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SPECIAL FEATURE: ORIGINAL ARTICLE

Accelerating Actions for Leveraging a Climate-Neutral, Sustainable Society

Transforming universities

Mobilizing research and education for sustainability transitions at Erasmus University Rotterdam, The Netherlands

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Abstract
The dominant model of universities, especially in the social sciences, is often based upon academic disciplines, objectivity, and a linear knowledge-transfer model. It facilitates competition between academics, educating students for specific professions from an objective, descriptive, and neutral position. This paper argues that this institutional model of universities is inadequate to contribute effectively to societal transitions towards just and sustainable futures. Taking the Erasmus University Rotterdam (EUR), the Netherlands, as an example, this paper illustrates the problems with the dominant (twentieth century) model of universities in the social sciences and explores what strategies universities can develop to transform. It introduces the notions of transformative research and transformative education: transdisciplinary, collaborative, and action-oriented academic work that explicitly aims to support societal transitions. It presents the design impact transition (DIT) platform as an 'institutional experiment' at the EUR and a concerted and strategic effort that lays bare current lock-ins of the dominant university model and the kind of institutional work needed to transform universities.

Keywords Transition · Sustainability · Transformative research · Transformative education · University

Introduction

Science is clear: our current economic development pathways based on fossil resources and linear growth leads to increasing global ecological destruction and socio-economic inequalities and is, therefore, unsustainable. This is hardly a new insight on the long term, but we are increasingly confronted with the impacts of this unsustainable development in the short term: ecological crises, geopolitical tensions, financial instabilities, and socio-economic tensions and protests. Against this backdrop, the failure of policy and business to provide concrete actions rather than ambitions and plans is striking. While economic and social progress has been achieved in terms of reducing global poverty, offering access to electricity, education, and health care, this progress has also led to increasing emissions, accelerated biodiversity loss, displaced communities, and conflicts over resources as recent reports by the Intergovernmental panels on climate change (IPCC[1]) and biodiversity (IPBES[2]) have identified.

The scientific understanding of these existential problems and the political consensus built around it has triggered academics to take a critical perspective upon dominant assumptions and approaches within their disciplines and to start

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[1] https://www.ipcc.ch/sr15/chapter/spm/.

[2] https://ipbes.net/global-assessment-report-biodiversity-ecosystem-services.

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exploring new ideas across disciplines (interdisciplinarity) as well as between science and practice (transdisciplinarity). In this process, it becomes increasingly clear that traditional, disciplinary academic structures are often unfit to accommodate such new forms of research and education (Trencher et al. 2014; Horan et al. 2019) and at worst are actually working against forms of research and education that support sustainability transitions (Fazey et al. 2021).

Dominant discourses, especially in fields such as economics, public administration, business or law, are fundamentally challenged by persistent and complex sustainability problems. They have developed in a context of economic growth, societal progress and their mainstream applications are based on the idea that research needs to be objective, disciplinary and focused on academic output (Donaldson et al. 2010). This is also the kind of science that is supported by current institutional structures which organize research and education in disciplinary ways. Since the social sciences have, thus, contributed largely to how society and our (developed) economies are organized (Kläy et al. 2015), it also becomes necessary to rethink the role of disciplines, academia, and academic institutions in addressing the consequences thereof. We, thus, accept the broad thesis already articulated by many that universities are currently incapable of addressing the scale and urgency of challenges like climate change (Rubens et al. 2017; Fazey et al. 2021).

Yet most universities in developed economies are still largely disciplinary and centered around academic knowledge that played such a central role in the historic build-up of the welfare society. Directly linked to it are the educational programs and the transfer of knowledge through education. Achieving socio-economic transitions to sustainable futures within planetary boundaries while meeting the basic needs of all in a just and inclusive manner requires to equip young people with completely new types of knowledge and competences, to provide them with a different education (Maxwell 2007; Bien and Sassen 2020; O'Riordan et al. 2020). While the ecological boundary conditions in terms of limiting climate change to 1.5 degrees and stopping the loss of biodiversity seem clear, the ways to get there are deeply contested, uncertain and far from evident. A transformation of energy, food, or health-care systems, to just name a few, is inevitable, but how to deal with such systemic changes is a process full of uncertainties, tensions, barriers, and ambiguities (Loorbach et al. 2017).

This explains the emergence of alternative approaches to science, be it reparative, engaged, transformative, or sustainability research (Kates et al. 2001; Van de Ven 2018; Hölscher et al. 2021), or to education, such as transformative learning, or competence-based education rather than focusing on reproducing (disciplinary) knowledge (Jasanoff 2004a; Scholz 2017). These different concepts and terms are witness of a search for new roles and forms of academic work and ways to produce knowledge of and for sustainability transitions. In general, it refers to academic practices that are reflexive and critical towards business as usual, and explorative and experimental with regards to the development and diffusion of knowledge. We, thus, consider the problem of reproduction of the existing through established structures and the search for new forms and practices to be relevant for both academic education and research (cf. Fazey et al. 2021).

In this paper, we explore the implications of the need for alternative types of research and education on the institutional design of universities: what are these alternative types of research and education, and which institutional changes are necessary for universities to support accelerating societal transitions? We answer this question through providing a synthesis of relevant literature and by using our home base, the Erasmus University Rotterdam (EUR), the Netherlands, as an illustration. Both authors are involved in action researching the Design Impact Transition (DIT) platform, a strategic initiative of EUR to drive the university transition towards a new institutional design. That is, we are employed as DIT academic and DIT academic lead to shape the platform and in so doing learn about how universities can transform to become a driver for just sustainability transitions, what the institutional work involved is and where the current lock-ins are. We systematically collect and analyze data throughout based on an approach inspired by reflexive monitoring (Van Mierlo et al. 2010). This paper is structured as follows: we first describe the currently dominant institutional design and its limitations "The 20th century university in transition?" and then introduce transformative research and education as a future orientation "Transformative research" and "Transformative education". Building on that, we describe the approach and activities of the DIT platform to drive the university transition towards a new institutional design "Transforming a university". We close by reflecting upon the need to proactively help guide and accelerate transforming universities "Reflection and discussion".

The twentieth century university in transition?

