

**From an entrepreneurial university to a sustainable entrepreneurial university:  
Conceptualization and evidence in the contexts of European university reforms**

Yuzhuo Cai & Ijaz Ahmad

Cai, Y., and Ahmad, I. (2021) 'From an entrepreneurial university to a sustainable entrepreneurial university: Conceptualization and evidence in the contexts of European university reforms.' Higher Education Policy. doi: 10.1057/s41307-021-00243-z

**Abstract**

Both the transformation from innovation systems to innovation ecosystems and university reforms in such a context require a renewed understanding of the nature of universities and their roles in society. While the recent flourishing concepts about new models of universities suggest that the notion of an entrepreneurial university needs to be replaced by a more suitable concept to capture the unprecedented changes in universities in the societal transformation, the features of a new model of university described by these concepts can hardly fit into a consistent framework. This paper responds to this research gap by integrating both conceptual and empirical literature about the transformations or reforms of universities, mainly in the European context. Our major research findings are as follows. First, we identified characteristics of an ideal-type university in innovation ecosystems, named a sustainable entrepreneurial university (SEU), in comparison with those of an entrepreneurial university. Second, we elaborated on three emerging roles of the SEU in innovation ecosystems. Third, we found that while a transition from entrepreneurial universities to SEUs can be seen in European university reforms, the paces of the transformations vary. At the end of the paper, we discuss the scholarly and policy implications of our research findings.

**Keywords:** sustainability, sustainable development goals, social responsibility, innovation ecosystem, higher education, literature review

## Introduction

Studies on knowledge-based societies have been increasingly focusing on two intrinsically interrelated transformations: societal transformation and university transformation (Cai, 2017). In addition to the shift from knowledge society 1.0 to knowledge society 2.0 (Rutten and Boekema, 2012), a new era towards which our contemporary society is transforming has been labelled as, for example, globalization 3.0 (Friedman, 2005), industry 4.0 (Ustundag and Cevikcan, 2018), and innovation ecosystems (Carayannis *et al.*, 2018). Of these concepts, the innovation ecosystem is a more inclusive concept that accentuates the ecologic and sustainable aspects of innovation systems (Oh *et al.*, 2016). In the context of societal transformation from an innovation system to an innovation ecosystem, a university does not merely serve as a primary engine for economic growth through knowledge transfer (Etzkowitz, 2008); rather, it is required to be more socially responsible (Grau *et al.*, 2017; Sørensen *et al.*, 2019), support sustainable development (Barth *et al.*, 2015) and promote social innovation (Georghiou, 2018). As stated by UNESCO's chief for higher education, Peter J. Wells (2017, 31), 'Perhaps never before in recent history has the role of higher education been so intricately tied to the economic, social, and environmental fabric of the modern world'. The societal changes demanding universities' broad roles also call for and lead to transformations (disruptive innovations) within higher education (Cai, 2017).

The societal transformation is reflected in the European Union (EU) policies calling for a transformation from an innovation system to an innovation ecosystem (Gretschmann and Schepers, 2016; Benedetti Fasil *et al.*, 2017), which has been reflected in the shift from the Lisbon Strategy (European Parliament, 2000) to the Europe 2020 Strategy (European

Commission, 2010). Fischer *et al.* (2010, 1) claimed that, ‘The Lisbon Strategy, with its predominantly supply-side and market-liberal orientation, has failed because it did not recognize the need for a European policy-mix’. To overcome the weakness of the Lisbon Strategy, the Europe 2020 Strategy was initiated ‘to boost European economy and promote a smart, sustainable, and inclusive growth, based on a greater coordination of national and European economic policy’ (European Federation for Elevator Small and Medium-sized Enterprises aisbl, 2010). In the context of societal transformation towards innovation ecosystems, European universities are required to reform themselves and transform their societal engagement roles (Gretschmann and Schepers, 2016; Reichert, 2019).

Innovations in both society and universities call for a renewed understanding of universities, especially in terms of their relations with society. As such, the notion of an entrepreneurial university (Etzkowitz, 1983; Clark, 1998), which has been widely regarded as a normative model for reforming universities in a knowledge-based economy, is showing its limitations in capturing the emerging features and roles of universities in innovation ecosystems. Although the concept of an entrepreneurial university is still popular in higher education studies, its applications are mainly for analysing universities’ economic contributions to society (Leisyte and Horta, 2011; Audretsch, 2014; Etzkowitz *et al.*, 2021). In such a context, universities are perceived as economic entities, commoditized knowledge producers, shapers of human capital, and crucial actors in networks (Boucher *et al.*, 2003). The concept of an entrepreneurial university is also discussed together with other similar ones in the literature on higher education research and innovation studies, including academic capitalism (Slaughter and Leslie, 1997), mode 2 knowledge production (Gibbons, 1998), and the third mission of universities (Etzkowitz *et al.*, 2000). All these concepts, to varying extents, tackle the economic functions

of universities, the conditions influencing the universities' performance of their economic roles, and related changes and challenges within universities.

Nowadays, universities' societal engagement roles are not merely on the economic dimension but also on the social dimension (Karlsen and Larrea, 2019; Cai and Liu, 2020; Perkmann *et al.*, 2021). Over the past decade, a few new concepts have been formulated to respond to the current transformation in higher education, such as civic university (Goddard and Vallance, 2013; Goddard *et al.*, 2016), ideas of a university ecology (Wright, 2016), engaged university (Benneworth, 2013), responsible university (Sørensen *et al.*, 2019), university 4.0 (Giesenbauer and Müller-Christ, 2020), and responsible research and innovation (RRI) (von Schomberg, 2011). All of these concepts have been proposed by European researchers based on observing, analysing, and predicting the transformations in European higher education largely as responses to the EU's innovation strategies. There are also concepts, such as sustainable university (Beringer, 2007), third-generation university (Wissema, 2009), mode 3 knowledge production (Carayannis and Campbell, 2012), socially responsible university (Grau *et al.*, 2017) and entrepreneurial university 2.0 (Liu and Van Der Sijde, 2021), which were developed based on the experience beyond the European context.

Although these findings suggest that the notion of an entrepreneurial university needs to be replaced by a more suitable concept to capture the changing features of universities, few studies have compared these concepts. This hampers advancing knowledge through synergy building. Moreover, the development of these new concepts is mainly based on the experiences of a small number of cases. There is little research trying to verify these concepts in broad empirical

settings. Furthermore, studies that have proposed new models of universities are often conceptual papers, with little attention paid to methodological considerations.

This paper aims to bridge these gaps by asking the following research questions: 1) How can the existing concepts that capture the new features of universities be compared? 2) How can the insights of existing concepts of universities be integrated to better conceptualize what a university ought to be in innovation ecosystems? 3) How is the transformation from the notion of an entrepreneurial university to a new model of university reflected in European university reforms? Our answers to these questions are based on synthesizing studies that conceptualize new models of universities and empirical studies on university reforms in Europe by following a rigorous methodological design. We focus on the European experience because the dynamics in European higher education reforms largely reflect the interplay between the dual logics of *being economically responsible* and *being socially responsible*, which underline innovation ecosystems (Lattu and Cai, 2020). The Europe 2020 strategy can be understood as the EU's vision and endeavour to build innovation ecosystems in Europe (Carayannis *et al.*, 2018).

The rest of the paper is structured as follows. In the second section, we introduce our method of writing a conceptual paper based on a literature review analysis. In the third section, we compare the advantages and disadvantages of the emerging concepts of universities. The findings of the comparison suggest the need to replace the entrepreneurial university concept with a new university model in line with the current development for building innovation ecosystems. In the fourth section, we synthesize the insights of the existing concepts of universities to better conceptualize an ideal-type university that has evolved from an entrepreneurial university. Here we label the ideal-type university as a sustainable

entrepreneurial university (SEU). In the fifth section, we discuss how universities' reforms in Europe evidence the transition towards the SEU. Lastly, we conclude with the scholarly contributions and policy recommendations of our research.

## **Methodology**

### ***Research design***

As a conceptual paper, our research design follows Jaakkola's (2020) suggestions on the methodology for writing conceptual papers. According to Jaakkola, empirical and conceptual papers share a common goal for knowledge advancement and common elements in research design. For instance, 'in the case of conceptual papers, arguments are not derived from data in the traditional sense but involve the assimilation and combination of evidence in the form of previously developed concepts and theories' (Jaakkola, 2020, 19). As such, when writing a conceptual paper, one should also determine, for example, what data in the form of theories and concepts are needed to address the research questions and then plan criteria for data collection, that is, selecting literature. The strategies for selecting theories and concepts (as research data) in a conceptual paper depend on two different research goals: 1) to apply existing theories, concepts, and analytical tools to conceptualize a focal phenomenon that is observable but not adequately addressed in the existing research and 2) to apply existing theories, concepts, and analytical tools to improve a particular concept, theory, or research domain that is internally incoherent or incomplete in some important respect (Jaakkola, 2020). In our study, our goal was close to the second one. Specifically, we tried to address shortcomings we identified in the existing literature: while the flourishing concepts about new models of universities suggest that the notion of entrepreneurial university needs to be replaced by a more

suitable concept to capture the unprecedented changes of universities in innovation ecosystems, the features of a new model of university (in the post-entrepreneurial university era), described, or implied by these concepts, are not always consistent with each other.

Our strategy to address this gap is to build synergy among the concepts. Thus, we applied the 12-dimension framework for comparing traditional ivory-tower universities and entrepreneurial universities developed by Etzkowitz (2017) and Etzkowitz *et al.* (2019) as an analytical tool to conceptualise an ideal-type university in innovation ecosystems by synthesizing the insights of existing concepts about new models of universities. The ideal type, as a conceptual tool originally proposed by German sociologist Max Weber (1864–1920), refers to a mental construct for the systematic characterization of a concrete situation. Specifically, it is defined as ‘formed by the one-sided accentuation of one or more points of view and by the synthesis of a great many diffuse, more, or less present and occasionally absent concrete individual phenomena, which are arranged according to those one-sidedly emphasized viewpoints into a unified analytical construct’ (Weber, 1904, 147). Given the specific objective, the foremost data used in our research were the studies that conceptualize the new features of universities. Moreover, we also used the empirical literature on European university reforms to verify how a transition towards an ideal-type university can be seen in practice. Such data go beyond Jaakkola’s (2020) suggestions.

### ***Methods of searching and selecting literature***

In our search and identification of relevant literature, we borrowed the methods used in literature review research, in which traditional and systematic techniques are distinguished (Jesson *et al.*, 2011). The traditional literature review is ‘often based on a personal selection of

materials because the writer believes the original authors have some important contribution to make to current knowledge' (Jesson *et al.*, 2011, 15). The systematic review requires more rigorous procedures to select the literature (Arksey and O'Malley, 2005).

In the search for the conceptual literature about new models and the roles of universities, we applied the traditional approach because of our familiarity with both higher education and innovation studies on new models of universities and universities' societal engagement throughout our research experience and ongoing research projects. Nevertheless, we acknowledge our limitations in following the explosive growth of academic publications. Thus, we also tried to find useful references by consulting some literature review articles on related topics, such as higher education social responsibilities (Hayter and Cahoy, 2016), university social responsibility (Jorge and Peña, 2017), RRI (Burget *et al.*, 2017) and regional academic entrepreneurship (Lopes *et al.*, 2020). Our identified studies dealing with new models of universities and new roles in universities' societal engagement are listed in Appendix I.

