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Toward an empirical research agenda for sustainability in higher education: exploring the transition management framework

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ABSTRACT

A large and growing body of research examining sustainability in higher education has emerged in the past decade. This literature is dominated by empirical and descriptive studies of specific approaches and individual initiatives, but lacks a cohesive research agenda and is not yet supported by strong theoretical underpinnings. This paper contributes to the advancement of this emerging field by exploring the theoretical framework of transition management (TM), a multi-scale, multi-actor, process-oriented approach and analytical framework to understand and promote change in social systems. The TM framework provides guidance toward informing and prioritizing future empirical research in this important emerging field.

1. Introduction

In response to growing societal concern about environmental degradation and intensifying calls for a transition to a more sustainable society, institutions of higher education throughout the world have begun to alter their educational missions and practices to incorporate and address sustainability. As this has occurred within the past decade, the role of higher education in the context of an ongoing societal transition toward greater sustainability has emerged as a subject of significant scholarly attention [1–3]. Although this emerging literature on sustainability in higher education is varied, it is dominated by empirical and descriptive studies of specific approaches, strategies and initiatives at specific institutions [4,5], but also includes prescriptive studies that often call on universities to play a more prominent role in sustainability and sustainability education [6–9]. Much of the descriptive literature to-date has focused on specific strategies or actions taken at specific institutions [10,11]. Descriptions of first-movers and early-institutional-actors that demonstrate potential ground-level initiatives for change has been a significant, and persistent, part of this work [8,11]. This often includes descriptions of "best practices" and details of development, implementation and assessment of individual programs [12–14].

The largely empirical focus of this emerging literature can be understood by considering the near-term immediate needs of sharing information in a rapidly changing environment and the hybrid scholar-practitioner perspectives of many individuals involved in the implementation and assessment of sustainability initiatives in higher education. Given the nascent stage of this research area, the emerging body of research appears to have minimal cohesion and some degree of repetition and redundancy. In addition, a strong theoretical underpinning of the research agenda has not yet been established.

Developed over the past decade by systems and governance researchers, transition management (TM) is a multi-scale, multi-actor, long-term, process-oriented approach and analytic framework used to both understand and promote transformations of major social systems [15]. TM encompasses dual functions: it is both (1) an intervention, management and governance approach to initiating transitions, and (2) an analytic framework to explore and understand historical transitions and use that understanding to inform governance of future transitions [16]. As such TM can be deployed for prescriptive purposes – in that it provides direction toward shaping policy processes, implementation and evaluation – and for descriptive purposes, in that it is useful for understanding the evolution of social transitions. The TM framework builds upon and contributes to a broader field of transition studies as well as theory of socio-technical systems – theory that recognizes

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a fundamental relationship between technology and society that suggests social change and technological change are interrelated, inseparable, and therefore need to be considered in conjunction [17].

Architects of TM speculate that the framework may be useful for sub-system, or sectoral analysis, as well as organization-level analysis, and they invite exploration of its potential value in different contexts to further develop empirical consideration of this theoretical framework [18]. To date the TM framework has been applied to sectors defined by various environmental subsystems including electricity [19], water [20], and transportation [21]. TM has also been applied to the regional scale [22], and recently to the urban scale [23], but to our knowledge the TM framework has not yet been explored within the specific societal sub-system of higher education.

To contribute to the advancement of the literature on sustainability and higher education, and in an attempt to provide some cohesion and a framework for informing and prioritizing future empirical research in this important emerging field, this paper explores the theoretical framework of TM. This exploration of TM in the context of higher education requires adjusting the TM lens to consider socio-technical change at three scales: society wide, within the higher education sector, and at the individual university-community scale. TM provides a framework for understanding the dynamics of structural change, so refocusing the TM lens to the societal sub-system of higher education assumes a complex co-evolution of economic, cultural, technological, and organizational factors influencing change within this sub-system [23].

The goals of this exploration are twofold: (1) to inform prioritization of an empirical research agenda in the field, and, at a more fundamental level (2) to enhance understanding of the interface between organizational change and social change related to sustainability. While many of the insights of this exploration are likely to be relevant to higher education in many contexts throughout the world, this paper draws on a largely North American and European literature as well as the authors' direct experiences in the United States system of higher education.

2. Background – higher education and movement toward sustainability

Universities have distinctive organizational cultures that value and promote learning and thus can play a vital role in processes of societal transformation that are reliant on educating new generations of citizens and leaders. Higher education has always been responsive to societal needs, and the history of higher education demonstrates an evolution of university structure and purpose that reflects directly on the dynamics of society's socio-technical systems [24–27]. As long-established, often deep-rooted institutions, universities can be slow to respond when societal needs emerge rapidly. Delay between the emergence of a societal impetus for change and the realization of universities' potential contributions to the needed change has been identified throughout centuries of history of higher education [28,29]. While all organizations respond to and participate in social change, universities as learning organizations represent a specific set of organizations with distinct potential for improving understanding of the interface between organizational change and social change.

