

Northumbria Research Link

Citation: Guerrero, Maribel, Heaton, Sovhi and Urbano, David (2021) Building universities' intrapreneurial capabilities in the digital era: the role and impacts of Massive Open Online Courses (MOOCs). *Technovation*, 99. p. 102139. ISSN 0166-4972

Published by: Elsevier

URL: <https://doi.org/10.1016/j.technovation.2020.102139>
<<https://doi.org/10.1016/j.technovation.2020.102139>>

This version was downloaded from Northumbria Research Link:
<http://nrl.northumbria.ac.uk/id/eprint/42872/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)

CITE:

Guerrero, M., Heaton, S., and Urbano, D. (2020). Building universities' intrapreneurial capabilities in the digital era: the role and impacts of Massive Open Online Courses (MOOCs). Technovation. In press.

BUILDING UNIVERSITIES' INTRAPRENEURIAL CAPABILITIES IN THE DIGITAL ERA: THE ROLE AND IMPACTS OF MASSIVE OPEN ONLINE COURSES (MOOCs)

Maribel Guerrero^{ab1}, Sohvi Heaton^{cd} and David Urbano^e

a School of Business and Economics, Universidad del Desarrollo, Av. Plaza 680, San Carlos de Apoquindo, Las Condes, Chile

b Newcastle Business School, Northumbria University, UK Corresponding author . maribel.guerrero@northumbria.ac.uk

c College of Business, Loyola Marymount University, Los Angeles, USA

d Institute for Business Innovation, Haas School of Business, University of California, Berkeley, USA. sheaton@berkeley.edu

e Department of Business and Centre for Entrepreneurship and Social Innovation (CREIS), Universitat Autònoma de Barcelona, Spain. david.urban@uab.cat

Funding

The authors would like to thank the anonymous reviewers for their insightful comments that contributed substantially to the development of the manuscript. David Urbano acknowledges the financial support from the Spanish Ministry of Economy & Competitiveness [project ECO2017-87885-P], the Economy & Knowledge Department—Catalan Government [project 2017-SGR-1056] and ICREA under the ICREA Academia Programme.

BUILDING UNIVERSITIES' INTRAPRENEURIAL CAPABILITIES IN THE DIGITAL ERA: THE ROLE AND IMPACTS OF MASSIVE OPEN ONLINE COURSES (MOOCs)

Highlights

- MOOCs represent a strategy to rebuild competitive advantages in the digital economy
- Universities' ordinary capabilities are transiting into intrapreneurial capabilities
- Universities' intrapreneurial capabilities generate sustained competitive advantage
- Intrapreneurial capabilities mediate the role of ordinary capabilities on outcomes
- Findings provoke a discussion about the key players in the digital educational market

Abstract

Massive open online courses (MOOCs) have received a lot of attention over the last few years. Although the technological/pedagogical aspects of MOOCs have been well articulated in the literature, empirical evidence substantiating MOOCs' role in university outcomes is scarce. This study aims to fill this gap by exploring the relationships among (a) ordinary capabilities that are necessary to achieve the university's core strategies (i.e., teaching quality, research quality, and administrative quality); (b) intrapreneurial capabilities that are necessary to accomplish the university's entrepreneurial strategy (i.e., MOOC orientation by assuming risks, sensing opportunities, and transforming routines to become more innovative and proactive); and (c) the expected university outcomes from these strategies (i.e., prestige in teaching/research, attraction of local/international students, and diversification in the income structure). Based on an analysis of 145 universities, the results show that MOOC-based intrapreneurial capabilities play a direct role in the achievement of university outcomes, as well as an indirect role, by mediating the positive effect of the university's ordinary capabilities on the university's outcomes. These findings contribute to the current understanding in entrepreneurship and strategic management debates about the antecedents/consequences of intrapreneurial capabilities. A provoking discussion and implications for theory, practice, and policymakers emerge from this study.

