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A Scoping Review: Examples Of Mission-Driven And Mission-Oriented Innovation In Engineering Education Research

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A SCOPING REVIEW OF EXAMPLES ON MISSION-DRIVEN AND MISSION-ORIENTED INNOVATION IN ENGINEERING EDUCATION RESEARCH

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ABSTRACT
Engineers of the future are being requested to become part of solutions for dealing with complexities in the world, exemplified by the adaptation of the 17 United Nations sustainable development goals (SDGs). Ensuring that engineering students are introduced to these is of the utmost importance, if sustainable solutions to grand challenges shall be developed, whether being of technological, social and cultural, and/or economic character. This paper entails a scoping review of the concept of mission-driven or mission-oriented innovation, as defined by the European Commission (EC) and the Organization for Economic Co-operation and Development (OECD), in engineering education research (EER). Seven papers were identified as relevant out of 50 papers derived from five databases, which were then reviewed by the two authors, indicating a substantial gap within engineering education research of mission-driven initiatives in education and research. It further reveals significant overlapping understandings, as the papers included often align their focuses with the SDGs without relating them to mission-driven or mission-oriented conceptual understandings. Outcomes of this scoping review propose that the field of EER acknowledges possible affordances, albeit challenges are still present, for engineering students in applying missions as a binding component for framing projects, cross-disciplinary collaboration, and partnerships with companies, authorities, or other stakeholders. Finally, future research directions are suggested in the field of EER with regards to mission-driven or mission-oriented innovation for grasping practical circumstances for staff and students involved in the works of dealing with complexities through missions.

1. INTRODUCTION

Since 2015, by the adoption of The United Nations Sustainable Development Goals (SDGs), member states of the UN have agreed to commit in seeking solutions for 17 overarching goals (The UN, 2016). This event has sparked shared support across international organizations and institutions as seen with The European Union (The EU) or The United States Government (The EU, 2023; NSB, 2020; Mazzucato et al., 2021). Foreseeing future impacts of global character for accommodating activities, strategies, or policies to solve the 17 SDGs is by default not achieved individually, as it requires multiple societal stakeholders to engage in collaboration to co-create innovate and sustainable solutions. A proposed framework concerning mission-driven and mission-oriented innovation policy (MOIP) has since emerged, which entails specific approaches for solving grand challenges related to the SDGs (Mazzucato, 2017; Purcell et al., 2019). Universities, nation states, the private and civil sectors are all requested to become involved across domains in solving specific missions and developing project-portfolios that can lead to innovative solutions for overcoming societal challenges (ibid).

Research and education are two pillars that shall contribute to positive changes, and herein are engineers a vital part (McQuarrie, 2022). Engineers have historically been involved in the transformation of societies dating back to the ancient civilizations of Greece and Egypt, and a great amount of the seven wonders of the world was designed by engineers (ICEE, 2021). Same needs can be transferred to settings of today, wherein engineering as an ability is required in the formation of solutions to the SDGs. In this matter, engineering education research (EER) plays a vital role in educating students that possesses skills and competencies to fulfil the UN's 2030 agenda (McQuarrie, 2022; Van den Beemt et al., 2020). However, since mission-oriented initiatives and grand societal challenges are complex entities, research and education cannot stand alone (Mazzucato, 2018; Wanzenböck et al., 2020). Both the civil society, policymakers, the private markets, and multiple governments have stakes in the sustainability agenda. In a political orientation, mission-driven and mission-oriented innovation is seen as pathways for decisions of economic nature (ibid.). Mazzucato and Wanzenböck et al. draws parallels to historical missions, such as the Manhattan project or the Apollo missions, that led to innovation in the stream of uncertainty and economical and technological advancements, producing both political and economic value (Ibid.). Today, even though no formal definition is developed by the OECD, there are found traces of what missions' entail: 1) directed, 2) challenge-oriented, and 3) boundary breaking (Wohlert et al., 2021). When perceiving mission-oriented innovation in settings of academia and higher education, the concept seems to consist of all the characteristics but seem to avoid politization when setting goals for mission-challenges. Research is a component in the processes occurring alongside the political sphere, although, abiding to strategies from both supranational and national levels (EUA, 2018). Arguments for the purpose of research and education institutions in this matter are found to be aligned with economic rationales, but perhaps as important is the transformative and innovative potentials of benefiting societies of the world (EC, 2019).

