned by leadership models based on objectives and action plans. In this third work package, a stakeholder analysis is required for HEIs to map their transition from a current curriculum model to a new, more innovative, agile, or robust one. A CDIOT curriculum lifecycle, tooled, could then be envisioned.

RESULTS AND DISCUSSION

Stakeholders involved in curriculum transformation

Using Mentimeter, diverse responses were elicited in response to the question: *"Who are the stakeholders who are currently involved in curriculum transformation in HEIs?*" as indicated in Figure 1.

For the participants, the key stakeholders involved in curriculum transformation include students, industry, government, lecturers/teachers/academics, accreditation boards, alumni, deans/leaders/heads, and the community. The words that appear in larger font were added most often.

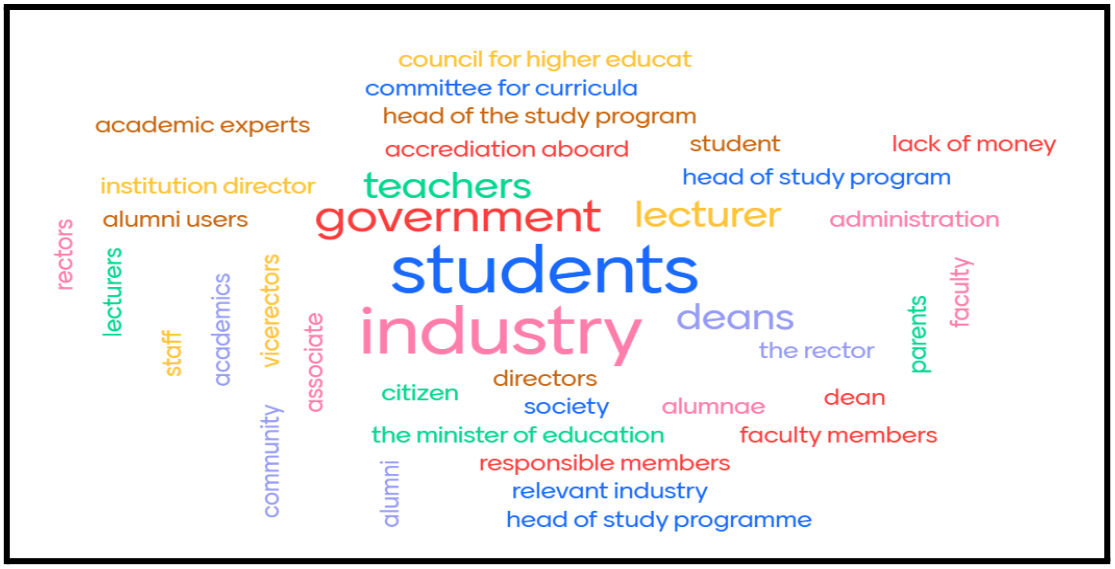

Figure 1. Stakeholders involved in curriculum transformation in Higher Educational Institutions

Curriculum transformation is not the responsibility of a single entity, as highlighted in Figure 1, but a collaborative effort involving multiple, internal and external stakeholders.

The quotations that follow are from the participants, as recorded from the workshop, and their evaluations.

- *"... the main stakeholders, the family and parents, the founders, government policy, relevant industry, academic experts, and the Minister of Education, which is sort of the one that covers it all. The ones who affect it are the academic experts, family, and founders."*

- *"... faculty members. And then, interestingly, administration. So, the administrators are also involved in the curriculum transformation."*

- *"Other players like faculty members and head of programmes. And also, we were discussing the teacher communities, …keen interest on specific fields like stem fields and so on… the most important were alumni, students, Dean or head of studies programme."*

- *"... Accreditation Board, Provisional Associate, and also the government are those who are responsible for setting some standard or regulation that we should follow… Students, faculty members, committee, rector, vice rector, and also the head of state programme, and also the administration, …who really run the curriculum."*

- *"So here, it seems, there are internal stakeholders and also external stakeholders in the form of industry and government."*

- *"… relevant industry alumni users and also the alumni… given the inputs to the curriculum regarding the demand of the industry or also the technology upgrade."*

Curriculum transformation involves a dynamic, complex and multi-stakeholder engagement process of change and adaptation, and encompasses future demand-induced change that meets future needs. Stakeholder consultation to gather diverse perspectives is critical. The need for constant review and evolution in response to societal, technological, and economic shifts is key, necessitating the inclusion of internal and external stakeholders.

The role of stakeholders in facilitating curriculum transformation

Figure 2 outlines the responses to the question, which was generated using Mentimeter: *"How are the stakeholders involved in curriculum transformation in HEIs?"*.