Keywords: ordinary capabilities; dynamic capabilities; intrapreneurial capabilities; sustainable competitive advantage; entrepreneurial universities; MOOCs

1. Introduction

Since the discovery of the World Wide Web (web) thirty years ago, the digital economy has represented opportunities and challenges for any organization (Porter, 2003). The digital economy is defined by the changing characteristics of digital information, new technologies, and new ways of communication that have produced profound transformations in internal processes, strategic organizational decisions, and new versatility for doing business in real time across many locations (Brynjolfsson & Kahin, 2002, p. 2). As a result, the digital economy is now the preeminent driver of economic growth and social change (Brynjolfsson & Kahin, 2002, p. 13). Even though universities tend to be large organizations with established routines in the development of the core activities of teaching and research (Guerrero et al., 2016a, 2016b), the digital economy is producing challenges in teaching and learning processes based on the reconfiguration of technological and digital skills demanded by the labor market (Brynjolfsson & Kahin, 2002). As the digital economy moves forward, universities are increasingly affected by adapting to the rapid teaching and learning advances in technology such as e-learning programs, massive online open courses (MOOCs), digital campuses that connect devices and virtual reality, telepresence education using artificial intelligence, as well as other technological experiments developed at university level (PWC, 2018, p. 4).

Although MOOCs are not the only strategy in the digital transformation of entrepreneurial universities, MOOCs have been considered the most significant technological advance of the millennium in the pedagogic part of higher education (Teece, 2018, p. 98). The main explanation is that MOOCs are courses delivered in online learning environments that depend on individual interests and adequate platforms/technologies (Alraimi et al., 2015). In contrast to offline learning environments, where participants are required to attend a scheduled training location, MOOCs attract substantially larger audiences from anywhere in the world in a relatively short period of time and without formal requirements in terms of fees, previous accreditations, or background (Alraimi et al., 2015; Christensen et al., 2013). In 2017, approximately 78 million students

participated in more than 9,400 courses offered by 800 universities around the world (Class Central, 2017b). Looking at MOOCs' trends (Hollands & Tirthali, 2015), universities differ in their approach to MOOCs. Firstly, universities such as Stanford and MIT were pioneers in adopting a proactive approach by developing their own MOOC platforms to offer their online courses, while other universities adopted a collaborative approach through international cooperative partnerships with MOOCs' providers (e.g., Coursera, EdX, Udacity, FutureLearn, etc.). Secondly, some universities adopted MOOCs as a strategic orientation to develop new online learning products, thinking about diverse generational segmentations that look for specific skills/knowledge, while other universities adopted MOOCs as an extension of an international orientation for positioning on the radar of students abroad (Lyons, 2017; Reich & Ruipérez-Valiente, 2019).

Despite the differences observed at the micro-level, previous studies on MOOCs have mainly focused on the macro-level questions. Anecdotal evidence suggests mixed results for university managers regarding the factors influencing demand/supply, changes in educational/pedagogical paradigms, instructional/technological design, and innovations in learning methodologies (Liyanagunawardena et al., 2013; WOS, 2017). For instance, the academic literature does not provide enough answers in strategic management about the potential positive impact of MOOCs on the resources, core activities—teaching and research—and outcomes of universities. Adopting both entrepreneurial and strategic management perspectives, MOOCs should be analyzed as a university's innovative/disruptive strategic orientation to offer new online learning products for individuals located anywhere, and as an extension of an international orientation for recruiting international participants and raising the university's visibility at the international level (Lyons, 2017; Ospina-Delgado & Zorio-Grima, 2016; Reich & Ruipérez-Valiente, 2019). Based on these arguments, MOOCs play a relevant role in the configuration of university business models, open collaboration practices (Belleflamme & Jacquemin, 2015; Guerrero et al., 2019b; Miller et al., 2014), the establishment of public/private providers of digital platforms, and the development of start-

ups that supply additional services (Banerjee & Duflo, 2014; Hollands & Tirthali, 2015). Extant studies are silent on how MOOCs are understood as a university orientation in the digital economy. Thinking about students' preferences for online/offline learning products markets, a MOOC orientation implies a philosophy determined by the nature/scope of online learning activities, the design of new business models, the required investment in resources, the improvement of existent routines, and the development of new entrepreneurial behaviors/capabilities (Ferguson et al., 2016; Miles & Arnold, 1991; Peterson, 1989).