Discussions of the role of higher education in society are often characterized by tension among three agendas: generating knowledge, educating citizens and leaders, and addressing pressing social issues [27]. It can be argued that all universities transmit powerful educational messages far beyond their specific teaching and research activities [30,31]. Concepts of "universities as citizens" [30] and/or "universities as change agents" [32,33] capture the potential for universities to be active, contributing, influential, responsive entities in society. Some suggest that higher education is currently experiencing a swing-back, a return, to an original purpose of cultivating civic responsibility and citizenship via a scholarship of engagement [34,35]. Such movement would require institutions of higher education to model civic responsibility and engagement at the organizational level [30]. It would also require that the universities' roles of teaching students and perpetuating knowledge through research need to be re-oriented or expanded to contribute more explicitly to societal needs and challenges. Historian Richard Freeland (1992) emphasizes that efforts to promote change in universities are successful when the change is incentivized and internalized into the distinctive culture and reward system of higher education institutions [26].

At the organizational level, individual universities share some similarities with other complex organizations such as companies, government entities, and non-governmental organizations [36]. Despite these similarities there is also something distinct about the "knowledge culture", the autonomy of students and faculty, and the breadth of possible lines of inquiry associated with the higher education sector that sets higher education institutions apart from organizations in other sectors. Burton Clark's (1983) seminal analysis of the organization and governance of higher education characterizes change in universities as bottom-up, incremental, and often invisible [24]. These unique characteristics of the higher education system highlight both the large potential of higher education to change and contribute to a larger societal transition but also the many challenges associated with a transition within higher education and with change in how universities interact with and influence the rest of society.

3. Exploring the TM framework for insights relevant to universities and sustainability

In its dual function as both (1) an intervention, management and governance approach to initiating transitions, and also (2) an analytic framework to explore and understand historical transitions, TM encompasses both prescriptive and descriptive capacities. Given that the growing literature on sustainability in higher education also encompasses both prescriptive and descriptive qualities, an initial resonance is apparent. Key elements of the TM framework with relevance to considering sustainability in higher education are summarized in Table 1. TM has adopted the multi-level perspective (MLP) which represents recognition of the critical importance of interaction among influences at three scales, landscape, regime and niche. Also in the descriptive realm, TM offers a useful distinction among four types of governance or management activities (strategic, tactical, operational, and reflexive). Another critical dimension is the notion of the progression of a transition through four phases (pre-development, take-off, breakthrough, and stabilization). The elements of the TM framework with a greater potential for prescriptive insights include the value of optimizing learning and innovation, integrating short-term and long-term thinking and planning, as well as defining some specific instruments with which to operationalize active contribution toward a transition. In considering how the TM framework may help inform prioritization of an empirical research agenda, several specific attributes of TM, related to scalar and temporal integration, multiple levels of action, and the role of the university in operationalizing a transition are worthy of review (Table 1).

3.1. The multi-level perspective: interaction of three levels

The need to consider simultaneous pressure for change at multiple scales, the so-called multi-level perspective (MLP), was

Table 1
Highlights of relevant insights from exploration of Transition Management to developing an empirical research agenda on sustainability in higher education.

Generally descriptive			Generally prescriptive		
Multi-level perspective. Interaction of three levels	Four types of activities	Phases of transition	Optimizing learning and innovation	Temporal integration	Instruments to operationalize Transition Management
Landscape: Diversity in how higher education responds to macrolevel societal pressures	*Strategic:* minimal attention in higher education sustainability literature to long-term goal formulation, vision development, etc.	Four-phase model of transition (*pre-development, take-off, breakthrough, stabilization)* may be challenging to apply to higher education	Great potential to harness unique learning cultures of higher education	Short- and long-term thinking interact	Universities are ideal sites for visioning, neutral convening, facilitating participatory processes and participatory social dialogue.
Regime: dominant practices in higher education include disciplines, tenure, degree system, majors, etc.	*Tactical:* Coalitions for sustainability in higher education are rapidly growing	What is the transition and vision in higher education?	Can universities learn to be learning organizations?	Backcasting: basing short-and longer term goals on long-term visions and short-term possibilities.	Universities have unique capacity for monitoring and evaluation
Niche: organizations and individuals within higher education are trying multiple new approaches. Opportunities for enhanced learning from niche	*Operational:* plethora of examples and studies on specific projects and efforts at individual universities	Different opinions about what phases higher education is in with respect to both its own transition and its role in contributing to a society-wide transition	Leadership and culture are not highlighted in TM, but are critical to consider	Organizational stability means universities have unique capacity for long-term thinking and visioning.	Universities are places for innovation and experimentation
	Reflexive: Potential for more valuation and assessment activities			Higher education enables thinking beyond incremental	

