From an analytical framework for understanding the innovation process in higher education to an emerging research field of innovations in higher education

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Abstract

While studies dealing with issues related to innovations in higher education proliferate, there has been little consensus on key concepts and central issues for research. To respond to the challenges, this paper calls for developing a new research field — studies on innovations in higher education, by integrating two disciplines, namely innovation studies and higher education research. As an initial effort, the paper constructs an analytical framework for understanding the innovation process, particularly in the context of higher education. In addition to its academic significance, the framework may have potential to guide practitioners to implement innovations in wiser ways.

Key words: Innovation studies; innovation process; organisational change, reform, higher education; university

Introduction

While economic development was traditionally a matter of the industry sector, in the era of knowledge-based society it has become increasingly dependent on cooperation between industry and knowledge production organisations (Lundvall, 1992, p. 22). In this context, the concept of innovation systems was raised (Edquist, 1997b; Freeman, 1987; Lundvall, 1992). Innovation systems consist of complex functions and interactions among various organisations and institutions (Edquist, 1997b; Kumaresan & Miyazaki, 1999; Lundvall, 1992; R. Nelson, 1993; Organisation for Economic Co-operation and Development [OECD], 1999) with the ultimate goal of boosting technological innovation and thereby enhancing economic competitiveness. North (1990) used the metaphors of players and rules to differentiate between organisations and institutions: while players follow the rules of the game, they can also influence those rules. In the context of innovation systems, organisations include government, enterprises, universities, and research institutes; institutions are, for example, policies and social norms (Edquist & Johnson, 1997). In a similar vein, Etzkowitz and Leydesdorff (1995, 1997) developed the Triple Helix model to understand the dynamic interactions between three key innovation actors—university, industry and government, which foster entrepreneurship, innovation, and economic growth. The development of a Triple Helix system is also associated with institutional change and institutional capacity building (Cai, 2015).

Among a variety of innovation actors, the role of universities in innovation systems is becoming increasingly crucial (Etzkowitz, 2004, 2013; Mowery & Sampat, 2005; R. R. Nelson & Rosenberg, 1993). Thus, one major theme of on-going higher education reforms around the world is concerned with how to effectively coordinate and facilitate universities to better interact with other actors to promote innovation (Dill & Vught, 2010; Laredo & Mustar, 2001), which leads to a transformation within higher education. Such transformation in higher education has been conceptualised in a variety of cognate concepts, such as, “academic capitalism” (Sheila Slaughter & Leslie, 1997), “entrepreneurial university” (Clark, 1998; Etzkowitz, 2004), “model 2 of knowledge

production" (Gibbons, 1998), "higher education as an industry" (Gumport, 2000), and "the third mission of university" (Etzkowitz, 1994). Accordingly, new public management (Hood, 2000) or new managerialism (Clarke & Newman, 1994, 1997) was applied in higher education as an innovative approach to responding to changing environments. All these are often called innovations in higher education, though without providing sufficient clarifications of innovation. Such reforms or innovations focus on the missions, strategies, and management of universities, but also entail changes in many aspects of higher education, such as policy, organisational structure, curriculum, teaching and learning, etc.

In spite of a growing volume of literature dealing with innovations in higher education, the research is quite fragmented and lacks some sort of "glue" to unite them, though there is a potential to build a synergy of various intellectual insights for advancing our knowledge more rapidly. The topic of innovation in higher education has likewise failed to enter the mainstream of "innovation studies" (Fagerberg, Martin, & Andersen, 2013; Fagerberg & Verspagen, 2009), which seeks theories of innovation from multiple perspectives. For instance, in both a recent literature review of innovation studies (Fagerberg, Fosaas, & Sapprasert, 2012; Martin, 2012) and an analysis of the evolution of innovation studies (Fagerberg et al., 2013; Fagerberg & Verspagen, 2009), innovations in higher education are little exemplified or discussed.

Due to the important role of universities or higher education in the innovation system, there is an urgent need to bring issues related to innovations in higher education to the centre of innovation studies. Studies on innovations in higher education can evolve into a more coherent research field by integrating both innovation studies and higher education research on innovation related issues. Actually, Berg and Östergren (1979) already asserted more than thirty years ago that "research about innovations in education should be assessed as part of innovation research in general" (p. 261). Based on an analysis of seven cases of successful innovation processes in Swedish higher education, they set out a number of propositions (see some examples in Table 1 in Section 3), providing a solid

basis for a comprehensive conceptualisation of innovation in higher education. Unfortunately, researchers have not responded to this call.

Calling the studies on innovations in higher education a new research field is not merely adding a new label. Rather, it is a joint scholarly effort towards developing profound approaches for a better understanding of the innovation process in higher education. Specifically, the field is about how universities as well as the system of higher education could be more innovative in response to the needs for developing innovation systems. The studies on innovations in higher education, as an integral part of higher education research, can equally be developed as a branch of innovation studies. While the former would certainly contribute to the latter since the university is becoming a key engine for industrial and social innovation, the wisdom of the latter would greatly facilitate the development of the former with more advanced theoretical insights and richer empirical experiences of innovations in general.

Regardless of such an ambitious call, the purpose of the paper is relatively modest. It mainly seeks to better understand the concept of innovation in higher education and then tries to shed light on the future development of studies on innovation in higher education. The term innovation has often been used in the higher education literature without a clear definition. It is generally perceived as radical changes or reforms in various domains of higher education, such as academic work, curriculum, teaching, learning and technology etc. (See, for example, Hannan & Silver, 2000; Hoffman & Spangehl, 2011; Kozma, 1985; Schneckenberg, 2009; Scott, 2012; Zhu & Engels, 2014). Meanwhile, many other higher education studies (See, for example, Clark, 1998; Sheila Slaughter & Leslie, 1997; Sheila Slaughter & Rhoades, 2004) talk about innovation related issues without explicitly using the term. These studies largely deal with the adaptation of universities to their changing environment. However, as criticised by Goddard and Vallance (2013, p. 49), most higher education researchers primarily pay attention to the external environment of the university, but

merely with regard to funding and regulative provisions, while paying relatively little attention to the much broader societal environment in which universities actually evolve (Cai, 2014c).

Regarding changes in the local economy and society in which a university is embedded, the innovation studies literature (e.g., innovation systems and regional economic studies) has already provided rich and insightful understandings. However, higher education researchers rarely consult this body of literature, and therefor there is an urgent need to establish dialogue between the research fields (Cai, 2014c) although some recent publications (Benneworth, Coenen, Moodysson, & Asheim, 2009; Cai & Liu, 2015b; Pinheiro, Benneworth, & Jones, 2012) demonstrate good efforts in this direction. Another problem in higher education studies is that the concept of innovation has been vaguely used without clear definition and focus.

