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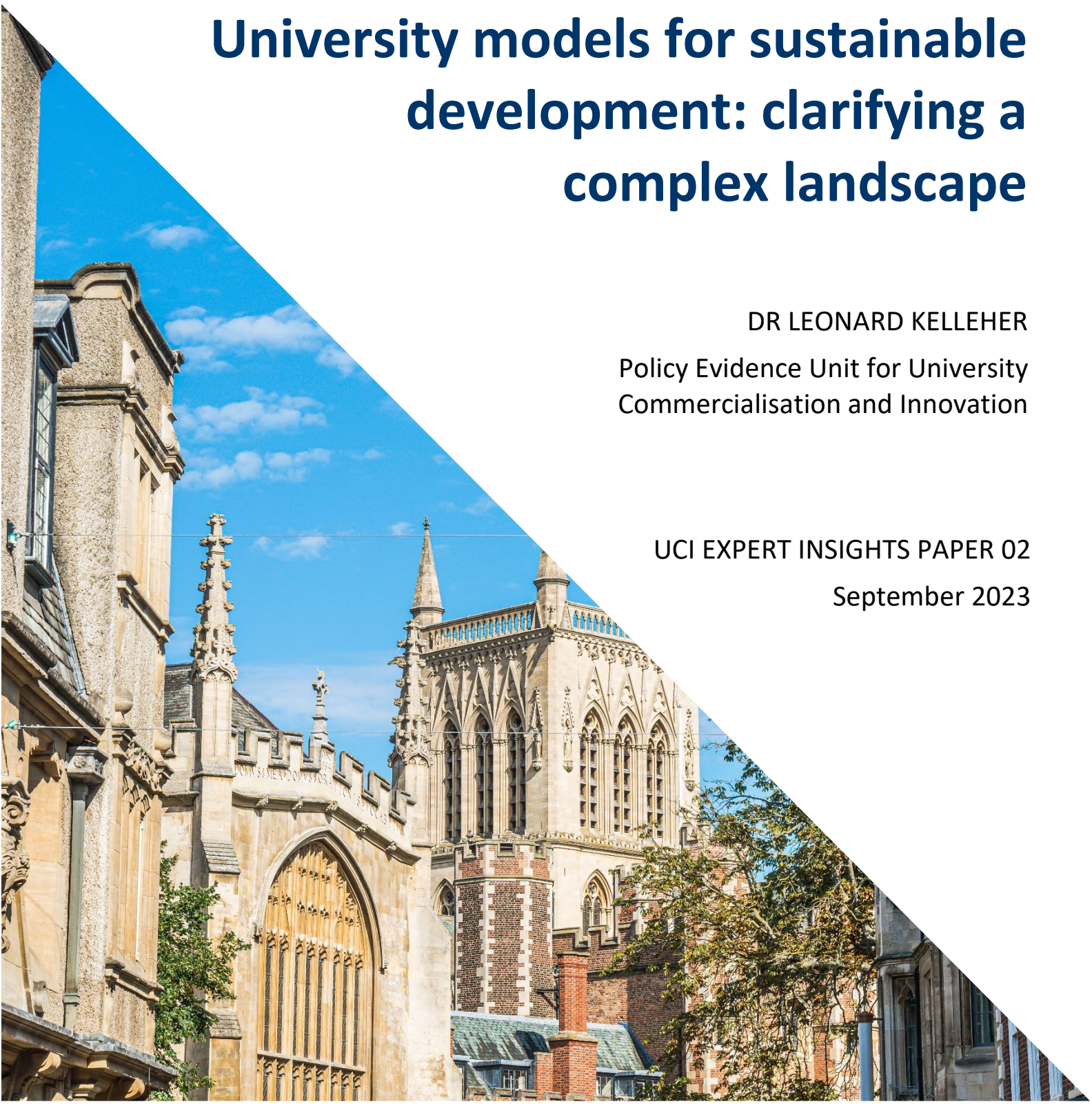
University models for sustainable development: clarifying a complex landscape



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University models for sustainable development: clarifying a complex landscape

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Universities are increasingly expected to play a more active role in driving sustainable development by boosting the pace of innovation and shaping its direction towards sustainable and equitable futures. Some argue that they are not rising to this challenge with the urgency commensurate with scientific warnings. In this insights paper, Dr Len Kelleher of the Policy Evidence Unit for University Commercialisation and Innovation (UCI), based at the University of Cambridge, explores the university models available to inform leaders' efforts to configure their institutions towards sustainable development. Further work is needed to inform how these models are being adopted and combined in real-world universities.