recognized in transition research before the TM framework was described, but TM incorporated this important concept [37]. Within the MLP, interaction among three scales, the macro-scale landscape, the meso-scale regime, and the micro-scale niche are critical to a system transition; this concept suggests several valuable insights related to future empirical research for considering sustainable transitions and higher education. When focusing explicitly on the higher education sub-system, landscape factors include macro influences like the costs and accessibility of higher education, the politics of education funding, society-wide economic conditions, climate change impacts, increasing costs of energy and food, and other global or macro-level factors that clearly influence decisions in higher education. There appears to be great variation in how different universities respond to landscape-level societal pressures, so one line of future empirical research could involve comparative analysis of multiple organizations to determine correlations between responses to various landscape level changes and internal characteristics of the organization. While some universities appear to be slow and selective in how they have responded to the sustainability challenges facing society, many others have embraced these challenges and integrated responding to these challenges into their long-term strategic planning as well as throughout their organization and community [2,3,38].

Considering the regime-level, the mainstream, there is a plethora of factors that may contribute to or detract from a transition toward sustainability within higher education. These include the rigidity and convention of academic disciplines, the repetitive academic calendar, and the asserted independence of faculty. Regime level also includes consideration of policy-makers of education and the demand-side of universities, i.e. categorizing what is it that prospective students expect from the university that they have chosen to attend. A valuable area of future research could involve analysis of the ways in which different universities, and/or the sector as a whole, are oriented toward or engaged in a transition, and in what ways are organizations of higher education oriented toward maintaining the status quo rather than fostering change.

Niche scale opportunities for innovative change in higher education include pioneering faculty who are challenging the conventional promotion system and specific universities that have altered their organizational structure to integrate sustainability into their core community values (in the United States, Middlebury College, the College of the Atlantic and the University of Arizona provide good examples). The level of niche experimentation and innovation at universities world-wide appears to be rising rapidly, but more thorough evaluation of these "experiments" would be valuable.

Recent research on Strategic Niche Management (SNM), a literature related to but distinct from the TM literature, highlights the critical importance of interactions and shared learning among different niche-level initiatives [39]. Considering this within the context of higher education and sustainability, empirical research on the communication and learning associated with the existing cross-sectoral organizations, such as Environmental Management for Sustainable Universities (EMSU) at the international level, and the Association for the Advancement of Sustainability in Higher Education (AASHE) in North America would be valuable. Improved understanding of existing communication mechanisms that are fostering the sharing of experiences at the niche-level could help direct future initiatives and enhanced cross-sectoral activity. These organizations are designed to provide support, informational resources, and networking within and across the higher education sub-system – researching these organizations by exploring and applying theory of organizational learning, boundary organizations, and social network analysis could identify opportunities for enhanced communication with potential to accelerate change.

As part of this research, it would be useful to assess and evaluate current potential venues for sharing lessons learned and experiences of micro-scale, niche experimentation among niche-level actors and others. These include conferences and meetings as well as publications and web-based forms of communication. At the international level, there are biennial conferences, meetings and workshops organized by EMSU, The Alliance for Global

Sustainability, and others. In North America, AASHE has a regular conference as does the "Greening of the Campus" network, and professional societies of academic staff also provide space for information sharing, i.e. the National Association of College and University Business Officers has an annual forum on sustainability and the American College Personnel Association recently convened a workshop on sustainability for a wide range of university professionals. Each of these organizations also hosts websites with an online space for communication and learning. Among the publications that provide dedicated venues for written sharing of niche-level experiences are the *International Journal of Sustainability in Higher Education, Journal of Education for Sustainable Development*, and *Sustainability: the Journal of Record*. Participation and engagement in these forums is growing each year, which may suggest that activity in this area is shifting from niche to regime; however, new niche-level initiatives demonstrating radical innovative change at individual universities continue to emerge. Future research could explore the effectiveness of these existing forums for supporting learning from these niche-level initiatives. The development of an international database for sharing niche-level innovative approaches and initiatives has not yet been developed, but would be helpful. An online network/database could facilitate learning by cataloguing, connecting, and disseminating knowledge about innovative university initiatives for sustainability.

3.2. Four types of activity

Drawing from organizational and management theory, TM specifies four types of activity within the evolution of a transition; these are strategic, tactical, operational, and reflexive activities [15]. *Strategic* focuses on high-level activities engaged in visioning, laying out long-term system-level goals and objectives and establishing the structure and context for social change. Activities at the strategic level require leadership capacity, long-term orientation, and integrated strategies that are applied to redefining common current visions and goals. The *tactical* level concentrates on agenda and coalition building at the sub-system level, and negotiations among stakeholders and actors. Tactical activities often focus on transformations of existing entities, structures, and institutions in ways that will better enable them to carry out the larger strategic goals. Enhanced networking and coalition building are critical to tactical level activities, as new relationships and linkages can facilitate different mechanisms for change. The *operational* level concentrates on experimentation, project building and implementation, with a focus on learning and co-production of knowledge in the short-term. The implementation of projects to test new technologies and ideas stimulates innovation and further development of alternatives. The *reflexive* level includes activities that evaluate and assess the current situation at various levels.