This paper tries to fill the gaps by constructing an analytical framework for understanding the innovation process in higher education by juxtaposing and integrating two bodies of literature, namely innovation studies and higher education research dealing with innovation issues. In so doing, it starts by building up a generic framework for understanding the innovation process based on reviewing and analysing the relevant literature in innovation studies. Then, the framework, together with each key element within it, is verified in the context of higher education, supported by the arguments and illustrations in the higher education literature. Finally, it concludes with some implications for the developing the research field on innovations in higher education.

Towards a generic framework for understanding innovation process: insights from innovation studies

Understandings of innovation in the literature of innovation studies

Innovation studies pursues "systematic and reliable knowledge about how best to influence innovation and exploit its effects to the full" (Fagerberg, Martin, & Andersen, 2013, p. 1). It has been developed since the 1960s and has now become a relatively large field, consisting of thousands of

researchers contemplating innovations from multiple theoretical perspectives, mainly the evolutionary perspective, the techno-economic perspective, and the socio-economic perspective (Lundvall, 2013). What puts university at the forefront in innovation studies is largely attributed to the innovation system approach (Edquist, 1997b; Lundvall, 1992) and the Triple Helix model (Etzkowitz & Leydesdorff, 1995, 1997), both of which take a broad socio-economic stance and accentuate that universities, among several other parties, are key components of knowledge-based societies.

According to Lundvall (1992), the innovation system approach is a focusing device that is alternative and supplementary to neo-classic theory in understanding economic systems from the perspectives of both theoretical understanding and policy-making. There is no single definition of innovation systems. One OCED (1997, p. 10) report has summarised a few classic definitions, and all of these share a common understanding that a national innovation system comprises complex functions and interactions among various actors and institutions. In this light, Edquist (1997b, p. 14) states that the innovation system "includes all important economic, social, political, organisational, institutional and other factors that influence the development, diffusion and use of innovations." To "reduce the complexity of the dynamics at play in the innovation systems of knowledge economy" (Zheng, 2010, p. 41), Etzkowitz and Leydesdorff (1995, 1997) identified three most important elements in the innovation system, namely government, industry, and university, and hence developed the Triple Helix model to depict the dynamic interactions between the three institutional spheres that foster innovation. One fundamental tenet of the Triple Helix thesis is that the Triple Helix interrelations between academia, industry, and government (mainly by taking on the role of the other) provide the optimal conditions enabling innovation (Etzkowitz, 2008).

In innovation studies (especially on innovation systems), there are a variety of definitions of innovation. Despite a lack of agreement on a unified understanding, Edquist (1997a, p. 10) made the observation that "all authors working within the systems of innovation approach are centrally

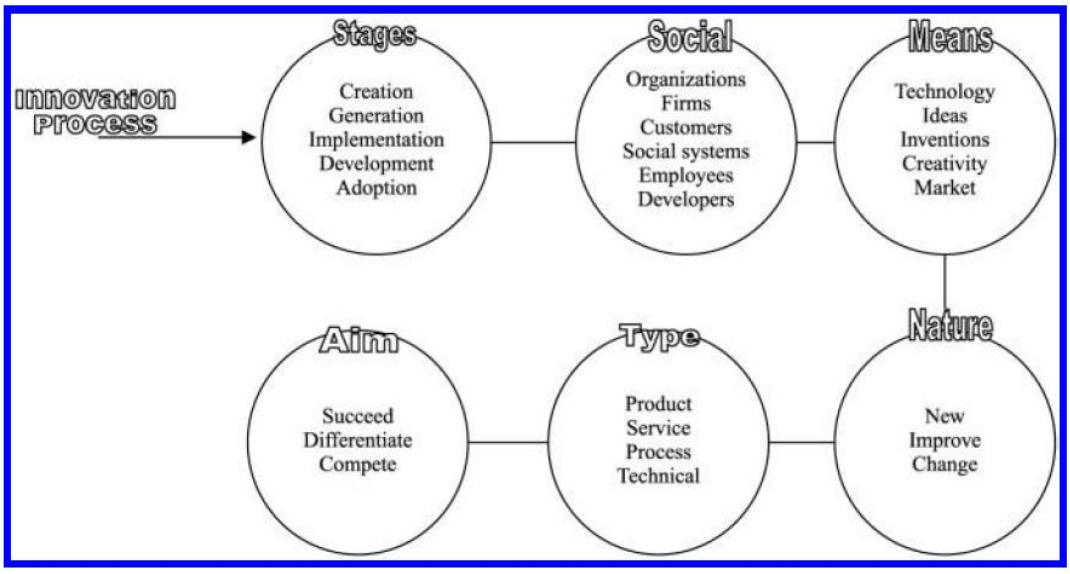
focused on technological innovation and, in addition, all are interested in organisational and institutional change." Lundvall (2010, pp. 8-9) maintained that innovation is an ubiquitous phenomenon in the modern economy that comprises learning, searching, and exploring, and eventually achieving results such as new products, new techniques, new forms of organisation, and even new markets that become widely used in society. He further stressed that innovation takes place in a gradual and cumulative way and is a process rather than a stage. Accordingly, an OECD report provides an encompassing definition for the concept of innovation: "An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method or a new organisational method in business practices, workplace organisation or external relations" (OECD & Eurostat, 2005, p. 46).

In spite of these shared views among various definitions of innovation as mentioned above, Baregheh, Rowley, and Sambrook (2009) claimed that "overall the number and diversity of definitions leads to a situation in which there is no clear and authoritative definition of innovation" (p. 1324). After collecting and analysing 60 definitions of innovation in various studies on innovation, they identified six key attributes of the innovation definitions (pp. 1331-1332):

- ***Nature of innovation*** *refers to the form of innovation as in something new or improved.*
- ***Type of innovation*** *refers to the kind of innovation as in the type of output or the result of innovation, e.g. product or service.*
- ***Stages of innovation*** *refers to all the steps taken during an innovation process which usually start from idea generation and end with commercialization.*
- ***Social context*** *refers to any social entity, system or group of people involved in the innovation process or environmental factors affecting it.*
- ***Means of innovation*** *refers to the necessary resources (e.g. technical, creative, financial) that need to be in place for innovation.*

• ***Aim of innovation*** *is the overall result that the organizations want to achieve through innovation.*

They further illustrate these attributes in a diagrammatic definition of innovation (Figure 1) in which innovation is defined as "the multi-stage process, whereby organisations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace" (Baregheh et al., 2009, p. 1334).