Engineers can be contributors to both factors, but questions arise concerning what engineering educations across the globe have initiated since 2015 in undertaking missions as core concepts of strategic relevance, and whether endeavours are found existing in literature pertaining to higher education institutions? Mission-oriented and

mission-driven are terms that has undergone changes in understanding throughout recent times, as in systemic public policies (big science to meet big problems) or as in a contemporary setting to address grand societal challenges. The key differences can be said to relate to an element of time and endurance (Mazzucato, 2017). As of writing, there is not a large sum of universities worldwide that actively has sought to implement mission-orientation as their key argument in educational strategies. Whether it is due to political influences or intrinsic motivation is not the purpose of this study.

1.2 Purpose of the study and research question

Recent literature has echoed the gaps in the context of universities' adaptation of SDGs as core drivers for educational strategies potential partnerships for collaboration (Purcell et al., 2019; Chankseliani & McCowan, 2021). Suggestions are prescribed for establishing conceptualizations and frameworks to be applied, that can bring forth possibilities of facilitation of missions and mission-projects without constraining the dynamics of the respective institutions (Chankseliani & McCowan, 2021; HESI, 2021). The field of higher education has since 2015 seen a rise in research pertaining to SDGs, in some cases aligned with the concept 'third mission of universities' (Neary & Osborne, 2018), but it appears that the trend of mission-driven and mission-oriented innovation has yet to reach EER. If engineering students and researchers across the globe should play a vital role in these perspectives, additional emphasis should be advocated for in the field of EER, which this paper addresses with mission-driven and mission-oriented concepts as its point of focus.

This paper is a response to the scarlessly available research within EER related to mission-driven and mission-oriented strategies or experiments. Integration of formalized practices based on theoretical and conceptual understandings are being requested by the European Commission (EC, 2018), but as no strict decisions have emerged on how to incorporate missions as the steering drivers for engineering students or researchers, it presumably becomes detached from actual teaching, study, or research practices. Suggestions for initiatives can, although, be found in common European agendas of higher education relevance, as exemplified by the European University Association's 2026-agenda (EUA, 2023). Furthermore, as mission-driven and mission-oriented practices and proposals are created through political negations and strategic decisions, it is difficult to grasp circumstances for engineering students and researchers. To achieve a better understanding of what mission-driven- and mission-oriented strategies and related practices entail in engineering education, a scoping review is conducted to present current characteristics found in research revolving around these concepts.

The driving research question for this study is as follows: *What characterizes mission-driven innovation, mission-driven strategies, or mission-driven policies in engineering education research?*

2. METHODOLOGY

2.1 Protocol

As a guiding methodological framework, Arksey and O'Malley's framework for scoping reviews is applied since it is referred to as the acknowledged standard when undertaking scoping reviews (Levac et al., 2010; Pham et al., 2014; Tricco et al., 2016; Denton & Borrego, 2021). It consists of five stages: 1) Identifying the research question, 2) Identifying relevant studies, 3) Study selection, 4) Charting the data, and 5) Collating, summarizing, and reporting the results (Arksey & O'Malley, 2005).

