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Beyond the Third Mission: Exploring the Emerging University Function of Co-creation for Sustainability

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Beyond the third mission: Exploring the emerging university function of co-creation for sustainability

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Abstract: This paper explores a global trend where universities are collaborating with local government, industry and civic organisations to advance the sustainable transformation of a specific town, city or region. With empirical evidence, we argue that this function of ‘co-creation for sustainability’ could be interpreted as the seeds of an emerging, new mission for the university. We demonstrate that this still evolving mission differs significantly to the economic focus of the third mission and conventional technology transfer practices, which we argue, should be critically examined. After defining five channels through which a university can fulfil the emerging mission, we analyse two frontrunner ‘transformative institutions’ engaged in co-creating social transformations in pursuit of materialising sustainable development in specific locations and regions. This study seeks to add to the debate on the third mission and triple-helix partnerships. It does so by incorporating sustainable development and place-based co-creation with government, industry and civil society.

Keywords: sustainability; co-creation; university; mission; transformation; collaboration; partnership

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1. Introduction

If you want to go fast, go alone. If you want to go far, go together. African proverb
Approximately 15 years ago Etzkowitz (1998) and Clarke (1998) alerted the world to the emergence of an ‘entrepreneurial university’. In this establishment, a ‘third mission’ of contributing to economic development had emerged alongside the ‘first mission’ of teaching and the ‘second mission’ of conducting basic research. Epitomised by institutions such as MIT and Stanford (Etzkowitz, 2002), for the entrepreneurial academy ‘identifying, creating and commercialising intellectual property have become institutional objectives’. Such activities may be undertaken in the aim of ‘improving regional or national economic performance as well as the university’s financial vantage and that of its faculty’ (Etzkowitz et al., 2000:313). Yet the emergence of this entrepreneurial ‘species’ (Martin, 2012) was not to signify the last chapter in the ever-evolving modern university. Over the last 15 years the physical condition of the planet and natural capital reserves have continued to worsen, threatening the sustainability of global economy activities (Rockstrom et al., 2009; Secretariat of the Convention on Biological Diversity, 2010; WWF, 2012).

In many institutions local manifestations of the global sustainability crisis are prompting a deviation from the pursuit of income generation and economic development alone. A broader and more ambitious function has emerged—that of a societal transformer and co-creator. Boundaries between ‘town and gown’ are dissolving as university actors collaborate with local government, industry and civic organisations (Mero, 2011) to drive the physical and sustainable transformation of a specific locality, region or societal sub-sector, with ambitions to influence broader society. Admittedly, many of the methods and approaches adopted in such partnerships appear little more than an accentuation of more established paradigms such as agricultural extension, action and participatory research, transdisciplinarity, urban reform and regional development etc. Yet what appears novel in the emerging co-creative function is the combining of these various roles into a systematic response to localised sustainability challenges, and most importantly, the integration of values of sustainable development¹.

In this paper we seek to describe both empirically and qualitatively the characteristics of this alternative function. Our study is guided by three questions: 1) To what extent has the academic function of co-creation for sustainability emerged in industrialised Europe, Asia and North America? 2) What are the characteristics of this emerging function and how does it differ to the third mission? 3) Through what channels may a university seek to execute this alternative function?

Building upon our earlier research (name deleted, 2013), we focus on the role of university² actors in particular and interpret the trend of cross-sector partnerships for sustainability transformations through the lens of ‘co-creation for sustainability’ (name deleted, 2012). We define this as a role where the university: *collaborates with diverse social actors to create societal transformations in the goal of materialising sustainable development in a specific location, region or societal sub-sector*. Our use of the term ‘transformation’ as opposed to ‘transition’ (Geels, 2002) is to emphasise the physical and permanent socio-technical changes that co-creative partnerships can potentially manifest. Our predominantly empirical study encompasses 38 collaborations from industrialised Europe, Asia and North America. Our chief argument is that this still emerging function of co-creation for sustainability could be regarded as the seeds of a new mission and species of university.

¹ The Earth Charter Initiative contains a useful description of the values and principles of sustainable development as agreed to by the international community. See URL <http://www.earthcharterinaction.org/content/pages/Read-the-Charter.html>

² In this study ‘university’ refers to any 4-year PhD granting academic institution; a definition also encompassing many US colleges.

In the next section, after a brief background discussion, we introduce the empirical backbone of this study—a worldwide analysis of partnerships carrying out the function of co-creation for sustainability. The third section then describes fundamental differences between the dominating notion of the third mission—which we interpret principally from the perspective of technology transfer activities—and the emerging function of co-creation for sustainability. Section 4 will present an analytical framework designed to identify the various channels a partnership may exploit when executing this alternative mission, with Section 5 presenting the results of an application of this framework to 38 cases around the world. Section 6 then presents two vastly differing case studies (‘The Oberlin Project’ by Oberlin College and the ‘2000 Watt Society Pilot Region Basel’ by the Swiss Federal Institutes of Technology (ETH) and Novatlantis) to illustrate how in reality these channels may be used, and also to paint the portrait of two frontrunner institutions. Section 7 seeks to outline future challenges concerning the scaling up and promotion of the emerging mission across academia, with the last presenting conclusions, limitations and areas for further research.

2. Background discussion

2.1 An emerging academic response to the sustainability crisis

The sustainability crisis has dual repercussions. Firstly, planetary level challenges such as climate change, environmental degradation, peak-oil, food security, access to resources and the economic-downturn are unfolding and interacting on a macro level to threaten the wellbeing of human settlements all across the planet (Komiyama and Takeuchi, 2006; Grimm et al., 2008; Heinberg, 2011; Rockstrom et al., 2009; World Bank, 2010). In addition, individual cities, communities and regions must also contend with a host of localised issues. These include ageing and environmentally problematic infrastructures such as energy, building and transport systems, changing population dynamics, local economic decline, manifestation of brownfields, urban sprawl and ecological degradation. With the roots of such complex and wicked sustainability challenges embedded in multiple areas of the complex social, economic, technological, political, cultural and environmental fabric of human settlements, it is little wonder that the generation of concrete and effective solutions is beyond the capability of many central and local government institutions (Myers & Kent, 2008). Partnerships and collaboration between academia, industry, government and civil society are thus increasingly seen as a pre-requisite for tackling various sustainability challenges (Clarke and Holiday, 2006; Talwar et al., 2011; Whitmer et al., 2010).

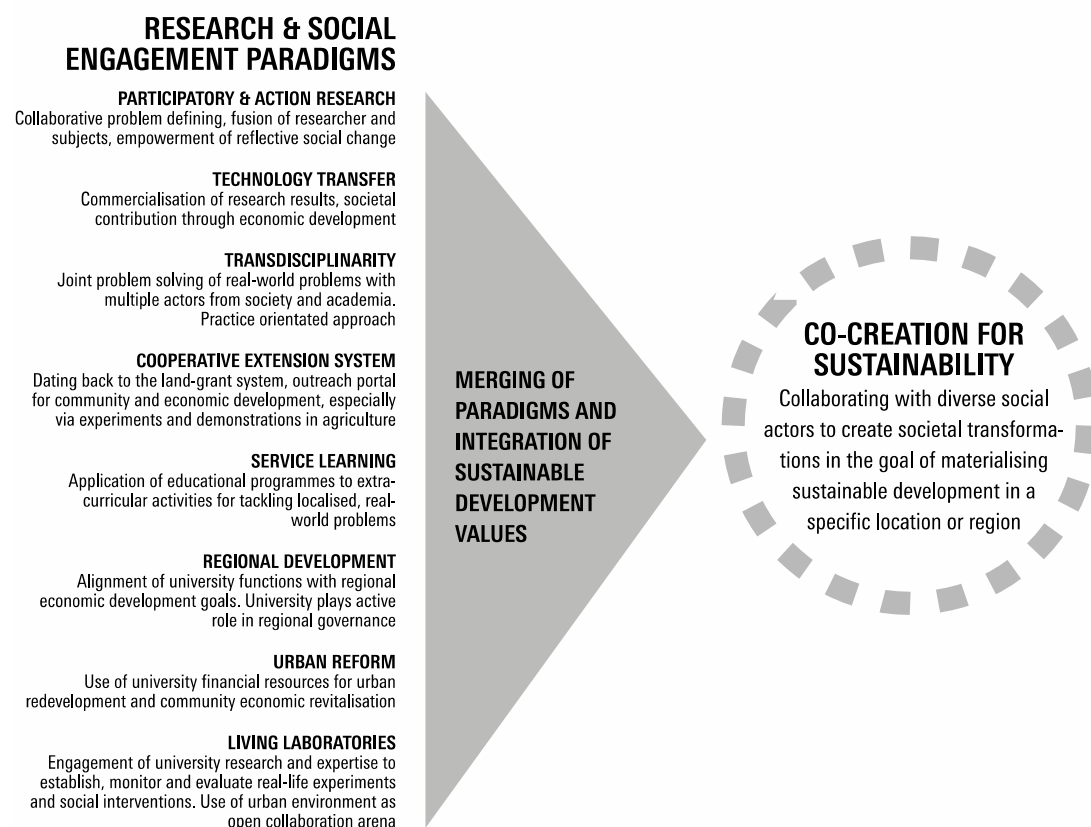
Universities clearly harbour a huge potential regarding such alliances. They are powerful generators of social and technological innovation (M'Gonigle and Starke, 2006), with an innate ability to link vast areas of expertise and activities across society (Arbo and Benneworth, 2007). Furthermore, they are manifestations of longevity and social stability with a non-profit focus and special capacity to foster long-term thinking critical for sustainability (Stephens et al., 2008). For such reasons, many scholars have argued that cross-sector university collaborations can significantly contribute to a local or regional transition to sustainability (Bardaglio, 2009; Stephens et al., 2009; Molnar et al., 2011; Trencher et al., 2013; Whitmer et al. 2010; Yarime et al., 2012). Coupled with this growing consensus, there are mounting calls for universities to tie their research agendas to real world sustainability issues (Crow, 2010) and direct their various functions to regional development needs (OECD, 1999; 2007).

Against this backdrop, the worldwide proliferation of cross-sector university partnerships for driving sustainability transformations in a specific area or sub-sector seems hardly surprising. Especially if viewed as a sub-set of a wider and growing population of non-academic sustainability (Bai et al., 2010) and climate experiments (Bulkeley and Broto, 2012). Yet the scale, ambition and comprehensiveness of many recently formed academic partnerships is striking. To cite but a few, in the US paradigms such as transdisciplinarity (Haberli et al, 2001; Scholz, 2000), regional development (Arbo and Benneworth, 2007; OECD, 1999; 2007), technology transfer (Mowery et al., 2004) and living laboratories (Evans, forthcoming; König, 2013) are melded into ambitious, but separate alliances from the Berkley and San Diego campuses of the University of California to accelerate a regional transition to a high-tech green economy and hasten the uptake of smart grid technologies, EVs and renewable energy. Across the Atlantic, administration from universities in Manchester have teamed up with the City to exploit the established functions of urban reform (Perry and Wiewel, 2005) and regional development to dramatically transform a 243 hectare strip in the city centre into a low-carbon hub of knowledge-driven business activity. University researchers are systematically integrating paradigms such as living laboratories and transdisciplinarity into this transformation effort by saturating the zone with monitoring equipment to utilise it as a living test-bed for areas such as energy, communications and transport (Evans, forthcoming). Furthermore, in some academic settings such as Oberlin College and the domain of the Swiss

Federal Institutes of Technology, the objective of driving a sustainable transformation in a particular region or city has even been elevated to an institutional priority. In choosing the term ‘co-creation for sustainability’ we are attempting to describe a recent, ambitious and systematic synergising of many previously established research and social engagement paradigms depicted non-exhaustively in Figure 1. These are exploited in varying degrees and combinations by a coalition built explicitly upon values of sustainable development and used in the goal of driving a technological, social or environmental transformation to sustainability in a specific location, region or societal sub-system. Yet in proposing this term for what others may refer to as ‘university-community partnerships for sustainability’ (Stephens et al., 2009), an ‘urban sustainability extension service’ (Molnar et al., 2011) or ‘regional sustainability initiatives’ (Zilahy and Huisingsh, 2009) we are placing an explicit emphasis on the process of co-creating physical and permanent transformations as opposed to the co-production of scientific knowledge (Hegger et al., 2012), which per say, does not necessarily guarantee action or transformation.