Source: Baregheh et al. (2009)

Figure 1. A diagrammatic definition of innovation

Although the diagrammatic definition above was developed mainly within business organisations and their environments, "the model seeks to present the 'essence' of innovation, no matter the organisational or disciplinary context" (Baregheh et al., 2009, p. 1333). "The six components of the model do not only describe the possible flow of the innovation process, they also indicate various starting points within the innovation process" (Baregheh et al., 2009, p. 1333).

While the model proposed by Baregheh et al. has potential for better understanding what innovation is, it may ignore some other important aspects of innovation. This is because of their

method for developing such model, by which the authors only compared and analysed various definitions of innovations but did not include in their literature analysis of those studies respectively discussing multiple aspects of innovations. Particularly, they failed to address several essential points from the insights of innovation studies, as presented below.

First, when analysing innovation, it is very important to be aware of the problem(s) to be addressed by an innovation activity (Hippel, 1994). The problem is related to the aim of innovation, but these are not exactly one and the same issue. Resolving certain problems faced by an organisation often triggers innovation. Once an innovation activity is initiated, though originally intended to just address a perceived problem, its aim may go beyond problem solving itself. Nevertheless, the problem as a triggering point of the innovation process must be tackled first when analysing innovation.

Second, in their model, Baregheh et al. (2009) excluded human actors in the innovation process. People are important in innovation. However, the recent research focuses primarily on innovation initiators, such as policy-makers, managers, and inventors, while paying little attention to those participating more passively in the innovation process, such as workers (Lundvall, 2013). This suggests that when analysing innovation, it is necessary to identify and differentiate between different groups of people playing various roles in the innovation process.

Third, Baregheh et al. (2009) did not include in their framework the perspective of innovation as an interactive process. Lundvall (2013, p. 33) emphasised that "a core in innovation studies is the conceptualisation of innovation as an interactive process involving many actors and extending over time." Following such understanding, an innovation process can be regarded "as one that starts with combining elements of existing knowledge and ends with new knowledge as an important output" (Lundvall, 2013, p. 33). Such a process is associated with organisational learning or a learning curve (Amin & Cohendet, 2000; MacKinnon, Cumbers, & Chapman, 2002; Sarah Slaughter, 1993; Stata, 1989), meaning that not only innovative ideas come from interactive learning but also that the

successful implementation of innovation requires a learning process in which organisations and actors constantly adjust the innovation process through the accumulation of experience, mistakes, lessons learned, and knowledge that one gains when carrying on innovation activities.

Fourth, Baregheh et al. (2009) paid little attention to potential challenges in the innovation process. As innovation by its very nature combines different disparate elements of knowledge, tensions, and challenges inevitably emerge when it comes to implementation (Lundvall, 2013). The emergence of an innovative idea or activity is just a starting point of the innovation process (Levine, 1980). To achieve a successful outcome, the key lies in effective innovation management and smart solutions to the challenges (Stata, 1989).

To further comprehend the interactive process of innovation and challenges in implementing innovation, the concept of institutionalisation may shed special light on it. Levine (1980) distinguished the implementation of organisational innovation into four stages, namely recognition of need (stage 1); planning and formulating a solution (stage 2); initiation of a plan (stage 3); and, institutionalisation (stage 4). This implies that only when an innovation is institutionalised can it be considered a successful implementation. Some scholars (Cai, Pinheiro, Geschwind, & Aarrevaara, 2016; Cai, Zhang, & Pinheiro, 2015) enhanced Levine's concept of institutionalisation of innovation by explicitly using the definition by Selznick (1957, p. 16): institutionalisation is an inherently historical process: "It is something that happens to an organisation over time, reflecting the organisation's own distinctive history, the people who've been in it, the groups it embodies and the vested interests it has created, and the way it has adapted to its environment." Cai et al. (2015) and Cai et al. (2016) identified a number of factors, which either facilitate or impede the institutionalisation process of innovation. Thus, when designing measures for implementing an innovation, the three factors must be the core in the processes of both planning and management.

An analytical framework for understanding innovation process

By integrating various insights on the innovation process as discussed above, an analytical framework for understanding it can be envisaged as in Figure 2. The blue colour boxes and the circle represent the six attributes in the innovation process described by Baregheh et al. (2009), while the others, such as the problems, people, learning curve and factor affecting institutionalisation of innovation, are additional ones supplemented by the insights of other innovation studies. Here the process of innovation is no longer linear as appeared the model by Baregheh et al. Rather, the more complex and interactive nature of the innovation process has been captured. The framework entails the following five steps in analysis.

1) To identify the innovation activity, the problem addressed by the innovation, address, and various people involved in the innovation.

2) To analyse the aim, type, and nature of innovation, as well as measures to institutionalise the innovation.

3) To examine how a learning curve in the innovation process takes place.

4) To identify in what stage the innovation implementation is and what challenges are faced in institutionalising the innovation.

5) To analyse what factors may affect the institutionalisation of innovation.

Next, I will interpret the framework, as well as each key elements of it, in the context of higher education.