When searching the empirical literature on university reforms in Europe, we followed the method of a systematic literature review. The literature search and selection were conducted in four steps. The first step was to select the relevant academic journals for our analysis. By consulting the lists of important higher education journals provided by Tight (2012), Kosmützky and Krücken (2014) and Vlegels and Huisman (2020) in their systematic literature reviews of higher education research, we identified 22 journals (all included in Scopus® databases) relevant to our research.

The second step involved selecting articles as sources of data for our analysis. We used the search words that covered reforms/transformations concerning higher education institutions'



engagement with society, government, business and citizens. These words were connected with various Boolean operators (see Table 1) to make an intelligent search query among the selected journals in the Scopus® databases. We matched these search words with the titles, keywords, and abstracts of the sources in our identified 22 journals. The period of publication was set from 1991 to 2019. The search was conducted on 9 July 2019, yielding 126 articles.

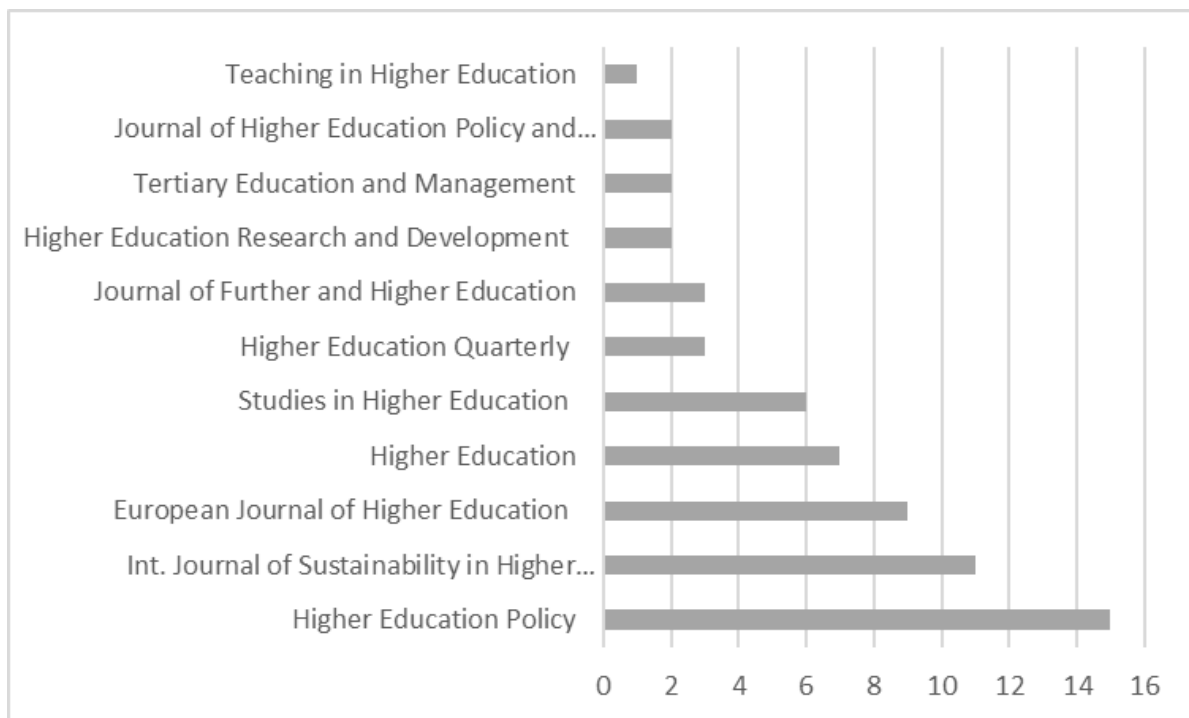
**Table 1. Search words, Boolean relations and justifications**

Search words and Boolean relations	Reasons for using the words
<p>TITLE-ABS-KEY = university OR higher education OR college</p> <p>AND</p> <p>TITLE-ABS-KEY = social engagement OR social-engagement OR community engagement OR community-engagement OR outreach OR public engagement OR {public-engagement OR community-campus partnership OR civic-engagement OR civic engagement OR collaboration OR stakeholder OR knowledge transfer OR knowledge-transfer OR commercialization OR start up OR spin out OR spin off OR start-up OR spin-out OR spin-off OR industry-academia OR industry academia OR academia-industry OR academia industry OR university-industry OR university industry OR industry-university OR industry university OR societal-engagement OR societal engagement OR societal-mission OR societal mission OR third-mission OR third mission OR citizenship</p> <p>AND</p> <p>TITLE-ABS-KEY = reform OR transform OR innovation</p>	<p>These words were chosen to limit the literature studies about higher education institutions.</p> <p>These words describe the activities related to universities' societal engagement.</p>
<p>TITLE-ABS-KEY = reform OR transform OR innovation</p>	<p>These words were chosen to identify articles dealing with transformations and profound changes.</p>

In the third step, we narrowed down our literature selection by manually checking the abstracts of each of the 126 articles. As our goal was to identify empirical research papers, we excluded review articles, essays, book reviews, papers in conference proceedings, and editorials. We

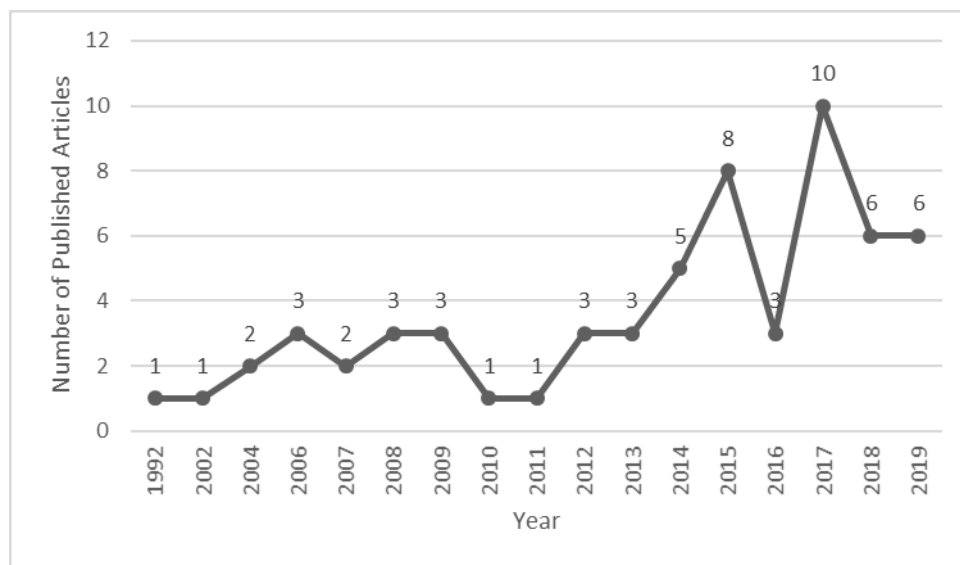
also excluded papers that did not cover higher education reforms in Europe. Hence, we ended up with 49 articles.

Lastly, we included another 12 handpicked articles that we knew or found through methods other than keyword searching. These included five articles from the special issue on the Role of Higher Education in the Socio-Economic Development of Peripheral Regions, edited by Kohoutek *et al.* (2017b) for *Higher Education Policy*; six articles from the special issue on the Institutionalization of Universities' Third Mission, edited by Pinheiro, Langa, *et al.* (2015) for the *European Journal of Higher Education*; and one article from *Teaching in Higher Education* (Wimpenny *et al.*, 2019). As a result, we had 61 articles for our analysis (see the full list in Appendix II). These articles only appeared in 11 of the 22 selected journals (Figure 1).



**Figure 1. The number of selected articles in journals**

In general, the number of publications on universities' societal engagement in Europe steadily increased (Figure 2). These articles have reported higher education reforms in 35 European countries: Albania, Austria, Belgium, Bulgaria, Bosnia and Herzegovina, Czech Republic, Croatia, Cyprus, Denmark, Estonia, Finland, France, Greece, Germany, Gibraltar, Hungary, Ireland, Italy, Iceland, Latvia, Lithuania, Malta, Macedonia, Norway, Netherlands, Portugal, Poland, Romania, Switzerland, Sweden, Slovakia, Slovenia, Serbia, Spain, and the UK.



**Figure 2. The number of publications on universities' societal engagement in Europe**

*Methods of analysing the literature*

The analyses of the conceptual and empirical literature applied different kinds of coding strategies. In comparing the major concepts of universities, our focus was on identifying the disciplinary perspectives, major focuses/propositions, and limitations of each concept. We synthesizing the insights of the existing concepts of universities and relevant studies for conceptualising what a university ought to be in innovation ecosystems by applying the 12-dimension framework developed by Etzkowitz (2017) and Etzkowitz *et al.* (2019), which was

originally designed for comparing ivory-tower universities and entrepreneurial universities. We used the results of the conceptual literature analysis as the analytical framework to analyse the empirical studies on university reforms in Europe, with an emphasis on the changing societal engagement roles of universities.

### **Comparing emerging concepts about new models of universities: A need for synergy building**

#### *Origination of the entrepreneurial university concept in the context of innovation systems*

Since the early 1990s, developing innovation systems (Lundvall, 1992; Nelson, 1993) has become a key policy drive for many countries to boost their economic growth and competitiveness (Edquist, 1997; Edquist and Hommen, 2008). In this context, the concept of an entrepreneurial university was developed. In the literature, Etzkowitz (1983, 2004) and Clark (1998), both from the USA, are often cited as the concept's originators. It should be noted that Röpke (1998), a German scholar, also proposed this notion in the same period.

Although these authors approach an entrepreneurial university differently, they share similar views on its major characteristics: 1) Universities tend to be more engaged with society, and knowledge capitalization lies at the centre of universities' societal engagement. 2) While universities interact more with government and industry, they become more independent in decision making. 3) By taking cross-sector actions, universities become involved in an environment of multiple logics that provide the sources and dynamics of innovation. 4) While being entrepreneurial, universities must take risks for innovation and being different. 5)

Entrepreneurial universities require the involvement of all their members and the support of an entrepreneurial culture (Etzkowitz *et al.*, 2017).

The notion of an entrepreneurial university has not only proliferated in the scholarly literature (Guerrero-Cano *et al.*, 2006) but has also become a global idea underlying university managers' thinking about how universities should be organized (Pinheiro and Stensaker, 2014). However, the legitimacy of the entrepreneurial university has been challenged, along with entering a new era of a knowledge-based society or innovation ecosystems. This is because the entrepreneurial university concept, emphasizing universities' economic role in regional innovation, does not explicitly address the new demands from contemporary society, which are concerned with social responsibility (Grau *et al.*, 2017; Sørensen *et al.*, 2019), sustainable development (Barth *et al.*, 2015), and social innovation (Georghiou, 2018).

***Emerging concepts of universities as a replacement for the entrepreneurial university model in the context of innovation ecosystems***

Since the turn of the 21st century, there has been an emerging awareness of the transition from an innovation system to an innovation ecosystem (Oh *et al.*, 2016). Cai *et al.* (2020, 2) defined innovation ecosystems as 'co-innovation networks, in which actors from organizations concerned with the functions of knowledge production, wealth creation and norm control interact with each other in forming co-evolution and interdependent relations (both direct or indirect) in cross-geographical contexts, and, through which new ideas and approaches from various internal and external sources are integrated into a platform to generate shared values for the sustainable transformation of the society'.