The novelty of this study is an attempt to connect the dots between scores of individual partnerships and propose a systematic framework to determine how exactly co-creative partnerships can bring about a sustainability transformation. This is a response to a gap in the literature, which has so far focused on individual or small sets of case studies (Trencher et al., 2013). Lastly, we attempt to discuss the grander implications of this global emergence of co-creation for sustainability for the missions of the university—a subject which, until now, has also been overlooked.

Fig. 1. Key properties of co-creation for sustainability



2.2 Overview of empirical research and methodology

The arguments in this paper are based on an analysis of 38 collaborations from three regions encompassing industrialised nations in North America, Asia and Europe. These geographical zones have been chosen to give a global perspective and encompass a wide range of cultural, linguistic, political, technological and academic contexts. The focus on industrialised nations is to ensure some degree of consistency concerning the social, political and economic conditions surrounding each case. The inventory of partnerships covered by this research appears in Appendix 1.

The primary objective of this empirical research is to gain a global perspective of the extent to which the function of co-creation for sustainability has emerged and developed throughout academia, in addition to pursuing a broad understanding of common characteristics and various driving mechanisms. This sample pool builds upon our previous research (name deleted, 2013) by including a further 11 partnerships coming to our attention recently. Our efforts represent an on-going ambition to identify, document and analyse cross-sector university partnerships for sustainability. Thus far, we have identified 38 cases from web searches, scans of academic literature, conference papers and databases from institutes such as the International Sustainable Campus Network³, European Network of Living Labs⁴ and funding bodies such as the EU Seventh Framework Programme⁵, in addition to communications with our network of peers, university sustainability offices and various research institutes around the world. This paper has considered any collaboration found satisfying the following criteria, either completed or on-going. That is, any which:

1. Has the objective of advancing the sustainable transformation of a specific geographical area or societal sub-system in industrialised Europe, Asia or North America.
2. Is initiated, coordinated or lead by university actors.
3. Involves a formal collaboration with any combination of partners from academia, industry, government and the civic sector.
4. Mainly addresses a community of external stakeholders.

Figure 2 below depicts the individual project timelines for each partnership included in our database (a description of each may be found in Appendix 1). Although ‘big names’ such as MIT, Harvard and Stanford are lacking due to the scope of the above criteria, our database nonetheless contains some highly influential institutions such as the University of California (Berkeley and San Diego), Cornell University, the University of Tokyo, National University of Singapore, in addition to several other major European universities such as the Swiss Federal Institutes of Technology (ETH), University of Manchester, and Milan, to name a few. Bearing in mind that there are countless other partnerships escaping our attention (particularly for linguistic reasons), this macro-level empirical research confirms that the formation of co-creative partnerships for sustainably transformations is not confined to one or two universities or locations. Instead, it appears to be a significant and relatively widespread trend in academia, observable in a diverse array of academic institutions all over the world.

A second observation is that, whilst there are a few on-going ‘veteran’ partnerships such as the 2000 Watt Society Pilot Regions by Novatlantis and ETH and UniverCity by Simon Fraser University, a great deal of partnerships have formed since 2010. Furthermore, as is particularly the case for the more ambitious alliances, many are committed to the long-term pursuit of sustainable development, with many lacking concise completion dates. From this it could be said with a fair degree of confidence that the emerging function of co-creation for

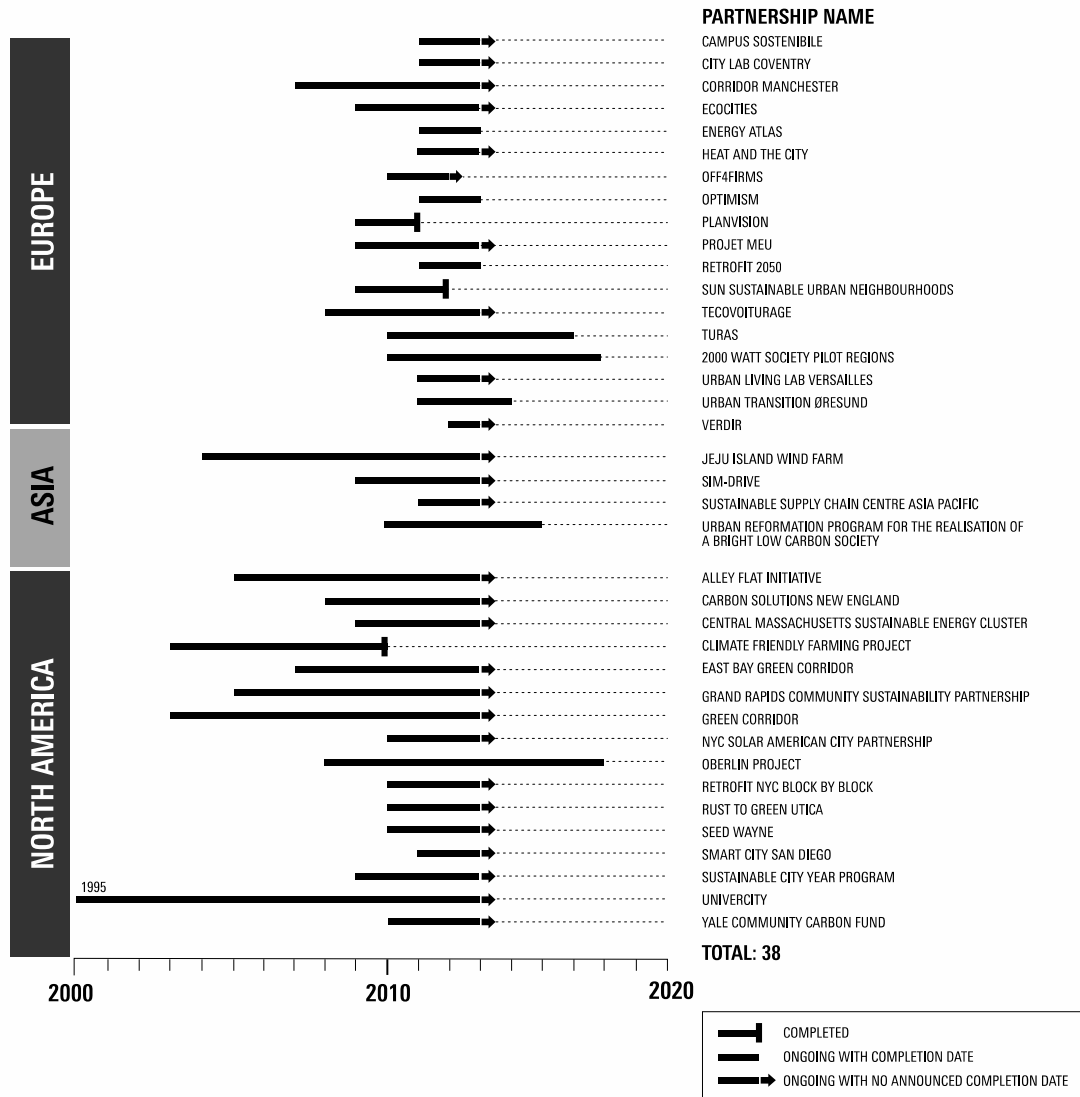
³ See URL <http://www.international-sustainable-campus-network.org/>

⁴ See URL <http://www.openlivinglabs.eu>

⁵ See URL http://www.cordis.europa.eu/fp7/home_en.html

sustainability is literally ‘scheduled’ to continue developing and expanding across academia; for the next several years at the very least, and possibly decades.

Fig. 2. Implementation periods for various partnerships



Section 3. Comparative analysis of third mission and emerging mission

It was argued above that the trend of co-creation for sustainability appears to be a significant trend and set to further develop in many academic settings around the globe. Yet it must be understood that the driving forces and characteristics of this function differ starkly to the dominating notions and patterns of social contribution and engagement promoted in academia until now. One way of illustrating this is to borrow concepts from transitions theory such as the ‘multi-level perspective’ (Geels, 2002), already utilised by Schneidewind and Augenstein (2012) and Stephens and Graham (2010) to describe interactions and tensions between sustainability initiatives and established cultures and norms in academia.

From the multi-level perspective, it could be argued that each example in our database constitutes a *niche* (the lower or micro level) where groups of *frontrunners* (Loorbach and Rotmans, 2010) are involved in conducting sustainability experiments that deviate from the *regime*. In the transitions theory, a niche is described as a small group of actors experimenting with novel practices and behaviour not conforming with that of the general regime (Geels, 2002; Rotmans and Loorbach, 2010). The regime (the middle or meso level) refers to the mainstream and dominating structure, culture and practices of the residing power and vested interests in a particular societal system (van den Bosch, 2010). The literature also describes a third layer *landscape* (top or macro-level) representing slow changing external factors such as cultural and political trends, institutional frameworks and long term economic developments (Bai et al., 2010; Berkhout et al., 2010). Understanding the tensions and contrasts, particularly between individual niches and the regime, is essential to grasping the full implications of the emergence of the new function of co-creation for sustainability. Although there are numerous possible ways of describing the many regimes in the academy, in this study we focus on what we term the ‘third mission regime’. In essence, this consists of firmly established and widely promoted concepts of societal contribution such as the ‘third mission’, the ‘entrepreneurial university’, ‘technology transfer’ and ‘triple-helix partnerships’. The articulation of this regime builds upon prior studies describing a rising ‘academic capitalistic regime’ (Bleiklie and Kogan, 2007) or ‘academic capitalist knowledge/learning regime’ (Slaughter and Rhoades, 2004) fuelled by market-driven and neo-liberal logic.

3.1 Critique of the ‘third mission regime’

The articulation of a ‘third mission’ emerged since the 1980’s as a consequence of global pressure on universities to play a more central role in the knowledge economy (Venditti et al., 2011). Like the term sustainability, the concept of a third mission is somewhat ambiguous. Yet in principal, it refers to diverse activities not covered by the first mission (education) and second mission (research) such as technology transfer, continuing education and social engagement in the form of public access to lectures and cultural assets, voluntary work and consultancy and so on (E3M Project, 2012). From this perspective, the term ‘social contribution’ is a useful synonym for describing the core notion of the third mission. The university has a long and established history of engaging with and contributing to society. For example, the US land grant system was created in a sense with an explicit ‘third mission’ (Martin, 2012), with universities expected to contribute to the surrounding community and agricultural economy by shaping research agendas in accord with local needs (Molnar et al., 2011; Mowery et al., 2004). Martin (2012) also argues that many medieval universities were in fact expected to contribute to both economic and cultural development. The articulation of the term ‘third mission’ and the birth of the entrepreneurial university should therefore be viewed as a mere expansion or accentuation of previous expectations (Saunders, 2010). Yet what is new in the university’s recent evolution is the magnitude of the contemporary forces seeking to align the creative powers of the university with economic development (ibid). Consequently, the idea of *societal* contribution is today widely perceived and promoted as being chiefly an *economic* contribution (Vorley and Nelles, 2008; Yusuf,

2007).