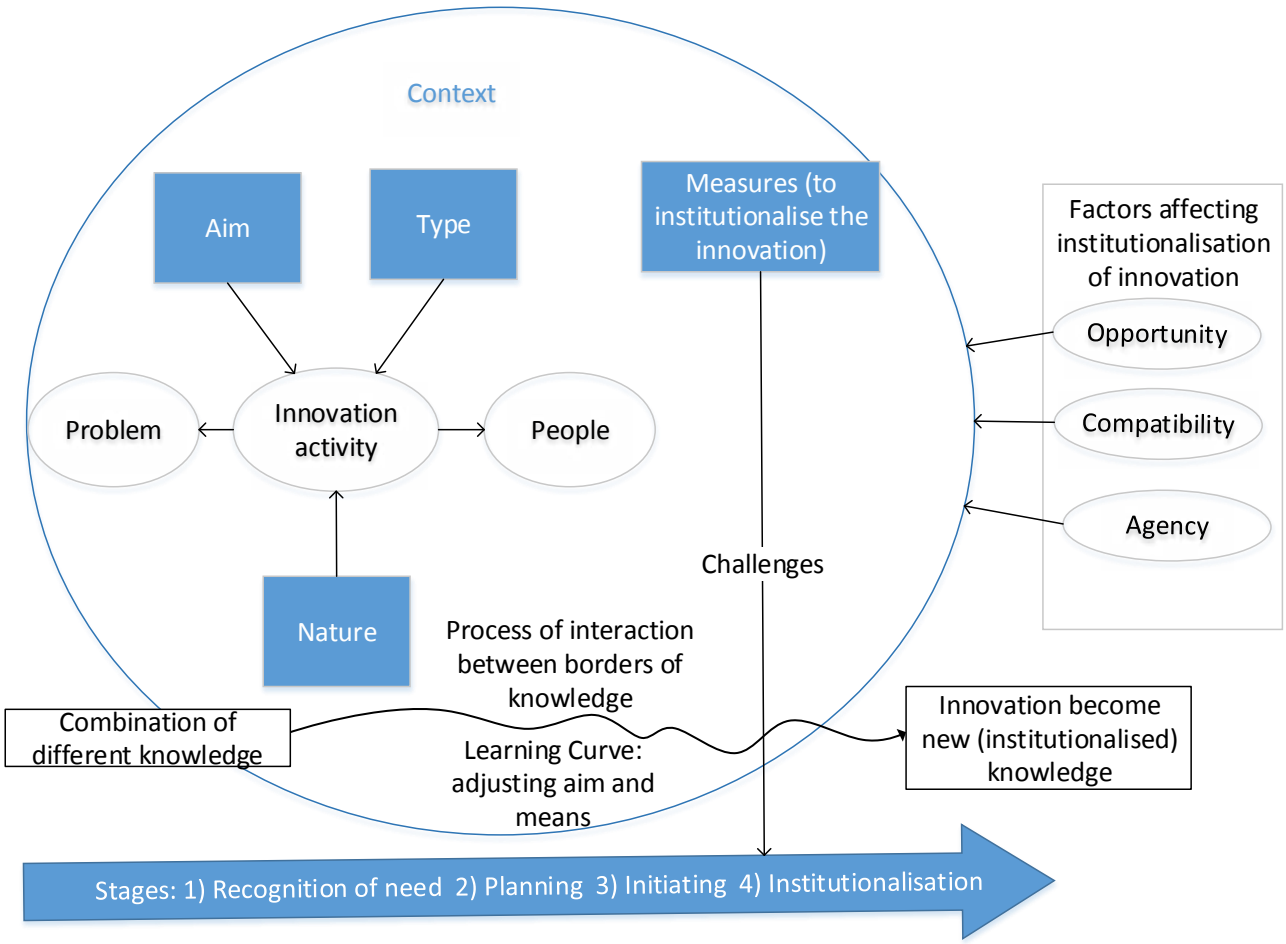


Figure 2. Analytical framework for understanding the innovation process

Understanding the innovation process in higher education

Point of departure

So far, there has been a lack of explanations of the meanings of innovation in the higher education literature. Some of the very few attempts at providing more detailed and comprehensive understandings of innovation are shown in Table 1, but they mainly touch upon some of attributes of innovation, such as nature, type, and aim, while the other elements are often overlooked, namely social context, means and stages. However, it is worth noting that when understanding innovation in higher education, Berg and Östergren (1979) already suggest that it is important to pay attention to the type of innovation, the social context of innovation, the means of innovation, and the aim of

innovation that are among the key attributes of innovation identified by Baregheh et al. (2009). Berg and Östergren claim as follows:

> any innovation theory must be limited to a certain type of innovation within a certain kind of system….The conditions for change are determined mainly by systems characteristics….Innovations which deviate from the system can occur only under the following conditions: …
>
> (a) there must be a 'crack' in the system. The 'crack' is created when components of the system deviate from its main characteristics; (b) there must be a connection between the 'crack' and the environment; (c) impulses from the environment flow into the 'crack'. …[I]nnovation per se is neither good nor bad. It is an important task of the members of the higher education system to be able critically to examine new ideas and reject undesired change. (pp. 266-267)

Nevertheless, neither Berg and Östergren nor other higher education researchers have continued to work in this direction.

Table 1. Attributes of innovation in the definitions of innovation in higher education literature [Insert Table 1 here]

Can the key components described in the framework (Figure 2) be applied in the context of higher education? Next, I will examine how higher education literature reflects the key elements in the innovation process. Instead of conducting a comprehensive literature review of studies related to innovations in higher education, my selection and use of literature are intended to find evidence of how each element in the innovation process in Figure 2 can be applied in the context of higher education. Due to the space limited, not all the literature I assembled is eventually used in the analysis. Nevertheless, I provide most of the studies in my collection in Table 2 to illustrate the major research themes that are related to innovations in higher education. Basically, the literature listed in the table are those studies that either explicitly use the concept of innovation or refer to other terms such as academic revolutions, new models of knowledge production, entrepreneurial university, and the third mission that largely deal with innovation issues in higher education. I will

discuss more details about the literature in the sections of 3.2 and 3.3, in which each element in the innovation process will be examined in the context of higher education.

Table 2 . Examples of publications related to studies on innovation in higher education

Topics of the studies	Sources of the studies
Innovations in higher education	(Christensen & Eyring, 2011), (Hoffman & Spangehl, 2011), (Calvani, 2003), (Bosco & Rodríguez-Gómez, 2011), (White & Glickman, 2007), (Berg & Östergren, 1979), (Wang, 2014), (Furst-Bowe & Bauer, 2007), (Levine, 1980).
Academic revolutions	(Zheng, 2010), (Etzkowitz & Viale, 2010), (Rodrigues, 2009), (Etzkowitz, 1990, 1994), (Molas-Gallart, Salter, Patel, Scott, & Duran, 2002), (Maxwell, 2007), (Maxwell, 2014), (Wissema, 2009).
New models of higher education/university e.g. entrepreneurial university, academic capitalism, model II of knowledge production, etc.	(Sheila Slaughter & Leslie, 1997), (Clark, 1998), (Etzkowitz, 2003b), (Gibbons, 1998), (Gumport, 2000), (Viale & Etzkowitz, 2010), (Markman, Gianiodis, Phan, & Balkin, 2004).

Third mission of university	(Goddard & Puukka, 2008), (Pinheiro et al., 2012), (Molas-Gallart et al., 2002), (Etzkowitz, 1994).
Technology innovation (ICTs) in higher education	(Zhu & Engels, 2014), (Amemado, 2014), (Carr, 2012).
New public management in higher education	(Amaral, Meek, & Larsen, 2003), (Deem & Brehony, 2005), (Deem, Hillyard, & Reed, 2007).

Six attribues in Baregheh et al.'s model

I will begin with the six attributes in Baregheh et al.'s model. Although Baregheh et al. (2009) illustrated their model of innovation process as a linear process, they acknowledged that the six components in the process are interrelated with each other in one way or another. They also suggest that when applying the framework in analysis one can start from any of the elements depending on the purpose of analysis.. Here, I will explain the six attributes in the higher education context starting with the nature of innovation and then following by type, stage, context, means and aim.