Along with the transformation from an innovation system to an innovation ecosystem, an increasing number of scholars have called for attention to extending the economic roles of universities as the core of an entrepreneurial university to broader roles in social and cultural transformation (e.g., Etzkowitz and Viale, 2010; Goddard and Vallance, 2013; Audretsch, 2014; Cai and Liu, 2020). As such, several new concepts have emerged, including *civic university* (Goddard and Vallance, 2013; Goddard *et al.*, 2016), *ideas of a university ecology* (Wright, 2016), *engaged university* (Benneworth, 2013), *university 4.0* (Giesenbauer and Müller-Christ, 2020), and *responsible university* (Sørensen *et al.*, 2019). To varying extents, these concepts address universities' role in meeting broader societal needs and challenges. This also requires universities to develop mutually beneficial engagements with their surrounding communities. These proposed university models also provide useful insights into how citizens can engage in developing RRI (Monsonis-Paya *et al.*, 2017). RRI 'is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability, and societal desirability of the innovation process and its marketable products' (von Schomberg, 2011, 9).

### ***Pros and cons of emerging university concepts***

Our analysis of the studies on these concepts revealed the following three major findings. First, while the above-mentioned concepts are intended to capture the new or expected features of contemporary universities that are more concerned with social responsibility, they rarely elaborate on how the economic role of universities that still underlies the mainstream of third-mission activities could be integrated into their social role. Such a dilemma is reflected in the question raised by Karlsen and Larrea (2019, 173): 'Does a responsible university need a third

mission?’. To answer this question, it is essential to know how a new model of a university that takes broad social responsibilities is distinct from that of an entrepreneurial university, and to what extent the new model evolves from the older one.

Second, these concepts are generally abstract and are not designed to effectively guide empirical analysis in various settings. The problem of lacking consistent frameworks for analysing contemporary university reforms has been implied in the book *The Responsible University: Exploring the Nordic Context and Beyond* (Sørensen *et al.*, 2019). In the conclusion of the book, Pinheiro *et al.* (2019) stated that due to the ‘ambiguous yet prevalent notions of societal responsibility’, ‘the editors made a conscious decision to allow authors considerable leeway regarding the conceptual and analytical lenses adopted in the case chapters’ (293). The authors considered such an approach ‘analytical eclecticism’ (Sil and Katzenstein, 2010) that moves beyond paradigms and combines elements belonging to different approaches and perspectives to capture a phenomenon’s complexity, contingency, and messiness (Pinheiro *et al.*, 2019). They also implied that it would be more helpful in empirical research, especially for comparative purposes, if suitable analytical frameworks could be developed to understand responsible universities.

Third, since all these university concepts (including entrepreneurial university) draw insights from various theoretical perspectives to help capture the features of universities in the context of societal transformations, they have different emphases and limitations (Table 2). This implies a necessity to integrate the insights of these concepts for a better conceptualization of the new features of universities and the new societal engagement roles of universities.

**Table 2. Comparing various conceptualizations of a university**

Concepts	Theoretical perspectives	Main focuses and conceptual contributions	Limitations
Entrepreneurial university	Sociology	<ul style="list-style-type: none"> <li>• Capitalization of knowledge</li> <li>• Risk taking and innovation</li> </ul>	<ul style="list-style-type: none"> <li>• Little attention is paid to universities' role in social and environmental changes.</li> </ul>
Civic university	Regional studies	<ul style="list-style-type: none"> <li>• Universities' reciprocal engagement with their embedded places, emphasizing social responsibility and civic engagement as their strategies</li> <li>• Universities as anchor institutions (place-based)</li> </ul>	<ul style="list-style-type: none"> <li>• While focusing on the emerging futures of universities, the old (still functioning) characteristics of entrepreneurial universities are not fully taken into account.</li> <li>• The importance of integrating the place-based role and global missions of universities is addressed but lacks theoretical elucidation on how multi-level missions can be integrated.</li> </ul>
Engaged university	Regional studies	<ul style="list-style-type: none"> <li>• The university is reinvented to simultaneously demonstrate societal value for a range of social interests.</li> <li>• An engaged university need not be an institution with which everyone is forced to engage at any cost, but those who value it are supported, and their efforts are strategically exploited.</li> </ul>	<ul style="list-style-type: none"> <li>• Although it extends the economic role of entrepreneurial universities to their role in creating social values, the focus remains on regional-level engagement.</li> </ul>
University ecology	Anthropology	<ul style="list-style-type: none"> <li>• Universities are in the field of ecology, not merely in a knowledge economy.</li> <li>• In the field of ecology, universities are embedded in a network of social relationships.</li> <li>• Universities develop symbiotic relations with stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>• The concept of university ecology is discussed on an abstract level.</li> </ul>
Responsible university	Eclecticism	<ul style="list-style-type: none"> <li>• Universities must behave with honesty, integrity, and decency.</li> <li>• A responsible university is used as an umbrella concept to accommodate various issues.</li> </ul>	<ul style="list-style-type: none"> <li>• The concept of a responsible university is broad.</li> <li>• There is no consistent analytical framework for understanding a responsible university.</li> </ul>
University 4.0	Psychology (worldview perspective)	<ul style="list-style-type: none"> <li>• University 4.0 is needed in times of complexity.</li> <li>• Universities facilitate synergies among different societal sectors.</li> <li>• Universities actively participate in societal change.</li> </ul>	<ul style="list-style-type: none"> <li>• The concept only focuses on the transformative features of universities.</li> <li>• The development of the concept is not in the context of the higher education literature.</li> </ul>
Responsible research and innovation	Science policymaking	<ul style="list-style-type: none"> <li>• Science improves the functioning of society by creating socially responsible innovations, requiring interactions between social actors and scientists.</li> </ul>	<ul style="list-style-type: none"> <li>• The abstract concept is not designed for empirical analysis.</li> </ul>



## **Synthesizing various conceptualizations of new features of university: Towards an ideal-type university**

The comparison of the concepts about new models of universities discussed above implies that in the context of transition from innovation systems to innovation ecosystems, universities that have undergone transformations towards the entrepreneurial university model are now expected to further evolve to a more suitable model or an ideal-type university. In this section, we identify the features of the ideal-type university by synthesizing relevant literature and then choosing a suitable label for the ideal-type university. In presenting the outcomes of our literature analysis here, however, we first discuss our naming of the ideal-type university and then summarize its major features. Thus, we avoid repeatedly mentioning the ‘ideal-type university’ without a name for it.

### *Naming an ideal-type university as an SEU*

To name the ideal-type university, our initial consideration was the concept of a ‘socially responsible entrepreneurial university’, which was proposed by Cai (2018) as a preliminary attempt to build synergies among new concepts of universities, mainly for integrating the economic and social responsibilities of universities in the context of innovation ecosystems. Similarly, Grau *et al.* (2017) proposed the concept of a ‘socially responsible university’ in their edited report of Global University Network for Innovation. Both works are mainly for addressing and demonstrating a new direction of university reforms, instead of building solid conceptual frameworks.

Although the concept of social responsibility has been commonly used in universities' mission statements and discussed in the academic literature, there is a lack of consensus on what is included in universities' social responsibilities. In other words, social responsibility is an elusive concept (Vellamo *et al.*, 2019). For instance, Hayter and Cahoy (2016) considered that social responsibility in higher education is generally about the public good or public interest. Vasilescu *et al.* (2010, 4178) understood university social responsibility as 'a sense of citizenship'. According to Jorge and Peña (2017, 304), universities' social responsibility means that they 'have to incorporate ethical, social, and environmental principles and values within their main functions'. By analysing a variety of studies on the social responsibilities of universities, Hayter and Cahoy (2016) concluded that 'the specific social responsibilities of institutions depend on their nature and mission' (15).

The difficulty in reaching a consensus on understanding the social responsibilities of universities is probably ascribed to the fact that the conceptualization of a university's social responsibility is largely based on drawing insights from the concept of corporate social responsibility developed in the business context (Hayter and Cahoy, 2016). As the nature of universities differs from that of private firms, corporate social responsibility cannot be directly translated into the higher education context (Vasilescu *et al.*, 2010).

Nevertheless, some emerging literature has been examining universities' social responsibilities through the lens of sustainability (e.g., Wright, 2002; Barlett and Chase, 2015; Tauginienė and Pučėtaitė, 2021). Many definitions of universities' social responsibility, as analysed by Jorge and Peña (2017), also accentuate the links between university's responsibility and sustainable development goals (SDGs)— the United Nations' blueprint to achieve a better and more

sustainable future for all (United Nations, 2015). The concept of sustainability is central to the definitions of innovation ecosystems, as what distinguishes an innovation ecosystem from an innovation system is its sustainable development dimension, along with value co-creation between interdependent actors in the system (Oh *et al.*, 2016; Smorodinskaya *et al.*, 2017; Walrave *et al.*, 2017). Trencher *et al.* (2014) used the concept of ‘co-creation for sustainability’ to stress the urgent need for universities to respond to environmental challenges and contribute to sustainable socio-economic development.

Thus, we decided to use the SEU concept to label the ideal-type university in innovation ecosystems. Our choice of using SEU was also inspired by the works of Wright (2002), Beringer (2007) and Walmsley *et al.* (2018), who have associated sustainable development with universities’ missions. Walmsley *et al.* (2018) even used the word SEUs when examining how entrepreneurial universities can contribute to achieving SDGs. However, they did not articulate what SEUs are. Moreover, from an operational perspective, we considered the SEU concept suitable because responsibilities related to sustainable development have been more clearly elaborated in the literature compared to social responsibilities. For instance, the literature on sustainable development often refers to Elkington’s (1998) triple bottom lines of sustainable development, consisting of environmental, social, and economic dimensions. Accordingly, a variety of tools for assessing sustainable development in higher education have been developed (Caeiro *et al.*, 2020). These can provide a solid basis for potentially conceptualizing and operationalize sustainability in higher education and the missions of universities to achieve SDGs.

### *Characteristics and societal engagement roles of an SEU*

Based on the discussions above, an SEU can be generally understood as an ideal-type university in innovation ecosystems; it has evolved from an entrepreneurial university that has integrated its economic, social, and environmental responsibilities for SDGs into its three intertwined missions, namely teaching, research, and societal engagement. To further define the SEU, we describe the core features of SEU, referring to both the characteristics of the SEU and the roles of the SEU in innovation ecosystems. The characteristics of the SEU can be best understood when comparing them with those of entrepreneurial and ivory-tower universities. In so doing, we used the 12-dimension categories for comparing traditional ivory-tower universities and entrepreneurial universities developed by Etzkowitz (2017) and Etzkowitz *et al.* (2019). We further grouped the categories according to the three missions of universities as well as the organization and administration for achieving the missions. In Table 3, we highlight what is new in SEUs based on synthesizing the studies that conceptualize changes in universities.