Impact through knowledge production and transfer

Universities and academic research have always been relevant and have had enormous impact on the development of society and its economic systems (Jasanoff 2004b). In the decades after World War II, universities have supported economic and human progress through technological and institutional advances. The social sciences (e.g., sociology, political sciences, economics, law, business, and innovation) co-evolved with the rise of the modern welfare state, its

bureaucracy and economic models. Through their research, universities developed knowledge, models, concepts, insight and observations, and formulated recommendations that would further progress. In this linear process of knowledge transfer, it is then up to policy and practice to take that knowledge and use or implement (or disregard) it. This conception is aided through sharp boundaries being drawn between academic and applied, or between pure and applied activities (Flyvbjerg 2001).

Over time, universities developed into an institutional environment that facilitated this highly successful model of academic impact through knowledge transfer and further optimized it. Much aligned with how society evolved in sectors, departments, and specializations, universities established faculties around emerging disciplines that became increasingly specialized on ever 'smaller' fractions of societal issues (Perkin 2007). Within those faculties, incentives and systems of recognition and rewards were set up that rewarded 'academic excellence' and research quality, often taking 'number of citations' or 'publication in highest ranked journals' in a specific field as a measure (Aksnes et al. 2019). Increasingly, universities became managed through strategies of command and control following ideas of 'new public management' (Bartels et al. 2020). Academic career paths are designed to follow a linear pathway within specific disciplines and reward academics for contributions to the field. In this, temporary contracts and competition for tenure are the norm for especially younger academics, creating precariousness and tensions (Ahmed et al. 2020). There are also structural inequalities, especially with regards to minorities and women in higher positions such as professorships (Fox 2006).

The EUR as example

Within Erasmus University Rotterdam (EUR[3]), the Netherlands, this model was very successful, especially in economic and public policy. The EUR emerged out of a regional economic school for higher education and has, since 1973, evolved to become one of the prominent Dutch universities with a strong economic and business profile. It produced Nobel laureate Tinbergen and its School of Economics remains very influential in developing models and theories in support of economic development. Its business school, the 'Rotterdam School of Management', occupies a top rank globally, and the 'Erasmus School for Social Sciences and Behaviour' is world leading in public administration, playing a role in mainstreaming ideas of new public management in the 1990s and network governance since the 2000s.

[3] See www.eur.nl (accessed 10-03-2023).

EUR Schools this way helped to shape and became successful in a context of economic growth, liberalization, deregulation, and globalization, developing and advocating values and practices such as profit maximization, business efficiency, and process management. It has historically achieved a top-ranked position on disciplinary academic standards: publishing in top-journals in the specific fields is a requirement for promotion or tenure, as is receiving grants in competition with peers. With it comes a dominant understanding of what constitutes 'good academic work'. Namely, as a 'neutral, objective and descriptive' activity: using models, theory, and empirical work to describe and analyze reality and formulate insight and perhaps recommendations. The dominant discourses, values, and the structures of disciplinary schools have been translated in educational programs, through which these are reproduced, reinforced and transferred to students.

In educating students, universities like EUR have been caught in a process of democratizing higher education, international competition and accomodating enormous growth in student population. Educational programs are often part of research groups within schools and act as platforms for academics to educate students within the different disciplines as part of their positions. The educational model is often based on established curricular and the body of knowledge accumulated within the disciplines. The focus is on transferring knowledge and tests play a central role. In organizational terms, academics are employed to teach a certain amount of their working time. The educational programs themselves receive government funding for each graduated student, incentivizing growth and optimization of the staff–student ratio (at EUR one of the highest in the Netherlands with 1–16). Over the past decades, this has led to an enormous growth in the number of programs and students, recently even leading to a temporary stop in recruitment of international students to the Netherlands.

Characterizing the twentieth century model

This 'twentieth century model' has been financed by substantial amounts of 'basic funding' for universities through national governments. Funding mechanisms and systems have developed for research in support of the production and transfer of knowledge. In research, funding schemes have developed within the disciplines and focused on financing excellent research, often supporting individual researchers that compete for grants with their peers. Intricate systems of calls, review, and selection have been put in place to ensure academic quality as well as innovation within the discipline. Collaborative grants are more and more common, especially at the European level, also emphasizing academic quality and proposing research projects that advance the state-of the-art in specific fields. Proposals often have to present

Table 1 Design principles of the twentieth century university

Institutional dimensions	Twentieth century model
Incentives	Excellence
Career paths	Academic and hierarchical
Funding	Subsidized grants and basic funding
Organization	Schools and support
Positioning	Outside society
Learning philosophy	Linear transfer

what and how they will research to receive funding. Funding schemes often fund up to 90% of the costs (e.g., salary costs and part of the overhead cost) but often much less, meaning that universities have to co-fund it themselves.

These funding mechanisms at universities are intimately linked to the dominant models of education and research. The basic funding universities receive are combined with the predictable income from education and the competitive grants from research funders as well as from contract research or foundations (VSNU 2022[4]). This last category is substantial, on average 30% of the funding is attracted through external sources, at the EUR it is typically well below 30% and declining. From a business model perspective, these mixed funding structures have led to a cost-based model: schools are focused on covering all costs for existing staff and educational and research commitments by combining the different streams of funding. Under pressures of budget cuts, growth in number of students, and the broader societal push towards efficiency and competition, it has led to decreasing spaces for experimentation and failure and increasing overhead costs and bureaucratic structures.

Simultaneously, a process occurred in the social sciences that led to a shift in how academic quality is predominantly defined. Whereas a lot of social sciences scientists in the 1960s and 1970s were engaged, idealistic, and sometimes activistic, over time they retreated within their disciplines and started to define academic quality in similar terms as the natural sciences: objective, descriptive, and empirical. Researchers should not engage with their subject of research but observe and analyze and formulate insight so that others can or cannot use it as they like. Combining these trends, we characterize the institutional design of the twentieth century university as follows (see Table 1).