The search queries for this study were completed in February 2023, in five databases: Scopus, EBSCOhost, Engineering Village, ProQuest and Web of Science. This was done for a thorough and holistic representation to be present, which emanated in several searches in multiple databases for documentation to increase the reliability of the findings (Denton & Borrego, 2021). The search did not include unpublished records, instead snowballing searches was done in Google (google.com and Google Scholar) to capture relevant studies not included or published in journals and conferences. An outcome was the discovery of review papers, strategic documents and funding information related to mission-driven or mission-oriented innovation (none of which had been through peer-review). Although, it did not bring forth relevance for engineering education, it was used to identify and cross-reference potential search words. The final search involved key search terms and to avoid limiting the potential results, it was intended to be broad in contrast to systematic literature reviews (Tricco et al., 2016).

(mission-driven OR mission AND driven OR mission-oriented OR mission AND oriented OR mission AND oriented) AND Engineer* AND Education* AND Sustain*

Figure 1 – Search terms applied

This scoping review does not entail a general overview of the state of MOIP as a concept, instead a solitary focus is placed on the terms mission-driven and mission-oriented innovation, which are used interchangeably for the purpose of this review, as the generic understanding applies to both terms (Wohlert et al., 2021).

2.2 Eligibly criteria

For this study, papers of all types were included in the initial screening of abstracts, however, to identify relevant studies limiters were applied based on following criteria: *year of publishing between 2015-2023, English Language*, *a Higher Education context*, *Engineering Education* or Similar wordings, *Sustainability* (or *SDGs*). The timeframe is set to entail publications after the adaptation of the SDGs by The European Union (2015), and the publications were required to involve *engineering education*.

2.3 Selection process

As scoping reviews can be defined as "a *type of research synthesis that aims to 'map the literature on a particular topic or research areas and provide the opportunity to identify key concepts; gaps in the research; and types and sources of evidence to*

inform practice" (Pham et al., 2014), the readings of abstracts and full texts was mainly linked to the latter of informing practice and to demonstrate gaps in research. Considering the novelty of mission-driven and mission-oriented innovation in EER, the purpose is to understand the context and degree of prior research. The apparentness in how limited the research on the topic of mission-driven and mission-oriented is, can be exemplified by the relatively small number of results (N=74), which made the main reviewer omit the screening of titles, instead abstracts were read for the entire pool. The screening process was also characterized by inclusion and exclusion criteria being developed post hoc, as the increasing familiarity of literature provided leeway for determining relevance (Arksey & O'Malley, 2005). In the phase of screening full texts (N=13), four reviewers independently read the papers to filter out potential redundant articles, generate preliminary codes, and to determine the relevance for the research question. This was done in accordance with inclusion criteria from the main reviewer, which the review-team was presented before coding. A meeting was subsequently held by the review-team after the coding phase, to align findings and reiterate any opposing understandings, resulting in adjustments of codes and extracts for final included papers (N=7). It should be stressed, that for a certain degree of validity to exist, at least two or more reviewers should read, confer, and reiterate findings in any type of literature review. A summarized description can be seen in the flowchart below (Fig. 1).