**Table 3. Comparison among three models of universities**

Missions	Spectrum category	Ivory-tower university (Based on Etzkowitz (2017) and Etzkowitz <i>et al.</i> (2019))	Entrepreneurial university (Based on Etzkowitz (2017) and Etzkowitz <i>et al.</i> (2019))	Sustainable entrepreneurial university (Authors' contribution)
Teaching	Teaching location	Teaching on campus	Teaching on/off campus	Teaching on/off campus on a global scale, often online-based (Sivapalan <i>et al.</i> , 2016)
Research	Knowledge mission	Knowledge production for own sake	Polyvalent knowledge (with theoretical, practical and interdisciplinary implications) (Etzkowitz and Viale, 2010)	Democracy of knowledge, driven by a pluralism of paradigms of knowledge modes, including modes 1, 2 and 3 (Carayannis and Campbell, 2012)
	Direction of research	Meandering stream of basic research	Multiple sources of input in research direction	Sustainable development goals as important sources of

				input in research direction (Waas <i>et al.</i> , 2010)
	Knowledge-related intention	Useful knowledge as an accident	Useful knowledge sought	Useful knowledge is not only economically valuable but also sustainable and socially desirable (von Schomberg, 2011; Benneworth, 2013).
Societal engagement	Technology and innovation transfer to industry	No organizational technology transfer capability and no firm formation	Technology transfer office, incubator integrated into innovation strategy to foster start-ups	From technology transfer to knowledge exchange (Cai <i>et al.</i> , 2020) and co-creation (Trencher <i>et al.</i> , 2014; Giesenbauer and Müller-Christ, 2020).
	University–society link	Isolated from society	Open to and serves external society	Serves the needs of society and shapes the future society (Shapiro, 2005)
	Contribution point	Operation for self-sustainability	Make significant contributions to regional development	The contributions are not only regional but also global (Goddard <i>et al.</i> , 2016; Cai <i>et al.</i> , 2019).
	Stakeholders	Single internal stakeholder	Multiple stakeholders – internal and external	Among multiple stakeholders, citizens’ roles are increasingly important (Goddard <i>et al.</i> , 2012).
Organization and administration for achieving the missions	Disciplines in organization	Discipline-based departments as primary units	Departments and interdisciplinary centres have equal status	Interdisciplinary collaboration is becoming institutionalized (Kandiko and Blackmore, 2008).
	Source of university administration	University administration only from academia	University administration from multiple sources, including industry and government	University networks become new sources of university administration (Wright, 2016; Kahle <i>et al.</i> , 2018).
	Perception of funding	Funding as a matter of right	Funding as a matter of exchange, something to be earned	Funding as a matter of exchange but underlined by social justice and moral responsibility (Geschwind <i>et al.</i> , 2019)
	Mindset	Academic mindset only	With entrepreneurial ethos	Reconciling both entrepreneurial (Etzkowitz, 2004) and sustainability mindsets (Kassel <i>et al.</i> , 2016; Giesenbauer and Müller-Christ, 2020). Academics’ societal engagement is driven by the motive to advance the societal role of universities rather than merely economic incentives (Iorio <i>et al.</i> , 2017). Compared to pursuing economic growth by exploiting resources underlying the

				entrepreneurial ethos, the sustainable mindset is oriented towards limiting the growth by preserving resources (Moon <i>et al.</i> , 2018).
--	--	--	--	---------------------------------------------------------------------------------------------------------------------------------------------

The characteristics of SEUs also imply the new roles of SEU in innovation ecosystems. Identifying the changing roles of universities in society has been used by Etzkowitz (2004) in his elaboration of the entrepreneurial university concept as an approach to distinguish paradigm changes in universities. Many studies dealing with the universities' role in regional innovation (See an example of literature review on the topic: Brekke, 2020) provide useful insights on changing roles of universities in contemporary society, particularly on a shift from promoting economic growth through technology transfer to many broad engagement roles for social transformation (e.g., Audretsch *et al.*, 2014; Pinheiro, Wengenge-Ouma, *et al.*, 2015; Tripl *et al.*, 2015; Cai and Liu, 2020). Among these, two studies (Reichert, 2019; Cai *et al.*, 2020) explicitly elaborated on the roles of universities in innovation ecosystems. Drawing on the literature dealing with the changing societal engagement roles of universities in innovation ecosystems, we identified three changing roles of an SEU in innovation ecosystems (Table 4).

**Table 4. Changing universities' societal engagement roles in transition from an entrepreneurial university to an SEU**

Roles	Models	Entrepreneurial university	Sustainable entrepreneurial university
-------	--------	----------------------------	----------------------------------------

Knowledge flow	<p><i>University as a knowledge producer for technology transfer.</i> Knowledge producer, as one direction move of the knowledge from the academy to the industry, is mainly reflected in the concepts of academic capitalism (Slaughter and Leslie, 1997). Mode 2 knowledge production (Gibbons, 1998) and the third mission of universities (Etzkowitz <i>et al.</i>, 2000).</p>	<p><i>University as anchor organization for knowledge exchange.</i> Knowledge exchange, as bi-directional of knowledge flow, has been described by Geuna and Muscio (2009) as: ‘[U]niversity–industry interaction does not involve only transferring knowledge from the former to the latter; it also helps academics to develop interesting research questions, conduct better research and provide improved understanding of research applications in industry’ (109). The bi-directional nature of knowledge exchange is fundamental to value co-creation, which is a key characteristic of both innovation ecosystems (Smorodinskaya <i>et al.</i>, 2017; Gomes <i>et al.</i>, 2018) and Mode 3 knowledge production (Carayannis and Campbell, 2012). Model 3 knowledge production extends Mode 1 and Mode 2 knowledge production, and it is defined as ‘the nexus or hub of the emerging twenty-first century Innovation Ecosystem, where people, culture, and technology ... meet and interact to catalyse creativity, trigger invention, and accelerate innovation across scientific and technological disciplines, public, and private sectors... and in a top-down, policy-driven as well as bottom-up, entrepreneurship empowered fashion’ (Carayannis and Campbell, 2012, 4).</p>
Interactions with innovation actors	<p><i>Universities’ reciprocal collaborations with industries and governments</i> are best illustrated in the triple helix model (Etzkowitz, 2008)</p>	<p><i>Universities for building trust among collaborators in innovation ecosystems.</i> The actors in innovation systems are more diverse and citizens are becoming increasingly important stakeholders (Carayannis and Campbell, 2012). Trust is considered a key factor to successful knowledge exchange and co-innovation. This can be explained by both social exchange theory and social network theory. From the former perspective, Muthusamy and White (2005) argue that [s]ince there is no way to assure an equivalent return for a favor, social exchange requires trusting others to discharge their obligations’ (418). From the latter perspective, trust is crucial for realizing the value of weak ties, which mostly contribute to the creation and diffusion of innovation (Gretzinger <i>et al.</i>, 2011).</p>
University and society relations	<p><i>Universities for meeting the societal needs</i>, for example, concerning economic growth and innovation, is a main characteristic of an entrepreneurial university (Etzkowitz, 2004).</p>	<p><i>Universities for shaping a better future society</i> (Shapiro, 2005), which means that ‘universities seek to achieve their developmental role through the transformation of society and production of new knowledge’ (Grau <i>et al.</i>, 2017, 460), can be captured from the perspective of universities as institutional entrepreneurs (Cai and Liu, 2020). Institutional entrepreneurs are those organizational or individual actors who not only initiate diverse changes in the institutional environment but also actively participate in the implementation of such changes (Battilana <i>et al.</i>, 2009). When universities, as well as members within them, become institutional entrepreneurs, they are able to change the institutional environment favouring innovation ecosystems development (Cai and Liu, 2020). The process of fostering institutional changes can be understood as social entrepreneurship (Chandra, 2017), which is “an innovative approach to achieve social mission” (Haugh, 2007, 744).</p>

It should be noted that our effort to distinguish an SEU from an entrepreneurial university and even an ivory-tower university, in the frameworks described in Tables 3 and 4, is mainly for an analytical purpose. In reality, there might be no universities meeting all the features of an SEU. Most universities' practices may reflect a mix of the characteristics of the three university models, although to varying extents, and this partially explains why universities in the world demonstrate a high degree of diversity. Our frameworks are useful for examining the directions and paces of university transformation/evolution from the model of entrepreneurial university to that of SEU in empirical investigations.

### **The transition towards a sustainable entrepreneurial university: Evidence from European university reforms**

To find evidence of the transition towards the SEU by analysing the articles reporting university reforms in Europe, we focused on how the three societal engagement roles of the SEU are reflected in the reforms and how universities achieve the three roles in organizational processes.

#### ***Reflections on the emerging societal engagement roles of universities in higher education reforms in Europe***

The first emerging role of SEUs is reflected in the shift from being key knowledge producers for technology transfer to anchor organizations for facilitating knowledge exchange. The empirical studies have demonstrated such a transition in two aspects. The most visible aspect is seen in university-industry collaboration, where universities gain much broader benefits from their collaborators than capitalizing knowledge. While universities play a more significant role in regional development, their partners (e.g., in the private sector) also support their development by joining university governance boards (Musial, 2010), providing jobs and



trainee opportunities for university students (Purcell *et al.*, 2019), imparting industry-relevant knowledge and skills to students to smooth their transition to the labour market (Sin and Amaral, 2017), advising on university construction designs and energy savings (Intrachooto and Arons, 2002), and so on. Moreover, when academics collaborate in research and development projects with industrial partners, they generate ideas that could hardly arise within academia (de Freitas *et al.*, 2014).

The other aspect is reflected in the co-creation process. Trencher *et al.* (2014) considered ‘co-creation for sustainability’ a new mission of universities, adding to their first, second, and third missions of teaching, research, and societal engagement, respectively. As such, the university has been transformed into ‘a multi-stakeholder platform engaged with society in a continual and mutual process of creation and transformation’, and such a ‘transformative university...forms the guiding image and physical representation of an institution actively working with co-creation for sustainability’ (Trencher *et al.*, 2014, 157–8). According to our conceptualization of an SEU, ‘co-creation for sustainability’ is not a new mission but one of the new features of an SEU that transforms the three missions of universities. Co-creation is associated with knowledge exchange. This has been demonstrated in a case study about the contributions of the University of Macerata, a social science and humanities university, to economic and social development in Macerata, Italy by involving local stakeholders and communities (Rinaldi *et al.*, 2018). In the process, the university has played a crucial role in ‘ensuring the representation of businesses in regional partnerships, establishing neutral places for networking meetings and networking events with businesses, and sharing resources to enhance the knowledge exchange’ (Rinaldi *et al.*, 2018, 78).

The second emerging role of SEUs is reflected in the shift from developing reciprocal collaborations with actors from industry and government sectors to building trust among more diversified actors, including citizens, in innovation ecosystems. Due to its trustworthy status in society, a university not only builds connections among actors across sectors via alumni and research partnerships, which are mainly reflected in the model of an entrepreneurial university, but it can also build trust among actors for developing co-innovation networks (Huang *et al.*, 2011). Through various consortia, universities often bring societal partners closer to developing new educational programmes, not only for local societal actors but also on a global scale. A study on an international Master's degree programme in Urban Quality Development and Management offered by five universities in Denmark, the Netherlands, Malaysia, and Thailand demonstrated how these universities have helped build trust among the stakeholders across these countries (Lehmann and Fryd, 2008). Another example was reported by Wimpenny *et al.* (2019) in their study on a European-funded OpenMed project that brought together five European universities and nine universities from the South Mediterranean region (Egypt, Jordan, Morocco, and Palestine) to develop innovative pedagogical practices. This cross-European project has not only linked various partners but also instilled a cross-cultural appreciation and mutual trust among the partners.