Redefining the university mission

The Strategy 2019–2024 of the EUR, with its focus on 'Creating positive societal impact', fits within broader calls for universities to focus on addressing grand societal challenges (Schneidewind and Singer-Brodowski 2014; Berchin et al. 2021). It is argued they can do so by engaging in co-creation for sustainability with regional actors (Trencher et al. 2014), through becoming more activistic (Gardner et al. 2021) or through a focus on their 'societal impact' (Reed and Fazey 2021). The latter seems often to be missing the more critical thinking and offers a broad range of different connotations. Some consider societal impact of universities to be the dissemination of academic output or the continuation of a further neoliberalization of the academic system (Bartels et al. 2020; Reed and Fazey 2021) through a focus on valorization, transfer offices, science communication, and the like. Others welcome it to reframe and open the dialogue on new roles for universities and their researchers to address societal challenges (Bradbury et al. 2019). Still others also highlight potential problems resulting from this shift to prioritise social impact, and warn for negative effects on academic freedom (Chubb and Reed 2017) or negative consequences of this impact such as an "impact or implode" paradigm (Reed and Fazey 2021).

Arguably, such discourses need to be accompanied by fundamental changes within the institutional design for universities to fully live up to their ambitions to contribute to societal transitions—this was the case for the focus on economic development under the third mission (Rubens et al. 2017) and it is the case for addressing societal challenges as this implies alternative ways of knowledge (co-) production and dissemination (Stephens and Graham 2010; Schneidewind et al. 2016; Deleye et al. 2019). Knowledge co-production and co-creation challenge and conflict with unidirectional models of knowledge transfer from science to society and are practically also hardly accomodated within universities that are organized in a Neo-Taylorist way based on disciplinary, academic and 'neutral' knowledge ideals (Bartels et al. 2020).

Universities have therefore seen increasing debates around their purpose and function in society—especially in relation to a mounting pressure to open up the 'ivory tower', while the way societies consider the legitimacy of scientific knowledge and academic involvement in public debate is changing (Saltelli and Funtowicz 2017). Thus, on the one hand, scientific evidence is more than ever guiding policy decisions, with expertise by virologists and epidemiologists guiding far-reaching interventions in many countries during the COVID19 pandemic. On the other hand, skepticism towards scientific authority and eroding trust in scientific expertise is mounting. To regain this societal trust and to become relevant for complex societal challenges, implies fundamental changes in how research and education are perceived, organized, and practiced.

From this account, the path dependency of future directions for universities and the broader academic system

[4] See https://www.universiteitenvannederland.nl/en_GB/change-in-research-funding (accessed 10-03-2023).

become clear—there are many structural and cultural barriers that stand in the way of adopting more transformative approaches to research and education, including institutionalized funding streams, pre-determined and internationally harmonized career paths, an academic workforce trained in doing 'excellent' research, deeply ingrained valuing of objectivist, disciplinary research and more. This means that while universities strategically aspire to engage with 'societal challenges' to achieve 'positive societal impact', there are many institutionalized values and practices that prevent mainstreaming of more transdisciplinary or normative ways of working. We will next introduce the concepts of transformative research and education before reflecting upon the transition in the university necessary to accommodate them.

Transformative research[5]

An emerging new paradigm

Since climate change and biodiversity loss started to emerge as persistent and complex problems, researchers and universities have been looking for new ways to do research and support societal transitions. Transdisciplinary research (Lang et al. 2012; Lam et al. 2021), for example, seeks to facilitate processes of co-creation between academics and practitioners to integrate different types of knowledge. Sustainability science (Kates et al. 2001; Miller et al. 2014) explores interdisciplinary collaboration across natural and social sciences in search of a more holistic and systemic understanding of persistent problems. Action research (Greenwood and Levin 2007; Bradbury et al. 2019; Wittmayer et al. 2021a) is re-emerging as an approach to address questions of societal transformation and democratization. Citizen science (Sauermann et al. 2020) mobilizes citizens in research processes, e.g., by collecting data and building a knowledge base for analysis. Finally, transition research (Markard et al. 2012; Loorbach et al. 2017) focuses on understanding the systemic patterns of inertia and transformation to develop governance strategies to guide and accelerate desired future transitions.

These alternative research approaches use existing quantitative and qualitative research methods in collaborative processes of knowledge co-production. Such knowledge co-production for sustainability is situated in particular contexts, builds on and captures the plurality of knowing and doing, is problem driven and goal oriented as well as interactive and collaborative among diverse actor groups (Norström et al. 2020). It can create space for experimental processes in which different types of scientific and practical knowledge are combined to rethink existing situations, redefine desired futures, and reposition short-term action. Knowledge is not created for its own sake (or mere career advancement), but with the "purpose to promote social analysis and democratic social change", and following an emancipatory intent for communities and organizations "to control their own destinies more effectively and to keep improving their capacity to do so within a more sustainable and just environment" (Greenwood and Levin 2007). Such knowledge co-production, thus, differs from more traditional descriptive analytical research and since it sets out to support societal transformation, we refer to this kind of research as transformative research.

From description to exploration

Transformative research does not refer to one specific research methodology or approach, but to a family of approaches that have in common a focus on action, research and participation related to just sustainability transitions (Greenwood and Levin 2007). Transformative research is part of a broader and loose movement in science towards more relevance, robustness and engagement that includes the approaches outlined above, but also others such as Mode-2 knowledge production (Gibbons et al. 1994; Nowotny et al. 2001), post-normal science (Funtowicz and Ravetz 1994; Wesselink and Hoppe 2011), science and technology studies (Funtowicz and Ravetz 1994; Saltelli et al. 2016; Dankel et al. 2017), and knowledge co-production in sustainability science and sustainability transitions research (Miller 2013; Miller et al. 2014; Caniglia et al. 2021).

Transformative research carries a future- and solutions orientation (Miller et al. 2014). It explores reconstruction of new or adapted structures, cultures, and practices that can then potentially replace the deconstructed unsustainable systems—a focus on that which 'can be'. According to Avelino and Grin (2017), such reconstruction combines an understanding of how things are at a certain point in time, with how they ought to be in the future, and crucially, how things 'can be' at any point in time. Transformative research also has affinities with the work of Science and Technology Studies scholars such as Sheila Jasanoff (2004a, 2015), who has emphasized the necessity to frame differing narratives of the same circumstances as sets of imaginaries—stories told about facts which in turn influence how those facts are interpreted. The reconstruction is not only about visions, imaginaries and narratives, but also encompasses action through experimentation with seeds of change to see what can be learned about putting these into practice (Wittmayer et al. 2019).