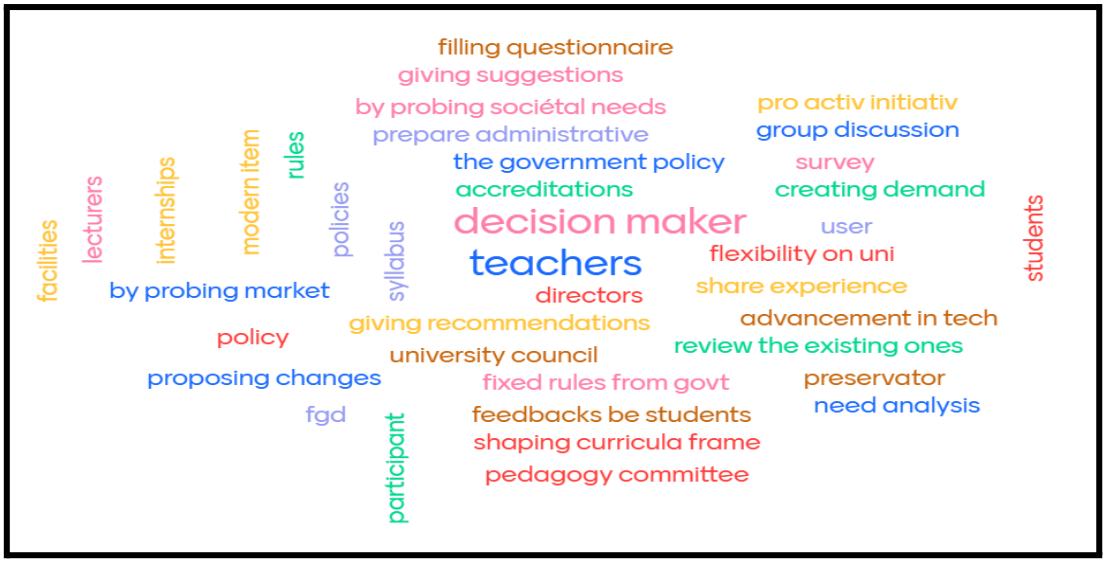

Figure 2. Role of stakeholders in facilitating curriculum transformation in Higher Educational Institutions

The main responses, as per Figure 2, demonstrated the role of the stakeholders as decision-makers, being teachers, dealing with accreditations, probing market and societal needs, creating demand, and giving and implementing recommendations. These stakeholders were found to play a role in shaping curricula, proposing changes, and highlighting societal needs.

- *"... it is not only about involvement, but also about integration… How can we integrate from different views or perspectives?"*
- *"...How important are the stakeholders in this process? And maybe it depends on the study programmes, the university and so on."*

The findings indicate that curriculum transformation is viewed as a complex, multi-dimensional process that integrates innovation, stakeholder engagement, and future-focused learning and thinking. External factors such as regulatory frameworks and societal shifts also play a key role in curricula adaptation to respond to these forces. This holistic view of curriculum development underscores the need for ongoing reviews, inclusive participation, and proactive planning to prepare students for a rapidly changing world.

Participants were also asked to draw rich pictures of the stakeholders involved in curriculum transformation and to depict their concerns and interests. Four rich pictures were generated, as presented in Figure 3, highlighting the diverse perspectives of participants concerning the multiple stakeholders that they identified as key to curriculum transformation.