The third emerging role of SEUs is reflected in the shift from better serving society's needs to shaping a better future society through fostering institutional changes. Compared with entrepreneurial universities' role in improving regional competitiveness and attractiveness (Häyrynen-Alestalo and Peltola, 2006; Westnes *et al.*, 2009; de Freitas *et al.*, 2014), SEUs become key agents in changing/optimizing their regions' institutional environments (Cai and Liu, 2020; Cai *et al.*, 2020). For instance, Delft University of Technology in the Netherlands

has not only established a new programme, called Design for Sustainability (DfS), for meeting consumer needs with fewer environmental and social impacts, but the university has also played an intermediary role in diffusing the ideas of DfS in the industry (Küçüksayraç *et al.*, 2017). Another example was observed in Purcell and her colleagues' (2019) study on adopting a sustainability mission at Plymouth University in the UK and the American University in Bulgaria, respectively. Both universities aimed to ultimately play a role in societal transformation and deliver on SDGs, thus contributing to global communities' economic, social, cultural, and environmental sustainability (Purcell *et al.*, 2019).

### *Variations in the transition towards SEU*

Although the transition towards SEU has been seen in reality, the pace of development varies. For instance, in a couple of European cities (Zurich and Vienna), universities' societal engagement largely addresses sustainability challenges (Trencher *et al.*, 2014), demonstrating the more visible features of SEUs. Similar observations were made by Rinaldi *et al.* (2018) in their study on the University of Macerata's (specializing in social science and humanities) regional engagement in Italy, as this case university has had a long-lasting and transformational effect on regional economies, in line with the EU's smart specialization strategies. In this case, citizens were becoming increasingly important stakeholders in universities and regional innovation. The universities reported here might be considered as frontrunners spearheading the development of the SEU.

For peripheral regions, the universities' contributions to regional development have been less significant, and they have more struggles with the tensions between institutional development and regional engagement (Čábelková *et al.*, 2017; Karlsen *et al.*, 2017; Šima *et al.*, 2017;

Šmídová *et al.*, 2017; Zhang *et al.*, 2017). This also implies that the regional context and university capacity determine the level of universities' transformation. As explained by Kohoutek *et al.* (2017a), in these regions, the universities' less pivotal role in improving regional attributes 'is either because of the incapacity of unlocking the path-dependent effects of regional periphery structures or because of limitations in research capacity, constraining the respective regions' progress to the knowledge/service society paradigm' (405).

### *Achieving new roles in organizational processes*

Our analyses of the empirical studies on European higher education reforms also serve as reminders that adopting new roles involves a complicated organizational process. Poole and Van de Ven's (2004, 376) asserted, 'organizational process gives a deep understanding of how change comes about by describing the generative mechanism that drives the process' of innovation. An organizational process includes setting the objectives of university reforms, conducting reform activities and involving stakeholders in the reforms and missions of universities. The new roles are introduced in European university reforms through setting reform objectives, for example, to promote sustainable development (Posch and Steiner, 2006; Beringer, 2007), enhance graduate employability (Sin and Amaral, 2017), foster community engagement (Rinaldi *et al.*, 2018) and advocate equity and social justice (Capano and Pritoni, 2019). To realize the reforms, universities have taken several actions, including curriculum reviews (Sin and Amaral, 2017), the establishment of new degree programmes (Lehmann and Fryd, 2008), the development of new indicators for assessing universities' societal engagement (Beringer, 2007) and changes in universities' missions (Krücken, 2014), and adopting interdisciplinary approaches to integrate teaching and research missions for societal

engagement (Posch and Steiner, 2006). Thus, the transition from an entrepreneurial university to an SEU has been reflected in the transformations of all three missions of universities. When universities perform new societal engagement roles, they involve a wide range of stakeholders. The stakeholders identified by our reviewed empirical studies are listed in Table 5.

**Table 5. Stakeholders involved in university reforms**

Stakeholders	Sources
Governments of different levels	(Vakkuri, 2004; Posch and Steiner, 2006; Deem <i>et al.</i> , 2008; Lehmann and Fryd, 2008; Westnes <i>et al.</i> , 2009; Musial, 2010; de Freitas <i>et al.</i> , 2014; Krücken, 2014; Donina <i>et al.</i> , 2015; Küçüksayraç <i>et al.</i> , 2017; Ratajczyk <i>et al.</i> , 2017; Rinaldi <i>et al.</i> , 2018; Capano and Pritoni, 2019; Purcell <i>et al.</i> , 2019; Takala and Korhonen-Yrjänheikki, 2019)
Business or industrial organizations	(Intrachotoo and Arons, 2002; Lehmann and Fryd, 2008; Westnes <i>et al.</i> , 2009; Musial, 2010; de Freitas <i>et al.</i> , 2014; Rosa and Teixeira, 2014; Küçüksayraç <i>et al.</i> , 2017; Ratajczyk <i>et al.</i> , 2017; Rinaldi <i>et al.</i> , 2018; Purcell <i>et al.</i> , 2019)
NGOs, churches, community leaders, hospitals	(Posch and Steiner, 2006; Lehmann and Fryd, 2008; Musial, 2010; Rosa and Teixeira, 2014; Mulà <i>et al.</i> , 2017; Ratajczyk <i>et al.</i> , 2017; Rinaldi <i>et al.</i> , 2018; Purcell <i>et al.</i> , 2019)
Students	(Posch and Steiner, 2006; Purcell <i>et al.</i> , 2019)
Alumni	(Musial, 2010)
Other universities	(Deem <i>et al.</i> , 2008; Lehmann and Fryd, 2008)
International organizations	(Lehmann and Fryd, 2008; Küçüksayraç <i>et al.</i> , 2017; Mulà <i>et al.</i> , 2017)
Employers of graduates	(Musial, 2010; Sin and Amaral, 2017)
Academics	(Intrachotoo and Arons, 2002; Ahola, 2006; Posch and Steiner, 2006; Lehmann and Fryd, 2008; Purcell <i>et al.</i> , 2019)

In complicated organizational processes, a variety of tensions are observed. The core of these tensions lies in the challenges of integrating the three missions of the universities. The current discussions about tensions mainly concern the different logics and interests underlying different missions. This is best illustrated by the question raised by Benneworth *et al.* (2015, 280): ‘how can the third mission be meaningfully institutionalized given the pressures on

university managers to focus on other areas'? It has been reported that the extent of integration of the teaching, research, and societal engagement missions ranged from a low degree (Krücken, 2014; Rosa and Teixeira, 2014) to a moderate level (Sin and Amaral, 2017). To cope with these tensions, some universities have established separate units to promote societal engagement, being decoupled from their academic and research functions (Krücken, 2014). Overall, the literature mainly reflects the struggles of universities that practice the entrepreneurial university model to mitigate tensions between universities' missions.

When universities are transitioning towards the model of SEU by integrating the economic, social, and environmental responsibilities for SDGs into the three missions of universities, it may increase complexities and uncertainties in university management. This is partially because there are no clear indicators for assessing the new roles of universities (Takala and Korhonen-Yrjänheikki, 2019). Beyond the literature included in our analysis, Lattu and Cai (2020) identified six tensions in universities' transformations towards taking responsibility for sustainable development in the Finnish context.

## **Conclusions**

By comparing the popular concepts of new models of universities (i.e., civic university, ideas of a university ecology, engaged university, responsible university, university 4.0, and RRI), we found that while these emerging concepts suggest replacing the notion of entrepreneurial university with a more suitable model to capture the recent changes of universities in the societal transformation from innovation systems to innovation ecosystems, they have not consistently identified the features of the new model of universities. Thus, there is a need to integrate the insights of the existing models of universities. As such, we synthesized existing

literature on new models of universities, leading to our conceptualization of an ideal-type university, which we named SEU. Given that SEU is based on how achieving SDGs is integrated into and transforming the existing missions of an entrepreneurial university, we identified new features of an SEU that are distinct from those of an entrepreneurial university (see Table 3 and Table 4).

Using the changing societal engagement roles of the SEU as a lens, we examined university reforms in Europe and revealed the following findings. First, the vivid stories of European university reforms in diverse contexts concretize the three roles of SEUs in innovation ecosystems in empirical settings. Second, the implementation of the new roles is reflected in universities' organizational processes, with foreseeable tensions. Third, the pace of transformation of universities towards SEU varies, depending on local contexts and universities' capacity. This somehow corroborates the observation by Moon *et al.* (2018) that the majority of higher education institutions have not addressed sustainability practices in a holistic way across their operations.

Our study, based on an analysis of university reforms in the European context, suggests that the shift from the model of an entrepreneurial university to that of an SEU is aligned with a paradigm change in the knowledge-based society: from an innovation system to an innovation ecosystem. As Europe, composed of diverse countries and regions, is in the process of the paradigm change, most European universities are not SEUs yet, although the direction of transition towards the model of SEU is observed. As the societal transformation towards an innovation ecosystem is a global tendency, the concept of SEU as an ideal-type university in the 'post-entrepreneurial university era' is likely to be applicable in other geographical contexts.

Although an SEU's responsibilities for SDGs are expected to be integrated into its teaching, research, and societal engagement missions, the discussions in the existing literature have mostly dealt with economic and social responsibilities. This is in line with the observation by Lattu and Cai (2020) that most universities engaging with SDGs are in the transition from being primarily economically engaged to being both economically and socially engaged, leaving the environmental dimension lagging behind.

Our study makes three contributions to extant literature. First, we advance the discussions on university transformations by conceptualizing an SEU as an ideal-type university. Second, as our conceptualization of an SEU is demonstrated to be useful for observing European university reforms reported in the literature, it can be applied as an analytical tool in potential empirical studies. Third, we pilot an innovative approach to writing a conceptual paper by using both conceptual and empirical literature as data sources. This approach helps resolve two struggles faced by researchers when writing conceptual articles (e.g., related to new models of universities): the lack of commonly accepted templates and empirical evidence (Jaakkola, 2020).

We acknowledge some limitations in our study. First, while empirical studies about universities' societal engagement are in the literature of both higher education research (mainly taking an inside-out perspective) and innovation and regional studies (largely representing an outside-in view), we mainly included higher education literature in our research to make our analysis more manageable and better fit the target journal's focus and scope. It would be interesting to compare the inside-out and outside-in perspectives in future research. Second, limited by the empirical data, that is, published journal articles on European university reforms, we can hardly



make a more systematic analysis about transformations of European universities through the lens of an SEU, for example, for comparing the differences between countries/regions and discovering enabling factors of SEU.

Our findings also lead to a set of policy recommendations. First, more explicit policies addressing the transition from entrepreneurial universities to an SEU are needed. While the EU's current innovation strategies intend to drive Europe into innovation ecosystems, higher education policies and reforms relatively lag behind. Although sustainability and social responsibility, as major issues addressed by SEUs, have become popular in higher education, the current European higher education reforms mainly focus on constructing entrepreneurial universities and their economic role in society. This has been reflected in the spread of the HEInnovate project, jointly developed by the OECD and the European Commission, based on the concept of an entrepreneurial university (Hofer and Kaffka, 2019). Encouragingly, our study has shown a tendency towards the SEU model in the practices of European university reforms. To speed up the process, pioneer activities, as observed in our study, can be promoted and legitimized by clear policies at the levels of both the EU and its member states.