Nature of innovation in higher education.

In general, the nature of innovation refers to the form of innovation as doing something new or doing the same thing better (Baregheh et al., 2009). Current higher education reforms documented in the literature can be seen as two types of innovation: "sustaining innovation" or "disrupting innovation," the terms used by Christensen and Eyring (2011) in their book *The Innovative University*. Christensen and Eyring make a distinction between the two terms:

> The first type, sustaining innovation, makes something bigger or better. …. A disruptive innovation, by contrast, disrupts the bigger-and-better cycle by bringing to market a product

> or service that is not as good as the best traditional offerings but is more affordable and easy to use. (p. xxiv)

They further stress that, while disruptive innovation in higher education potentially benefits a large group of consumers and stakeholders, it becomes a threat to university traditions. In practice, the disruption innovation and sustaining innovation may occur simultaneously in higher education:

> Though traditional universities contribute to perform the critical, unique functions of discovering and preserving knowledge and of educating students in face-to-face communities of scholars, they also face disruptive innovations that call for re-examination. If they cannot find innovative, less costly ways of performing their uniquely valuable functions, they are doomed to decline, higher global and national rankings notwithstanding. (Christensen & Eyring, 2011, p. xxv)

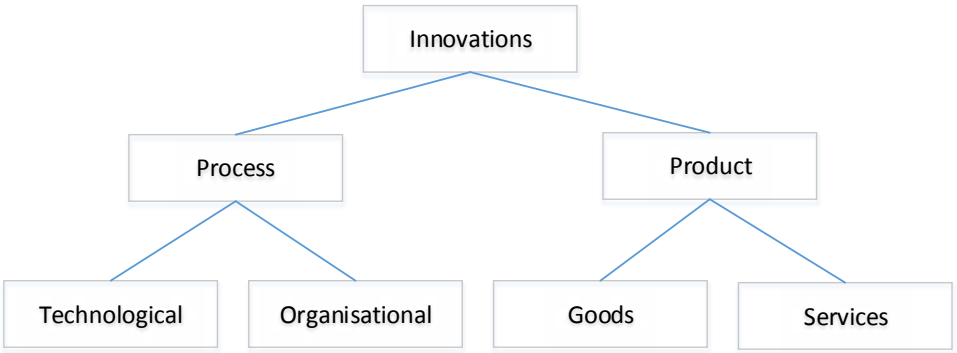
The majority of empirical studies on higher education reforms are concerned with doing the same things better. In recent years, however, an increasing number of studies tend to focus on disruptive innovation in higher education, often in the concepts of academic revolutions, new models of knowledge production, entrepreneurial universities, academic capitalism, etc. The research in this camp examines more radical or paradigm changes that disrupt the trajectory and lead to further paradigm changes. One key feature of the paradigm shift is characterised by the integration of social and economic development with teaching and research in the concept of "third mission" (Etzkowitz, 1994, 2003a). Such innovation is perfectly described by Hoffman and Holzhüter (2011) in their book chapter—the evolution of higher education. As they put it, "innovation resembles mutation, the biological process that keeps species evolving so that they can better compete for survival" (p. 3). They also pinpointed that university "has historically been slow to adopt the realities of this natural selection process" (p. 4). A similar observation has been made by Krücken (2003, p. 317): "In universities, new ideas only slowly diffuse into practice, and the orientation towards historically entrenched concepts play a much stronger role." These arguments imply that universities are

excessively addicted to what they are used to. As disruptive innovation is, by nature, against such inertia, it is not difficult to understand why there are so many challenges and conflicts in the process of paradigm change in higher education, as observed by many higher education researchers (See, for example, Sturgeon, 2012; Szkudlarek & Stankiewicz, 2014; Tuunainen, 2002). Thus "the university's innovation must be informed by self-awareness and by an understanding of history" (Christensen & Eyring, 2011, p. xxv).

Certainly, the nature of innovation is crucial in the innovation process, and determines the potential challenges as well as the implementation approaches. To further understand what innovations are in higher education, we need to move on to the attribute of innovation type.

Type of innovation.

A commonly cited taxonomy of innovations developed by Edquist (2001) understands innovation as either a new or improved product or process that has economic value (Figure 2). "Product innovations may be goods or services. It is a matter of what is being produced. Process innovations may be technological or organisational. It concerns how goods and services are produced" (p. 7). In the context of higher education, the goods and services are, for example, graduates, research outputs, patents, students, etc. The interest of the higher education literature in innovation is mainly concerned with process innovation, specifically, innovations in teaching/curriculum, research, management, and governance (Hannan & Silver, 2000; Wang, 2014; Zhu & Engels, 2014), where the "goods" and "services" are produced.



Source: Edquist (2001)

Figure 3. Typology of innovations

The term "technology" in higher education is somewhat unclear. The most concrete and commonly accepted examples are teaching and research (Musselin, 2007). Regarding innovation in the process of teaching, "typical innovations that currently dominate the debate in higher education are related to the integrated use of information and communication technologies (ICTs), the adoption of student-centred learning and the use of collaborative learning approaches" (Zhu & Engels, 2014, p. 137). The innovation in the research process is underlined by several prevalent theories in higher education, such as academic capitalism (Sheila Slaughter & Leslie, 1997), triple helix (Etzkowitz, 2008), and model 2 knowledge production (Gibbons, 1998), all of which are characterised by the capitalisation of knowledge as an emerging model of knowledge production (Viale & Etzkowitz, 2010). While changes constantly take place in the traditional functions of teaching and research, it is the third mission or social engagement function (Etzkowitz, 1994) that disrupts the traditional trajectories of teaching and research in universities.

"Organisational and technological innovations are intertwined" (Lam, 2005, p. 128), and this is also the case in higher education (Wang, 2014). The organisational innovations discussed in higher education literature can be interpreted as a response to pressing demands for new ways of organising and implementing the innovations in teaching and research as well as for better fulfilling the third mission. A special focus of organisational innovation in higher education is on enhancing the capacity of universities for the capitalisation of knowledge and facilitating universities' social engagement (Sheila Slaughter & Rhoades, 2004). The concrete examples are about new missions and strategies (third mission and entrepreneurial university), the new management approach (new public management), new organisational units (e.g. technology transfer offices), and new ways of organising academic staff and academic work (academic capitalism and academic entrepreneur). To

what extent have the technological and organisational innovations been achieved in higher education? It is about the stages of innovation, which will be discussed below.