This shift in focus from society to the economy may be observed in many spheres, both inside and outside the academy. As argued by Vendetti et al. (2011), the OECD in particular has tended to focus discussions concerning the third mission and societal contributions to technology transfer activities encompassing patenting, licensing and creation of spin-off firms and technology parks. Especially over the last decade, this organisation is going to great lengths to emphasise economic benefits and gains in international competitiveness for governments when universities focus their third stream activities on innovation transfer and spurring regional development (OECD, 1999; OECD, 2007). In the UK, the national government has even gone so far as to term 'wealth creation' the key focus of the third mission (Klein, 2002; Venditti et al., 2011). Similar ideas may be observed within academia itself. In the literature, for example, an embodiment of the third mission has emerged in the form of an 'entrepreneurial university' since creating a whole genre of scholarship (see Rothaermel et al. 2006). In such discourses, the entrepreneurial institution is seen as an 'engine of economic growth' (Yusuf, 2007) with both government and academic pro-entrepreneurial discourses driven by success stories such as the high-tech driven economic prosperity supposedly attained by linkages between Silicon Valley and Stanford (Etzkowitz, 2003). What is often forgotten is that the emergence of the entrepreneurial model is a phenomenon occurring in few universities, particularly concentrated in the US (Yusuf, 2007). Regardless, the entrepreneurial model with active university-industry partnerships and technology commercialisation efforts has been framed and increasingly normalised and promoted in public policy around the globe via the notion of a third mission (Vorley and Nelles, 2008).

At a rhetorical level, there have been attempts to introduce the concept of sustainability and green innovation into discussions on the third mission and university-industry-government relations by both scholars (Carayannis and Campbell, 2010, 2011; Etzkowitz and Zhou, 2006; Puuka, 2008) and organisations such as the OECD (2007). Yet in practice, this has not re-orientated the bulk of discourses or technology transfer activities—which are concentrated in a narrow spectrum of highly specialised fields—towards sustainable development. As evidence, in 2009 the AUTM reported that patent disclosures from US universities, hospitals and research institutes were distributed as medicine (24.5%), biomedical engineering (14.2%), life sciences (10.4%) and computer engineering (9.6%), with disclosures in the field of environmental science, for example, only making up 1.0%. This trend is also echoed in figures for the distribution of university launched spin-off firms. For example, at the University of California San Diego campus, 58% of 120 start-ups formed from 2000 to 2010 were in biomedicine and life-sciences, with the remainder in engineering, software and physical sciences (UC San Diego, 2010). Similar patterns exist in earlier figures, with Shane (2004) finding more than half of spinoffs formed at MIT to be biotechnology and software companies and Lowe (2002) reporting two-thirds of spinoffs from the entire University of California system to be in the fields of biotechnology, pharmaceutical or medical devices.

In pro-entrepreneurial discourses some argue that there is no substantial evidence suggesting that the narrow economic focus of the third mission and rise in conventional university-industry links has had any discernable negative impacts on the university (Yusuf, 2007). However such positive appraisals are ignoring an array of concerns voiced against the rise of the third mission regime. For example, some have described the neglect of the humanities at the expense of revenue generating fields of applied sciences (Canaan and Shumar, 2008; Slaughter and Rhoades, 2004; Washburn, 2006), with others identifying a breakdown of shared governance norms and the spread of market-logic driven, corporate-style management across academia (Bleiklie, 2007; Rhoades, 2005; Saunders, 2010). Regarding conventional technology transfer and intellectual property (IP) practices, Kenney and Patton (2009) argue that the current system is not economically optimal or geared towards the social interest of rapid and widespread commercialisation. Jensen and Thursby (2001) have also produced

quantitative evidence to suggest that many technology transfer offices are prioritising profit over widespread diffusion of scientific inventions. Such arguments are echoed in the contempt expressed by many US corporations, particularly in IT, towards aggressive university IP practices that *hinder* rather than facilitate collaboration (Mowery, 2007). Others still expressed concerns about the deterioration of the traditional culture of open science as the assertion of IP rights threatens the efficiency and economic logic of the ‘scientific commons’ or the common pool of scientific knowledge (David, 2003; Heller and Eisenberg, 1998; Mowery et al., 2004; Nelson, 2004).

Based on reasons outlined above, our position is that the potential of the third mission regime to function as a useful guiding concept or propelling force in the quest for low-carbon development and the sustainable transformation of individual towns, cities and regions is yet to be proven, despite attempts to tack-on the concept of sustainable development or green innovation. Business as usual economic development continues to undermine the life-supporting functions of the Earth (Millennium Assessment, 2005) and the long-term prosperity of countless human settlements is overshadowed by complex sustainability issues such as adapting to global climate issues on a local scale, decoupling economic development from carbon emissions (World Bank, 2010) and securing energy and food security (Brown, 2011). In such a context, the relevancy of this model in achieving desirable human development needs to be critically examined. The need for an alternative mission and ‘social contract’ between academic science and society (Gibbons, 1999) has thus never been greater.

3.2 Co-creation for sustainability as an alternative mission

In contrast to the narrow economic scope of the third mission, for a variety of reasons set out systematically below, the function of co-creation for sustainability is far better equipped to bring about the sustainable transformation of a specific geographical area. Essentially, this is due to a fundamental difference in focus—that of *contributing* to economic development verses that of actually *creating* societal transformations in pursuit of realising sustainable development. To demonstrate this, Table 1 below contrasts the key characteristics of the dominating interpretation and enactment of the third mission against those observed in the 38 partnerships forming our empirical analysis.

- *Objective*
Contrasting to the pursuit of economic development and revenue generation for industry and the university, the function of co-creation for sustainability aims to address localised sustainability issues by creating socio-technical and environmental transformations in the goal of materialising sustainable development in a given geographical area.
- *Model*
Influential institutions such as MIT and Stanford constitute the prototype of a university aligned with the third mission (Etzkowitz, 2002; 2003). In the alternative function, the concept of a ‘transformative university’—a multi-stakeholder platform engaged with society in a continual and mutual process of creation and transformation—forms the guiding image and physical representation of an institution actively working with co-creation for sustainability (front runner institutions are described in Section 5).
- *Paradigm*
In the new function, the concept of sustainability provides the intellectual paradigm and guiding principle for all undertakings, whereas it is market logic and a conception of private science that motivates execution of the third mission (Saunders, 2010; Slaughter and Rhoades, 2004, David, 2003).

Table 1. Comparison of key properties in the third and emerging mission

	THIRD MISSION	EMERGING MISSION
Function	Technology transfer	Co-creation for sustainability
Objective	Contribute to economic development	Create societal transformations to materialise sustainable development
Model	Entrepreneurial university	Transformative university
Paradigm	Market logic and entrepreneurship	Sustainability
Disciplines	Mainly natural sciences and engineering	Broad range of fields including humanities and social sciences, in addition to natural sciences and engineering.
Approach	<ul style="list-style-type: none"> • Closed-model innovation • Device orientated • Response to problems in isolation 	<ul style="list-style-type: none"> • Open-model innovation • Place and stakeholder orientated • Comprehensive, systematic response to several, interwoven problems. • Systematic use of various methods and channels.
Timeframe	Short to mid-term	Mid to long-term
Collaboration type	Specialists from academia, industry & government.	Large scale coalition with both specialists and non-specialists from academia, industry, government & civil society
University actors	Faculty or students, with aid from administration and tech-transfer office	Faculty/researchers, administration, bridging organisations and students
Chief driver(s)	<ul style="list-style-type: none"> • Specialised scientific knowledge • Technological innovation 	<ul style="list-style-type: none"> • Specialised and multi-disciplinary scientific knowledge • Technological and social innovation • Socially embedded knowledge and transdisciplinary mutual learning • Environmental transformations
Setting	Laboratory/controlled environment (technology park, ventures, incubators)	Real-world setting: specific location (community, city, region etc.)
Catalyst	Technical or scientific problem	Sustainability problem
Channels	<ul style="list-style-type: none"> • Patents/inventions/licenses • Spin-off firms, technology parks • Conferences, publications • Consultation, supply of graduates 	<ul style="list-style-type: none"> • Knowledge management • Technology transfer or economic development • Technical demonstrations & experiments • Reform of built and natural environment • Socio-technical experiments

- *Disciplines*
As argued earlier, the majority of technology transfer activities in the conventional model are concentrated in the natural sciences (notably life sciences) and engineering (especially computer and bio-engineering). The emerging function, however, involves faculty from a much broader range of fields, typically consisting of

interdisciplinary collaborations.

- *Approach*
Although approaches vary, in the alternative function there is a shift from corporate-style closed model R&D to an open innovation model (König (2013) that is place and stakeholder—rather than *device*—orientated. Furthermore, co-creation for sustainability will typically draw upon and integrate a wide array of methods (see Figure 1) into a systematic response to several interwoven sustainability problems.
- *Timeframe*
With sustainable development being more a journey than a fixed state (Vos, 2007) many alliances are committed to the long-term pursuit of sustainable development, often for periods of a decade or more. On the other hand, technology transfer activities operating under the third mission typically aim for tangible, commercialisable results in the short to mid-term.
- *Collaboration type*
In contrast to the third mission where civil organisations are absent from many ‘triple-helix’ or university-industry-government partnerships (Etzkowitz et Zhou, 2006; Yang et al., 2012), in the new role universities may actively seek the participation of a broad range of non-specialists and civil society.
- *University actors*
Conventional research commercialisation efforts are usually initiated by faculty, and sometimes students, with the aid of technology transfer offices (Zhang, 2007). In the emerging mission many partnerships are initiated by actors from administration and ‘bridging organisations’ such as sustainability offices or institutes (name deleted, 2013).
- *Chief drivers*
Unlike the third mission driven uniquely by technological innovation and specialised scientific knowledge from a narrow set of fields such as biotechnology and IT, in the contrasting function sustainability transformations are brought into fruition via alternative means. These include both specialised and multi-disciplinary scientific knowledge (i.e. from multiple fields) and include technological and social innovation. Other drivers include broader forms of socially embedded knowledge and trans-disciplinary (i.e. both multi-disciplinary and cross-sector) mutual learning (see Scholz, 2000) amongst vast groups of researchers, government officials, practitioners and civilians. Lastly, other key drivers include construction or urban and ecological reform projects (elaborated in Section 4).
- *Setting*
In the place-orientated mode of co-creation for sustainability, the partnership addresses itself to a specific geographical area, context and community of stakeholders. This differs to many conventional technology transfer activities, where the focus is not so much on a particular location as it is on moving innovation towards industry (via licensing) or directly to a national or international market (via spin-off creation).
- *Catalyst*
In the third mission, technical, industrial or scientific challenges are the main catalyst for research activities leading to technology transfer initiatives. On the other hand, the process of co-creation for sustainability is triggered by societal challenges such as ‘how to create a sustainable energy system?’ or ‘how to create a resilient, post-fossil

fuel economy?’ (Rotmans and Loorbach, 2008).

- *Channels*

As documented in the literature, (Mowery et al., 2004; Mowery, 2007; Philpott et al., 2009) technology transfer channels consist of patenting and licensing, spin-off firms and technology park creation, contract research and consulting, publications, conferences and supply of graduates. Although these avenues may also be exploited when pursuing the new function, the university will typically exploit additional channels such as *demonstration projects*, *reform of built or natural environment*, and *socio-technical experiments* (discussed in detail in Section 4).