Second, universities' engagement on a global scale should be emphasized in future policies. While universities in innovation systems often have a local focus, their engagement in innovation ecosystems crosses the boundaries of geographical locations (Sotarauta *et al.*, 2016; Cai *et al.*, 2019). When the EU's innovation strategy calls for effective ways of integrating research, innovation, and application, it also stresses the importance of international innovation cooperation (Lamy *et al.*, 2017). However, in current higher education policies and practices,

international research cooperation primarily aims for research excellence within academia and lacks interactions with other activities in global innovation networks.

Third, because universities occupy a transformative space in engaging with multiple stakeholders, higher education policies should comprise a policy mix. The policy-mix concept has been used by scholars to investigate the formulation and implementation of innovation policies in a multi-level, multi-actor context (Uyarra, 2010), and is now also applied in research policy analysis (Cocos and Lepori, 2020). Currently, higher education policies are mainly developed in the higher education sector. From a policy-mix perspective, not only should stakeholders from different sectors be involved in higher education policymaking as a more commonly used approach currently, but more joint policies between ministries are expected to more effectively address universities' changing roles in innovation ecosystems, for example, for co-creation and achieving SDGs.

### **Conflict of interest statement**

On behalf of all authors, the corresponding author states that there is no conflict of interest.

### **References**

- Ahola, S. (2006) 'From 'different but equal' to 'equal but different': Finnish AMKs in the Bologna process.' *Higher Education Policy* 19 (2):173-86.
- Arksey, H., and O'Malley, L. (2005) 'Scoping studies: towards a methodological framework.' *International Journal of Social Research Methodology* 8 (1):19-32. doi: 10.1080/1364557032000119616.

- Audretsch, D., Lehmann, E., and Wright, M. (2014) 'Technology transfer in a global economy.' *The Journal of Technology Transfer* 39 (3):301-12. doi: 10.1007/s10961-012-9283-6.
- Audretsch, D. B. (2014) 'From the entrepreneurial university to the university for the entrepreneurial society.' *The Journal of Technology Transfer* 39 (3):313-21. doi: 10.1007/s10961-012-9288-1.
- Barlett, P. F., and Chase, G. W. (2015) *Sustainability in Higher Education*. Cambridge, MA: MIT Press.
- Barth, M., Michelsen, G., Rieckmann, M., and Thomas, I. (2015) *Routledge Handbook of Higher Education for Sustainable Development*. London and New York: Taylor & Francis.
- Battilana, J., Leca, B., and Boxenbaum, E. (2009) 'How Actors Change Institutions: Towards a Theory of Institutional Entrepreneurship.' *The Academy of Management Annals* 3 (1):65-107. doi: 10.1080/19416520903053598.
- Benedetti Fasil, C., Biagi, F., Boden, M., Christensen, P., Conte, A., Di Comite, F., Goenaga Beldarrain, X., et al. (2017) *Current Challenges in Fostering the European Innovation Ecosystem*. Luxembourg: Publications Office of the European Union.
- Benneworth, P. (2013) *University engagement with socially excluded communities*. Dordrecht ; London: Springer.
- Benneworth, P., de Boer, H., and Jongbloed, B. (2015) 'Between good intentions and urgent stakeholder pressures: institutionalizing the universities' third mission in the Swedish

- context.' *European Journal of Higher Education* 5 (3):280-96. doi: 10.1080/21568235.2015.1044549.
- Beringer, A. (2007) 'The Lüneburg Sustainable University Project in international comparison: An assessment against North American peers.' *International Journal of Sustainability in Higher Education* 8 (4):446-61.
- Boucher, G., Conway, C., and Van Der Meer, E. (2003) 'Tiers of engagement by universities in their region's development.' *Regional Studies* 37 (9):887-97.
- Brekke, T. (2020) 'What Do We Know about the University Contribution to Regional Economic Development? A Conceptual Framework.' *International Regional Science Review*:0160017620909538. doi: 10.1177/0160017620909538.
- Burget, M., Bardone, E., and Pedaste, M. (2017) 'Definitions and Conceptual Dimensions of Responsible Research and Innovation: A Literature Review.' *Science and Engineering Ethics* 23 (1):1-19. doi: 10.1007/s11948-016-9782-1.
- Čábelková, I., Normann, R., and Pinheiro, R. (2017) 'The Role of Higher Education Institutions in Fostering Industry Clusters in Peripheral Regions: Strategies, Actors and Outcomes.' *Higher Education Policy* 30 (4):481-98. doi: 10.1057/s41307-017-0059-3.
- Caeiro, S., Sandoval Hamón, L. A., Martins, R., and Bayas Aldaz, C. E. (2020) 'Sustainability Assessment and Benchmarking in Higher Education Institutions—A Critical Reflection.' *Sustainability* 12 (2):543. doi: 10.3390/su12020543.

- Cai, Y. (2017) 'From an analytical framework for understanding the innovation process in higher education to an emerging research field of innovations in higher education.' *Review of Higher Education* 40 (4):585-616. doi: 10.1353/rhe.2017.0023.
- Cai, Y. (2018) 'Towards a socially responsible entrepreneurial university: conceptual and analytical framework building ' *SPIRAL* 2018 (1):1-4.
- Cai, Y., Ferrer, B. R., and Lastra, J. L. M. (2019) 'Building University-Industry Co-Innovation Networks in Transnational Innovation Ecosystems: Towards a Transdisciplinary Approach of Integrating Social Sciences and Artificial Intelligence.' *Sustainability* 11 (17):1-23. doi: 10.3390/su11174633.
- Cai, Y., and Liu, C. (2020) 'The Role of University as Institutional Entrepreneur in Regional Innovation System: Towards an Analytical Framework.' In *Examining the Role of Entrepreneurial Universities in Regional Development*, edited by Miguel Torres Preto, Ana Daniel and Aurora Teixeira, 133-55. Hershey PA: IGI Global.
- Cai, Y., Ma, J., and Chen, Q. (2020) 'Higher Education in Innovation Ecosystems.' *Sustainability* 12 (11):4376. doi: 10.3390/su12114376.
- Capano, G., and Pritoni, A. (2019) 'Varieties of hybrid systemic governance in European Higher Education.' *Higher Education Quarterly* 73 (1):10-28.
- Carayannis, E. G., and Campbell, D. F. J. (2012) *Mode 3 Knowledge Production in Quadruple Helix Innovation Systems, SpringerBriefs in Business* 7. New York: Springer.
- Carayannis, E. G., Grigoroudis, E., Campbell, D. F. J., Meissner, D., and Stamati, D. (2018) 'The ecosystem as helix: an exploratory theory-building study of regional co-opetitive

- entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models.' *R&D Management* 48 (1):148-62. doi: 10.1111/radm.12300.
- Chandra, Y. (2017) 'Social Entrepreneurship as Institutional-Change Work: A Corpus Linguistics Analysis.' *Journal of Social Entrepreneurship* 8 (1):14-46. doi: 10.1080/19420676.2016.1233133.
- Clark, B. R. (1998) *Creating entrepreneurial universities: organizational pathways of transformation*. New York: Pergamon.
- Cocos, M., and Lepori, B. (2020) 'What we know about research policy mix.' *Science and Public Policy* 47 (2):235-45. doi: 10.1093/scipol/scz061.
- de Freitas, S., Mayer, I., Arnab, S., and Marshall, I. (2014) 'Industrial and academic collaboration: hybrid models for research and innovation diffusion.' *Journal of Higher Education Policy and Management* 36 (1):2-14.
- Deem, R., Mok, K. H., and Lucas, L. (2008) 'Transforming higher education in whose image? Exploring the concept of the 'world-class' university in Europe and Asia.' *Higher Education Policy* 21 (1):83-97.
- Donina, D., Meoli, M., and Paleari, S. (2015) 'The new institutional governance of Italian state universities: what role for the new governing bodies?' *Tertiary Education and Management* 21 (1):16-28.
- Edquist, C. (1997) 'Systems of innovation approaches--their emergence and characteristics.' In *Systems of innovation: technologies, institutions and organizations*, edited by Charles Edquist, 1-35. London: Printer.

- Edquist, C., and Hommen, L. (2008) *Small country innovation systems : comparing globalisation, change and policy in Asia and Europe*. Cheltenham: Edward Elgar.
- Elkington, J. (1998) 'Partnerships from cannibals with forks: The triple bottom line of 21st-century business.' *Environmental Quality Management* 8 (1):37-51. doi: 10.1002/tqem.3310080106.
- Etzkowitz, H. (1983) 'Entrepreneurial scientists and entrepreneurial universities in American academic science.' *Minerva* 21 (2-3):198-233.
- Etzkowitz, H. (2004) 'The evolution of the entrepreneurial university.' *International Journal of Technology and Globalisation* 1 (1):64-77.
- Etzkowitz, H. (2008) *The triple helix: university-industry-government innovation in action*. New York ; London: Routledge.
- Etzkowitz, H. (2017) 'Innovation Lodestar: The entrepreneurial university in a stellar knowledge firmament.' *Technological Forecasting and Social Change* 123:122-9. doi: <https://doi.org/10.1016/j.techfore.2016.04.026>.
- Etzkowitz, H., Bikkulov, A., Kovaleinen, A., Leitner, K. H., Poutanen, S., Grey, D., Leonchuck, L., et al. (2017) 'Metrics for the Entrepreneurial University.' *Triple Helix Working Papers* 2017 (1).
- Etzkowitz, H., Dzisah, J., and Clouser, M. (2021) 'Shaping the entrepreneurial university: Two experiments and a proposal for innovation in higher education.' *Industry and Higher Education*:095042222199342. doi: 10.1177/0950422221993421.

- Etzkowitz, H., Germain-Alamartine, E., Keel, J., Kumar, C., Smith, K. N., and Albats, E. (2019) 'Entrepreneurial university dynamics: Structured ambivalence, relative deprivation and institution-formation in the Stanford innovation system.' *Technological Forecasting and Social Change* 141:159-71. doi: <https://doi.org/10.1016/j.techfore.2018.10.019>.
- Etzkowitz, H., and Viale, R. (2010) 'Polyvalent Knowledge and the Entrepreneurial University: A Third Academic Revolution?' *Critical Sociology* 36 (4):595-609. doi: 10.1177/0896920510365921.
- Etzkowitz, H., Webster, A., Gebhardt, C., and Terra, B. R. C. (2000) 'The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm.' *Research Policy* 29 (2):313-30. doi: 10.1016/s0048-7333(99)00069-4.
- European Commission. (2010) *EUROPE 2020: A strategy for smart, sustainable and inclusive growth*. Brussels: European Commission
- European Federation for Elevator Small and Medium-sized Enterprises aisbl. Access (2010) 'Europe 2020: A strategy for smart, sustainable and inclusive growth.' <https://www.efesme.org/europe-2020-a-strategy-for-smart-sustainable-and-inclusive-growth>.
- European Parliament. (2000) *Lisbon European Council 23 and 24 March 2000: Presidency Conclusions*. Brussels: European Parliament.
- Fischer, S., Gran, S., Hacker, B., Jakobi, A. P., Petzold, S., Pusch, T., and Steinberg, P. (2010) *"Europe 2020" – Proposals for the Post-Lisbon Strategy, International Policy Analysis*. Bonn: Friedrich Ebert Stiftung.