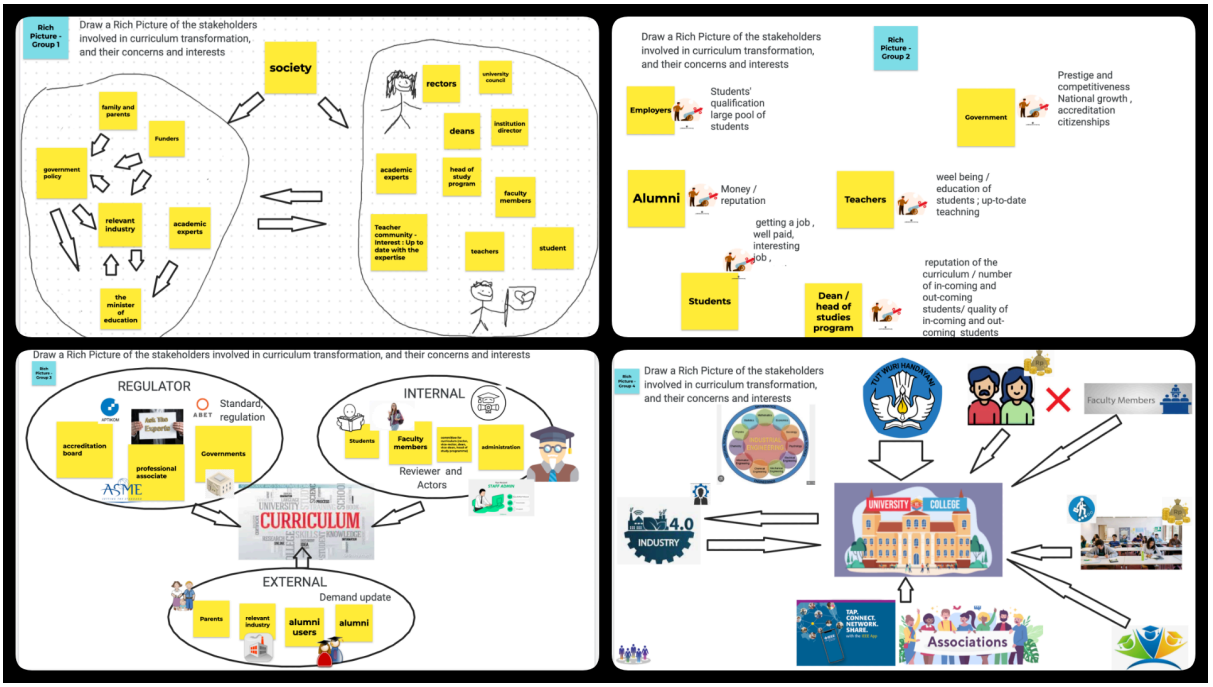

Figure 3. Rich pictures of stakeholders involved in curriculum transformation and their concerns and interests

Curriculum transformation is dynamic and continuous, characterised by its iterative nature in this context, as well as the engagement and collaboration between multiple groups of stakeholders.

- *"We must analyse every stakeholder that must be involved in curriculum transformation."*

The curriculum evolves constantly, incorporating input from various stakeholders to ensure it remains relevant and aligned with contemporary needs. Stakeholders play varied roles in curriculum transformation, providing feedback and suggestions to decision-making, giving policy guidance and conducting needs analysis to influence the design and implementation of curriculum changes. The diverse roles ensure that the curriculum is aligned with both academic and market needs. While stakeholder involvement is crucial, not all stakeholders have equal power or influence, which can lead to disparities in whose needs are prioritised. For example, industry input may drive the curriculum toward a more skills-based approach, while academic experts may push for theoretical depth. Balancing these roles is critical to ensuring that the curriculum remains holistic, addressing both practical job market requirements and broader educational goals like critical thinking, creativity, and citizenship.

The concept of inclusivity and diversity is captured under regulation and brought about by multi-stakeholder and multidisciplinary push factors, implying differing experiences, needs and expectations for curriculum transformation. When curriculum transformation is conceptualised in this frame, the process begins with a critical assessment of whose knowledge is included or excluded. Consultations with diverse communities are conducted, and students' varied lived experiences are considered. Practically, this perspective encourages curriculum designers and educators to integrate multiple perspectives into teaching materials, textbooks, and classroom discussions.

Power dynamics play a significant role in determining whose voices are heard and whose opinions shape the process. A multistakeholder approach is essential for creating a

well-rounded and relevant curriculum. Power imbalances among stakeholders can affect the outcome, as some groups, such as government regulators or industry leaders, may hold more influence than others, such as students or faculty. Curricula may prioritise certain interests, such as employability, over others, potentially marginalising important but less commercially viable areas of knowledge. The challenge is managing diverse inputs to create a coherent, balanced curriculum that meets both educational and professional standards.

- *"... in terms of transformation, the whole aspect of power and the role that the different stakeholders play is something very significant. So, if you're looking at curriculum transformation, think about society, think about the different organisations, think about indigenous, and all those particular aspects…"*

The influence of external actors, such as the government, on higher education and curriculum decisions, could lead to conflicts of interest. Power dynamics in curriculum transformation reveal the complexity of balancing stakeholder interests. The findings point to the significant control that governments and other external bodies have over curriculum content, often overshadowing the input of educators and students. This centralisation of power can stifle innovation and limit the responsiveness of curricula to local or student-specific needs. The discussions of power also expose how entrenched interests, such as those of policymakers or administrators, can prevent meaningful reform. While external regulation may ensure standards and quality, it can also hinder flexibility, making the curriculum less adaptable to new educational paradigms, such as interdisciplinary learning or digital literacy, resisting changes that redistribute power within the educational system, such as giving more voice to students or industry leaders in curriculum design.