As has become clear from above, a systematic comparison of the two functions of technology transfer and co-creation for sustainability reveals striking differences. Our argument is that so great are these differences, it is unhelpful to consider the role of co-creation for sustainability as being a mere offshoot or different enactment of the third mission. Instead, we assert that these two functions could be considered as two distinctly *differing* but *compatible* missions. That is to say, we are proposing here that the emerging function of co-creation for sustainability be viewed as what could potentially be the seeds of a new mission, still in the process of developing and inventing itself. By arguing this, we are well aware that co-creative activities for sustainability transformations would not be suitable for a great majority of institutions around the world due to differing mission focuses. We also acknowledge that in some institutions and contexts the promotion or expansion of co-creative activities for sustainability would almost certainly encounter tensions with the incumbent values and practices of the third mission regime, which as argued earlier, is formulated almost entirely in economic terms. A clash of interests could also be exasperated in the presence of demands for cost-effectiveness, commercialisable results and short to mid-term economic gains. This would be in many ways conflict with the long-term, value-laden and open source approach of experimental group innovations for sustainability transformations, which all too often encounter high levels of uncertainty, complexities and obstacles, as soberly indicated by Fadeeva (2004) and König (2013).

Despite this, as will be shown in Section 6, conventional technology transfer activities can be compatible with the emerging mission and integrated systematically into wider transformation efforts. Furthermore, some front-runner institutions have even gone so far as to elevated the act of pursuing the sustainable transformation of a specific town or region through cross-sector partnerships to an institutional priority.

Section 4. Channels for carrying out the emerging mission

This section describes an analytical framework resulting from the question: *By which channels may university actors attempt to execute the emerging mission and drive the sustainable transformation of a particular geographical area or societal sub-sector?* The framework has been reached both *deductively* (by sourcing and applying theory and channels observed by other scholars) and *inductively* (by creating generalisable descriptions of the various approaches observed in the 38 cases gathered for our database). This question was integrated into the database structure and data recorded for each entry from a document analysis of university and scholarly publications, websites, press articles and in some instances, semi-structured interviews with key university actors. Deductions from the literature and inductive, empirical observations were then fused into a preliminary framework, and then applied to each case. Descriptions for each variable were then re-worked to better reflect characteristics observed in the sample pool, with the resultant framework sent to the leaders of several partnerships for feedback. The final and non-exhaustive framework proposed below (summarised and systematically compared in Table 2) is thus the result of a re-iterative process of induction, deduction, application and then ‘fine-tuning’ and adjustment.

- *1. Knowledge management* (knowledge and communication driven)
Here scientific actors and practitioners attempt to create, process and diffuse to key stakeholders and decision makers the knowledge required to drive a technical, environmental or societal transformation in a particular location. In the context of transferring *codified* knowledge—i.e. easily stored and transferrable ‘official’ knowledge (Lundvall and Johnson, 1994)—typical manifestations of this channel include collaborative research efforts culminating into publications (e.g. reports, journal articles, websites etc.) and conferences, as well as policy tools and decision making instruments. As for transferring *tacit* knowledge—i.e. socially embedded, ill-defined and difficult to codify—suitable avenues may include consulting, training of key stakeholders and decision makers and even transfer of graduates. This broad channel also encompasses varied roles such as *governance* Sedlaceck (2013) or *communication, translation and mediation* as suggested by Cash et al. (2003) where university actors may create public discussion spaces for awareness raising, mutual problem defining and resolving conflicts and trade-offs.
- *2. Technical demonstrations & experiments* (science and technology driven)
In this channel, researchers, scientists and practitioners focus on demonstrating and testing unproven technological innovation in real-world settings with the basic aim of assessing suitability for, or encouraging wider diffusion. A natural consequence of this channel may entail the eventual transfer of a particular innovation to market via any of the mechanisms in the third channel of *technology transfer*. Also represented in the literature, what we refer to here as a ‘demonstration project’ is often referred to as an ‘innovation project’ (Van den Bosch and Rotmans, 2008) or ‘pilot project’ (Vreugdenhil et al., 2009). Initiatives falling into this channel include both temporary testing projects which ‘disappear’ after a set-time frame and withdrawal of scientific enquiry, and permanent demonstrations or installations where the experiment is left to function after the completion of scientific testing and data gathering.
- *3. Technology transfer and economic development* (technology and economy driven)
The aim of this channel is to spur low-carbon economic growth and diffusion of green technologies in a specific locality or region. This essentially consists of ‘harder’ outputs (Philpott, 2011) such as patenting and licensing to industry, or the creation of spin-off firms, technology parks and cluster zones (McCauley and Stephens, 2012). Section 3 argued that the majority of conventional technology

transfer activities are concentrated in a narrow set of fields not aimed at spurring green innovation or sustainable development. In the emerging mission, however, diverse university actors such as researchers, technology transfer offices, administration and development officers attempt to drive sustainable development by exploiting what may appear to be conventional technology transfer practices. Yet several peculiarities should be highlighted. Firstly, such efforts are part and parcel of a wider transformative strategy typically exploiting other avenues and involving a vast array of societal actors. Secondly, technology transfer and commercialisation initiatives are usually explicitly committed to driving low-carbon growth by fostering business start-ups, employment, training and widespread adoption of particular technologies in a specific place and set of stakeholders (McCauley and Stephens, 2012).

- *4. Reform of built and natural environment* (environmental transformation driven)
 Unlike demonstration or pilot projects implemented for mainly scientific purposes, here the focus is on transforming or restoring the built or natural environment—and not necessarily for scientific reasons. In the built environment, this may involve university administration-led real estate development, neighbourhood reform or infrastructure improvements (e.g. Corridor Manchester). Examples include the new construction or revitalisation of existing business and residential areas through green buildings and urban design or the improvement of infrastructures such as energy, transport and communication networks. For efforts to improve the natural environment, this may include the restoration of natural eco-systems, reform of agricultural or forestry practices, or creation of man-made natural spaces. Funding for such projects may be derived from private investors, philanthropists and government grants, often boosted by heavy financial commitments from the university itself (e.g. UniverCity by Simon Fraser University). University-led reform and re-vitalisation of a particular neighbourhood or area is a well-established trend documented in the ‘urban reform’ literature (see Wiewel and Perry, 2005). Yet what is distinctly new in urban reform efforts implemented in the cadre of co-creation for sustainability is the presence of values and principles of sustainable development, and the combining of other social engagement paradigms depicted in Figure 1 earlier.
- *5. Socio-technical experiments* (multi-actor learning and socio-technical innovation driven)
 This channel encompasses a distinctly social dimension—often fused with technical artefacts—leading to new configurations of services, technologies, businesses, policies, financial and legal tools and so on. These may be ‘invisible’ or ‘intangible’ in contrast to, for example, technical demonstration projects, the creation of actual products or reform of the built or natural environment. Also, as such experiments may be non-scientific and non-technical, administration and outreach sectors of the university may play a major role in creating innovation for this channel. Concrete examples may include the building or re-configuration of a food or consumption network, the re-organising of technological artefacts (e.g. car sharing) or the introduction of an experimental incentive or policy tool designed to change behaviour of citizens or the private sector. The definition of *bounded socio-technical experiments* (BSTEs) from Brown et al. (2003:291), that is; the introduction of a ‘new technology, service, or a social arrangement on a small scale’ provides a solid theoretical starting point for this channel. Due to high levels of uncertainty regarding results, exploring and ‘learning by doing and doing by learning’ (Brown et al., 2003:292) provides the principle means by which a societal transformation occurs. That said, we are pursuing a much broader definition, as the term BSTE does not reflect the blurry borders and permanence of certain socio-technical experiments observed in our empirical study—many of which are purely social.

Table 2. Framework of five channels in the emerging mission

	1. Knowledge management	2. Technical demonstrations & experiments	3. Technology transfer and economic development	4. Reform of built or natural environment	5. Socio-technical experiments
Objective	To create, process and disperse specific knowledge to relevant stakeholders and decision makers.	To test, demonstrate and evaluate technical innovation.	To disperse high-tech green innovation and stimulate sustainable, economic development.	To transform or restore the built and natural environment.	To create a new socio-technical configuration
Driver	Knowledge and communication	Science & technology	Technology and economy	Environmental transformations	Multi-actor learning and socio-technical innovation
Mode	Traditional	Traditional	Post-traditional	Post-traditional	Post-traditional
Typical Manifestations	<ul style="list-style-type: none"> • Collaborative research • Publications • Conferences • Discussion spaces • Consulting & training 	<ul style="list-style-type: none"> • Pilot or verification projects • Demonstration & testing facilities 	<ul style="list-style-type: none"> • Patenting & licensing to industry • Fostering of business ventures and employment • Green cluster zones 	<ul style="list-style-type: none"> • Construction & development projects (e.g. buildings, landscape) • Infrastructure upgrades (e.g. power grids, roads/paths, transport facilities) • Natural environment restoration 	<ul style="list-style-type: none"> • Stakeholder driven experiments with various social, technical, legal, financial and policy tools.

Section 5. Results of analytical framework

The above framework will now be applied to each of the 38 cases in our inventory. Results are indicated in Table 3 and Table 4 and then tallied in Figure 3 below. Key persons in each collaboration (in most cases the project leader) were electronically sent a survey explaining each level of the framework. They were asked to designate those channels best describing *overall* the approach and various activities in the partnership concerned. This was particularly vital in those cases where certain activities were seemingly able to fit into more than one channel. Despite these incidences of potential overlap, the main value of this application of the framework lies in its ability to show those channels which tend to be the most or least exploited, as well as the overall quantity exploited by the sample pool.

As in our earlier research (name deleted, 2013) we have split cases into two groups: *focused* (those concentrated on one or two sub-systems such as smart grids and renewable energy) and *comprehensive* (those simultaneously targeting several such as buildings, transport and energy etc.). Some key findings are as follows:

- *Quantity of channels*
Co-creative partnerships are formal representations of numerous, de-centralised initiatives, each embedded in a larger and integrated system seeking to advance social, technical and environmental transformations for sustainability. Tables 3 and 4 are the quantitative reflection of this. *Comprehensive* collaborations in Table 3 are exploiting on average 3.6 channels per partnership, and those in the *focused* pool exploiting on average 3.0 channels. This appears to be demonstrating both the necessity of each channel for pursuing the objectives of each partnership concerned, as much as it does their capacity to co-exist and synergise each other. Although depicted here in isolation, the essential message is that university actors are simultaneously combining channels into systematic and comprehensive responses to localised sustainability challenges. Regarding the minor discrepancy in average quantity of channels used for the *comprehensive* and *focused* pool, this is undoubtedly influenced by the overall volume of activities in each partnership—which is itself determined by budgetary and temporal restraints, number of actors involved, and additionally, the amount of societal sub-areas targeted.
- *Technology transfer and economic development*
Despite widespread promotion in academia as a desirable means of contributing to society, Figure 3 is conveying that *technology transfer and economic development* is the least commonly used channel. This is undoubtedly indicative of the involvement of many university actors, both scientific and non-scientific, from outside research intensive engineering and hard science disciplines where commercialisation of academic inventions is most prevalent. Yet in the cases where this channel is exploited, as shown in Tables 3 and 4, technology transfer and knowledge driven economic development initiatives are taking place in tandem with other channels as part of a wider transformative strategy. This testifies to the capacity of the third mission to co-exist with and complement the emerging mission of co-creation for sustainability.
- *Knowledge management*
This has emerged in Table 3 as the most widely used channel in both pools. Although many reasons could explain this, we interpret this as firstly being indicative of the fact that, despite its ability to perform a host of other functions, for many actors the university is above all a place of knowledge production. We also see this as signalling the importance of this channel in generating and diffusing the co-produced intelligence required to kick-start the more physical mechanisms required to drive a

sustainability transformation.