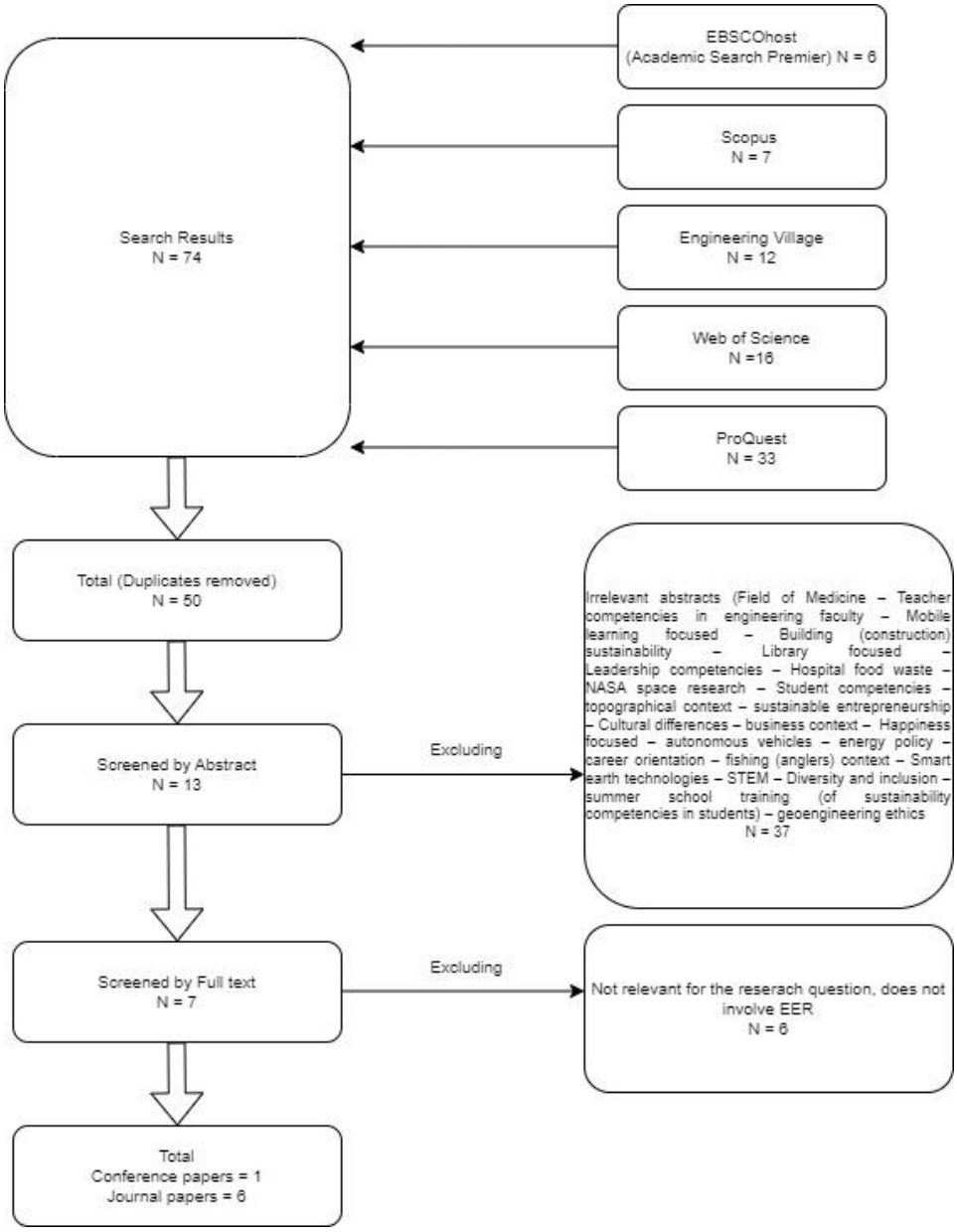

Figure 2 – Flowchart of the scoping process

3. Findings

Based on the charted data derived from extracts from the coding phase, the following section will present the outcomes found. A thematic inspired analysis, for summarizing information aligned with the research question, has been applied for the reporting of findings. These have, as Levac et al. (2010) suggest, a resemblance of similar qualitative analytical techniques which is not explicitly clear in Arksey & O'Malley's (2005) framework. The findings are organized based on three dominant categories: *Mission-driven and mission-oriented indicators*, *strategies and political processes*, and *innovation*. These have constituted the main theme of *characteristics in mission-*

oriented and mission-driven activities, processes, or projects in EER, which have led to three analytical themes: *Framing innovation, Strategic and political arguments*, and *Processes of mission-driven and mission-oriented innovation in EER*. It should be disclaimed that due the minimal appearances of mission-driven or mission-oriented framing or application at an institutional level in the seven articles, SDGs was also included during the coding phase, but without explicitly being used as a term for the search string. Again, this demonstrates the meagre focus on mission-driven and mission-oriented initiatives in EER, contrasting the commonly applied related framing aligned with SDGs (which are plentiful in research – as well in EER).