[5] Parts of this section are drawing upon the collaborative DIT paper Transformative Research and we want to acknowledge the other contributors Bogner, K., Hendlin, Y., Hölscher, K., Lavanga, M., Vasques, A. Von Wirth, T. and De Wal, M. to this: https://www.eur.nl/en/media/2021-11-dit-working-paper-1dit-platformerasmus-university-rotterdam2021 (accessed 01-31-2023).

From multi- and inter- to transdisciplinarity

To explore such alternative futures and narratives as well as to integrate a deeper understanding of how it works in practice, more than scientific knowledge is needed (Hirsch Hadorn et al. 2008; Flyvbjerg et al. 2012). Consequently, transformative research approaches are inter- and transdisciplinary and include the participation of and collaboration with societal stakeholders in addition to trained scientists from multiple disciplines (Kates et al. 2001; Saltelli et al. 2016). Such research approaches are necessary not only to draw on knowledge from across disciplines and actor groups, but also to draw on normative orientations providing guidance for developing solutions, and to increase ownership, and legitimacy, but also accountability, for both problem understanding and possible solutions from all involved (Lang et al. 2012).

It also means that insights derived from using different research perspectives and approaches are necessary. For example, Avelino (2011, p. 22) contends that we "cannot afford" to choose sides between different approaches to science in the face of questions concerning persistent (complex, normative) problems and transition processes. Thus, what is needed here is the knitting together of kindred—and even conflicting—perspectives; and the refusal of letting any one of these dominate at the exclusion of all others, that is methodological and possibly theoretical pluralism (Midgley 2011). It has been suggested that the interpretive research paradigm can offer the openness to accommodate such pluralism (Avelino 2011; Avelino and Grin 2017) as can a pragmatic stance (Greenwood and Levin 2007; Popa et al. 2015). Such a stance requires transformative researchers to be skilled in a repertoire of research methods and to engage in methodologically rigorous research, if only because outcomes will have a direct effect on the lives of stakeholders (Greenwood and Levin 2007).

From objectivity to reflexivity

In order not to reproduce unequal power relations, taken-for-granted framings or habitual practices through its system analysis or its experimental and generative practice, transformative research practice needs an outspoken orientation and commitment to increase overall reflexivity. There are a range of ways through which reflexivity can be engaged in research processes: from accounting for the positionality of the researcher, allowing differences to be voiced to attending to the broader contexts within which results are produced and shared (Finlay 2002). At its fundament, it acknowledges the impossibility of researchers being positioned 'outside' of their research (Schwartz-Shea 2006). Going beyond, reflexivity in transformative research also concerns the capacity of individuals and groups to not only diagnose persistent problems but also to confront the approaches, structures and systems that reproduce them (Voß et al. 2006; Hendriks and Grin 2007), which is often related to modernity. As a capacity, the reflexivity of a transformative research project can then be considered as its "ability to interact with and affect the institutional setting in which it operates" (Beers and Van Mierlo 2017). Such a view on reflexivity allows for agency of individuals and also for systems change, and is, thus, generative of alternative structures, cultures and practices.

To summarize, transformative research refers to academic practices in which 'academic' researchers work together with practitioners to reframe and interpret existing contexts, the persistent problems present and their historical origins. Based on this, they can collaboratively explore and experiment with transformative alternatives (narratives, futures, scenarios, practices, models, structures). Subsequently, they can reflect, learn, and adapt their understanding and approaches based on progress made and insight developed. To do so, they need to be able to use different methods, tools, and approaches, and play different roles (e.g., researcher, knowledge broker, facilitator, mediator, and translator). In these processes, researchers become engaged with their subject and explicitly explore desired future changes.

Transformative education[6]

An emerging new paradigm

Finding new ways to address complex persistent problems requires a critical analysis and rethinking of our disciplines and how they contribute to social change. It is now broadly agreed upon amongst sustainability and education researchers that proactively dealing with sustainability transitions requires more than deep knowledge within a specific discipline and literacy about persistent sustainability problems. It also requires an interdisciplinary perspective and a critical mindset. It requires the ability to collaborate across disciplines and professions. It requires an experimental and entrepreneurial way of working to contribute to societal value creation.

The academic educational system has for longer been discussed as problematic when it comes to educating students (learners) for sustainability transitions (Bien and Sassen 2020; O'Riordan et al. 2020). A general argument is that the predominantly knowledge-oriented and disciplinary education limits the learner's ability to navigate complexity and enhance a linear problem-solving approach rather

[6] Parts of this section draw upon the unpublished DIT working paper on Transformative education and we want to acknowledge the contributing authors Elvira, Q., Dorst, K. and Beers, PJ.

than a more design oriented, experimental, and creative one. What is generally needed is that learners develop an orientation towards societal issues and reform processes in societal systems. Through educational programs, learners need to 'unlearn' as well as go through a process that helps them to understand and appreciate complexity, diversity, and uncertainty, as opposed to understanding the world through one specific paradigm or discipline (Scholz et al. 2006; Herrero et al. 2019).

From transfer to co-creation and social learning

'Transformative education' (Paul and Quiggin 2020) in the context of societal transitions is about learning about transitions and sustainability but even more so about the process of personal transformation enabling learners to let go of predeveloped assumptions, social conventions and what is considered 'normal' (Sutherland and Crowther 2008). If we need to fundamentally change how society and the economy work, learners need to be able to challenge, alter, and replace the status quo. Transformative education, therefore, entails an experiential process through which students develop a new outlook through engaging with a variety of practices, perspectives, and types of knowledge. Learners who go through such a process experience a "paradigmatic shift" by having their frame of reference—assumptions and expectations that direct their tacit points of view and influence their thinking, beliefs, and actions—challenged, reflected upon and acted on.