- Socio-technical experiments*

This channel has also emerged in Table 3 as widely used across all partnerships in both the comprehensive and focused pool. This is testifying to the presence of many non-technical initiatives aimed at transforming more social dimensions of human settlements.

Fig. 3 Tally and distribution of various channels used by each partnership

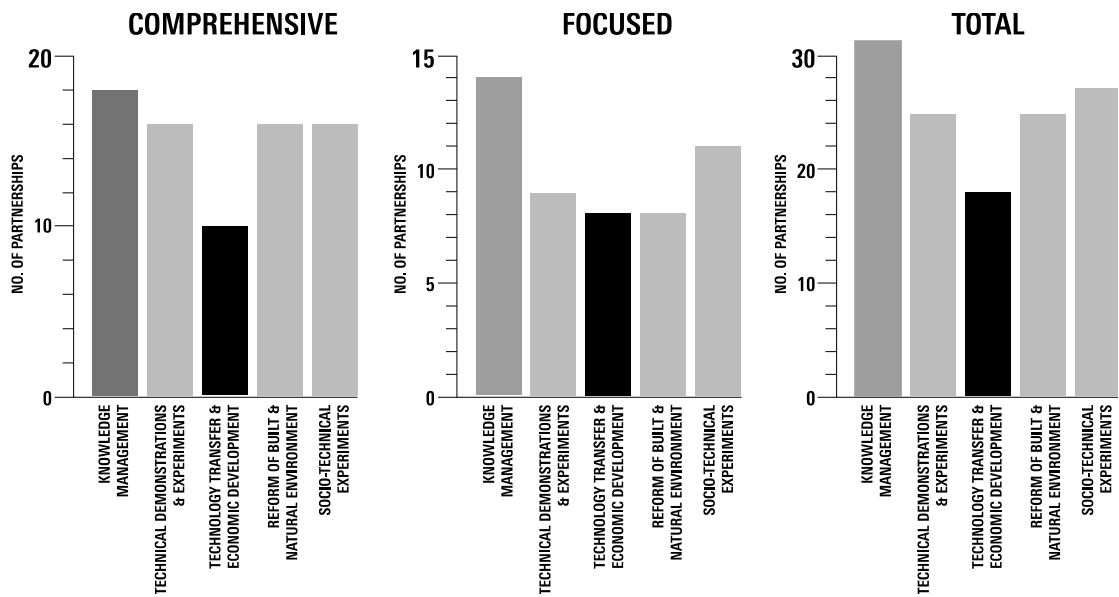


Table 3. COMPREHENSIVE partnerships – various channels used

Project Name	Lead academic institution(s)	Knowledge management	Technical demonstrations & experiments	Technology transfer & economic development	Reform of built or natural environment	Socio-technical experiments
Asia						
Urban Reformation Program for the Realisation of a Bright Low Carbon Society	University of Tokyo	●	●			●
EU						
Campus Sostenibile	University of Milan, Polytechnic Institute of Milan		●		●	●
City Lab Coventry	Coventry University	●	●	●	●	●
Corridor Manchester	Manchester Metropolitan University, University of Manchester	●	●		●	●
EcoCities	Manchester University	●			●	●
SUN Sustainable Urban Neighbourhoods	University of Liege				●	●
2000 Watt Society Pilot Region Basel	Novatlantis, Swiss Federal Institute of Technology (ETH) domain	●	●	●	●	
Urban Living Lab: Versailles	University of Versailles Saint Quentin en Yvelines (Fondaterra)	●	●	●	●	●
TURaS	University College Dublin	●	●	●	●	●
Urban Transition Øresund	Lund University	●	●			
Verdir	University of Liege		●	●	●	●
North America						
Carbon Solutions New England	University of New Hampshire	●				●
Central Massachusetts Sustainable Energy Cluster	Clarke University (Institute for Energy & Sustainability)	●	●	●	●	
East Bay Green Corridor	University of California, Berkeley	●	●	●		●
Grand Rapids Community Sustainability Partnership	Grand Valley State University	●	●		●	
Green Corridor	University of Windsor	●	●		●	●
Oberlin Project	Oberlin College	●	●	●	●	●
Rust to Green Utica	Cornell University	●			●	●
Smart City San Diego	University of California, San Diego	●	●	●	●	●
Sustainable City Year Program	University of Oregon	●				
UniverCity	Simon Fraser University	●	●	●	●	●

TOTAL: 21

Table 4. FOCUSED partnerships - various channels used

Project Name	Lead academic institution(s)	Knowledge management	Technical demonstrations & experiments	Technology transfer & economic development	Reform of built or natural environment	Socio-technical experiments
Asia						
JeJe Island Wind Farm	Jeju National University	●	●	●	●	●
SIM-Drive	Keio University	●	●	●		
Sustainable Supply Chain Centre Asia Pacific	National University of Singapore	●	●	●		
EU						
Energy Atlas	Berlin Institute of Technology	●	●	●	●	
Heat and the City	University of Edinburgh	●				
Off4Firms	ETH Zurich	●	●			●
Plan Vision	University of Natural Resources and Life Sciences, Vienna	●			●	●
Projet MEU	Ecole Polytechnique Fédérale de Lausanne	●				
OPTIMISM Optimising Passenger Transport Systems	Coventry University (Coventry University Enterprises Ltd)	●		●	●	●
Retrofit 2050	Cardiff University	●				
Tecovoiturage	University of Versailles Saint Quentin en Yvelines (Fondaterra)	●	●	●		●
North America						
Alley Flat Initiative	University of Texas	●	●		●	●
Climate Friendly Farming Project	Washington State University	●	●	●	●	●
NYC Solar American City Partnership	City University of New York	●	●	●	●	●
Retrofit NYC Block by Block	Pratt Institute				●	●
SEED Wayne	Wayne State University					●
Yale Community Carbon Fund	Yale University				●	●

TOTAL: 17

Section 6. Case studies of frontrunner transformative institutions

6.1 Overview

This section consists of two case studies to compliment the theory and macro-level empirical analysis so far. It aims to firstly provide two concrete examples of how a university⁶ may exploit the five channels just described to bring about the sustainable transformation of a particular geographical area or societal sub-system. The second aim is to illustrate a larger point that the function of co-creation for sustainability is in fact capable of becoming an institutional priority—or *mission*—in vastly differing settings and contexts. The two cases enabling these objectives are the ‘2000 Watt Society Pilot Region Basel’ programme by the ETH domain and Novatlantis, and the ‘Oberlin Project’ by Oberlin College, USA. The first consists of a ‘veteran’ partnership initiated by a large-scale, public research university and associated institutes in urban Switzerland. In contrast, the latter, still in its infancy, was formed by a small-scale, private liberal-arts college in semi-rural Ohio, USA. These partnerships were chosen for several reasons; namely, their level of ambition and long-term time horizons, their utilisation of a wide range of channels, and lastly, the remarkable level of institutional support given to pursuing the objectives of each alliance. Both cases could qualify for a more extended analysis and are not intended to show results or impacts. Rather, our aim is to bring attention to two front-runner institutions that share many characteristics of the institution that we have envisioned as a ‘transformative university’. Data was obtained from university publications, academic and press articles, coupled with field visits and interviews with key persons.

The cases are structured as follows: After describing the socio-cultural context, objectives and key characteristics such as project organisation, we proceed to interpret several of the various initiatives in each collaboration through the framework of the five channels described above.

⁶ As already mentioned, in this study a ‘university’ refers to any 4-year, PhD granting academic institution. With this broad definition from our international perspective outside of the USA, we consider Oberlin College as a university.

Table 5: Summary of two cases

	Case 1: 2000 Watt Society Pilot Region Basel	Case 2: Oberlin Project
Summary	Long-term effort to accelerate the transition to a '2000-watt society' and promote uptake of sustainable urban development in Switzerland. The city of Basel is used as testing and demonstration site for innovation in mobility, buildings and urban development.	Ambitious project initiated by David Orr and Oberlin College to rejuvenate the entire town of Oberlin by transforming it into a prototype of a self-sufficient, resilient and post-fossil fuel community.
Target area	Basel, SWITZERLAND	Oberlin and Lorain County, Ohio, USA
Collaboration period	2000 – 2017 Status: on-going	2008 – 2017 (tentative) Status: on-going
Long-term targets	2000-watts per capita by 2075	Climate (GHG emissions) positive by 2050
Institutional profile	Swiss Federal Institutes of Technology (ETH) domain Large-scale, public research university consisting of two campuses and four research institutes in urban Switzerland. Strong in engineering, science and technology. Entire domain consists of over 19,000 administration and staff and 24,000 students.	Oberlin College Small-scale, private liberal-arts college in semi-rural town, USA. Strong in music, liberal arts and environmental studies. 2900 students and 1100 administration and staff.
Main university actors:	bridging organisation (Novatlantis), faculty/researchers	faculty/researchers, administration, students
Scope	COMPREHENSIVE (mobility, construction, urban planning and development)	COMPREHENSIVE (green buildings, urban and economic revitalisation, renewable energy and energy efficiency, green ventures, sustainable agriculture, sustainability education, green policies and financing)
Engagement paradigms	transdisciplinarity, urban reform, living laboratories, technology transfer	urban reform, living laboratories, co-operative extension, participatory and action research, service learning, transdisciplinarity, regional development, technology transfer

6.2 The 2000 Watt Society Pilot Region Basel

The 2000 Watt Society Pilot Region Basel programme is an umbrella for a series of interconnected initiatives intended to showcase primarily technical solutions for sustainable mobility, building and urban development. It seeks to foster a city-wide transition to a 2000-watt per capita society, with the wider ambition of accelerating a national de-carbonisation effort. Its roots date back to an ETH vision from the 1990's where, in response to climate change and energy security, consumption of primary energy is reduced to 2000 watts per capita with no loss in living standards. This vision also has at its core IPCC climate science and the ultimate objective of keeping post-industrial temperature rises to below 2 degrees⁷. A pre-requisite for attaining such the 2000-watt goal is a massive overhaul of Switzerland's building stock, energy production and road transport (Jochem et al., 2002).

In 1998 the ETH board formally promoted this vision by stating publically its support and integrating the 2000-watt vision into the *Sustainability Strategy for the ETH Domain*⁸ (Marechal et al., 2005). Steps were then taken to translate this initially scientific concept—of which feasible realisation dates were estimated at anywhere from 2050 to 2150—into an implementation project. An industry practitioner was recruited from the engineering and architectural sector to head a cross-sector sustainability platform later called Novatlantis. The subsequent task was to extract research results from the ETH domain and apply them to cross-sector implementation projects to spur low-carbon development and innovation in urban Switzerland.

⁷ Spreng, D. (2013) Interview by author, ETH Zurich, February 13.

⁸ See: Board of Swiss Institutes of Technology (ETH-Rat) (1998) *2000-watt society: Swiss model sustainability strategy for the ETH domain* (in German). Wirtschaftsplattform ETH Zurich: Zurich.