Assuming Teece's (2012) thesis that an entrepreneurial orientation is linked with the improvement of existing routines, a MOOC orientation represents a step beyond the ordinary capabilities that are necessary to achieve the university's core strategies (i.e., teaching quality, research quality, and administrative quality) toward the development of intrapreneurial capabilities to accomplish the university's entrepreneurial strategy (i.e., assuming risks, sensing opportunities, and transforming routines to become more innovative and proactive), and to achieve the expected results (i.e., universities' outcomes such as prestige in teaching/research, attraction of local/international students, and diversification in income structure) in the digital economy (Barreto, 2010; Guerrero et al., 2016b, 2019a; Jantunen et al., 2005; Teece, 2007, 2012; Teece et al., 2016; Zahra et al., 2006). The literature recognizes that entrepreneurial universities with strong dynamic capabilities find strategic alternatives to leverage their strengths with innovative business models, updating their brand for a changing educational environment; others that are in a less favorable position and are unable to develop a successful strategy may face a steady decline (Teece, 2018, p. 99). Based on this reasoning, three research questions emerge concerning the antecedents, the consequences, and the mediating effect of universities' intrapreneurial capabilities: (i) antecedents: how do universities' ordinary capabilities contribute to the intrapreneurial capabilities required in the MOOC market? (ii) consequences: how do ordinary and intrapreneurial capabilities contribute toward capturing the expected university outcomes in the

MOOC market? (iii) mediating effect: how do intrapreneurial capabilities mediate the contribution of ordinary capabilities toward the university's outcomes in the MOOC market?

Inspired by the previous research questions, the objective of this study is to investigate the role and the impact of a MOOC orientation on building universities' intrapreneurial capabilities in the digital economy. Merging the theoretical bases of the strategic management and entrepreneurship fields, we explain the microfoundations of universities' intrapreneurial capabilities and propose a conceptual framework that answers our research questions. Using a unique dataset of 145 universities around the world that developed 67 percent of the MOOC courses offered during 2012 to 2017, the findings shed some light on the antecedents (ordinary capabilities) and the consequences (university outcomes) of intrapreneurial capabilities when universities adopt a MOOC orientation in the digital economy. The study enhances three academic debates in the strategic management and entrepreneurship fields: firstly, discussion about the technological and entrepreneurial transformation of universities to compete simultaneously in online and offline learning environments (Burd et al., 2015; Crossan & Apaydin, 2010; Daly, 2017; Ghemawat, 2017; Guerrero & Urbano, 2019a; Klofsten et al., 2019; Lyons, 2017; Nambisan, 2017); secondly, discussion about the role of MOOCs as important enablers, and their mediating role connecting antecedents and outcomes to generate universities' value-added in the digital economy (Aguinis et al., 2017; Eriksson, 2014); and thirdly, we provoke discussion about the role and actions of key players such as university managers, employers, and higher education authorities in the digital higher education market (Guerrero and Urbano, 2019a, 2019b; Kässi & Lehdonvirta, 2019; OECD, 2018; Reich & Ruipérez-Valiente, 2019).

After this introduction, the paper is organized as follows. Section 2 introduces the microfoundations of universities' intrapreneurial capabilities in the digital economy, suggesting the research hypotheses and proposing the conceptual framework. Section 3 presents the methodology, describing the data and the research methods used in the empirical study. Section 4 discusses the main findings of the study considering the literature reviewed. Section 5 proposes

implications for theory, practice, and policymakers. Finally, Section 6 presents the main conclusions, limitations, and future research lines.