To help us understand these changes of perspective that occur in students, we draw on transformative learning theory (TLT). Transformative learning is "a deep, structural shift in basic premises of thought, feelings, and actions. It is a shift of consciousness that dramatically and permanently alters our way of being in the world" (O'Sullivan et al. 2016). It often describes learning that occurs when a learner engages in activities that cause or allow them to see a different worldview from their own (Mezirow 2003) and is largely understood as a means of adapting to the needs and demands of the broader, social–cultural context (Dirkx 1998). Teaching for change is not limited to the individual student journey; complex issues as well require innovative solutions, that irrevocably lead to change.

From individual to collaborative

When working toward change, design thinking—an iterative model and prototyping mindset to show people that change might be possible—considers how focusing on questions, ideas, and integration of stakeholder requirements can foster creativity and innovation. Design thinking's process of quickly building and iterating on solutions is valuable for generating the evidence necessary to persuade stakeholders to fund and support a fledgling idea. Design thinking emphasizes the importance of collaboration and multiple perspectives, which builds human connections, creating empathy, which helps in making better decisions. Whether it is transformative learning or design thinking the collaboration between people is central to bringing about change.

Collaborative learning reflects the ideas that the shared learning of interdependent stakeholders—the presence and participation of other learners is the defining component—is a key mechanism for arriving at more desirable futures. To gain insights into these desirable futures, learning should form a bridge between complexity and governance in that it describes and explains the co-evaluation between actors, structures and practices. This means in concrete terms that teaching the "how" of complex social issues requires interactive and collaborative learning processes (community of learners) (Miller 2022). Curriculum design that enables the "what" of complex social issues to continually emerge and be redefined through group interaction around intersubjective production practices prepares students for the kind of experimental creativity, reflexivity, and collaboration that will be required to produce new sustainable ways of knowing and living.

In this process, it is essential to (be able to) combine and possibly integrate diverse types of knowledge (transdisciplinarity) to address the complexity of problems and the diversity of perceptions of them. Transdisciplinarity is inherently a process of co-creation and collaboration: you cannot do it by yourself. To make such collaboration productive and transformative implies on the one hand a structured way to engage students as well as to facilitate a process of joint learning. On the other hand, it requires the learner to take a holistic perspective to look into the world. Findeli (2001) stressed that this holistic approach is inherent to design thinking; extending boundaries by emphasizing that a project will more likely produce sense-making results the further one extends the limits of the system in which a project evolves.

From knowledge to capacities

Encountering new concepts and terminology from other disciplines that do not fit existing mental models may result in a disorienting dilemma for the learner. This is the first step in transformative learning. Under the right conditions, this may lead to a revision of their existing mental models (i.e., critical reflection). To complete the process of transformative learning, these revised mental models must then be iteratively vetted and synthesized through reflective discourse with collaborators to generate a salient and inclusive integrated conceptual framework (Pennington et al. 2013). Transformative education, thus, has at its core a collaboration between learners: instead of an individual learning

process, it implies a learning journey that a learner goes through in interaction and collaboration with her or his environment (including peers, teachers, and practitioners), building upon ideas around group and team learning (Decuyper et al. 2010).

In this approach, 'sharing', 'co-construction', and 'constructive conflict' are considered as the basic collaborative learning processes. Where the basic process variables are responsible for the power of team learning, the facilitating process variables give context and focus to team learning, influencing both its efficiency and effectiveness (DeCuyper et al. 2010). These collaborative learning processes lead to outcomes that describe what learners should know**,** understand**,** and be able to do in a course or program (Huba and Freed 2000). It provides direction for the design of instructional activities and clearly communicates to learners the end-product of the learning journey. The outcomes of transformative education should be knowledge, skills, attitudes and mindset that can be used in future debates about complex social problems. In general, these include outcomes relating to cognitive ('think'), relational ('connect'), entrepreneurial ('act'), and reflexive ('learn') competences. These four dimensions are interrelated and in one way or another used in recent literatures on sustainable education (Berchin et al. 2021), inner development goals[7] or transformative learning (Pennington et al. 2013).

To summarize, transformative education implies the creation of programs that are inter- and transdisciplinary and cater for a student journey that is transformative in itself but also builds transformative capacities in the students. This is a process that can only be partly assessed in summative ways through tests and exams, and also requires formative assessments in terms of qualitative feedback and reflexive learning. It also means program designs that include practitioners, group exercises, experiences and a diversity of teachers representing different views from academia and practice. By definition, this not only requires collaborative efforts from academics from different disciplines, but also that they develop curricula together to provide an integrated and overall coherent program for the students.

Transforming a university

In 2020, Erasmus University launched its Strategy 2024 'Creating Positive Societal Impact' following a longer discussion from within the different schools and across campus, that there is a need for more scientific relevance and collaboration to address complex societal challenges (Erasmus University Rotterdam 2019). Under its strategy, the EUR started a wide number of initiatives focused on impact in education and research and changing university structures and conditions to enable impact-oriented academic work, including recognition and rewards, measuring and evaluating societal impact, and bringing impact into education (Erasmus University Rotterdam 2022)[8].

It also links up to, for example, the cross-university program of Dutch universities on Recognition & Rewards (Erkennen en Waarderen). The Recognition & Rewards program is a response to the need for a modernized system of recognition and rewards that moves away from the one-sided emphasis on research performance, and more towards including scientific education and impact in quality assessment (Universiteiten van Nederland 2019). Consequently, the newly updated Standard Evaluation Protocol that is used to evaluate research units has incorporated a greater emphasis on societal impact, open science, diversity and talent policy (Universiteiten van Nederland 2020).

As part of Strategy 2024, the EUR initiated the Design Impact Transition (DIT) platform as one of the strategic projects.[9] DIT is funded for four years as an 'institutional experiment' with the explicit aim to explore, through action research, how the transition of the university could be accelerated. It experiments with a new model of how a transformative university could be and, in this process, encounters the barriers and resistance against it from the existing model. Its aim is to advance sustainability and transition in education and research and do so by exploring how the university more broadly could become more impactful on sustainability transitions. It received a budget of over four million Euros and started in the summer of 2021.

DIT aims to establish the institutional basis for developing design, impact and transition-oriented education, research and engagement. As a facilitator and catalyst for impact-oriented academic ecosystems, co-creation with stakeholders in transitions, and societal engagement, it has a threefold mission:

1. Advance transdisciplinary design, impact, and transition methodologies and programs.
2. Develop and nurture transformative academic ecosystems to impact the envisioned changes.
3. Help scholars develop their design, impact, and transition career pathways.