Transitions evolve as activities at these different levels interact with and reinforce each other. Strategic activities have influence over tactical, operational, and even reflexive activities in top-down processes, while experimentation and the associated learning that occurs at the operational level with reflexive initiatives often influences the strategic level through bottom-up processes. While the explicit recognition of these four types of activity is standard in management and organizational theory, its application in transition management to sector- and society-wide scales rather than the organizational scale provides a useful perspective for considering different kinds of tools, initiatives and efforts that may contribute to a societal transition.

When considering empirical research on change in universities for sustainability, examination of these four types of activities is useful in several respects. Firstly, review of the growing literature on sustainability in higher education reveals an imbalance of attention to these four levels with a predominant focus on tactical and operational activities, and minimal attention to strategic and reflexive activities [40,41]. Strategic factors have broad and far-reaching implications, and focused examination of this set of dynamics, while admittedly challenging to study, could yield useful results. Within the existing literature, some studies assume a strategic commitment [40] while others explore the challenges when there is no such commitment [41], but there is very little exploration of how to foster strategic level activity [40,41]. Reflexivity – the disciplined and deliberate examination of one's own activities – can provide data on which to base refocusing or significantly altering one's approach. A reflexive approach toward efforts to incorporate sustainability into university activities requires documentation of development processes and key decision points, in addition to the evaluation of programmatic outcomes. A greater focus on reflexive work in the literature on sustainability in higher education would enhance systematic learning about the how's and why's of effective practices.

Robust interconnection among strategic, tactical, operational, and reflexive activities could strengthen change-focused initiatives and enhance or accelerate a transition. Research exploring the interactions and synergies among these different types of activities at specific universities of different types could be instructive. And acknowledging Freeland's (1992) observation that efforts to promote change in universities are generally only successful when the change is incentivized and internalized into the distinctive culture and reward system of higher education institutions [26], future research could focus on interaction between these four types of activities and the potential for changing incentives as well as the culture and the reward system of higher education.

3.3. Phases of transition

The TM framework incorporates a system perspective on transitions, viewing them as gradual, continuous processes of social change where a relatively stable state of the system is transformed into a different, stable, yet dynamic, state. The TM literature articulates how developments in many domains and at many scales contribute to a societal transition, and TM assumes that governance or decision-making by key actors, has some degree of influence, but not full control, over the possible pace and direction of a given transition [18]. Within the TM framework four distinctive stages of a transition are described: (1) pre-development, (2) take-off, (3) breakthrough, and (4) stabilization. The *pre-development phase* is stable, with no visible change to the status quo. The *take-off phase* is where initial change begins as the system starts to shift. The *breakthrough phase* is characterized by structural changes that occur in reaction to a wide variety of interacting and reinforcing social, economic, technological, ecological, cultural, and institutional changes. Finally, the *stabilization phase* is recognized by the achievement of a new dynamic equilibrium as the rate of social changes slows. Building on a systems perspective, these phases of transition are characterized by non-linear behavior where positive feedback loops accelerate change, and each domain has its own dynamics.

When considering the application of the TM framework to the topic of moving higher education toward integrating and contributing toward sustainability, questions arise such as "at what stage of transition is a given university or the higher education system currently located?" and "what should higher education transition to?" Some might argue that the sub-system of higher education is still in the pre-development stage [40], while others may perceive recent changes in interdisciplinary programs, teaching and research, and enhanced community engagement in universities as evidence that the system is at or close to a break-through point moving into

regime change. The fact that professional societies of academic staff have identified sustainability as a topic of significant concern to their membership and are seeking to provide resources to assist with related challenges (for example, the National Association of College and University Business Officers now has an annual forum on sustainability), could be viewed as an indicator of sustainability becoming mainstream in higher education.

The articulation of four defined phases of transition suggests a steadily forward progression that may be apparent in hindsight but difficult to plan. The complexity of the higher education system and its own internal subsystems and the frequent unpredictability of both internal and external dynamics make a "progress" model elusive at best. At worst, when deployed in the context of efforts to effect change, a linear view may give potential change agents an inflated or diminished view of their situation – both of which can derail or stifle nascent initiatives.

Some literature in education for sustainable development seeks to identify "best practices" within a single institution or set of institutions [42]. This approach can develop an ambitious vision of what the ideal sustainable university would look like once it reaches "stabilization," but it runs the risk of downplaying significant real-world dynamics. For example, the assumption that an ideal, stabilized state can actually be reached may be quite daunting for potential change agents whose universities are far from ideal in a number of areas. What the best practices analysis leaves out is just how those practices were developed – and how different cultures and contexts may impact whether or not those practices may actually be considered "best."

A potentially interesting area of empirical research would be to survey different actors to gauge their perceptions of the phase of transition at which their university – or the system as a whole – currently sits. Understanding variation in perceptions of the magnitude of past change as well as the potential for future change toward sustainability among different actors or sets of actors, i.e. administrators, faculty, staff and students, could identify gaps in communication as well as provide guidance on the value of engaging in more shared visioning activities.