We are living through a 'polycrisis', a particularly turbulent period of human history, disrupted by interrelated environmental, geopolitical and socioeconomic risks (WEF, 2023). To avoid future crises and build resilience to those that do emerge, policymakers aim to harness science, technology and innovation (STI) systems to drive sustainable development (OECD, 2023). Universities are being called on to play more active roles in boosting the pace of innovation and shaping its direction to enable societal transitions towards more sustainable and equitable futures. Achieving these ambitions will depend, in part, on universities' ability to adopt new models, incorporate new resources and capabilities, and work in new ways. However, whether they can achieve this is uncertain, given that they are typically regarded as stable, loosely-coupled and risk-averse organisations (Bui and Baruch, 2013).

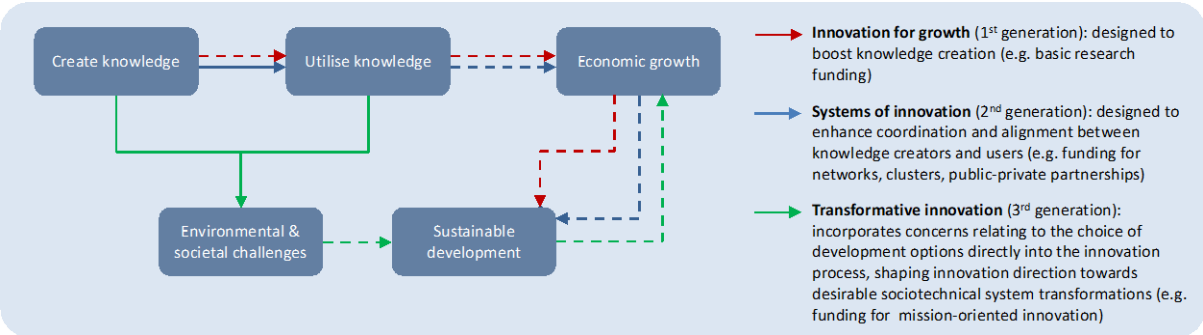
In this insights paper, I explore what university 'models' – proposed conceptualisations regarded as important by their advocates – have emerged to help inform leaders' efforts to shape their institutions' portfolio of innovation-focused activities to drive sustainable development. I begin by introducing the three generations of STI policy which have shaped policymaking over the last eighty years, highlighting their inherent weaknesses in driving innovation towards sustainability. I then describe the range of old, evolving and new university models associated with these generations.

The evolution of STI policy

STI policy has evolved through three generations over the last eighty years (Schot and Steinmueller, 2018). Each has a different rationale for state intervention, and include differing assumptions concerning how policy contributes to economic growth and sustainable development (Figure 1):

- **Innovation for growth** (1st generation) – market failures limit private investment in research, justifying state intervention to boost knowledge creation. It is assumed that knowledge transfer follows, generating economic growth. Sustainable development is assumed to follow economic growth and regulation
- **Systems of innovation** (2nd generation) – system failures impede knowledge flows within innovation systems, justifying state intervention to enhance coordination and alignment between knowledge creators and users, build capabilities to innovate, and strengthen knowledge-based linkages between individuals and organisations. Again, it is assumed that economic growth follows, with both this stimulus and regulation leading ultimately to sustainable development
- **Transformative innovation** (3rd generation) – transformative system failures impede the development of sociotechnical systems along acceptable trajectories. State intervention is justified not only to boost the pace of innovation, but also to shape its direction through incorporating environmental and societal concerns explicitly into the innovation process. It is assumed that this generates sustainable development, which in turn generates economic growth.

Figure 1| Three generations of STI policy



A solid line indicates an aspect that has been explicitly addressed whereas a dashed line indicates an aspect that is expected to follow automatically once some prior activities have been conducted.

Source: (Daniels et al., 2020).

Each generation also includes inherent weaknesses regarding sustainable development. First generation policies emphasise scientific breakthroughs and technological challenges associated with social and environmental needs, but neglect long-term sociotechnical systems transformation and may exclude non-research actors from innovation processes. Second generation policies focus on stimulating entrepreneurship or improving knowledge producer/user coordination in relevant areas, but may exclude civil society from innovation processes and also promote incremental rather than transformative change. Third

generation policies emphasise anticipation, bottom-up experimentation and learning within innovation processes for social and environmental needs in order to create conditions for deep sociotechnical system changes.

Old, new and evolving university models

The increasing urgency associated with sustainable development has seen both the evolution of well-established university models and the emergence of new models regarded as important in meeting challenges of the polycrisis. Here, we summarise a range of models associated with all three generations of STI policy, highlighting current gaps in our knowledge.