The model DIT works from is to experiment with the idea of a transformative university: what values would it

[7] See here https://www.innerdevelopmentgoals.org/.

[8] See https://www.eur.nl/en/about-eur/strategy-2024/strategy-practice (accessed 10-03-2023).

[9] See here https://www.eur.nl/en/about-eur/strategy-2024/strategy-practice/dit-platform (accessed 10-03-2023).

foster, which institutional design elements would it exhibit and how would transformative academic work be practiced. Drawing upon the described characteristics of transformative research (Sect. "Transformative research") and education (Sect. "Transformative education") and a design-based approach, DIT developed a 'narrative for change' (DIT platform 2023)[10] that outlines the following principles and values underlying an academic environment for transdisciplinarity:

- *Together*: providing space to connect, collaborate, and exchange
- *Profound*: value and apply academic rigor
- *Systemic*: research and develop new ways of thinking, doing, framing, and organizing
- *Appreciative and respectful*: being inclusive and honoring different points of view
- *Experimental*: learning-by-doing
- *Reflexive and self-reflexive*: Challenging ourselves and others.

From these values, DIT develops transformative research and education initiatives, projects and activities that in themselves challenge the dominant university model. The tensions DIT encounters in actually practicing university transition already shed light on the types of structural changes necessary and the institutional design for a transformative university. In the following, we describe several DIT activities to illustrate future directions of universities and to shed light on the tensions with the twentieth century model. Our knowledge about these activities is based on our involvement with the DIT initiative in different capacities: as DIT academic and DIT academic lead, we have been part of the initiative and its action research from its inception.

Career paths and organizing

From DIT's vision on academia as a collaborative, experimental, and action-oriented environment, it built up a platform that is designed for (i.e., rewards and recognizes) collaboration and transformative academic work. An organizational structure was developed consisting of a core team of designers, facilitators, developers, and academic and organizational leaders.[11] Rather than being considered 'support' functions, these roles are responsible for transforming research and education and require a diversity of expertise, skill, and knowledge that are complementary to research and education skills. Around this core team, a group of academics is engaged: these continue to be employed by their respective faculties and are linked via secondments to DIT. Each DIT academic formulates their assignment allowing them to (continue to) research specific issues related to the design of a future university. Through this organizational set-up, DIT practically explores new ways of devising academic career paths and organizing diverse teams needed to support transformation.

As part of the academic assignments and DIT's mission, the aim is to develop wider engagement with the university community to build academic ecosystems: partly self-organized networks of academics that share knowledge and experience, meet and collaborate across disciplines and institutional boundaries and together work on transformative changes. For example, in the ecosystem around transformative education, EUR academics at large discuss and share new models for transformative learning, develop shared publications, and exchange ideas to develop new educational programs and trainings for staff. The core team of DIT supports these types of activities by bringing in design skills, communication, and organizational support to co-create events that are engaging, sustainable, and fun.

As an example of such a collaborative effort, DIT is currently co-organizing university-wide dialogs on sustainability. It had already proposed to do so to the university boards, but the process accelerated following 'OccupyEUR', a local student protest in December 2022[12] which is part of a broader global movement to cut the ties between universities and the fossil industry. After students were evicted from the campus by the police, academic staff rallied in their support, pressuring the university board to take more rapid and substantial action on sustainability.[13] DIT then supported and worked with a team of all female academics to organize a round table with students, staff and the university board with the goal to formulate concrete steps the university can take in understanding and cutting its ties with the fossil industry. It led to a concrete and substantial commitment of the university board to address the climate emergency and mainstream sustainability.[14] Thereafter, DIT was commissioned by the university board to organize a series of dialogs and sessions and has organized it so that the academics working on these will receive formal acknowledgement of this institutional

[10] See the extended description of the mission and approach here: https://www.eur.nl/en/media/2021-11-narrative-changedit-platformerasmus-university-rotterdam2021 (accessed 10-03-2023).

[11] See https://www.eur.nl/en/about-eur/strategy-2024/strategy-practice/dit-platform/about-dit (accessed 10-03-2023).

[12] See https://www.eur.nl/nieuws/statement-college-van-bestuur (accessed 10-03-2023).

[13] See https://www.eur.nl/nieuws/dit-solidair-met-de-ontruimde-studenten-van-occupyeur (accessed 10-03-2023).

[14] See the declaration here: https://www.eur.nl/en/news/erasmus-university-rotterdam-declares-climate-and-ecological-emergency (accessed 10-03-2023).

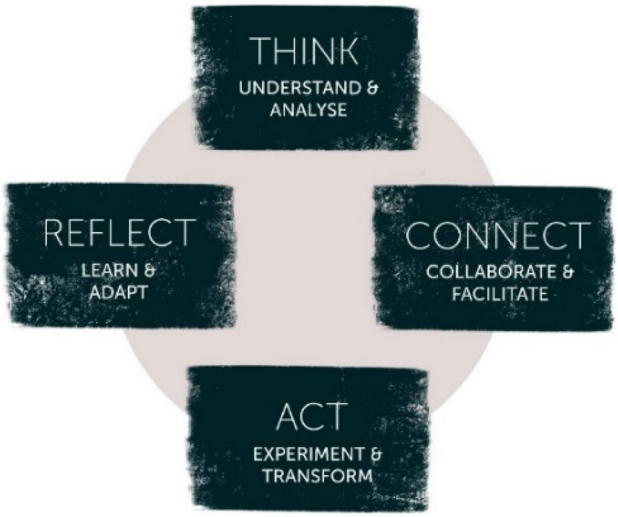

Fig. 1 Transformative capacities. Source: Erasmus School of Philosophy and DIT Platform (2022, p. 13)

work by receiving a compensation of 0.1 fte. This is a very practical way to actually 'recognize and reward' academics for impact.