- Friedman, T. L. (2005) *The world is flat : a brief history of the globalized world in the twenty-first century*. London: Allen Lane.
- Georghiou, L. (2018) *A European ecosystem for social innovation*. Luxembourg: Publication Office of the European Union.
- Geschwind, L., Kekäle, J., Pinheiro, R., and Sørensen, M. P. (2019) 'Responsible Universities in Context.' In *The Responsible University: Exploring the Nordic Context and Beyond*, edited by Mads P. Sørensen, Lars Geschwind, Jouni Kekäle and Rómulo Pinheiro, 3-29. Cham, Switzerland: Palgrave Macmillan
- Geuna, A., and Muscio, A. (2009) 'The Governance of University Knowledge Transfer: A Critical Review of the Literature.' *Minerva* 47 (1):93-114. doi: 10.1007/s11024-009-9118-2.
- Gibbons, M. (1998) *Higher Education Relevance in the 21st Century. UNESCO World Conference on Higher Education*. Paris: UNESCO.
- Giesenbauer, B., and Müller-Christ, G. (2020) 'University 4.0: Promoting the Transformation of Higher Education Institutions toward Sustainable Development.' *Sustainability* 12 (8):3371.
- Goddard, J., Hazelkorn, E., Kempton, L., and Vallance, P. (2016) *The Civic University: The Policy and Leadership Challenges*. Cheltenham: Edward Elgar.
- Goddard, J., Kempton, L., and Vallance, P. (2012) 'The Civic University: Connecting the Global and the Local.' In *Universities, Cities and Regions: Loci for knowledge and*

*innovation creation* edited by R. Capello, A Olechnick and G. Gorzelak. London: Routledge.

Goddard, J., and Vallance, P. (2013) *The university and the city*. Edited by Gillian Bristow. 63 vols, *Regions and Cities*. London and New York: Routledge.

Gomes, L. A. d. V., Facin, A. L. F., Salerno, M. S., and Ikenami, R. K. (2018) 'Unpacking the innovation ecosystem construct: Evolution, gaps and trends.' *Technological Forecasting and Social Change* 136:30-48. doi: <https://doi.org/10.1016/j.techfore.2016.11.009>.

Grau, F. X., Goddard, J., Hall, B. L., Hazelkorn, E., and Tandon, R. (2017) *Higher education in the world 6. Towards a socially responsible university: Balancing the global with the local*. Girona: Global University Network for Innovation.

Gretschmann, K., and Schepers, S. (2016) 'Revisiting innovation: Revolutionizing European innovation policy by means of an innovation ecosystem.' In *Revolutionising EU Innovation Policy: Pioneering the Future*, edited by Klaus Gretschmann and Stefan Schepers, 1-25. London: Palgrave Macmillan UK.

Gretzinger, S., Hinz, H., and Matiaske, W. (2011) 'Strong Ties, Weak Ties and the Management of Innovation: The Case of Danish and German SMEs.' In *New Developments in the Theory of Networks: Franchising, Alliances and Cooperatives*, edited by Mika Tuunanen, Josef Windsperger, Gérard Cliquet and George Hendrikse, 277-98. Heidelberg: Physica-Verlag HD.

- Guerrero-Cano, M., Kirby, D., and Urbano, D. (2006) A literature review of entrepreneurial university: a institutional approach. Paper presented at the 3rd Conference of Pre-communications to Congresses. Business Economic Department. Autonomous University of Barcelona., Barcelona, June
- Haugh, H. (2007) 'New Strategies for a Sustainable Society: The Growing Contribution of Social Entrepreneurship.' *Business Ethics Quarterly* 17 (4):743-9. doi: 10.5840/beq20071747.
- Häyrynen-Alestalo, M., and Peltola, U. (2006) 'The problem of a market-oriented university.' *Higher Education* 52 (2):251-81.
- Hayter, C. S., and Cahoy, D. R. (2016) 'Toward a strategic view of higher education social responsibilities: A dynamic capabilities approach.' *Strategic Organization* 16 (1):12-34. doi: 10.1177/1476127016680564.
- Hofer, A.-R., and Kaffka, G. (2019) 'Chapter 7: HEInnovate: facilitating change in higher education.' In *Entrepreneurial Universities: Collaboration, Education and Policies*, edited by João J. Ferreira, Alain Fayolle, Vanessa Ratten and Mário Raposo, 135-52. Cheltenham: Edward Elgar Publishing Limited.
- Huang, J., van den Brink, H. M., and Groot, W. (2011) 'College Education and Social Trust: An Evidence-Based Study on the Causal Mechanisms.' *Social indicators research* 104 (2):287-310. doi: 10.1007/s11205-010-9744-y.
- Intrachotoo, S., and Arons, D. (2002) 'Nurturing green innovations for academic institutions.' *International Journal of Sustainability in Higher Education* 3 (2):155-63.

- Iorio, R., Labory, S., and Rentocchini, F. (2017) 'The importance of pro-social behaviour for the breadth and depth of knowledge transfer activities: An analysis of Italian academic scientists.' *Research Policy* 46 (2):497-509. doi: 10.1016/j.respol.2016.12.003.
- Jaakkola, E. (2020) 'Designing conceptual articles: four approaches.' *AMS Review* 10 (1):18-26. doi: 10.1007/s13162-020-00161-0.
- Jesson, J., Matheson, L., and Lacey, F. M. (2011) *Doing Your Literature Review: Traditional and Systematic Techniques*. London: SAGE Publications.
- Jorge, M. L., and Peña, F. J. A. (2017) 'Analysing the literature on university social responsibility: A review of selected higher education journals.' *Higher Education Quarterly* 71 (4):302-19. doi: doi:10.1111/hequ.12122.
- Kahle, J., Risch, K., Wanke, A., and Lang, D. J. (2018) 'Strategic Networking for Sustainability: Lessons Learned from Two Case Studies in Higher Education.' *Sustainability* 10 (12):4646.
- Kandiko, C. B., and Blackmore, P. (2008) 'Institutionalising interdisciplinary work in Australia and the UK.' *Journal of Institutionalising Research* 14 (1):63/676.
- Karlsen, J., Beseda, J., Sima, K., and Zyzak, B. (2017) 'Outsiders or Leaders? The Role of Higher Education Institutions in the Development of Peripheral Regions.' *Higher Education Policy* 30 (4):463-79. doi: 10.1057/s41307-017-0065-5.
- Karlsen, J., and Larrea, M. (2019) 'Does a Responsible University Need a Third Mission?' In *The Responsible University: Exploring the Nordic Context and Beyond*, edited by Mads

- P. Sørensen, Lars Geschwind, Jouni Kekäle and Rómulo Pinheiro, 173-99. Cham, Switzerland: Palgrave Macmillan
- Kassel, K., Rimanoczy, I., and Mitchell, S. F. (2016) "'The Sustainable Mindset: Connecting Being, Thinking, and Doing in Management Education".' *Academy of Management Proceedings* 2016 (1):16659. doi: 10.5465/ambpp.2016.16659abstract.
- Kohoutek, J., Pinheiro, R., Čábelková, I., and Šmídová, M. (2017a) 'Higher Education Institutions in Peripheral Regions: A Literature Review and Framework of Analysis.' *Higher Education Policy* 30 (4):405-23. doi: 10.1057/s41307-017-0062-8.
- Kohoutek, J., Pinheiro, R., Čábelková, I., and Šmídová, M. (2017b) 'The Role of Higher Education in the Socio-Economic Development of Peripheral Regions.' *Higher Education Policy* 30 (4):401-3. doi: 10.1057/s41307-017-0068-2.
- Kosmützky, A., and Krücken, G. (2014) 'Growth or steady state? A bibliometric focus on international comparative higher education research.' *Higher Education* 67 (4):457-72.
- Krücken, G. (2014) 'Higher education reforms and unintended consequences: a research agenda.' *Studies in Higher Education* 39 (8):1439-50.
- Küçüksayraç, E., Wever, R., and Brezet, H. (2017) 'Universities' intermediary role in the "design for sustainability" field: Case studies from the Netherlands and Turkey.' *International Journal of Sustainability in Higher Education* 18 (3):455-72.
- Lamy, P., Bruder Müller, M., Ferguson, M., Friis, L., Garmendia, C., Gray, I., Gulliksen, J., et al. (2017) *LAB – FAB – APP Investing in the European future we want: Report of the independent High Level Group on maximising the impact of EU Research & Innovation*

*Programmes*. Brussels: Directorate-General for Research and Innovation, European Commission.

Lattu, A., and Cai, Y. (2020) 'Tensions in the Sustainability of Higher Education—The Case of Finnish Universities.' *Sustainability* 12 (5):1941.

Lehmann, M., and Fryd, O. (2008) 'Urban quality development and management: Capacity development and continued education for the sustainable city.' *International Journal of Sustainability in Higher Education* 9 (1):21-38.

Leisyte, L., and Horta, H. (2011) 'Introduction to a special issue: Academic knowledge production, diffusion and commercialization: policies, practices and perspectives.' *Science and Public Policy* 38 (6):422-4. doi: 10.3152/030234211x12960315267697.

Liu, S., and Van Der Sijde, P. C. (2021) 'Towards the Entrepreneurial University 2.0: Reaffirming the Responsibility of Universities in the Era of Accountability.' *Sustainability* 13 (6):3073. doi: 10.3390/su13063073.

Lopes, J., Ferreira, J. J., Farinha, L., and Raposo, M. (2020) 'Emerging Perspectives on Regional Academic Entrepreneurship.' *Higher Education Policy* 33 (2):367-95. doi: 10.1057/s41307-018-0099-3.

Lundvall, B.-Å. (1992) *National systems of innovation : towards a theory of innovation and interactive learning*. London, New York: Pinter Publishers.

Monsonis-Paya, I., Garcia-Melon, M., and Lozano, J. F. (2017) 'Indicators for Responsible Research and Innovation: A Methodological Proposal for Context-Based Weighting.' *Sustainability* 9 (12):29. doi: 10.3390/su9122168.

- Moon, C. J., Walmsley, A., and Apostolopoulos, N. (2018) 'Governance implications of the UN higher education sustainability initiative.' *Corporate Governance: The international journal of business in society* 18 (4):624-34. doi: 10.1108/cg-01-2018-0020.
- Mulà, I., Tilbury, D., Ryan, A., Mader, M., Dlouhá, J., Mader, C., Benayas, J., Dlouhý, J., and Alba, D. (2017) 'Catalysing Change in Higher Education for Sustainable Development: A review of professional development initiatives for university educators.' *International Journal of Sustainability in Higher Education* 18 (5):798-820.
- Musial, K. (2010) 'Redefining external stakeholders in nordic higher education.' *Tertiary Education and Management* 16 (1):45-60.
- Muthusamy, S. K., and White, M. A. (2005) 'Learning and Knowledge Transfer in Strategic Alliances: A Social Exchange View.' *Organization Studies* 26 (3):415-41. doi: 10.1177/0170840605050874.
- Nelson, R. R. (1993) *National innovation systems: a comparative analysis*. New York ; Oxford: Oxford University Press.
- Oh, D.-S., Phillips, F., Park, S., and Lee, E. (2016) 'Innovation ecosystems: A critical examination.' *Technovation* 54 (Supplement C):1-6. doi: <https://doi.org/10.1016/j.technovation.2016.02.004>.
- Perkmann, M., Salandra, R., Tartari, V., McKelvey, M., and Hughes, A. (2021) 'Academic engagement: A review of the literature 2011-2019.' *Research Policy* 50 (1):104114. doi: 10.1016/j.respol.2020.104114.