2. Theoretical Background and Research Hypotheses

2.1 Microfoundations of universities' intrapreneurial capabilities in the digital economy

In this research, we merge strategic management and entrepreneurship theoretical foundations to discuss universities' MOOC orientation and its role in the development of universities' intrapreneurial capabilities in the digital economy (see Table 1).

Table 1: Microfoundations of intrapreneurial capabilities

Dimensions	Strategic management	Entrepreneurship	Entrepreneurial universities in the digital context
Traditional vs dynamic perspective	Ordinary capabilities vs dynamic capabilities (Teece, 2007)	Resources/capabilities vs entrepreneurial capabilities (Antoncic and Hisrich, 2003)	Universities' routines vs intrapreneurial capabilities
Entrepreneurial orientation	Transformation of existing routines into dynamic capabilities that generate entrepreneurial actions that help to capture sustained competitive advantages (Teece, 2012; pp.1397-1398)	Entrepreneurial orientation promoted by individuals with entrepreneurial behaviours that prevents inertia to maintain competitive advantages (Covin and Slevin, 1999; Antoncic and Hisrich, 2001; p. 498)	Higher-level competencies that determine that entrepreneurial organisations will be able to improve/transform their routines into entrepreneurial actions to integrate, build, and reconfigure internal/external resources to address the challenges of the digital economy
Operationalization	New business models (Teece, 2012)	New products/process, innovations, new corporate ventures (Antoncic and Hisrich, 2001)	University MOOC's business model orientation
Dimensions of entrepreneurial orientation	<ul style="list-style-type: none"> - <i>Sensing</i>: identification and assessment of an opportunity - <i>Seizing</i>: mobilization of resources to address an opportunity and to capture value from doing so - <i>Transforming</i>: continued renewal (Teece, 2007; p. 1396)	<ul style="list-style-type: none"> - <i>Proactiveness</i>: taking initiative by anticipating and pursuing new opportunities to enhance competitiveness - <i>Innovativeness</i>: engage and support new ideas and innovative processes to capture value - <i>Self-renewal</i>: reformulation, reorganisation, and organisational change (Lumpkin and Dess, 1996, p.142-148)	<ul style="list-style-type: none"> - <i>Sensing</i>: scanning new opportunities to date digital educational strategies - <i>Seizing</i>: open innovation with MOOCs' providers/platforms - <i>Transforming</i>: renewal of offline courses and development of new online courses
Outcomes	Performance and sustained competitive advantage (Teece, 2007; Eriksson, 2014)	Performance and competitive advantage (Narayanan et al., 2009; Sirén et al., 2017)	University outcomes associated with a sustained competitive advantage
Research questions	Antecedents: - How do MOOCs could be considered as a strategic orientation that contributes to the evolutionary process of universities' ordinary capabilities into the required intrapreneurial capabilities in the digital economy? Consequences: - How do ordinary capabilities and intrapreneurial capabilities contribute to capturing the university's outcomes in the digital economy? Mediation effect: - How do intrapreneurial capabilities mediate the contribution of ordinary capabilities in university's outcomes in the digital economy?		