- *"... various stakeholders are involved in curriculum transformation, in which each of them has their own purpose and input to the curriculum."*

It is important to gather input from various sources, such as advancements in technology, industry needs, and alumni feedback, to inform curriculum updates. In countries where government regulations dictate curriculum changes, the process can be rigid and top-down, but the inclusion of other stakeholders ensures that the curriculum reflects real-world requirements. Curricula must remain relevant to job market demands. Institutions can bridge the gap between academic learning and professional practice by involving industry experts and alumni. The emphasis on market needs, though, may overshadow educational goals, such as critical thinking, ethical education, or cultural sensitivity. Also, rigid regulatory frameworks might stifle innovation, limiting the curriculum's ability to evolve in response to emergent trends in education.

- *"It's important that all the stakeholders… to engage them in the process, and to entice the faculty to engage in curriculum transformation… also the quality assurance, relevant associations and external accreditation."*

In highly centralised systems, the government has significant control over curriculum design, leaving little room for flexibility. In contrast, a decentralised approach allows institutions more autonomy. Government involvement ensures that national priorities, such as economic growth, societal values, or political stability, are reflected in education. However, heavy regulation can limit innovation and responsiveness, as institutions may be bound by outdated frameworks that do not reflect current educational needs. The tension between freedom and control is a key issue, as educators and institutions may struggle to balance compliance with regulatory demands, against the need for innovative, flexible curricula that cater to local and global contexts.

Participants indicated that feedback and participation are key in curriculum transformation. They noted that curriculum transformation is compulsory and emergent, imposed versus emergent, and that strong leadership is required.

Figure 4 was developed based on the findings to depict a framework for multi-stakeholder engagement in curriculum transformation in an evolving context.

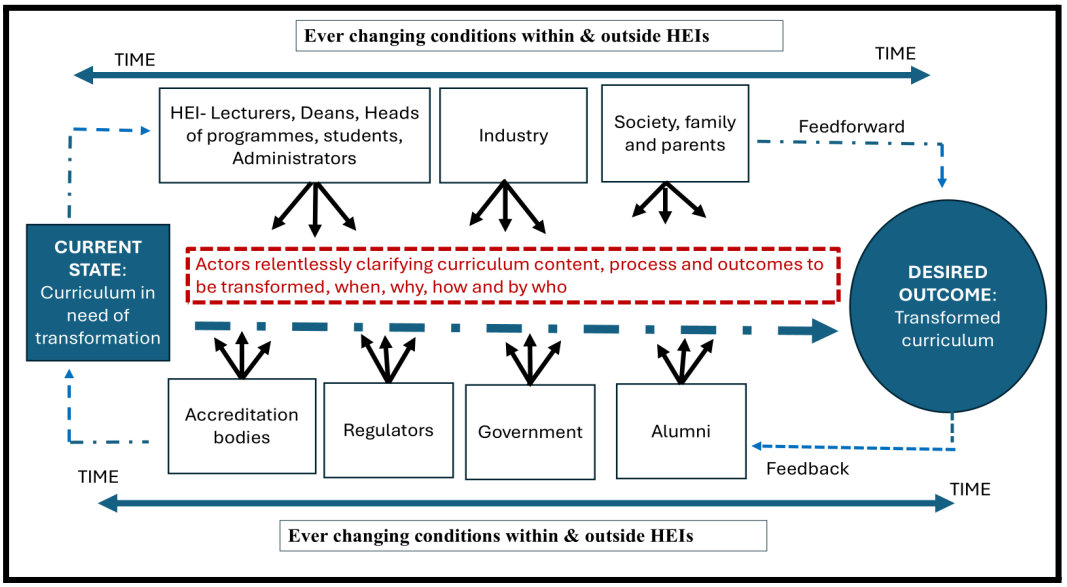

Figure 4. Framework for multi-stakeholder engagement in curriculum transformation. Source: Constructed by the authors.

As indicated in Figure 4, it is important that the curriculum is relevant to societal needs and shapes the transformation process by aligning educational content with pressing societal, economic, and environmental challenges. Collaboration with industry, policymakers, and the community is critical for the curriculum to be relevant to the culture, context and country. Curriculum transformation is time-consuming and iterative, with the engagement of multiple stakeholders relentlessly clarifying curriculum content, process and outcomes to be transformed, when, why, how and by whom in an ever-changing environment, within and outside HEIs, as highlighted in Figure 4.

CONCLUSION AND RECOMMENDATIONS

The study asserts the importance of the participation of diverse stakeholders in HEIs with respect to the curriculum, and the diverse roles and perspectives that need to be surfaced and capitalised on, to ensure education that is relevant, prepared and responsive.