- Pinheiro, R., Geschwind, L., Kekäle, J., and Sørensen, M. P. (2019) 'Over the Cuckoo's Nest: Towards a Nordic Model of the Responsible University?' In *The Responsible University: Exploring the Nordic Context and Beyond*, edited by Mads P. Sørensen, Lars Geschwind, Jouni Kekäle and Rómulo Pinheiro, 173-99. Cham, Switzerland: Palgrave Macmillan
- Pinheiro, R., Langa, P. V., and Pausits, A. (2015) 'The institutionalization of universities' third mission: introduction to the special issue.' *European Journal of Higher Education* 5 (3):227-32. doi: 10.1080/21568235.2015.1044551.
- Pinheiro, R., and Stensaker, B. (2014) 'Designing the Entrepreneurial University: The Interpretation of a Global Idea.' *Public Organization Review* 14 (4):497-516. doi: 10.1007/s11115-013-0241-z.
- Pinheiro, R., Wengenge-Ouma, G., Balbachevsky, E., and Cai, Y. (2015) 'The role of higher education in society and the changing institutionalized features in higher education.' In *The Palgrave International Handbook of Higher Education Policy and Governance*, edited by Jeroen Huisman, Manuel Souto-Otero, David D. Dill and Harry de Boer, 225-42. Basingstoke: Palgrave Macmillan.
- Poole, M. S., and Van de Ven, A. H. (2004) 'Theories of organizational change and innovation processes.' In *Handbook of Organizational Change and Innovation*, edited by M.S. Poole and A.H. Van de Ven, 374-97. Oxford: Oxford University Press.
- Posch, A., and Steiner, G. (2006) 'Integrating research and teaching on innovation for sustainable development.' *International Journal of Sustainability in Higher Education* 7 (3):276-92.



- Purcell, W. M., Henriksen, H., and Spengler, J. D. (2019) 'Universities as the engine of transformational sustainability toward delivering the sustainable development goals: "Living labs" for sustainability.' *International Journal of Sustainability in Higher Education* 20 (8):1343-57.
- Ratajczyk, N., Wagner, I., Wolanska-Kaminska, A., Jurczak, T., and Zalewski, M. (2017) 'University's multi-scale initiatives for redefining city development.' *International Journal of Sustainability in Higher Education* 18 (1):50-62.
- Reichert, S. (2019) *The Role of Universities in Regional Innovation Ecosystems*. Brussels: EUA.
- Rinaldi, C., Cavicchi, A., Spigarelli, F., Lacchè, L., and Rubens, A. (2018) 'Universities and smart specialisation strategy: From third mission to sustainable development co-creation.' *International Journal of Sustainability in Higher Education* 19 (1):67-84.
- Röpke, J. (1998) *The Entrepreneurial University: Innovation, Academic Knowledge Creation and Regional Development in a Globalized Economy*. Marburg, Germany: Philipps-Universität.
- Rosa, M. J., and Teixeira, P. (2014) 'Policy reforms, Trojan horses, and imaginary friends: The role of external stakeholders in internal quality assurance systems.' *Higher Education Policy* 27 (2):219-37.
- Rutten, R., and Boekema, F. (2012) 'From Learning Region to Learning in a Socio-spatial Context.' *Regional Studies* 46 (8):981-92. doi: 10.1080/00343404.2012.712679.
- Shapiro, H. T. (2005) *A larger sense of purpose : higher education and society*. Princeton, N.J. ; Woodstock: Princeton University Press.

- Sil, R., and Katzenstein, P. J. (2010) *Beyond Paradigms: Analytic Eclecticism in the Study of World Politics* New York and Basingstoke: Palgrave Macmillan.
- Šima, K., Benneworth, P., Pinheiro, R., and Beseda, J. (2017) 'What are the Cultural Preconditions of Universities' Regional Engagement? Towards a Disciplinary Sensitive Model of the University–Region Interface.' *Higher Education Policy* 30 (4):517-32. doi: 10.1057/s41307-017-0056-6.
- Sin, C., and Amaral, A. (2017) 'Academics' and employers' perceptions about responsibilities for employability and their initiatives towards its development.' *Higher Education* 73 (1):97-111.
- Sivapalan, S., Clifford, M. J., and Speight, S. (2016) 'Engineering education for sustainable development: using online learning to support the new paradigms.' *Australasian Journal of Engineering Education* 21 (2):61-73. doi: 10.1080/22054952.2017.1307592.
- Slaughter, S., and Leslie, L. L. (1997) *Academic capitalism : politics, policies, and the entrepreneurial university*. Baltimore, Md. ; London: Johns Hopkins University Press.
- Šmídová, M., Šmídová, O., Kyllingstad, N., and Karlsen, J. (2017) 'Regional Development: Lifelong Learning as a Priority in Norway and the Czech Republic?' *Higher Education Policy* 30 (4):499-516. doi: 10.1057/s41307-017-0060-x.
- Smorodinskaya, N., Russell, M., Katukov, D., and Still, K. (2017) Innovation Ecosystems vs. Innovation Systems in Terms of Collaboration and Co-creation of Value. Paper presented at the Hawaii International Conference on System Sciences 2017, Hilton Waikoloa Village, Hawaii, 3-7 January.

- Sørensen, M. P., Geschwind, L., Kekäle, J., and Pinheiro, R. (2019) *The Responsible University: Exploring the Nordic Context and Beyond*. Cham, Switzerland: Palgrave Macmillan
- Sotarauta, M., Heinonen, T., Sorvisto, P., and Kolehmainen, J. (2016) *Innovation ecosystems, competences and leadership: Human spare parts and venture finance ecosystems under scrutiny*. Helsinki: Tekes – the Finnish Funding Agency for Innovation
- Takala, A., and Korhonen-Yrjänheikki, K. (2019) 'A decade of Finnish engineering education for sustainable development.' *International Journal of Sustainability in Higher Education* 20 (1):170-86.
- Tauginienė, L., and Pučėtaitė, R. (2021) *Managing Social Responsibility in Universities*. Charm, Switzerland: Palgrave Macmillan.
- Tight, M. (2012) 'Higher education research 2000–2010: Changing journal publication patterns.' *Higher Education Research & Development* 31 (5):723-40.
- Trencher, G., Yarime, M., McCormick, K. B., Doll, C. N. H., and Kraines, S. B. (2014) 'Beyond the third mission: Exploring the emerging university function of co-creation for sustainability.' *Science and Public Policy* 41 (2):151-79. doi: 10.1093/scipol/sct044.
- Trippl, M., Sinozic, T., and Lawton Smith, H. (2015) 'The Role of Universities in Regional Development: Conceptual Models and Policy Institutions in the UK, Sweden and Austria.' *European Planning Studies* 23 (9):1722-40. doi: 10.1080/09654313.2015.1052782.

- United Nations. (2015) *Transforming our world: the 2030 Agenda for Sustainable Development*. Edited by General Assembly. Vol. A/RES/70/1 New York: United Nations.
- Ustundag, A., and Cevikcan, E. a. (2018) *Industry 4.0 : managing the digital transformation*. Cham, Switzerland: Springer.
- Uyarra, E. (2010) 'Conceptualizing the regional roles of universities, implications and contradictions.' *European Planning Studies* 18 (8):1227-46.
- Vakkuri, J. (2004) 'Institutional change of universities as a problem of evolving boundaries.' *Higher Education Policy* 17 (3):287-309.
- Vasilescu, R., Barna, C., Epure, M., and Baicu, C. (2010) 'Developing university social responsibility: A model for the challenges of the new civil society.' *Procedia - Social and Behavioral Sciences* 2 (2):4177-82. doi: <https://doi.org/10.1016/j.sbspro.2010.03.660>.
- Vellamo, T., Elias Pekkola, and Taru Siekkinen. (2019) 'Technical Education in Jeopardy? Assessing the Interdisciplinary Faculty Structure in a University Merger.' In *The Responsible University: Exploring the Nordic Context and Beyond*, edited by Mads P. Sørensen, Lars Geschwind, Jouni Kekäle and Rómulo Pinheiro, 203-31. Cham, Switzerland: Palgrave Macmillan
- Vlegels, J., and Huisman, J. (2020) 'The emergence of the higher education research field (1976–2018): preferential attachment, smallworldness and fragmentation in its collaboration networks.' *Higher Education*. doi: 10.1007/s10734-020-00600-8.

- von Schomberg, R. (2011) 'Prospects for technology assessment in a framework of responsible research and innovation.' In *Technikfolgen abschätzen lehren. Bildungspotenziale transdisziplinärer Methoden*, edited by M. Dusseldorp and R. Beecroft, 39-61. Dordrecht: Springer.
- Waas, T., Verbruggen, A., and Wright, T. (2010) 'University research for sustainable development: definition and characteristics explored.' *Journal of Cleaner Production* 18 (7):629-36. doi: <https://doi.org/10.1016/j.jclepro.2009.09.017>.
- Walmsley, A., Apostolopoulos, N., and Moon, C. (2018) 'The entrepreneurial university as an engine for sustainable development.' *International Journal of Innovation and Regional Development* 8 (4):358. doi: 10.1504/ijird.2018.10018586.
- Walrave, B., Talmar, M., Podoyntsyna, K. S., Romme, A. G. L., and Verbong, G. P. J. (2017) 'A multi-level perspective on innovation ecosystems for path-breaking innovation.' *Technological Forecasting and Social Change*. doi: <https://doi.org/10.1016/j.techfore.2017.04.011>.
- Weber, M. (1904) "Objectivity" in social science and social policy.' In *The Methodology of the Social Sciences*, edited by Weber Max, 49-112. Glencoe, IL: The Free Press (Translated by Edward Shils and Henry A Finch, 1949).
- Wells, P. J. (2017) 'UNESCO'S Introduction: The role of Higher Education Institutions today.' In *Higher Education in the World 6. Towards a Socially Responsible University: Balancing the Global with the Local*, edited by Francesc Xavier Grau, John Goddard, Budd L. Hall, Ellen Hazelkorn and Rajesh Tandon. Barcelona: Global University Network for Innovation (GUNi).

- Westnes, P., Hatakenaka, S., Gjelsvik, M., and Lester, R. K. (2009) 'The role of Universities in strengthening local capabilities for innovation - A comparative case study.' *Higher Education Policy* 22 (4):483-503.
- Wimpenny, K., Nascimbeni, F., Affouneh, S., Almakari, A., Maya Jariego, I., and Eldeib, A. (2019) 'Using open education practices across the Mediterranean for intercultural curriculum development in higher education.' *Teaching in Higher Education*:1-16. doi: 10.1080/13562517.2019.1696298.
- Wissema, J. G. (2009) *Towards the third generation university : managing the university in transition*. Cheltenham: Edward Elgar.
- Wright, S. (2016) 'Universities in a knowledge economy or ecology? Policy, contestation and abjection.' *Critical Policy Studies* 10 (1):59-78. doi: 10.1080/19460171.2016.1142457.
- Wright, T. S. A. (2002) 'Definitions and frameworks for environmental sustainability in higher education.' *Higher Education Policy* 15 (2):105-20. doi: [https://doi.org/10.1016/S0952-8733\(02\)00002-8](https://doi.org/10.1016/S0952-8733(02)00002-8).
- Zhang, Q. T., Larkin, C., and Lucey, B. M. (2017) 'An Empirical Study of the Innovative Culture in Ireland's Higher Education Institutions.' *Higher Education Policy* 30 (4):533-53. doi: 10.1057/s41307-017-0039-7.