3.4. Optimizing learning and innovation

Another defining element of TM is the emphasis on learning. Learning is fundamental to change, and the TM framework highlights the importance of short- and long-term learning by individuals, organizations and communities. The framework assumes both learning-by-doing and doing-by-learning. While TM acknowledges learning at and across multiple levels and scales, a particular focus on learning that occurs at the niche level, when new innovative ideas or technologies are tested and implemented, is apparent.

Several recent studies have enhanced the TM literature by suggesting different approaches to induce learning for a societal shift. These contributions have particular potential to suggest leverage points for considering the role of universities in a societal transition. For example, it is suggested that creating opportunities for individuals to collectively develop and discuss long-term visions and to consider alternative future scenarios can foster social learning in productive and effective ways [43]. And the learning associated with small scale, bounded experimentation with new and emerging technologies can contribute to higher-order learning that can foster change [44–46]. A potentially interesting area of empirical research would study to what extent and in what ways do universities provide an appropriate and effective forum to foster visioning, dialogue, and higher-order learning to incubate multi-party, multi-scale learning.

As organizations, universities exhibit a deep irony (paradox): though universities focus on learning, they themselves learn slowly, if at all. In one observer's view, "it will be necessary to institutionalize self-reflective forms of organizational learning for real progress toward more sustainable universities. … Universities need to learn to be learning organizations" [47]. This suggests that another valuable area of empirical research would be to adopt and apply from organizational theory methods of assessing and modifying mechanisms for organization learning.

3.5. Temporal integration

Among the most powerful aspects of the TM framework is temporal integration, referring to simultaneous consideration of long-term (at least 25 years) and short-term goals, planning, implications and policy-making. This is powerful because this is different than the many real-world decision-making processes that tend to prioritize the near-term. The concept of "backcasting" is one particular aspect of this temporal integration that involves basing goals, both short-term and longer term goals, on long-term visions and short-term possibilities [48,49].

This acknowledgement and fostering of interactions between the short-term and the long-term enables critical connections to be made between incremental and more radical or ambitious plans. Despite calls for radical and transformative change, incremental change is the pragmatic reality in most instances, so facilitating temporal integration of near-term incremental steps with long-term visions offers valuable potential.

The institutional stability of universities means that higher education actually has strong potential to encourage and engage in long-term and big-picture thinking that is difficult to do in other sectors or sub-systems of society. At the same time, the continual influx of new students and adaptations to societal funding sources ensure that universities are also subject to tangible short-term influences. The critical value of coupling incremental action with long-term planning and visioning within TM lends higher education significant potential to play a more prominent role in societal transitions than is currently acknowledged by authors of transition management.

A sense of temporal integration is largely missing in the sustainability in higher education literature. While there are some studies that incorporate a temporal dimension [13], many studies take a snapshot of a given university or set of universities at a particular point in time [50]. No matter how detailed the description or case study, or how many variables or indicators are examined, it is very difficult to understand the dynamics of change through data gathered at a single moment in time. Although snap-shot analysis may provide a wealth of empirical data about institutional organization, academic research and curriculum, campus planning and operations, without a temporal dimension empirical data has minimal value for understanding the structural dynamics of a transition.

3.6. Instruments to operationalize transition management

Within the TM literature several specific instruments have been described to operationalize these key elements. Among these are transition *experiments* that can provide data on a wide range of alternative options, *participatory social dialogue* and participatory governance at all levels that encourages broad engagement from many actors, and *monitoring and evaluation* that results in reflexive governance and management [15]. An additional instrument is the *transition arena* that involves creating an institutional space for niche scale interaction among innovators with various backgrounds and ambitions to develop shared long-term perspectives and a transition agenda. The transition arena is a multi-actor governance instrument intended to stimulate and coordinate innovation by creating shared problem definitions and shared long-term goals [15]. Another

instrument is *collective visioning* of alternative transition states and transition pathways. The transition management framework implies moving to a different state, which requires the development of a vision of an alternative state.

The activities laid out for implementing transition management place a premium on openness, inclusivity, integration of multiple perspectives, and flexibility in moving between high-level and ground-level views. Universities have particular strengths in these areas, and are often recognized as "neutral" or disinterested parties whose agenda revolves around generating knowledge to inform decisions rather than making societal choices. Thus, the higher education sector is a strong candidate for partnering with government in the transition management context, where universities can convene dialogic and participatory processes with somewhat less suspicion than the government itself.

A final point related to universities and operationalizing TM is related to novel ways that universities might engage with their communities and other organizations and entities within society. There is great potential for the university to form new kinds of community partnerships and engage with external organizations and entities in novel ways to facilitate change toward sustainability [32], and additional empirical research identifying and assessing different models of university-community engagement would be beneficial [51].