First generation policies incentivise universities to boost knowledge creation, but not its purposeful diffusion and exchange (what we refer to in the UK as knowledge exchange or KE). Historically, these policies have been most frequently associated with the **knowledge factory** model of the university (Youtie and Shapira, 2008), wherein knowledge spillovers are seen as enabling new knowledge to be utilised by nearby firms to drive innovation.

Regarding sustainable development, first generation policies emphasise scientific breakthroughs and technological challenges associated with social and environmental needs (Daniels et al., 2020). However, no university model focussing specifically on breakthrough research has yet emerged. This is an important gap in our understanding, considering that a number of countries have established advanced research and innovation agencies modelled on the Defense Advanced Research Projects Agency which will seek to work with universities to accelerate future-oriented and breakthrough innovation projects (e.g. the UK's ARIA, Germany's SPRIN-D, South Korea's K-DARPA and ARPA-H in the US).

Second generation policies incentivise universities to improve knowledge creator/user coordination as a means to boost the efficiency and effectiveness of knowledge flows. Because this can be achieved through a wide range of KE channels, a variety of university models are associated with these policies:

- **Relational university** emphasises KE linkages between universities and large firms (Uyarra, 2010)
- **Entrepreneurial university** was originally conceived as a whole-of-university approach to pursuing non-traditional opportunities for growth (Clark, 2001), but is now often associated with academic/student entrepreneurship and licencing, supported by university IP policies and structures including technology transfer offices, incubators and science parks (Etzkowitz et al., 2000)
- **Systemic university** focuses on the university's systemic boundary-spanning role within regional clusters and supply chains, particularly involving small and medium enterprises, and within university-government-industry networks (Etzkowitz and Leydesdorff, 2000; Hughes and Kitson, 2012; Lester, 2005)

- **Civic/engaged university** emphasises a broader role for the university in addressing the development needs of regional partners including industry, government and civil society (Chatterton and Goddard, 2000; Gunasekara, 2006).

The increasing importance of sustainability has seen an emerging evolution of these models towards innovation for sustainable development. Examples include the civic/engaged university acting as a change agent for regional sustainability transitions (Peer and Stoeglehner, 2013; Radinger-Peer and Pflitsch, 2017; Sedlacek, 2013) and the entrepreneurial university pivoting towards innovation that is both sustainable and economically viable (Menter, 2023; Sarpong et al., 2023; Wakkee et al., 2019).

Third generation policies incentivise universities to shape the direction of innovation along socially acceptable trajectories. A new range of models are emerging to describe how this may be achieved, some of which are highlighted below:

- **Human development university** focuses on the university shaping its teaching, research and impact missions to build people's capabilities, empowering them to act more sustainably (Boni, Lopez-Fogues and Walker, 2016; Boni and Gasper, 2012; Boni and Walker, 2013)
- **Developmental university** emphasises the incorporation of the UN Sustainable Development Goals into university teaching, research and impact missions to shape the long-term sustainable development needs of specific geographical areas (McCowan, 2016, 2019)
- **New power university** advocates an expanded third university mission of social responsibility, incorporating a set of values focussing on participation, network governance and radical transparency (Grant, 2021)
- **Purpose-driven university** emphasises the university reconfiguring its three missions under an overarching purpose of strategically contributing to the long-term wellbeing of all people and the planet (Hurth and Stewart, 2022)
- **Transformative university** calls for the adoption of a new and fourth university mission of co-creation for sustainability to address local sustainability issues by managing sociotechnical and environmental transformations in a given geographical area (Guzmán-Valenzuela, 2016; Parker and Lundgren, 2022; Trencher et al., 2014).