The 2000-watt society Pilot Region Programme emerged in 2001 after the City of Basel (population 186,000) responded favourably to a Novatlantis proposition to which it stipulated that any project be focused on application rather than research.⁹ It was thus born as a Novatlantis mediated alliance between the ETH domain, the City of Basel and two local universities. It was intended as a framework for a series of sustainability projects in the areas of mobility, construction and spatial development that would be fed immature technical innovation from the ETH domain, and implemented with the aid of the City and private enterprises. CHF 400,000 of funding was provided from ETH for an initial 10-year period, with remaining funds to be sourced from industry and government¹⁰.

By taking the measures just described above, as well as communicating these avidly to society, ETH thus established itself as a front-runner transformative university where one of the priorities—or missions—become that of bringing about socio-technical transformations in view of realising a 2000-watt society. The following application of the five-channel framework provides an overview of some key projects and activities in the Basel pilot region.

- *Knowledge Transfer*
The pilot region is committed to translating and communicating results to ‘end-users’ of knowledge in government and industry across Switzerland. To this end, published reports and forums have progressively accompanied implementation and demonstration projects over the last 10 years, particularly in the field of mobility. Authored by ETH domain scientists and industry experts, such publications deal with acceptance levels regarding LNG, biogas and electrical vehicles and also serve as decision-making tools for fleet managers. In parallel, the transmission of experiences from building and urban development has taken place through forums across Switzerland for real-estate developers and government officials¹¹.
- *Technology transfer or economic development*
Revenue generation through identification and commercialisation of IP is not a major focus of the Basel Pilot Region, which is an open-ended collaboration model committed to free flow of data and results to all interested stakeholders.¹² Nevertheless, technology transfer to industry is an inevitable ‘by-product’ of cross-sector cooperation. Most noteworthy is R&D, testing and evaluation of a hydrogen-driven street cleaning vehicle prototype called ‘hy.muve’ (CCEM, 2011) of which the fuel-cell powertrain was developed by ETH scientists. Efforts are now moving towards commercialisation and diffusion through serial replication for further demonstrations, in addition to socio-economic studies on acceptance of hydrogen technology, market potential and cost-effectiveness.
- *Technical demonstrations and experiments*
The core of demonstration and pilot projects in the Basel Pilot Region are focused in the field of personal mobility. Over 10 years these ETH scientist led initiatives have engaged automobile manufacturers, transport operators and key stakeholders in the development, demonstration and evaluation of solutions for the short term (natural gas), mid-term (biogas) and long term (hydrogen fuel cells). Key outcomes so far include trials of both natural gas and biogas powered taxi-fleets (Lienin et al., 2004; 2005) in addition to trials of the ‘hy.muve’ hydrogen driven municipal street sweepers with Canton workers (CCEM, 2011).

⁹ Stulz, R. (2012) Telephone interview by author, March 9.

¹⁰ Stulz, R. (2013) Interview by author. Zurich, Switzerland, February 12.

¹¹ Binz, A. (2013) Interview by author. Zurich, Switzerland, February 12.

¹² Bach, C. (2013) Interview by author. Swiss Federal Laboratories for Materials Science and Technology (EMPA) Switzerland, February 12.

- *Reform of built or natural environment*
A precondition for a 2000-watt society is a highly energy efficient or even ‘passive’ building stock (Jochem et al., 2004). Therefore, another core focus of the pilot region is on the ‘less scientific’ task of driving a sustainable transformation of the local building and urban development cycle. To this end, Novatlantis and faculty from the University of Applied Sciences and Arts North-western Switzerland (FHNW) cooperate with the City in three ways: i) architectural competitions awarding large-scale development rights to tenders best integrating 2000-watt society principles ii) setting building codes 10% higher than national standards to ensure energy performance for heating and interiors of all new buildings in Basel at least satisfy ‘Minergie’ rating¹³ and iii) government subsidies to foster sustainable building innovation and replication of flagship projects.

For more than a decade, ETH has established itself as a frontrunner transformative institution. Through the Novatlantis portal, a significant portion of its scientific resources have been devoted to the goal of spurring sustainable urban development in Basel in view of accelerating a national transition to a 2000-watt per capita society. This objective was explicitly elevated to an institutional level with formal and publicly made support from the ETH board for the 2000-watt society. Yet institutional priorities have since changed drastically. In 2008 a new presidency on the ETH board prompted a sudden shift in official energy strategy to a 1-tonne-CO₂ society (Boulouchos et al., 2008) with the 2000-watt vision dismissed as a mere ‘metaphor’ during a press conference (Morosini, 2010). One eventual consequence of this shift in strategy has been a financial downscaling of Novatlantis activities, which have now in effect been ‘outsourced’ to the City of Basel, industry and FHNW¹⁴. Despite such challenges, the 2000-watt society and Basel Pilot Region programme have survived. This appears largely due to steadfast political commitment to the 2000-watt goal—not just from Basel, but all over Switzerland¹⁵—as well as the stability of pilot region members¹⁶, many of who have been involved since its origins.

The 2000 Watt Society Pilot Region Basel programme is currently in a phase of re-visioning, with the City of Basel committing CHF 2.6 million for the period 2013-2017. By doing so, the City has clearly signalled the importance of the partnership in harnessing the necessary creative forces from academia, industry and local government to driving the sustainable transformation of Basel in view of a 2000-watt per capita target by the year 2075.

6.3 The Oberlin Project: Oberlin College, US

The Oberlin Project is an attempt to transform and revitalise the entire town of Oberlin, Ohio (population approximately 8000) in the USA. Located in the ‘rust belt’ extending over the mid-western and north-eastern states (Vey, 2007), Oberlin is surrounded by cities and towns struggling for survival with the decline of localised, heavy industries. The collaboration is a large-scale partnership between Oberlin College, the City of Oberlin, private enterprises, investors and civic groups. Largely initiated by David Orr—one of the forefathers of the academic sustainability movement—its origins lie in a resolve to simultaneously address interlinked and converging crises of climate change, peak oil, environmental degradation and economic decline (Orr; 2011B).

The collaboration has emerged since 2008 from a vision shared by David Orr, the President of Oberlin College and the City manager. The ultimate aim is to transform greater Oberlin into a

¹³ Martin, N. (2013) Interview by author. City of Basel, Switzerland, February 18.

¹⁴ Stulz, R. (2013) Interview by author. Zurich, Switzerland, February 12.

¹⁵ The City of Zurich for example has voted for inclusion of the 2000-watt society into its constitution, legally binding the City to pursuit of the 2000-watt target until 2050. Furthermore, the 2000-watt society is also integrated into Swiss federal energy policy.

¹⁶ Binz, A. (2013) Interview by author. Zurich, Switzerland, February 12.

prototype of post-fossil fuel prosperity based upon economic, social and environmental resiliency and sustainability. The partnership has fixed six goals: 1) Create climate positive town by shifting City and College to renewables, improving efficiency and drastically reducing carbon emissions; 2) Stimulate local economy through existing and new ventures in energy efficiency, solar deployment, food and sustainable resources; 3) Establish 20,000 acre green belt for supplying local foods, forestry and bio-fuel products and carbon sequestration; 4) Create sustainability educational alliance with local schools and college; 5) Convert 13-acre downtown block into 'Green Arts District', and finally; 6) Serve as replicable prototype for other communities (The Oberlin Project A). To this end, under the guidance of a core committee, members are divided into six teams around the themes of energy, economic development, policy, education, community engagement and foods, agricultural and land resources.

The project was originally conceived for implementation over seven years; the first two for feasibility studies and planning, and the latter for construction and implementation, which started in late 2011. Initial estimates for the entire project have been put at \$US140 million, with \$US55 for the first phase in a total of four (Orr). Funds are being sourced from a combination of private investments, state and federal support, tax credits, philanthropy and savings generated from improvements in energy, materials and water efficiency (Orr, 2011B). Described as a 'full spectrum sustainability' experiment (Orr, 2011A), the project functions as a de-centralised 'portfolio' of individual sustainability initiatives. Each is designed as part of a larger and integrated system contributing to the prosperity, resilience and sustainability of the larger community (Orr, 2011B). The following application of the five-channel framework is non exhaustive, merely providing a snapshot of innumerable initiatives being conducted by the various sub-groups.

- *Knowledge Transfer*
In the aim of laying the foundations for a rapid transition to a climate positive and resilient community, the Oberlin Project has both contracted to and worked with industry, regional agencies and think tanks to produce a series of reports and white papers¹⁷. Various themes covered include local knowledge on residential energy efficiency, green transport, local potential for wind and solar power, green jobs and investments, and policy options for sustainable transformations. Findings are shared with key stakeholders by College members who ‘translate’ results and ensure they are used to shape City strategies and policy¹⁸. The Climate Action Plan of Oberlin (City of Oberlin, 2013) is one example of this knowledge being transferred into actual policy.
- *Technical demonstrations and experiments*
The Oberlin Project is looking to foster innovative and unproven technologies and functions as a living laboratory for their demonstration and testing. One area in progress involves the integration of ‘socio-technical feedback’ from an Oberlin College born venture Lucid Design Group (Peterson, 2012). Based upon principles from natural systems that self-regulate via dynamic feedback, various pilot projects are being developed to provide real-time data on water/energy availability and consumption to building users and residents. Initiatives under way include the development and installation of ‘dashboards’ and dynamic data displays in residences and businesses, and the development and installation of a ‘bio-regional dashboard’ in the local library and elementary school¹⁹. Driven by Internet, these dashboards display live building and city-level data on water availability, usage and treatment, and energy production and consumption²⁰.
- *Technology transfer and economic development*
A key focus of the Oberlin Project is the transformation of the local economy into a ‘sustainability and new technology innovation district’ (The Oberlin Project B). To this end, project actors seek to foster local business ventures through support mechanisms such as local purchasing policies²¹. Such nurturing strategies are focused on energy efficiency, solar deployment and local resources such as food, timber and agriculture. Other future plans include the establishment of a ‘Green Business Park’ to both foster new and lure existing ventures to the area, in addition to generating venture capital via a community green investment fund²².
- *Reform of built or natural environment*
The physical core of the Oberlin transformation will be the development of a 13-acre ‘Green Arts District’ rated platinum level by the US Green Building Council. Through new construction and reform efforts, the district will comprise of an art museum, auditorium, hotel, restaurant, business complex, and other cultural facilities. The goal of initiatives in this channel is to create local employment, increase local revenue (Orr, 2011B) and re-spark the liveability and attractiveness of downtown. For ecological reform, this is driven by the acquisition of a 20,000-acre patchwork of land to be permanently designated for food, timber, bio-fuel and carbon sequestration projects.
- *Socio-technical experiments*
One large-scale initiative in this channel is an attempt to transform local agricultural

¹⁷ See for example, URL <http://www.oberlinproject.org/research-and-policy/policy-papers>

¹⁸ Braziunas, K. (2012) Telephone interview by author, December 7.

¹⁹ Ibid.

²⁰ See URL <http://www.oberlindashboard.org>

²¹ Braziunas, K. (2012) Telephone interview by author, December 7.

²² Ibid.

production and consumption. Efforts are currently fixed upon the mapping of local food flows from production, distribution, processing/manufacturing, storage and consumption to waste (The Oberlin Project C). This will lead to a system re-configuration to achieve 70% localisation throughout the entire chain over the next 20 years. Other planned socio-experiments include local policies to encourage uptake of energy efficiency upgrades and renewables in the civic and private sector.