3.1 Summarization of papers

Table 1 present an overview of the articles included for this scoping review of mission-driven and mission-oriented innovation initiatives at engineering educations that exists in literature. However, as the final pool consist of a scarce and limited number of articles, this scoping review arguably functions as an indicator for the novelty of mission-driven proclamations in engineering education. The articles have been mapped according to year of publication, theoretical indicators, applied methods, whether they mention or relate to the SDGs or mission-driven and mission-oriented innovation, and whether empirical data is included, which they build their work upon.

In general, the generic information from the pool of articles resemblance the novelty of the concepts but also highlights that mission-driven and mission-oriented aspects and activities are few (almost non-existing) in engineering education. Combined with the notion of a minor use of empirical data, it showed that only 2 out of 7 articles build their arguments on empirical data.

Concerning the articles depicted use of methods, case-studies were most frequent (N=3) with interviews the second most frequent (N=2). It opens for question related to the general tendency that are common among all seven articles, which is whether the research objectives are placed on students, the organization, or research projects in a mission-driven and mission-oriented framing.

It appears to reflect the same tendencies as choices of methods when perceiving theoretical indicators, since theoretical arguments and explanations most often concern either a specific research project or student contexts. Enquiry-based or problem-based learning are found applied in 2 of the 7 articles but like categories of empirical data inclusion or method indicators, theoretical representations is also omitted in certain examples (N=2). System thinking and organizational theory both appear in one article each, arguably either concerning the institutional structures for mission-driven transformations into research or education or specific ways of framing sustainability at universities undertaking aspects mirroring mission-driven conceptualizations.

When perceiving how the articles depict their framing of core concepts as drivers for their research, both SDGs and mission-driven and mission-oriented terms are found applied. In mission-driven and mission-oriented innovation frameworks, such as

Mazzucato's (Mazzucato, 2017), it explicitly pertains to sustainable solutions – in a general sense according to the 17 SDGs. Articles included in this study either frame their context according to one of these or both. Most common in the content and purpose of the articles is SDGs as a main argument (N=5), indicating that authors acknowledge the importance of SDGs for constructing and steering their research. It is however, also commonly found that the concepts of mission-oriented or mission-driven innovation appear in similar frequency (N=4). What is quite interesting is how often articles present both terms consecutively (N=2). This indicates that the general framing accords to the 17 SDGs but simultaneously adheres to a specific understanding of dealing with the SDGs.

As no concrete requirements are placed upon the specific approaches for the processes of scaling grand challenges of society and the designs for dealing with missions (Mazzucato, 2017; 2018), it is, as described by Wanzenböck et al., likely due to the aspect of *growth* implicit in mission-driven innovation conceptualizations (EC, 2018). As missions are to be tackled in collaboration across sectors, divergent and convergent views on problems might be in risk of affecting the problem-solution space (Ibid.), and as described by the Global Research Council, missions shall be economically feasible, which can further hinder the aim for decentralized partnerships (UK Research & Innovation, 2019).