4. Apparent limitations of TM to considering universities and sustainability

Organizational theory recognizes leadership and culture as features of organizational dynamics that have a particularly powerful impact on learning [52]. The TM framework does not facilitate explicit consideration of either of these important features.

The dynamics of power and leadership and their roles in promoting or opposing structural change has not yet been given a particular focus within the TM literature, although the literature does recognize that transitions are ultimately shifts in power – empowering niche-players is a crucial part of TM [15]. A growing body of literature on leadership argues that leadership is not just centralized but is also dispersed: leadership opportunities are available to any member of an organization, no matter what the rank [53,54]. Thus leadership can come from any corner of the higher education sector – from research university to liberal arts college to community college and beyond – and from any corner of a given institution – from senior officials to students to faculty to operations staff and beyond. Leaders call for learning; they inspire learning; they leverage learning. The reflexivity of the relationship between leaders and learning is important to consider, and could be an additional area of future empirical research. Empirical investigation of "leadership" in its multiple forms with regard to sustainability in higher education could be an additional valuable area of future research. And with respect to additional theoretical development of the TM framework, the dispersed potential of power (and its association with learning) is, perhaps, an under-articulated but critical component of TM; additional exploration of the complexity of power and influence within the TM framework could enhance TM theory.

Another critique of TM is that it assumes a certain cultural homogeneity [55]. Culture is pervasive, dynamic, and often subtle until some sort of a clash emerges. It can be said that there is a "culture of higher education" that values learning, a "culture of North American higher education," a "culture of European higher education, a "culture of 21st century higher education," and so on. It can also be said that there is a research university culture within which individual institutions have distinctive cultures. And within universities, different departments, disciplines and individuals have distinct cultural differences.

Insufficient attention to culture is dangerous in our increasingly multi-cultural, diverse societies, and this assumption is also dangerous in the higher education sub-system. Cultural differences at multiple levels, including individual, departmental, disciplinary, organizational, and regional cultural differences, may present barriers to the participatory, collective governance and visioning that is called for in TM. A recent study of cultural dimensions of institutional change at the University of British Columbia demonstrates the challenge of heterogeneity in cultural attitudes and highlights a vicious circle; culture impacts whether you can change, but it is difficult to change culture [56]. Recognition of and sensitivity to distinctive cultural dynamics is a particular area of learning that can have multiple payoffs in the context of societal transitions.

5. Reflections and concluding thoughts

A fundamental premise of the TM framework is that the identification of the various complex mechanisms by which different actors influence ongoing transitions in different ways may empower and enable actors to be made aware of the impact on these processes so that their actions can be better aligned towards contributing to a desired transition [23].

An over-arching justification for the application of some components of the TM framework to consideration of future empirical research on higher education and sustainability is related to the complexity of the higher education sector. Wide variation in individual organizations is associated with how, why and when they were established, how they are financed, size, diversity/homogeneity of the student body, geographic location, balance of focus on undergraduate vs. graduate education, public/private, religious/secular, and more. Variation among systems of higher education in different parts of the world adds another element of complexity, as national systems and structures of higher education are embedded in their own cultural and social contexts that precipitate a unique set of challenges and opportunities [32]. Additional complexity exists within individual institutions as internal subcultures often have competing incentives and time scales; i.e. students are transient while faculty and staff are often on campus for many years; students bring a sense of urgency for change that can be a helpful impetus but can also create friction. Student and faculty calendars have different moments of intensity when compared to operational and some administrative staff, making coordination challenging. Obvious structural aspects that contribute to an institution's ability to foster community and civic engagement and to position itself for strategic involvement in broad social change include reward systems (processes for promotion, tenure, and hiring), leadership, infrastructure, and public relations (admissions, recruiting, alumni communication, etc.) [30,57]. The particular combination of characteristics that defines each individual university shapes its distinctive culture and influences potential for specific strategies for engaging in a sustainability transition.

Distilling TM concepts and adapting them in the context of higher education by refocusing on this particular sector that is a sub-system reveals several areas that have not yet received significant attention in the literature of sustainability in higher education. When adapted and amplified, the TM framework does indeed suggest priorities for future research and initiatives. The organizational dynamics of universities, as individual organizations and particularly as a sector of society, have not been closely examined. And the existing literature on sustainability within higher education has a predominant focus on tactical and operational activities, often reporting on best practices, with minimal attention to either critical strategic level dynamics or reflexive

activities that could facilitate and accelerate change. The learning/leadership/culture cluster suggests examining several issues in relation to mechanisms for interaction, communication, and decision-making among subunits within and across higher education institutions. Analysis of who are the thought leaders and what are the networks that cut across higher education at the sector and individual institution levels would be valuable. Exploration of these areas may help identify new routes for enriching faculty perspectives on sustainability; they may suggest a new framing for sustainability that is particularly compelling for an organizational subunit; and they may highlight previously untapped professional networks that have potential to mobilize subunits across a wide range of organizations. The potential for the university to form new kinds of community partnerships and engage with external organizations and entities in novel ways is great, and additional research identifying and assessing different models of university-community engagement would be beneficial.