Stages of innovation.

"Stages of innovation refers to all the steps taken during an innovation process which usually start from idea generation and end with commercialisation" (Baregheh et al., 2009). This is also perceived in higher education studies. In a study on innovation in community colleges, Thor (2011, p. 60) states, "Innovation is a continuous process of improvement and not a moment in time or a satisfying brainstorm session." To understand the stages of innovation in higher education, I borrow from Levine (1980), who distinguishes four stages in the innovation process: 1) recognition of need, 2) planning and formulating a solution, 3) initiation and implementation of a plan, and 4) institutionalisation, when analysing the organisational innovation in an American university. In higher education, the dominant innovation ideas such as entrepreneurial university, third mission, and academic capitalism, have been largely acknowledged among the participants and stakeholders of many universities. In the literature on strategic management and innovation studies, there are various descriptions of the stages in the process (e.g., Rogers, 2003; van de Ven, 1986; Zaltman, Duncan, & Holbek, 1973), but the core elements are similar to Levine's framework.

Now, the world of higher education is full of, if not overwhelmed, by new ideas. What challenges the higher education reformers and draws more attention from higher education researchers is how to implement and institutionalise these ideas. Institutionalisation, as a central concept of institutional theory, can be defined as a process "by which social processes, obligations, or actualities, come to take on a rule-like status in social thought and action" (Meyer & Rowan, 1977, p. 341). Once institutionalised, the social orders and rules are beyond question and cannot be compared to alternatives.

Recent years have witnessed a growing number of studies on the institutionalisation of higher education reforms and innovation (see, for example, Aypay & Kalaycia, 2008; Bringle &

Hatcher, 2000; Cai, 2014b; Cai et al., 2015; Colbeck, 2002; Owen-Smith, 2011). The successful institutionalisation of innovation in higher education implies significant changes in formal and informal institutions. Formal institutions are reflected in the organisation's formal structure and organisational missions, while the informal ones are reflected in the form of values and norms underlining actual organisational members' practices. However, the two sets of institutions are often loosely coupled (Meyer & Rowan, 1977; Weick, 1976), particularly in the context of higher education (Musselin, 2007; Sporn, 1999). Universities often strategically cope with and respond to external pressures, such as public demands and governmental mandates, by modifying their mission statements, launching new policies, and establishing new units, while their internal activity structure is to a large extent retained (Krücken, 2003). Therefore, when understanding the institutionalisation of innovation in university, "one has to take 'two speeds' of change into account" (Musselin, 2007, p. 317).

Context of innovation.

As indicated by Baregheh et al. (2009), the context can be both the social system and the organisational culture. When understanding innovation in higher education, it must be located in the contexts of societal and organisational levels where innovation is embedded. Both the social and organisational environments surrounding an innovation largely determine the extent of the challenges in the process of implementing the innovation.

Any innovations in higher education are part of and connected to a large social system in which higher education and universities are embedded (Berg & Östergren, 1979). Thus innovations in higher education can generally be understood as responses to the changing nature of society and the economy (Clark, 1998; Goddard & Vallance, 2013; Sporn, 1999). As Etzkowitz (2003b, p. 110) puts it, "academic entrepreneurship has … expanded from an organisational growth regime into a regional economic and social development strategy." While universities, through transforming their functions, largely contribute to the knowledge economy, the socio-economic context also influences

the innovation process in higher education. However, the higher education literature does not sufficiently account for the socio-economic contexts in which universities are embedded and in which their innovations take place (Cai, 2014c; Pinheiro, 2011).

To fill such a gap, higher education researchers may first consult the research in innovation studies, because maintaining a high sensitivity to the social context is important in innovation studies (Cai, 2015), particularly for understanding reform and innovation in higher education (Steiner-Khamsi, 2014). Indeed, university has been elevated to a prime engine for economic growth from its secondary status in the past (Etzkowitz, 2004), and how to promote innovations in higher education is becoming a central issue in studies on the innovation system approach (Edquist, 1997b; Lundvall, 1992) and the Triple Helix model (Etzkowitz, 2008; Etzkowitz & Leydesdorff, 1995, 1997). For instance, the supporting contexts or institutional logics for Triple Helix development discussed in the Triple Helix literature (Cai, 2015) can be of use for comprehending the contexts in which higher education is embedded.

Compared to the little attention to the larger social context, more higher education studies talk about the relations between innovation and organisational culture. Successfully innovation implementation requires a supportive organisational culture (Clark, 1998; Gebremeskel, 2015; Zhu & Engels, 2014). According to Clark (1998), to build entrepreneurial university, it is important, along with other measures, to develop a strong organisational culture that embraces changes. Zhu and Engels (2014) assert that an innovative, open, and supportive organisational cutlure with clear goals, a collaborative spirit, and shared vision is pertinent for the implementation of instructional innovations.

Means of innovation.

In the business environment, means of innovation refers to "the necessary resources (e.g. technical, creative, financial) that need to be in place for innovation" (Baregheh et al., 2009, p. 1332). In other words, the means refers to measures for implementing the innovation. As will be

discussed later on the aim of innovation, innovations in higher education are mainly for integrating the role of social and economic engagement into teaching and research, as well as for coping with related organisational transformations. To facilitate such kinds of innovation, the higher education literature calls attention to the importance of social structure (as discussed in the preceding sub-section), governance and policy framework (Enders, de Boer, & Weyer, 2013; Maassen, 2003), incentives for academics (Markman et al., 2004), and the culture for innovation (Thor, 2011; Zhu & Engels, 2014). While there is a general consensus that implementing and institutionalising innovation requires support from culture, there are different views regarding the role of policy mandates and incentives or individuals in the innovation process. Some major controversies, for example, revolve around two issues: 1) whether innovations are externally driven or internally driven, and 2) whether or not external incentives can drive innovation.

Regarding the first issue, Sheila Slaughter and Leslie (1997) argue in their book, *Academic Capitalism*: *Politics, Policies, and the Entrepreneurial University*, that academic capitalism (as a kind of innovation) is a result of reaction to external financial pressure due mainly to governmental financial constraints as well as corresponding changes in governmental policies. In this line of thinking, numerous studies are exploring what policies may induce innovations in higher education. However, as argued by Berg and Östergren (1979, p. 264), "coercive strategies do not seem to work... Such innovations cannot simply be inserted from outside: they have to be created anew within the system by those who are members of it." Even Slaughter in her later work (Sheila Slaughter & Rhoades, 2004), has changed her view by stating that academia is no longer a passive entity merely acted upon by corporations and other external market forces, but rather the actors who initiate academic capitalism. Concerning the second issue, Markman et al. (2004), in an empirical test about how pay policies affect the entrepreneurial activity of academics involved in technology transfers, found that incentives to academics and their departments are negatively related their entrepreneurial activity, which runs contrary to theoretical predictions.