This way, DIT is seeking to create a context within which both academics and others are working on a specific form of impact, assuming that as academics, they will also investigate this through publications, proposals, courses, and programs as part of their academic work. This specific form of 'impact' itself is always linked to societal transitions or in this case the university transition: as transformative academic work, it builds upon a hypothesis around persistent problems and explores a desired direction for change. This is different from the formal Recognition and Reward approach in which 'impact' is added to research, education and management as core activities and mainly framed in neutral terms as 'societal engagement'. This often means that impact is added to the existing workload and to develop the impact profile implies the need to first excel in research and/or education.

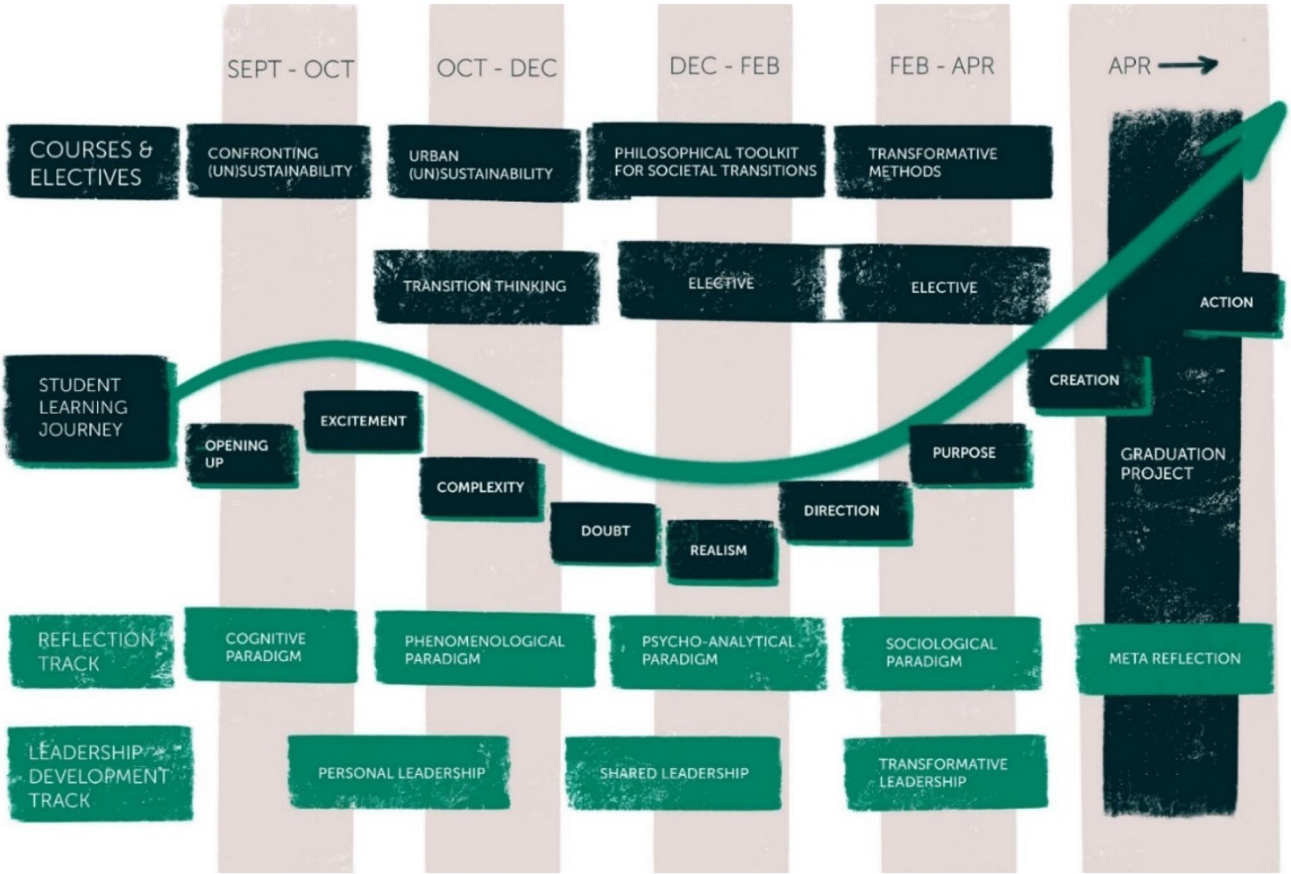

Fig. 2 Original program design Master of Societal Transitions. Source: Erasmus School of Philosophy and DIT Platform (2022, p. 17)

Transformative education and the Master in Societal Transitions

The transformative learning philosophy as outlined under Sect. "Transformative education" has been translated in the design of a new masters program on Societal Transitions.[15] For it, the DIT team built a program to support the development of four different capacities with students (see Fig. 1) through a learning journey (see Fig. 2) in which co-creation and constructive conflict are embedded. The program engages learners in a process of confronting assumptions and facing the ecological crisis via developing systemic understanding and appreciation for plurality towards practical tools and methods for engaging in societal transitions. Their journey ends by developing a collaborative and transformative intervention where students show their progress on each of the competences. Added to the program are a leadership and a reflexivity track meant to support the students and teachers to systematically reflect upon their progress, emotions, and challenges (Erasmus School of Philosophy and DIT Platform 2022).

The governance of the program was to be a 'joint venture': different groups from different schools and institutes of the EUR were to contribute to the program and invest in its development. Contributions were to be calculated based on actual cost (salary plus overhead) and income and revenues were to be shared according to contributions made. This model, however, conflicted with the dominant model, where masters programs are governed by one school and the hiring of external staff (i.e., from other schools) is done based on salary cost. Not only does this not cover actual costs, but it also effectively translates into the purchase of a 'service', thereby disincentivizing actual collaboration. This program received official accreditation by the end of 2022 and now creates internal dynamics around the need for revisiting the organizational model of financing masters programs, but also the need for new exam boards for interdisciplinary programs and synchronization across different programs on campus to facilitate exchange, combined tests, shared lectures and in general more coordinated programming.