We offer two closing insights to give courage to supporters of sustainability in higher education. First, it is useful to recognize a fundamental paradox at the heart of higher education organizations: they are institutions designed to teach, but not to teach themselves. Change, therefore, comes slowly and incrementally. Second, the research agenda on sustainability in higher education should balance rich description of specific aspects of university activities in sustainability with robust and comparative analysis of the dynamics and interactions between networks, scales, and levels across higher education and among multiple organizations. Such empirical research would enable more generalizable and therefore more broadly applicable results and insights that could have a significant influence on current and future development and planning of sustainability initiatives within higher education.

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References

[1] Filho WL, editor. Sustainability and University life. Peter Lang Publishers; 2000.
[2] Rappaport A, Creighton SH. Degrees that matter, climate change and the University. Cambridge, MA: MIT Press; 2007.
[3] Creighton SH. Greening the Ivory Tower: improving the environmental track record of Universities, Colleges and other Institutions. , Cambridge, MA: MIT Press; 1998.
[4] M'Gonigle M, Starke J, Planet U. Sustaining the World, reinventing the University. Gabriola Island. BC, Canada: New Society Publishers; 2006.
[5] Barlett PF, Chase GW, editors. Sustainability on Campus, stories and strategies for change. Cambridge, MA: MIT Press; 2004.
[6] Orr D. Earth in mind, on education, environment, and the human prospect. Washington DC: Island Press; 1994.
[7] Cortese AD. Higher education's critical role in creating a healthy, just, and sustainable society. In: Simpson W, editor. The Green Campus: meeting the challenge of environmental sustainability. Alexandria, Virginia: APPA; 2008.
[8] Filho WL, editor. Innovation, education, and communication for sustainable development. Peter Lang Publishers; 2006.
[9] Bowers CA. University reform in an era of global warming; 2008.
[10] Beringer A. The Luneburg Sustainable University Project in International comparison: an assessment against North American peers. International Journal of Sustainability in Higher Education 2007;8(4):446–61.
[11] Davis G, Wolski M. E-waste and the sustainable organization: Griffith University's approach to e-waste. International Journal of Sustainability in Higher Education 2009;10(1):21.
[12] Ferrer-Balas D, Buckland H, de Mingo M. Explorations on the University's role in society for sustainable development through a transition approach. Case-study of the Technical University of Catalonia. Journal of Cleaner Production 2009.
[13] DeCarolis JF, Goble RL, Hohenemser C. Searching for energy efficiency on Campus, Clark University's 30-year quest. Environment 2000;42(4):9–20.
[14] Stefanovic IL. Education alliance for a sustainable Toronto. International Journal of Sustainability in Higher Education 2008;9(4).
[15] Loorbach D. Transition management: new mode of Governance for sustainable development. Utrecht: International Books; 2007.
[16] Kemp R, Parto S, Gibson RB. Governance for sustainable development: moving from theory to practice. The International Journal of Sustainable Development 2005.
[17] Geels FW, Schot J. Typology of sociotechnical transition pathways. Research Policy 2007;36(3):399–417.
[18] Rotmans J, Kemp R. More evolution than revolution: transition management in public policy. Foresight – The Journal of Future Studies, Strategic Thinking and Policy 2001;3(1):15–31.
[19] Verbong G, Geels F. The ongoing energy transition: lessons from a socio-technical, multi-level analysis of the Dutch electricity system (1960–2004). Energy Policy 2007;35(2):1025–37.
[20] Geels FW. The hygienic transition from cesspools to sewer systems (1840–1930): the dynamics of regime transformation. Research Policy 2006;35(7):1069–82.
[21] Geels FW. The dynamics of transitions in socio-technical systems: a multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). Technology Analysis and Strategic Management 2005;17(4):445–76.
[22] Scholz RW, Stauffacher M. Managing transition in clusters: area development negotiations as a tool for sustaining traditional industries in a Swiss prealpine region. Environment and Planning A 2007;39:2518–39.
[23] Loorbach, D., Urban transitions and Urban transition management: the case of Rotterdam, In: Workshop on Urban Transitions; 2009: Manchester, UK.
[24] Clark BR. The higher education system: academic organization in cross-National perspective. Berkeley: University of California Press; 1983.
[25] Bursztyn M. Sustainability science and the University: towards interdicsiplinarity. In: Working Paper for Center for International Development at Harvard University, No. 24; 2008.
[26] Freeland R. Academia's golden age: Universities in Massachusetts 1945–1970. New York: Oxford University Press; 1992.
[27] Vorley TAJN. (Re)Conceptualising the academy: Institutional development of and beyond the Third Mission. Higher Education Management and Policy 2008;20(3).
[28] Altbach PG, Berdahl RO, Gumport PJ. Higher education in American Society. Prometheus Books; 1994.
[29] Clark BR. Creating entrepreneurial Universities: organizational pathways of transformation. Issues in higher education. New York: Elsevier; 1998.
[30] Boyle ME. Learning to neighbor? Service-learning in context. The Journal of Academic Ethics 2007;5(1):85–104.
[31] Waas, T. and A. Vergruggen, University research for sustainable development: Characteristics identified, In: EMSU 2008; 2008: Barcelona, Spain.
[32] Stephens JC, Hernandez ME, Roman M, Graham AC, Scholz RW. Higher education as a change agent for sustainability in different cultures and contexts. International Journal of Sustainability in Higher Education 2008;9(3):317–38.
[33] Troyer ME. Needed correlative university reforms: in role as change agents: governance climate and structure. In: Annual Meeting of the American Educational Research Association. Chicago Illinois: ERIC; 1974.
[34] DiPadova-Stocks L. Two major concerns about service-learning: what if we don't do it? And what if we do? Academy of Management Learning and Education 2005;4(3):345–53.
[35] Freeland R. Academia's golden age. Oxford; 1992.
[36] Doppelt B. Leading change toward sustainability: a change-management guide for Business, Government, and Civil Society. Sheffield UK: Greenleaf Publishing; 2003.
[37] Genus A, Coles AM. Rethinking the multi-level perspective of technological transitions. Research Policy 2008;37(9):1436–45.
[38] Rappaport A. Campus greening, behind the headlines. Environment, Science and Policy for Sustainable Development 2008;50(1):6–16.
[39] Schot J, Geels FW. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. Technology Analysis & Strategic Management 2008;20(5):537–54.
[40] Sherman DJ. Sustainability: what's the big idea? A strategy for transforming the higher education curriculum. Sustainabilty: The Journal of Record 2008;1(3).
[41] Thompson R, Green W. When sustainability is not a priority: an analysis of trends and strategies. International Journal of Sustainability in Higher Education 2005;6(1):1–17.
[42] Bosch SVD, and M Taanman. How innovation impacts society, patterns and mechanisms through which innovation projects contribute to transitions; 2008.
[43] Berkhout F, Hertin J, Jordan A. Socio-economical futures in climate change impact assessment: using scenarios as "learning machines". Global Environmental Change 2002;12:83–95.
[44] Brown HJ, Vergragt PJ, Green K, Berchicci L. Learning for sustainability transition through bounded socio-technical experiments in personal mobility. Technology Analysis and Strategic Management 2003;13(3):298–315.
[45] Brown HJ, Vergragt PJ, Green K, Berchicci L. Bounded Socio-technical Experiments (BSTEs): higher order learning for transitions towards sustainable mobility. In: Elzen B, Geels FW, Green K, editors. System innovation and the transition to sustainability: theory, evidence and policy. Cheltenham: Edward Elgar; 2004. p. 191–222.