Paper ID	Author(s), year, title, DOI / ISSN	Publisher	Theoretical perspectives	Methods applied	Mentions mission-driven and mission-oriented or SDGs	Empirical data (if available)
[a]	Aguilar, A., Wohlgemuth, R., & Twardowski, T. (2018). Perspectives on bioeconomy, https://doi.org/10.1016/j.nbt.2017.06.012	Journal: New Biotechnology 40 (2018) 181–184	N/A	N/A	Mission-driven	N/A
[b]	Willicks, F., Varney, V., & Haberstroh, M. (2018). Board 97: Sustainable Development Goals Meet "Third Mission": The Engineers Without Borders Challenge in Germany. https://doi.org/10.18260/1-2--30147	Conference: ASEE 2018	Problem-based learning (PBL	Solution concepts	Both mission-driven and SDGs	Two-part evaluation – standardized questionnaire (pre-and post-evaluation)
[c]	M. Jütting, "Crafting Mission-Oriented Innovation Ecosystems: Strategic Levers for Directing Collaborative Innovation Toward the Grand Challenges,", doi: 10.1109/TEM.2022.3171735.	Journal: IEEE Transactions on Engineering Management	N/A	Multiple case-studies (cross-case), document analysis, semi-structured interviews	Mission-driven	N/A
[d]	Mihály, S., Remetey-Fülöpp, G., Kristóf, D., Czinkóczky, A., Palya, T., Pásztor, L., Rudan, P., Szabó, G., & Zentai, L. (2021). Earth observation and geospatial big data management and engagement of stakeholders in Hungary to support the SDGs. doi.org/10.1080/20964471.2021.1940733	Journal: Big Earth Data 2021, VOL. 5, NO. 3, 306–351	N/A	Status review (related to Earth observation (EO) and geospatial data (GI)), case study	SDGs	N/A
[e]	JM Serna, TS Chaparro, WM Purcell, CM Aldeanueva (2022). Driving Transformational Sustainability in a University through Structural and Academic Innovation: A Case Study of a Public University in Spain, EISSN-1941-1766	Journal: Advances in Engineering Education 2022: Volume 10 Issue 1	Organizational theory	Case study	SDGs	Student surveys. Student employability follow up. Periodic academic commissions. Official quality assurance procedures applied by the Spanish higher education authority. Outputs of partnerships.
[f]	Randles, S., Dewick, P., Hannan, E., Nicholson, D. T., Rietbergen, M., Taylor, C., Vargas, V. R., Wadham, H., & Withycombe Keeler, L. (2022). Applying enquiry and problem based learning to mission-oriented innovation policy: From policy to pedagogy to teaching and learning practice. doi.org/10.1108/JIEB-04-2021-0046	Journal of International Education in Business, 15 (1). pp. 52-73	EPBL based on Problem-based learning (PBL), Enquiry-based learning (EBL)	Systematic literature review, in-situ experiments, researchers own subjective experiences, design workshops	Mission-oriented innovation	N/A
[g]	Riekki, J., & Mammela, A. (2021). Research and Education Towards Smart and Sustainable World. doi.org/10.1109/ACCESS.2021.3069902	Journal: IEEE Access	System-thinking	N/A	Both mission-driven and SDGs	N/A

Table 1 – Overview of the papers included (with Paper IDs as points of reference)

3.2 Mission-driven characteristics in EER

The included articles for this study generally entail framings that peripherally mention mission-driven or mission-oriented innovation (or research and education) and SDGs to argue for the relevance of including the concepts in research or education in engineering educational contexts. Through the coding and thematic categorization, findings concern the characterization of mission-driven and mission-oriented concepts, as differences was found related to both on which levels and in which situations these concepts occur. It further seeks to encapsulate what the research question aims to uncover in explicating EER and examples of mission-driven and mission-oriented across published research. It should be noted that the novelty of mission-driven activities and processes in EER affected the thematic representation– therefore, an article is necessarily not applied in each analytical theme.

3.2.1 Framing innovation

In engineering education specific contexts, mission-oriented and mission-driven representations range from sporadic and minor involvement to explicit and concrete uses of mission-driven frameworks or conceptual understandings. In here, a strong buzzword appearing is *innovation*. In paper [a], innovation is applied as an urgent aspect for research projects working towards a stronger bridging of science and technology in a bio-economical perspective. They argue that support is needed to facilitate and sustain mission-oriented research by long-term commitment from industry and society and without it, innovation will cease to exist. Paper [f] frames innovation as a process that is bound to transform how institutions engages global issues that differs from previous technology-pushing solutions. The authors argue that pillar 2 in the Horizon Europe program is a direct framing of mission-oriented innovation policy for research institutions in the respective member states shall address system transformation in conjunction. Another framing of missions at an institutional level is found in the paper by [d], pointing towards a political dimension, as no grand challenge or mission-projects will suffice if not all relevant stakeholders, including governments and politicians, are collaborating internationally – both concerning research and decision-making.