Navigating the landscape

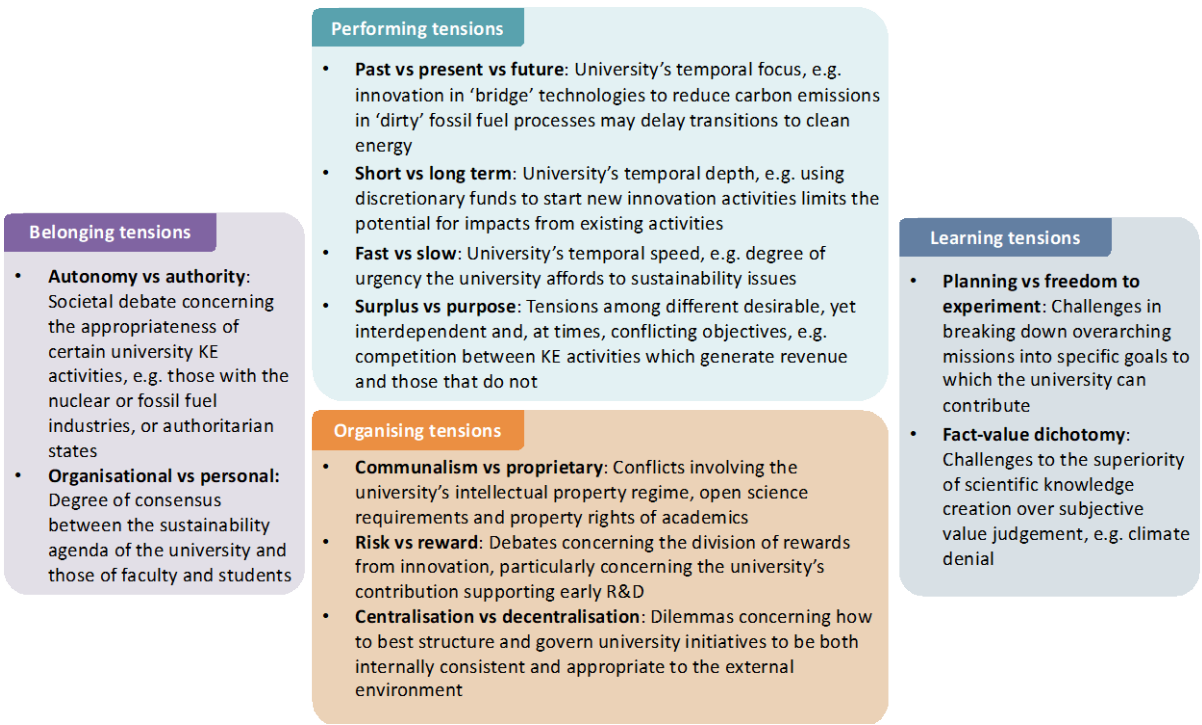
The concept of 'sustainability' is itself ambiguous, contested, and 'intertemporal' – i.e. strategic choices considered sufficient today may be regarded as insufficient tomorrow (Garud and Gehman, 2012; Geels, 2011). Even though universities have historically been at the forefront of sustainable development efforts, warnings are now being sounded that they are not going far or fast enough in tackling urgent societal challenges (Bulten et al., 2021; Stephens, Frumhoff and Yona, 2018; Urai and Kelly, 2023). This means that university leaders will have to consider how best to configure their universities to contribute to both sustainable development and economic growth on a dynamic and ongoing basis.

The complex landscape of available models discussed here can help inform leaders' efforts to configure and reconfigure their universities. However, it also raises a number of questions which require further research.

First, we need to better understand what models university leaders are using to inform their reconfiguration efforts to address the growing emphasis on sustainable development. While a consensus has not yet emerged, conceptual arguments have been made that transformative universities are best suited to solve humanity's most wicked problems (Giesenbauer and Müller-Christ, 2020; Giesenbauer and Tegeler, 2020; Loorbach and Wittmayer, 2023). But in adopting a transformative model, universities must recognise that knowledge production addressing sustainable development goals is more complex than other forms of knowledge production, must be aware of the trade-offs and co-benefits between these goals and how these interactions contribute to transformative change (Romero-Goyeneche et al., 2021).

Second, we need to develop better approaches to enable universities to tackle 'wicked problems', characterised by high levels of complexity, uncertainty and contestation. For example, the ambiguous and contested nature of sustainability will see universities increasingly experience 'tensions' – contradictory, conflicting or inconsistent demands that seem to require the selection of one or the other (Bartunek and Rynes, 2014). A selection of tensions raised by university academic and KE leaders in the course of UCI's programme of work is summarised in Figure 2. We are currently exploring approaches to how such tensions can be strategically managed.

Figure 2| Selection of tensions experienced by university leaders associated with their portfolio of innovation-focused activities



Third, we need to know more about *how* real world universities can (re)configure to adopt new models and combine them with existing models. In our recent report (Ulrichsen and Kelleher, 2022), we identified that university leaders saw their institution's 'dynamic capabilities' – their high-level abilities to sense and shape opportunities and threats, to seize opportunities, and to transform operations to support long-term growth – as being important in reconfiguring to meet the challenges of the post-pandemic landscape. We at UCI are currently exploring the types of capabilities universities have used to enable these dynamic capabilities.

Conclusion

Policymakers and societies want to see universities play more active roles to boost and shape innovation for sustainable development. If universities are to meet these ambitions, they must incorporate new resources and capabilities, and work in new ways. Consequently, the choice of model university leaders draw upon to shape their institutions' portfolio of innovation-focused activities is an increasingly critical strategic consideration.

With this insights paper, I hope to assist leaders in this process by clarifying the range of models currently available, the assumptions and weaknesses inherent in the policy thinking which has shaped their emergence, and factors to consider in choosing which model to adopt. I also highlight the need for further research to inform the adoption and expansion of these idealised models in real-world universities.

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