[46] Brown HS, Vergragt PJ. Bounded socio-technical experiments as agents as systemic change: the case of a zero-energy residential building. Technological Forecasting and Social Change 2008;75(1):107–30.
[47] Albrecht P, Burandt S, Schaltegger S. Do sustainability projects stimulate organizational learning in universities? International Journal of Sustainability in Higher Education 2007;8(4):403–15.
[48] Mulder KF. Innovation for sustainable development: from environmental design to transition management. Sustainability Science 2007;2(2):253–63.
[49] Quist J, Vergragt P. Past and future of backcasting: the shift to stakeholder participation and a proposal for a methodological framework. Futures 2006;38:1027–45.
[50] Beringer A, Wright T, Malone L. Sustainability in higher education in Atlantic Canada. International Journal of Sustainability in Higher Education 2008;9(1):48–67.
[51] Stephens JC, Hernandez ME, Boyle ME. Learning from University-Community Partnerships (past and present) for sustainable development. In: George Perkins Marsh Institute Working Paper No. 2009–04. Worcester, MA: Clark University. Available from: http://www.clarku.edu/departments/marsh/news/workingpapers.cfm; 2009.
[52] Luthans F. Organizational behavior. , New York: McGraw-Hill; 2008.
[53] Ancona D. Leadership in an age of uncertainty. Cambridge, MA: MIT Leadership Center; 2005.
[54] Knowledge@Wharton. Why everyone in an enterprise can – and should – be a leader [cited 2008 July 25]; Available from: http://knowledge.wharton.upenn.edu/article.cfm?articleid=893; 2003.
[55] Meadowcroft J. Steering or muddling through? Transition management and the politics of socio-technical transformation, In: Workshop on "Politics and governance in sustainable socio-technical transitions"; 2007: Berlin.
[56] Moore J. Seven recommendations for creating sustainability education at the university level. International Journal of Sustainability in Higher Education 2005;6(4):326–35.
[57] Maurrasse DJ. Beyond the campus: how Colleges and Universities form partnerships with their communities. New York: Routledge; 2001.