There is a clear potential for the frontrunner institution of Oberlin College to leapfrog the widely promoted model of the entrepreneurial university and become a prototype of a ‘transformative institution’—one dedicated to co-creating societal transformations in view of materialising sustainable development. As evidence, firstly, Oberlin has already established itself as a pioneer in the campus sustainability movement by erecting in 1995 the Adam Joseph Lewis Centre, the first authentically green building in American higher education (Orr, 2011B). The impacts of this single monument on building practices have been vast, with the US Department of Energy dubbing the centre as ‘one of the 31 milestone buildings in the 20th century’ (William McDonough + Partners). Secondly, the sustainable transformation of Oberlin has become an institutional objective—and therefore mission—of the College. This may be observed from the direct involvement of the President as a lead partner, and a formal engagement to the Climate Positive Development Programme of the Clinton Climate Initiative²³.

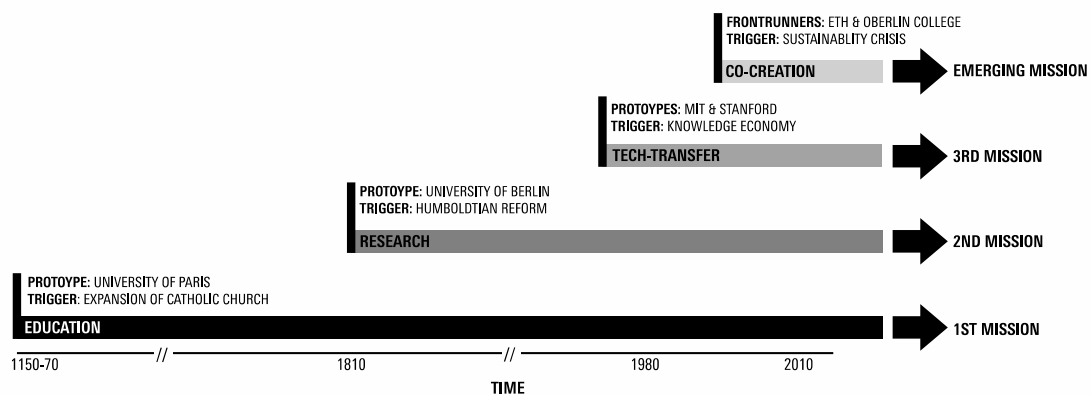
²³ Ibid.

Section 7. Future perspectives

As has become apparent until here, the characteristics of transformative universities and co-creative partnerships for sustainability transformations are fundamentally different to those of conventional third mission activities. These qualitative differences are clearly demonstrating that the global phenomenon of the entrepreneurial university does not constitute the final chapter in the evolution of the modern university.

By defining an ‘alternative’ mission, we are not implying that the university should reject the older, more established roles of education, research and technology transfer. Nor are we arguing that it is fully emerged or developed. On the contrary, the various missions of the university are continuously evolving and adapting to changes in the world at large, just as they co-exist and even synergise each other in certain establishments. The trajectory and form of the modern university has been influenced by societal triggers and front-runner institutions throughout history (Ford, 2002). As shown in Figure 4, the roots of the modern university stretch back for the better part of 1000 years to the University of Paris where the sole mission was education and training conducted in the context of the Catholic Church (Arbo and Benneworth, 2007; Ford, 2002). Viewed on such a timescale, the introduction of the second mission of research is a much more recent phenomenon triggered by the Humboldt-led establishment of University of Berlin in 1810 (Wittrock, 1993). More recent still is the appearance of the third mission and the role of technology transfer, whose roots date well back before the 1980 introduction of the Bayh-Dole Act (Mowery et al., 2004). Although fuelled by a complex array of interwoven factors (see Etkowitz, 2002) a major catalyst for the birth of the entrepreneurial species was clearly changes in scientific practices and government policy that reflected the transition to a ‘new’ or ‘knowledge-based’ economy’ (Etkowitz, 2000; Slaughter and Rhoades, 2004).

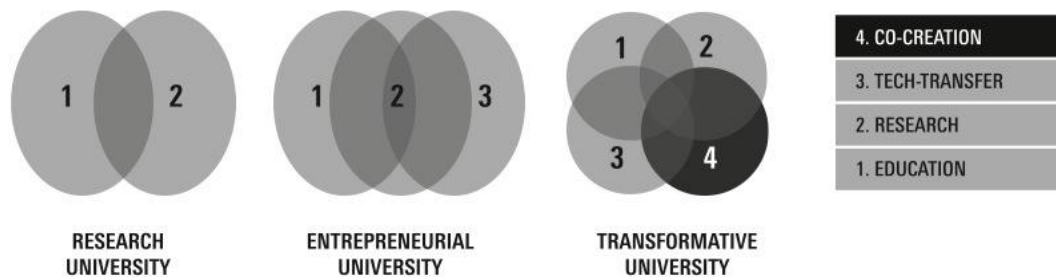
Fig. 4. Emergence of four missions with triggers and institutional prototypes and frontrunners



This is not to say these missions should be viewed in isolation, nor that the emerging co-creative function should become the sole focus of a particular institution. Just as entrepreneurialism and technology transfer do not bear great significance for many smaller or humanities focused institutions, neither would the mission of co-creation for sustainability become an institutional priority for many universities around the world. Instead, our argument is that in this evolutionary context it appears that the sustainability crisis is prompting the emergence of a new ‘species’—the transformative university. As illustrated in Figure 5, just as the missions of education, research and technology transfer are able to co-exist, overlap and re-enforce each other in both the research university and entrepreneurial university (Vorley and Nelles, 2008), we envision that co-creation for sustainability could potentially co-exist and compliment the first three missions in a transformative university. This was demonstrated in part by the two case studies where technology transfer and entrepreneurial efforts for commercialisation and economic development are implemented in the cadre of a

wider, comprehensive strategy for social, technical and environmental transformations.

Fig. 5: Co-existence and potential synergies of the four missions



Concerning the conditions necessary for further propagating the academic function of co-creation for sustainability, it should not be forgotten that the individual collaborations collated in our empirical research are presently little more than isolated niches formed by frontrunner individuals (Rotmans and Loorbach, 2008) and frontrunner institutions (Schneidewind and Augenstein, 2012). This interpretation from transitions theory implies that it is inconceivable at this early stage that the still immature function of co-creation for sustainability could immediately be scaled-up to the point of superseding the widely promoted and normalised third mission regime. That said, there is no reason to suggest that the role of co-creation for sustainability could not continue to evolve, expand and take root in academia in the form of either ‘niche-coalitions’ (ibid) or a ‘global niche level’ (Geels and Raven, 2006:387) where localised projects and experiences are connected via a global field or community. Of particular relevance here is the evolution of sustainability science (see Miller, 2012), which has progressed from a new and marginalised research field into a ‘vibrant discipline in its own right’ (Spangenberg, 2011:275) now present in numerous major research universities across the globe.

Although sustainability science is facing institutionalization issues of its own (Yarime et al., 2012), the expansion of this discipline has clearly been fuelled by the formation of global networks, which has in turn led to the establishment of dedicated journals, the hosting of annual conferences and the creation of research and education institutions and funding channels (Miller, 2012). In the same way, any scaling-up of the function of co-creation for sustainability towards a status capable of constituting a new mission for the university must also entail the formation of such networks across academia and other social sectors, in addition to the publication of results and sharing of experiences via journals and conferences. From this perspective, the 2012 ISCN Symposium at the University of Oregon, focusing on the ‘power of partnerships’ and off-campus sustainability initiatives, was clearly an important first step towards the institutionalisation of the function of co-creation for sustainability (ISCN, 2012).

Section 8. Conclusion

In this paper, we have described the key characteristics of what could be interpreted firstly as a significant deviation from the logic and practices of the third mission, and secondly, as the seeds of an alternative mission and species of institution emerging in response to the sustainability crisis. Our qualitative and empirical analysis depicts a radical paradigm shift in the social functions of the academy. A move from the idea of simply *contributing* to economic and societal development via technology transfer to actually *transforming* and *co-creating* society in the pursuit of sustainable development via a much broader range of channels, approaches and actors. The process of co-creation for sustainability and the transformative institutions that we have described involves a merging and synergising of diverse research and social engagement paradigms such as urban reform, transdisciplinarity, regional development and living laboratories, in addition to the integration of conventional technology transfer and commercialisation activities into a wider development and research agenda. These complimentary approaches are united under a framework built upon values of sustainable development; an alliance harnessing the knowledge and expertise from academic, government, industry and civic actors to the transformation of the physical, technological and social structures of a specific geographical location.

As we have shown with our macro-empirical analysis, the function that we term ‘co-creation for sustainability’ has emerged and established itself in a vast array of academic and social contexts in Europe, Asia and the US. Furthermore, with many alliances committed to the long-term pursuit of materialising sustainable development in a particular geographical area or sub-sector, this function appears set to continue developing and evolving for several years at least. The university is therefore being provided with a precious and growing occasion to renew its social contract and evolve in a direction more aligned to the societal and environmental needs of human settlements.

The policy implications of this evolutionary pathway and the emergence of a co-creative function for sustainability are vast. Government policy and discourses from influential organisations such as the OECD (1999; 2007) and the World Bank (Yusuf and Nabeshima, 2010) are currently axed on harnessing the creative and networking powers of the university to the goal of driving economic growth through the normative framework of a ‘third mission’ and ‘entrepreneurial university’. Yet simultaneous global and local manifestations of diverse sustainability challenges such as climate change, food, water and energy security, ecological decline and decaying socio-economic conditions are threatening the relevancy of pursuing economic development alone. The needs of human settlements in this century are situated at the intersection of social, environmental and economic interests. The question that therefore emerges is: *How can government policy and incentive systems such as funding mechanisms acknowledge this and encourage university actors to pursue a much broader development agenda founded upon place-based sustainability needs?* One answer to this question appears to be the preparation of specially earmarked research funds that have the ability to signal to university actors that place-based, collaborative and transformative efforts directed at the sustainability needs of external stakeholders is valued (Whitmer and al., 2010, Trencher et al., 2013). Funds fostering co-creative partnerships such as the Seventh Framework Programme in the EU and various federal and state green stimulus grants in the US appear to be one such solution. Yet the growth of the co-creative function is also posing institutional and organisational challenges for the university itself, which traditionally, has not actively rewarded or fostered transdisciplinary efforts seeking to generate socio-technical transformations addressing place-based needs (Crow, 2010; Yarime et al., 2012). Additionally, for the co-creative mission to gain further traction, it will also need to navigate existing incentive structures in academia centred on the legitimisation of new knowledge (through publications) and its potential for production (through research funding). Long-term

involvement with society, which is both complex and uncertain, sits at odds with academic career progression that values a constant stream of research outputs.

Regarding the limitations of this study, the most significant is related to its scope and selection criteria for cases, designed to ensure a consistent and systematic comparison. Yet in doing so we have overlooked the applicability of the transformative model of co-creation for sustainability in non-industrialised nations. Clearly, this is an area warranting future research as some large and prestigious research universities are working with diverse stakeholders to co-create sustainable communities in other less developed parts of the world. Furthermore, with our focus on the specific role of the university, we have not included many other cross-sector sustainability collaborations where the academy plays only a secondary role to other actors. Other limitations concern the availability of data. Although we have endeavoured to include all cases fitting our criteria, there are undoubtedly many others escaping our attention, both actual and completed. The global population of university collaborations for sustainability transformations is therefore yet to be fully quantified and assessed. Lastly, we have encountered many difficulties in gaining data for suitable cases in regions such as Asia and Europe due to linguistic reasons. This highlights the need for more information sharing across academia and more research, both qualitative and empirical, into the emerging trend of co-creation for sustainability.