The above examples show that there is a lack of both theoretical and empirical understanding on what constitutes innovation, regardless of the claims in some studies about elements common to successful innovations in higher education (Furst-Bowe & Bauer, 2007; Sorensen, 2003), such as a sense of priority among people in senior positions, commitment and continued support from top leadership, systematic planning methods, inclusive and participatory processes, and effective, multidirectional communication. Such a gap could be reduced by incorporating in the analytical framework other elements, such as the factors affecting institutionalisation of innovation, as discussed later.

The aim of innovation.

In their review of definitions of innovation in the business and management literature, Baregheh et al. (2009) find that with reference to type, means, social context, and stages of innovation, few studies address the aim of innovation. However, the situation seems to be opposite in studies in higher education dealing with innovation issues. As mentioned earlier, innovations in higher education are often regarded as universities' responses to demands arising from the knowledge-based society. Therefore, the aims of innovation in higher education discussed in the literature are relatively clear, mainly relating to the new roles (such as the third mission) of university in the economy and the transformation within universities in order to perform certain roles.

Universities have always attached great importance to economic development. But the impact differs between short-run and long-run effects (Armstrong & Taylor, 2000, pp. 18-19). The short-run multiplier effects are mainly through universities' employing local workers, using large areas of land, and demanding local services. Universities' long-term effects on regional economic development can be observed in the following ways.

- University will enhance the quality of local labour through training graduates.

- The existence of a university in the region acts as an incentive for local firms to expand their activities in order to take advantage of its highly skilled graduates.
- A university's highly skilled staff may provide knowledge support and expert advice to local development agencies as well as to local firms.
- The presence of a university in an area enhances the cultural as well as the economic attractiveness of an area for mobile firms and highly skilled workers.

The innovations in higher education are generally aimed to better achieve such long-term effects. Moreover, university is not only a supporter of innovation in industry but has become increasingly intertwined with industrial innovation (Etzkowitz, 2003a, p. 294). As such, the innovations in higher education are often associated with performance drivers, for example, measured by "the rate of knowledge development" and "the speed of knowledge transfer and exploitation" (Paz Salmador, Dooley, & Kirk, 2007, p. 322). Within the context of the Triple Helix model and the shift from Model 1 to Model 2 knowledge production, Davey, Baaken, Muros, and Meerman (2011, p. 10) identify eight different ways in which university cooperates with and contributes to business: 1) Collaboration in research and development (R&D), 2) Mobility of academics, 3) Mobility of students, 4) Commercialisation of R&D results, 5) Curriculum development and delivery, 6) Lifelong Learning (LLL), and 7) Entrepreneurship and Governance. These reflect the aims of many innovations in higher education and, consequently, are the arenas where innovations in higher education take place. Within such a context, innovations are also important for universities to transform their internal functions to respond to environmental pressures.

While the economic role of university is placed at the centre of innovations in higher education, it must be noted that the missions of universities are not confined to serving economic development, but are also about transforming the economic structure and bringing new values to society (Cai, 2014a). In this line of thinking, Maxwell (2007) deplores that the academic quest of

universities for improving knowledge might be dangerously and damagingly irrational when taking the stand that university is supposed to help make a better world. Thus, he calls for "a major intellectual and institutional revolution in the aims and methods of inquiry, from knowledge-inquiry to wisdom-inquiry" and contends that "almost every branch and aspect of academic inquiry needs to change" (p. 112). This dimension of innovation has so far rarely been mentioned and explored in higher education studies. As a whole, both the university's innovation as a way to better contribute to the economic development or human wellbeing is, in Furst-Bowe and Bauer (2007)'s words, to create new value for the stakeholders of university.

A summary of the six attributes of innovation process in the context of higher education.

The aforementioned analysis in the previous section indicates that the six attributes of innovation developed by Baregheh et al. (2009) are relevant for understanding innovation in higher education. In the higher education context, the six components in the innovation process can be described as follows. The aim of innovation is mostly to develop the economic role of university, but recently there is an increasing awareness of university's contribution to human wellbeing and the future of society. Most innovation addresses the problems associated with these general aims. The type of innovation is concerned with both output and organisation of teaching and research activities as well as new missions and managerial approaches. The nature of innovation can be either doing things differently or doing the same thing better. The innovation normally takes place in steps: recognition of need, planning, initiation, and institutionalisation. Instead of using the term *social context*, it is more appropriate to just say *context*, referring to both the organisational environment and the wider social context in which innovation in higher education is embedded. Typical means for supporting innovation are policies and financial incentives as well as the initiatives for cultural changes.

Additional elements in the analytical framework

Now I will move onto the four additional elements added to the model by Baregheh et al. (2009), namely the problem to be addressed by innovation, the people involved in the innovation process, the learning curve, and factors affecting the institutionalisation of innovation.

Problems to be resolved by innovation.

As mentioned earlier, when discussing innovations or radical reforms in higher education, the higher education literature often attaches great importance to their aims mainly in response to the societal demands or the changing roles of university in society. Under such a general aim, specific innovations in higher education are actually for resolving existing problems or challenges, as illustrated by many higher education studies. For instance, in a special issue on innovations in higher education edited by Glickman and White (2007), the contributors examined the various innovative approaches to tackling different challenges faced by universities. The university reforms/innovation around the world are also geared to address the challenges in society and the search for solutions. For instance, when Etzkowitz and Viale (2010) discuss the third round academic revolution, based upon the creation of entrepreneurial universities embedded in Triple Helix relations, they consider such innovation to be a response to the challenges and demands in the knowledge-based societies. Particularly, in both advanced and developing societies, the economic development requires knowledge creation and diffusion, but traditional ivory tower universities could not meet such needs. Thus, the reforms on enhancing entrepreneurship in higher education have been launched world-wide to promote university's engagement in socio-economic development.

People involved in the innovation process.