3.2.2 Strategic and political arguments

The articles included do all, to various degrees, frame mission-driven and mission-oriented innovation in engineering education as being rooted in strategies and political processes. Differences are found to refer to either the purpose of research including both engineering and non-engineering disciplines, the financial support needed from governments or businesses, or trans- and international collaboration through initiatives from supranational institutions. Most frequent, when perceiving politics and strategies in EER concerning mission-driven and mission-oriented innovation, is the association made between funding, e.g., from the European Union, and the possibility to design and enact on missions and mission-projects (N=4). It can be, as [f] or [g] portrays, in the argumentation for choosing mission-driven research campaigns where politics and strategies appear, often related to specific supranational education and research

initiatives such as Horizon Europe. Paper [d] describes, that the management of earth observation and geospatial big data require national partnerships with similar peers but also support from the Hungarian government and international alliances, although not involving missions but instead SDGs. The cross-case analysis produced by [c] explores how collaborative innovation was conceptualized by studying 15 mission-oriented ecosystems in Germany and found that the most important stakeholders to involve in mission-oriented innovation collaborations was politicians and political processes. If the presence of these were missing, financial support to the collaborative ecosystems would potentially cease to exist. Politics was also found to be directly linked to the prompting and scaling of solutions into society – both nationally and globally (Ibid.). An important aspect to consider, is the design of missions, the cross-sector collaborations that involve a mix of authorities, scientist, entrepreneurs, and the civil society, which can be complex and challenging to facilitate if decisions are made top-down [f]. Furthermore, if universities, and herein EER, shall become involved and heard in the process of creating innovation, external stakeholders, such as aforementioned, shall also proactively become engaged with educators that train students in mission-driven and mission-oriented approaches to education (ibid.). Transgressing borders of educational institutions and moving beyond internal structures of universities, is what [e] describes as a necessity for dealing with complexities (such as the SDGs) through research and education for generating long-term impact.

3.2.3 Processes of mission-driven and mission-oriented innovation in EER

As mission-oriented and mission-driven innovation in EER are relatively underexplored concepts, programs, courses, or research projects rarely involve concrete and explicit orientation towards existing frameworks. The pool of papers derived are primarily describing efforts and examples in ongoing and finished research, as the papers all are peer-reviewed and therefore work-in-progress and early stages of experimentation are perhaps yet to be submitted or published. The difference is whether research projects apply it into practice (N=3), or merely include mission-driven and mission-oriented concepts as argumentation for a relevance (N=4), often in conjunction with SDGs as a focal point. One example of a framing according to Mazzucato's mission-oriented innovation policy framework is found in the literature review of synergies between Enquiry- and Problem-based learning (EPBL) and mission-oriented innovation by [f]. They used their findings from the review to experiment in-situ with two undergraduate modules at the Faculty of Science and Engineering and Faculty of Business and Law (Manchester Metropolitan University). In these experiments, mission-oriented innovation and EPBL were constructed and applied in such a way, that both the university and surrounding industries and societal stakeholders was explicitly included in the attempt to establish cross-faculty interactions and inter- and transdisciplinary routines for both staff and students. Paper [c] examined the 15 technology-based ecosystems according to the concepts of mission-oriented innovation and grand challenges. This serves as an example on how ecosystems, wherein stakeholders from all sectors are collaboratively engaged, and

both private and public entities support processes of innovation through funding. His proposal to successful eco-systems reflects a notion of bridging solutions across domains and interests, even when divergent perspectives exist. This implies translating grand challenges into missions that *value capture* rather than value creates, meaning even distribution of value among participants and stakeholders. The similarity between mission-oriented innovation and *system-thinking* is explored in paper [g], and their argument is based on the premise that system-thinking involves a holistic and multidisciplinary approach to problem-solving, where the focus is on identifying and addressing the root of problems, rather than just their symptoms. The necessity for interdependent and interconnected relationships between all included components and stakeholders is found in system-thinking, which can be transferred into a mission-oriented innovation understanding. To this, the authors argue, that SDGs and solutions to tackle them, are requiring cross- or interdisciplinary commitment, which makes a system-thinking approach suitable for creating coherent project-portfolios in relation to missions and promoting diverse research cultures (Ibid.).