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Appendix 1: Inventory of collaborations used for empirical analysis

Name	Lead academic institution(s)	Target area	Description & Focus	Collaboration period
EUROPE				
Campus Sostenibile	University of Milan, Polytechnic Institute of Milan	ITALY, Milan	Project to transform entire campus neighbourhood of both institutions into an exemplary urban model of quality of life and environmental sustainability.	2011 – n/a* Status: ongoing
City Lab Coventry	Coventry University	ENGLAND, Coventry City	Initiative to establishing Coventry City as a test-bed, incubation hub and international showcase for low carbon innovation, with focus in transport, buildings, IT, green business, high-tech start-ups.	2011 – n/a Status: ongoing
Corridor Manchester	Manchester Metropolitan University, University of Manchester	UK: Central Manchester (Oxford Road)	Aims to dramatically reform the built environment and infrastructure on 243 hectare strip of Oxford Road to create low-carbon hub of knowledge driven business activity, simultaneously generating economic growth and employment.	2007 – n/a Status: ongoing
EcoCities	Manchester University	UK: Manchester City	Seeks to provide Greater Manchester with a future scenario based blueprint for an integrated climate change adaptation strategy stretching to the year 2050.	2009 – n/a Status: ongoing
Energy Atlas	Berlin Institute of Technology	EU: Berlin	Development, application and transfer of decision-making and planning tool for making comprehensive assessments of energy demand, energy balancing and planning, based on a digital 3D model of Berlin city.	2011 – 2013 Status: ongoing
Heat and the City	University of Edinburgh	SCOTLAND, Glasgow & Edinburgh	Project to develop action-learning blueprint for catalysing transitions to sustainable district heating in 'cold climate' cities.	2011 – n/a Status: ongoing
Off4Firms	ETH Zurich	SWITZERLAND and EU	An incentive scheme for firms to reduce energy consumption and GHG emissions in employee households.	2010 – n/a Status: ongoing
OPTIMISM Optimising Passenger Transport Systems	Coventry University (Coventry University Enterprises Ltd)	EU wide	Project seeking to contribute to more sustainable and integrated transport system in Europe, by focusing on passenger behaviour and developing a modelling technique to visualise new and improved service offerings.	2011 – 2013 Status: ongoing
Plan Vision	University of Natural Resources and Life Sciences, Vienna	AUSTRIA: Freistadt	A co-research effort with the Town of Freistadt to clarify and integrate the relationship between spatial planning, energy demand and district renewable energy supplies. Results integrated into urban development and district biomass heating.	2009 – 2011 Status: completed
Projet MEU	Ecole Polytechnique Fédérale de Lausanne	SWITZERLAND, La Chaux-de-Fonds, Lausanne, Martigny et Neuchâtel	Partnership that has created IT visualization tools to aid monitoring and planning of energy usage in small towns, for local government.	2009 – n/a Status: ongoing
Retrofit 2050	Cardiff University	UK: Cardiff/South East Wales, Greater Manchester	Cross-institution research effort exploring retrofitting of the built environment as a means of bringing about the sustainable transformation of two UK urban centres for the period 2020-2050.	2011 – 2013 Status: ongoing
SUN Sustainable Urban Neighbourhoods	University of Liege	Meuse-Rhine Euregion	Participatory action research and multi-actor learning driven alliance to put seven urban neighbourhoods on pathway to sustainability and stimulate a stagnating socio-economic fabric.	2009 – 2012 Status: completed

Tecovoiturage	Université de Versailles Saint Quentin en Yvelines (Fondaterra)	1. FRANCE 2. Versailles, Saint-Quentin-en-Yveline	Free car sharing programme created in order to reduce transit related GHG emissions in both national higher education and Saint-Quentin-en-Yvelines, outer Paris.	2008 – ongoing Status: ongoing
TURaS	University College Dublin	Various cities across EU (Brussels, Dublin, London, Rome, Sofia, Ljubljana, Nottingham, Seville, Rotterdam, Stuttgart, and Aalborg)	Ultimate goal is to contribute to a EU wide transition to sustainability and resiliency by measuring and comparing transition demonstrations from various participating sites and producing a set of strategies and practical tools for exploitation by other European cities.	2010 – 2016 Status: ongoing
2000 Watt Society Pilot Region Basel	Swiss Federal Institute of Technology (ETH) domain (Novatlantis)	SWITZERLAND, Basel	Long-term effort to accelerate the transition to a ‘2000 Watt Society’ and promote sustainable development through various partnerships in Basel, with wider ambition of accelerating national de-carbonisation in mobility, buildings and urban development.	2001 – 2017 Status: ongoing
Urban Living Lab: Versailles	Université de Versailles Saint Quentin en Yvelines (Fondaterra)	FRANCE, Versailles	Collaboration to 1) carry out experiments in areas such as energy efficiency, EV transport, low-carbon urban planning, green jobs and 2) diffuse already completed or ongoing sustainability initiatives into the community and accelerate the transition to sustainable development.	2011 – n/a Status: ongoing
Urban Transition Øresund	Lund University	SWEDEN & DENMARK, Øresund region	Alliance to promote sustainable growth in the Øresund Region by mobilising municipalities, universities and businesses for cross-border cooperation. Aims to develop cross-border methods and tools for sustainable urban transformation within 1) sustainable planning processes 2) sustainable construction and 3) financing.	2011 – 2014
Verdir	University of Liege	BELGIUM, Greater Liege	Transform industrial waste zones into centres of urban agriculture and aquaculture, stimulating the local economy and creating employment.	2012 – n/a Status: ongoing
ASIA				
Jeju Island Wind Farm	Jeju National University	KOREA: Jeju Island	Technology-driven effort to drive the development of the wind power industry on Jeju Island, creating jobs, boosting the local economy and building a sustainable energy base.	2004 – n/a Status: ongoing
SIM-Drive	Keio University	JAPAN: Fujisawa City & Ota-ku Tokyo	Collaborative R&D and commercialisation project for electric lithium-ion technology powered EVs. Flagship project consists of 8-wheeled 100% electrical bus prototype. In the goal of accelerating societal shift to EVs, now launched as venture supplying R&D and consulting services to industry.	2009 – n/a Status: ongoing
Sustainable Supply Chain Centre Asia Pacific	Singapore National University	1. SINGAPORE 2. Asia-Pacific	Responding to predicted growth of trade and commerce in Asia, collaboration based out of National University of Singapore to develop the knowledge and business tools to diffuse green logistics and supply chain innovation.	2011 – n/a Status: ongoing
Urban Reformation Program for the Realisation of a Bright Low Carbon Society	University of Tokyo	JAPAN: Chiba, Kashiwanoha	Large-scale applied research driven initiative to design blueprint for low-carbon, elderly citizen friendly community and demonstrate its feasibility via demonstration projects.	2010 – 2015 Status: ongoing
NORTH AMERICA				

Alley Flat Initiative	University of Texas	USA: Austin, Texas	Initiative proposes new 'alley flats' as sustainable and affordable housing alternatives for Austin; detached residential units that utilize Austin's underused network of alleyways to increase availability of affordable housing.	2005 – n/a Status: ongoing
Carbon Solutions New England	University of New Hampshire	USA: New Hampshire, New England	Partnership to promote collective action in pursuit of a low carbon society for New England. Targeting areas such as GHG emissions & economics analysis, climate action plan, green economy and clean energy, sustainable forest yields, analyses and research results are communicated to key decision-makers.	2008 – n/a Status: ongoing
Central Massachusetts Sustainable Energy Cluster	Clarke University (Institute for Energy & Sustainability)	USA: Massachusetts, Worcester	Strategic alliance to build a clean energy and renewable cluster zone to spur transition to low-carbon economy in Worcester and the surrounding area. In addition to luring existing businesses, also provides training, consulting and start-up assistance.	2009 – n/a Status: ongoing
Climate Friendly Farming Project	Washington State University	USA: Washington State	A project headed by WSU seeking to help local dairy, dryland grain and irrigated vegetable farmers develop sustainable agricultural practices that mitigate climate change.	2003 – 2010 Status: completed
East Bay Green Corridor	University of California, Berkeley	USA: California, East San Francisco	Alliance to build high-tech green economy and renewable energy and business infrastructure in the East Bay area of San Francisco by constructing new green cluster zone for spin-off firms from UCB and LBNL and attracting existing companies to area.	2007 – n/a Status: ongoing
Grand Rapids Community Sustainability Partnership	Grand Valley State University	USA: Michigan, Grand Rapids	Academic-city formed partnership, with over 200 businesses, institutions and organisations are mobilized in coalition to revitalise rust-town of Grand Rapids and promote sustainability in diverse areas such as building, economy, energy, food and water, waste and alternative fuels.	2005 – n/a Status: ongoing
Green Corridor	University of Windsor	CANADA: Ontario, Windsor	Project integrating public art, sustainable technologies, scientific monitoring and public information along two kilometers of roadway at Canada-USA border crossing. With a grassroots engagement, members and students are engaged in process transforming built and natural environment, infrastructures, energy production and socio-cultural fabric of area.	2003 – n/a Status: ongoing
NYC Solar American City Partnership	City University of New York	USA: Various areas across NYC	Through Solar American City Partnership, a collaboration to accelerate the diffusion of solar energy across NYC grid. Focused on creating solar mapping and zoning tool to determine most effective locations for solar installations, and also developing web-based platform to assist residents with permit and funding applications for solar installations.	2010 – n/a Status: ongoing
Oberlin Project	Oberlin Project	USA: Ohio, Oberlin	Ambitious project initiated by David Orr and Oberlin College to rejuvenate the town of Oberlin by transforming it into a prototype of a self-sufficient, prosperous and resilient post-fossil fuel community.	2008 – 2017 (tentative) Status: ongoing
Retrofit NYC Block by Block	Pratt Institute	USA: New York City: Brooklyn	Programme to help New York property owners in six boroughs exploit state and federal fiscal incentives to weatherise their buildings and take measures to increase energy efficiency. Is a continuation of Retrofit Bedford Stuyvesant project.	2010 – n/a Status: ongoing
Rust to Green Utica	Cornell University	USA: New York, Utica	Participatory action research effort to connect key stakeholders and generate strategies and projects that will trigger Utica's transition from a 'rust town' to a green economy.	2010 – n/a Status: ongoing

SEED Wayne	Wayne State University	USA: Michigan: Detroit	Largely student driven effort to collaboratively build sustainable food system on campus and in local community of Detroit. Involves student-run vegetable and herb gardens on campus, weekly farmers market and local produce selling initiatives.	2010 – n/a Status: ongoing
Smart City San Diego	University of California, San Diego	USA: California, San Diego	Effort to accelerate regional transition to green economy and hasten diffusion of smart grid technologies, EVs, charging infrastructure and renewable energy.	2011 – n/a Status: ongoing
Sustainable City Year Program	University of Oregon	USA: Oregon, Gresham, Salem, Springfield	To drive sustainable community change in various cities across the state of Oregon by applying the educational and research resources of the university to a city for one full academic year. In this service learning programme, 20-30 courses across several disciplines work on designing and implementing projects.	2009 - n/a Status: ongoing
UniverCity	Simon Fraser University	CANADA: British Columbia, Burnaby	New development of mountain top area on campus grounds into sustainable, compact and multi-use community for 10,000 residents. Includes residences, shops and services and school.	1995 – n/a Status: ongoing
Yale Community Carbon Fund	Yale University	USA: Connecticut: New Haven	Initiative targeting low-to-moderate income homes as part of carbon offset initiative. Programme saves homeowners money by installing programmable thermostats and conducting weatherisation.	2010 – n/a Status: ongoing
TOTAL:				38

* (n/a) Information not available