The higher education literature pays special attention to both innovation initiators (e.g., university leaders and managers) and innovation participants (e.g., academic staff), for example, when addressing management innovation. As universities are highly institutionalised organisations (Meyer, Ramirez, Frank, & Schofer, 2007; Pinheiro, Wengenge-Ouma, Balbachevsky, & Cai, 2015), there are always tensions between the top managers who have initiated reforms and the academics

who are participating in the reforms (Clark, 1983; Musselin, 2007) The latter often either resists changes or decouples their practical work from formal structural changes (Krücken, 2003; Townley, 1997). The reluctance of academics to change/reform is to a large extent due to the heavy inertia of traditional academic identity, which has originated and been sustained throughout universities' historical development (Townley, 1997). Moreover, the stakeholders are usually important in the implementation of all kinds of reforms in higher education (Amaral & Magalhães, 2002). Thus, clearly identifying the people involved in the innovation process must be a starting point in innovation analysis. Both Sheila Slaughter and Rhoades (2004) and Pinheiro (2011) found crucial roles of individual academics in the innovation process in both initiating and implementing innovations. In another study on a Chinese university's engagement in regional development, Cai and Liu (2015a) identified a few individual actors, such as some university leaders, regional governmental leaders, and some others taking actions crossing the boundaries of university and industry, who not only initiated innovation but also were active in creating a supporting institutional environment.

Interactive process and learning curve.

The emergence of innovation in higher education is largely due to its interaction with other sectors, as illustrated by the Triple Helix model (Etzkowitz, 2008; Etzkowitz & Leydesdorff, 1995, 1997), as well as interaction between different knowledge spheres, as seen in the integration of ICT in teaching and learning in higher education (Lyons, 2009). While innovation naturally comes with challenges, what is crucial in the implementation is to learn from experience, as Boyce (2003, p. 133) claimed:

The challenge of successful change is less planning and implementing and more developing and sustaining new ways of seeing, deciding, and acting. Successful change is about learning enough collectively so that institutional consequences, outcomes, and

inquiry change. Sustaining change in higher education is dependent upon sustaining the conditions of learning in an institution.

Factors affecting institutionalisation of innovation.

Successful organisational change or innovation must be institutionalised (Levine, 1980), which requires changes in values and assumptions (Boyce, 2003). Drawing on Levine (1980) and institutional theory (Greenwood, Oliver, Sahlin, & Suddaby, 2008), Cai et al. (2016) identified three key factors affecting institutionalisation of innovation, namely profitability, compatibility, and agency. In this light, any measures for facilitating institutionalisation of innovation are in one way or another concerned with one or more of these factors.

Profitability refers to tangible or intangible benefits that are perceived by either an organisation or its members as consequences of the innovation. Profitability contributes to the institutionalisation of innovation. As innovation can hardly bring immediate profits, the profitability can also mean the opportunity of a potential pay-off. Innovation initiators' efforts to promote innovation ideas, such as via lobbying or consensus building among the stakeholders, are mainly about convincing the stakeholders about the potential benefits of the innovation (Kinser, 2007).

Compatibility refers to the degree to which the norms, values, and goals of an innovation are congruent with the organisational environment or social context. There would be more challenges in institutionalisation of innovation if the innovation is straying too far from the principles and values of the organisation (Curry, 1992; Levine, 1980).

Agency refers to the actions conducted by some individuals, or "institutional entrepreneurs" (Battilana, Leca, & Boxenbaum, 2009), to change the existing institutional rules for facilitating innovation. In the higher education context, the institutional entrepreneurs may be policy-makers, top managers, and even some academics, as demonstrated in a case study on successful university's engagement in local economy and innovation development (Cai & Liu, 2015a).

After this lengthy discussion on an analytical framework for understanding innovation processing higher education, I will conclude with some implications for future study, particularly in the direction of developing a research field of innovations in higher education. The development of the emerging research field is to supplement innovation studies and to align innovation in higher education with innovation in society. On the one hand, it deals with what and how higher education needs to be innovative to support and lead innovations in society. On the other hand, it explores what policy frameworks need to be adapted to facilitate the alignment between innovation in university and innovation in society. So far, such a field of study is in the pre-paradigmatic stage, and the existing studies dealing with innovations in higher education are diverse. One fundamental task for developing the field is to consolidate the conceptualisation of innovation in higher education, which is what this paper exactly aimed to do.

While a general analytical framework for understanding innovation processes has been proven useful in the higher education context, more empirical applications are needed for its further improvement. However, given the space limitations of the paper, here I focus solely on analytical framework development. The analytical framework may contribute to studies on innovation in higher education in three ways. First, it may advance our scholarly understanding of innovations in higher education. Second, with this framework, we can easily compare studies on innovation in higher education and hopefully develop synergies among them. Third, and most importantly, it will hopefully help policy–makers and managers to find and develop innovative solutions to the challenges encountered in their work, and to be aware of the possible factors that could facilitate the implementation of innovation.

There is certainly a long way from a sound understanding of the concept of innovation in higher education to a research field of innovations in higher education. Nevertheless, the framework suggests some essential questions to be posed when analysing innovations in higher education. Some examples can be provided as follows. What is the problem to be addressed by an innovation? What

do we expect from the innovation, in addition to resolving the originally targeted problem? From what we expect and to what extent do we want to resolve the problem with the innovation? Is the innovation characterised by doing the same things better or doing things differently? How to distinguish the innovation in terms of its type and development stage? To what extent is the innovation compatible with the organisational and social context? What resources and approaches can be used to facilitate the implementation of the innovation? What are the challenges in implementing the innovation? And by manipulating what factors can the challenges be largely resolved?

Finally, some suggestions for future research on innovations in higher education can be provided as follows. First, consulting the innovation studies literature is particularly useful for those who research innovations in higher education. Many problems, challenges, and gaps in higher education innovation studies are expected to be resolved by applying insights and theories from innovation studies.

Second, the unique empirical ground in higher education may offer opportunities for testing, enriching, and developing theories of innovation. Although university is considered to be one of the main actors in innovation studies, most scholars of innovation studies have economics and sociology as their disciplinary background, and their research interests are in business or society in general. They tend to look at university changes from the outside in. As such, their views on the nature and dynamic of universities may be limited. In this respect, to collaborate with higher education researchers is also a very practical and effective way to supplement and complement innovation studies.

Third, as studies on innovations in higher education are regarded as part of innovation studies as well, the challenges and directions in the latter may help better prepare the way of proceeding in the former. For example, the tendency of innovation studies is well addressed in the book *Innovation studies: Evolution and future challenges* (Fagerberg et al., 2013). Drawing on the insights of

(Fagerberg et al., 2013) and discussions in the studies, the following issues are provided as examples to demonstrate what would be the direction of studies on innovation in higher education: The field of study is expected to achieve a high degree of consensus on some core theories, methodological approaches and important research problems to be addressed; the empirical research must keep pace with the fast changing economy, society and the world; increasing cooperation and communications with neighbouring fields of science are needed to enhance the field of study; individuals' roles must be carefully considered in innovation processes in higher education.

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