4. Limitations, discussion, and recommendations

4.1 Limitations

To obtain a satisfactory degree of breadth and feasibility when identifying relevant studies, there have for the purpose of this review been excluded sources of information (e.g., grey literature or theoretical papers) due to the maintaining of comprehensiveness in the scope (Levac et al., 2010). It is acknowledged by the authors of this review, that potentially relevant studies have been in risk of being left out, but it is not an uncommon procedure for engineering education researchers occupied with scoping reviews to do so (Denton & Borrego, 2021). For retaining a concrete area of interest, further limitations arise by the exclusion of papers outside of Higher Education, in lieu, engineering education was selected to showcase the current gaps of mission-driven and mission-oriented research in that exact domain and to limit additional noise. The risk of neglecting valuable sources of information is therefore present, as this review did not seek to explore SDGs in higher education, but preliminary searches demonstrated that these are predominantly found in literature beyond EER and without being aligned with the terms of mission-driven or mission-oriented. In addition, a potential limitation concerning this study is the concepts of mission-oriented and mission-driven innovation in engineering education originated as a political idea and tool, and therefore examples that arise related to research or education across engineering education institutions rarely involve student activities, which also align with the final pool of articles and their expansion of focus to structural and educational political processes.

4.2 Implications for EER in mission-driven and mission-oriented contexts

The purpose of this scoping study was primarily to highlight the novelty and lack of research concerning mission-driven and mission-oriented innovation in EER – as commonly agreed upon in scoping reviews (Pham et al., 2014; Denton & Borrego,

2021). Reasons for why mission-oriented innovation concerning EER are limited, as of writing, is potentially related to the vast and incomprehensible number of stakeholders needed according to e.g., Mazzucato's mission-oriented innovation policy framework. Organizational theory can be used to argue for the intricate, and often complicated, nature of decision-making in organizations. Since mission-driven and mission-oriented innovation in Mazzucato's conceptual framework entails bottom-up processes, there can occur several difficulties related to a horizontal governance structure Bryson et al., 2006). Uneven balances and competing institutional routines and cultures can also prevent holistic and equal partnerships, and lack of commitment by stakeholders, which in return, demotivates and prevents the feeling of ownership (ibid.). Top-down decision-making in mission-oriented and mission-driven initiatives are also in risk of failure (Nutt, 1999). Often, managers or leaders tend to reward successes rather than failures (ibid.). This can potentially be argued for in business contexts that are market-driven, but in situations revolving around innovation through mission-projects, it is a guarantee that some will fail and not produce innovative solutions – but some will succeed (Mazzucato, 2018; EC, 2018). This is, although to a minor degree, also supported by findings of this review, as few examples were found to involve a clear and concrete involvement of mission-driven and mission-oriented concepts. For a deeper comprehension of the element of collaborating across disciplines, institutions, and sectors, a reference is made to Christiansen et al. (2023).

4.3 Recommendations for future research

Based on the findings, recommendations for further research should 1) consider entailing specific aims to uncover and design functioning ways of bottom-up mission innovation, 2) examine how cross-sectoral collaboration and mission-driven innovation in an engineering education context can establish research across sectors and domains with other disciplinary partners, and 3) re-conceptualize mission-driven and mission-oriented frameworks suitable for higher education, and preferably, include multiple voices and understandings in these designs, as the predominant framework currently used, developed by Mazzucato (Mazzucato, 2017; EC, 2018), is a solitary proposal – in some sense, contradicting the presented call for multiple and diverse perspectives.

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