The study highlights the importance of engaging the multiple, diverse perspectives of the stakeholders with respect to understanding the curriculum transformation process, and their roles. It is thus critical for HEIs to forge networks to enable diverse stakeholders in engineering education to collaborate and engage for strengthening of the curriculum for the future. The study also highlights the value of employing various innovative digital tools, such as Mentimeter and rich pictures, for relevant rich, real-time data created by the stakeholders. The use of the digital tools provide a valuable systemic perspective highlighting the multiple stakeholders and their diverse perspectives, thereby engaging a complex problem. It also gives a voice to diverse stakeholders in engineering education who may not be considered in curriculum transformation. The study produced a framework (Figure 4) that can be used to

drive engineering education by strengthening the networks among the diverse stakeholders involved in curriculum transformation.

The study emphasises the importance of the stakeholder analysis to help HEIs map their transition from a current curriculum model to a transformed curriculum. This analysis informs and guides continuous multi-stakeholder engagement and collaboration within HEIs for effective curriculum transformation. Various stakeholders should be included in curriculum transformation to necessitate a critical review of power and voice in education. The rich pictures generated in the study provide valuable illustrations of how critical it is to consider the elements of power and voice in the curriculum.

Diverse stakeholders who are key in shaping the various curriculum-related activities, as highlighted in the study, resonate with conceiving, designing, implementing, and operating a curriculum model as espoused in the CDIO framework. CDIO Standard 9 on Enhancement of Faculty Competence on the teaching concerns, more at course level, is of importance. For change and transformation management of the whole curriculum, not only the teaching aspects are to be considered. The engineering aspects of curriculum, knowledge and skills of curriculum transformation of faculty members should be effective and actionable. System skills, as for products or processes, are an outcome for integrated curriculum architectures, as emphasised by the CDIO Standard 3 principles. An integrated curriculum provides connections between different courses and learning experiences throughout the curriculum. Transformation also involves a significant managerial dimension, underpinned by leadership models for making action and risk plans a reality in accordance with milestones.

The study also highlights the importance of the nexus of curriculum engineering and change management skills of programme leaders, and how vital it is as part of developing faculty competencies, in personal, interpersonal, process, and curriculum-building skills. These need to be regularly evaluated and updated, where appropriate. CDIO Standard 12 on Programme Evaluation for systematic improvement highlights the need for "documented evidence that programme evaluation methods are being used with key stakeholders, including students, faculty, programme leaders, alumni and working life representatives". Their involvement is best required when systematic and continuous improvements are made to a curriculum, such as between external accreditation cycles, in a reactive manner, even pro-reactive for being prepared for any contingency triggering educational programs. This constellation of internal and external stakeholders (Figures 3 and 4) becomes even more important when considering curriculum transformation rather than their improvements to be ready for uncertain and unpredictable contexts, to reinforce robustness and resilience to destabilising and unforeseen events.

Drawing on the stakeholder management matrix, it becomes pertinent to identify those stakeholders who have power and interests, to be able to devise ways of gaining their support to ensure actual curriculum transformation. Within the context of HE, it is evident that executive HEI leaders are the ones with both power and interests. They also have the power to be able to influence and mobilize resources (including financial, human, and technological). It is therefore critical to engage them early on in curriculum transformation efforts, while keeping those stakeholders with power but little interest, well-informed about curriculum transformation.

While the findings of this study provide valuable insights into stakeholder roles in curriculum transformation and highlight the importance of a multi-stakeholder approach, they cannot be generalised to the broader population of stakeholders involved in curriculum transformation. Instead, the findings are only transferable to similar contexts where stakeholder analysis and

curriculum transformation are critical. Future research could involve a more diverse pool of participants from various cultural, institutional, and regional contexts to enhance the diversity of perspectives and enrich the understanding of the roles of stakeholders in curriculum transformation in a variety of settings. Future quantitative research is needed to operationalise the proposed framework for multi-stakeholder engagement in curriculum transformation to validate or modify it to enhance its explanatory power and also provide a more nuanced understanding of power relations, resistance to rapid changes, conflicting interests, and the evolving roles of stakeholders in curriculum transformation in a VUCA world.

ACKNOWLEDGMENTS

This work is part of the DECART project, a EU funded Erasmus+ Cooperation partnership in higher education, www.decartproject.eu, n°2022-1-FR01-KA220-HED-000087657. The authors thank all the respondents for their input. The content of this paper is the sole responsibility of the authors, and the European Commission is not liable for any use that may be made of its information. The authors state that no generative artificial intelligence technology was used in the creation of this communication.

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