Transformative research

To explore and develop new ways to organize research, DIT academics are building ecosystems around transformative research, where in working groups, workshops, and collaborative writing, the academic basis for doing transformative research is laid (Wittmayer et al. 2021b). But they also apply more traditional academic research on the university itself to identify the tensions, barriers and drivers towards transformative research. This includes classic interviews and workshops with those fellow academics across different schools that do engaged work to understand which forces support and hinder them in doing such academic work. Two striking insights emerged from this. First, that a lot of researchers are uncertain and sometimes afraid that deviating from the dominant academic pathways threatens their possibilities for promotion, while they do not know what the rewards for a more impact-oriented approach would be or how they could do that. Second, researchers at all levels (from PhD to retired professors) say that they now 'accept certain unpleasant tasks to be rewarded in the next phase': PhD that do education and work on a professor's project and expect to be able to do their own research when they become postdoc up to professors that will finally write the book they want when they retire. The results are shared with the university board and are communicated via policy briefs (DIT Platform 2022) and interviews with the university magazine.[16]

Another stream of more action-oriented research is about new ways of funding for which DIT partners with ACCEZ, a knowledge program by the Dutch Province of South Holland to accelerate the development of its circular economy. ACCEZ has rounded off its first stage of transdisciplinary and impact-oriented research funding in 2022 and together with DIT is now taking stock of lessons learned (DIT Platform and ACCEZ 2023). Together, they want to learn about how research programs that allow for more transformative forms of academic work (e.g., participatory, engaged or action-oriented) are designed with a focus on their funding and governance. While this work is ongoing, emerging lessons include: (a) the topic needs to be formulated in a way that it is interesting for a broad array of actors including universities, policy makers, businesses, and civil society; (b) funding needs to be available already for a prephase that leads to a research proposal—this initial phase is where actors with different perspectives come together to understand each other's questions and knowledge needs; (c) exchange between research projects of a research program needs to be facilitated to increase learning amongst one another and find synergies; (d) funding needs to cover all costs including salary, overhead and risk; (e) funded activities should allow for anticipatory, experimental, future-oriented, reflexive, and critical work in relation to the societal problem at hand; (f) funders need to become partners; and (g) trainings on skills and competences pertaining to inter- and transdisciplinary work (e.g., communication, facilitation, etc.) needs to be provided to all those funded.

[15] See https://www.eur.nl/en/esphil/master/societal-transitions (accessed 10-03-2023).

[16] See for example https://www.erasmusmagazine.nl/en/2023/01/26/positive-and-impactful-research-currently-not-tenable-at-this-university/ (accessed 10-03-2023).

Table 2 Core design principles for a transformative university

Institutional dimensions	Twentieth century model	Transformative university
Incentives	Excellence	Relevance
Career paths	Academic and hierarchical	Role diversity
Funding	Subsidized grants and basic funding	Entrepreneurial and basic funding
Organization	Schools and support	Schools and ecosystems
Positioning	Outside society	Part of society
Learning philosophy	Linear transfer	Co-creation

Institutional design

These activities try to shape research, education and engagement within the EUR in a new way and in doing so also identify barriers and mechanisms now in place that prevent it. As an 'institutional experiment' DIT seeks to systematically do so, using a reflexive monitoring inspired approach (Van Mierlo et al. 2010; Beers and Van Mierlo 2017) internally to track and reflect upon these interactions; with an ultimate goal to support structural changes within the university structures towards accommodating transformative academic work. In a very general way and based on the experiences so far, we can summarize the contours of a new institutional design for a transformative university in Table 2.

Reflection and discussion

In this paper, we sought to explore the way universities can transform so that they become a driving force for societal transitions towards sustainable and just futures. Building on the literature, we argued that the currently dominant model in many universities is shaped around a notion of progress and subsequent role of academic research and education that is not sufficient for this purpose. Instead, it is optimized around the accumulation of knowledge within disciplines, educating professionals for specific positions and in general understanding academia as a producer and provider of objective knowledge. While many universities are engaging in a process to reconnect to society in support of sustainability, this often remains limited to specific institutes or initiatives: a wider transformation of universities is needed but only small steps are visible.

Taking the Erasmus University Rotterdam (EUR), the Netherlands, as an example, we aimed to illustrate the problems with the dominant (twentieth century) model of universities in the social sciences, but also how experimentation can take place to support a transition. Within the broader context of Dutch universities' efforts to diversify career paths and engage with complex societal challenges, EUR's Strategy 2024 pushes the university community to open up for more diverse forms of research and education to increase societal impact and relevance. The DIT initiative was highlighted as shedding light upon the structural and institutional changes needed through being an institutional experiment accompanied by action research.

With no claims to be all encompassing, this example shows that a university transition implies institutional work: career incentives, organizational structures and funding schemes often work against collaboration, transdisciplinarity and entrepreneurship. But also, the approach to research, definitions of 'academic quality', epistemological perspectives, and attitudes towards working with practitioners are often hampering steps forward and, thus, need to be addressed. Within EUR discussions on these topics as well as initiatives within and around the existing organization have been developing for awhile, but to build up the momentum and pressure for transformative change requires a much more concerted and strategic effort.

We also have to note that the ideas presented in this paper are primarily focused on the internal transition of universities. Obviously, aiming on the longer term to have a different kind of impact in the outside world. Right now, the dominant model of external collaboration is often 'triple helix': institutional exchange and partnerships between academia, government and industry to advance societal growth and innovation. A transformative university would allow for and facilitate more networked collaboration and co-creating between academics and social actors to advance just sustainability transitions. It would imply critical positioning and developing a self-assessment of what is unjust and unsustainable and formulating conditions upon which collaboration is possible or not. It would require developing university-based future visions and aims to collaborate for.

The DIT platform in our paper acted as an example of a concerted and strategic effort to build momentum. It needs to be understood in its context and is only two years into operation. While it will not achieve a full transition by itself, it already uncovered some of the sore points and structural constraints for achieving critical changes. In doing so, it opened institutional conversations and actions around these. In its design and approach, however, it might serve as exemplar and inspiration for others that seek to help scale and diffuse ideas about a transformative university. Be it at the operational level as academic or at a more institutional level as policymaker: it requires a critical analysis of the

current status quo, an inspiring and transformative vision for the future and an experimental, learning-by-doing action approach to make transformation work in practice.

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Data availability For this paper we have not analysed or generated datasets but build on literature, publishes interviews and conceptual work. One can obtain the relevant materials from the references below.

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