Source: Authors

2.1.1 MOOC orientation

According to the strategic management literature (Teece, 2018), certain capabilities are crucial when the digitalization of education demands rapid innovation and globally dispersed sources. In these dynamic environments, universities should adopt an entrepreneurial orientation to transform old routines into new ones (Teece, 2012, 2018). In this sense, the role of university managers should be to transform universities and shape ecosystems through *sui generis* strategic acts that neither stem from routines nor need give rise to new routines (Teece, 2012, p. 1395). According to the entrepreneurship literature, entrepreneurial orientation is the university's transformation that prevents inertia to be sustainable and competitive (Covin & Slevin 1999; Sirén et al., 2017). In the broadest definition, entrepreneurial organizations are integrated by individuals' entrepreneurial behaviors (Antoncic & Hisrich, 2001, p. 498) that are beneficial for transforming routines into new ones (Pentland & Feldman, 2005) to capture sustainable outcomes. In a narrow definition, universities become innovative, risk-taking, and proactive in fostering entrepreneurial and innovative initiatives in their communities, comprising students, professors, managers, and staff (Guerrero & Urbano, 2012, 2019a). However, environmental uncertainty refocuses the attention of organizational orientations that it consists of underlying philosophies that determine the nature and scope of organization's activities and plans (Peterson, 1989). Organizational orientations result in varied perceptions of priorities in terms of how clients are viewed, and how organizations implicitly define the business model and decision-making processes (Miles & Arnold, 1991, p. 48). In the university context, the university's strategy is mainly focused on the core activities of teaching and research by defining actions, investing in resources, and exploiting ordinary capabilities (i.e., the routines that help to achieve the quality of teaching and research based on their experiences), as well as on capturing the expected results from the core activities (i.e., fees, number of students, academics, income for research projects, etc.). For example, by implementing an international orientation, universities define new actions and investments, acquire capabilities (i.e., if the ordinary ones are not enough to implement this strategy), and anticipate results (i.e., an

increase in the number of foreign students and collaborations). It does not mean that all university communities will be internationalized, but a percentage follow this strategic orientation. Based on this reasoning, a MOOC orientation is part of a university's strategy (Ferguson et al., 2016; Hardy et al., 1983) that defines several activities/actions that require investment in resources and new capabilities for developing new online learning products.

2.1.2 Intrapreneurial capabilities

In the strategic management field, dynamic capabilities are considered higher-level competencies that determine universities' ability to integrate, build, and reconfigure internal/external resources/competencies to shape rapidly changing business environments (Teece, 2007, 2017; Teece et al., 1997). In the entrepreneurship field, the capability concept is predominantly based on insights from the resource-based view, where endowments of organizational resources, which are durable and difficult to imitate, differentiate the organization from its competitor (Antoncic & Hisrich, 2003, pp. 10–11). By merging both theoretical foundations, we find similarities in the dimensions used to operationalize dynamic capabilities (strategy) and dimensions used to operationalize entrepreneurial orientation (intrapreneurship). According to Teece (2012, p. 1396), dynamic capabilities are strategically operationalized through the identification of opportunities (sensing), mobilization of resources to address an opportunity and capture its value (seizing), and renewal (transforming). Similarly, Lumpkin and Dess (1996, pp. 142–148) propose the operationalization of an entrepreneurial orientation through dimensions such as proactiveness (taking the initiative by anticipating and pursuing new opportunities to enhance competitiveness), innovativeness (the tendency to engage and support new ideas, novelty, experimentation, technological and innovative processes to capture value), self-renewal (reformulation, reorganization, and organizational change), and risk-taking (the assumption of affordable losses or adverse outcomes). Following these theoretical bases, intrapreneurial (dynamic) capabilities exist within organizations with an entrepreneurial orientation, such as the so-called entrepreneurial universities (Guerrero & Urbano, 2012, 2019a). Therefore, in this paper, intrapreneurial capabilities are understood as higher-level

competencies that determine that entrepreneurial organizations will be able to improve/transform their routines into entrepreneurial actions to integrate, build, and reconfigure internal/external resources to address the challenges of the digital economy. In the digital economy, the emergence of universities' intrapreneurial capabilities could be associated with the MOOC orientation (Eesley & Wu, 2015; Lopes et al., 2019; Teece, 2018). In this assumption, the initial inputs will be the ordinary capabilities used to capture the outcomes associated with teaching and research activities. These inputs and outputs should be reconfigured when the university adopts a specific orientation (i.e., MOOC orientation), because this will require the development of unique intrapreneurial capabilities (i.e., sensing opportunities, assuming risks, transforming routines, being innovative, and seizing by being proactive).

2.1.3 Operationalization of intrapreneurial capabilities

Adapting the operationalization of dynamic capability categories (Teece, 2007, 2012) and intrapreneurial dimensions (Lumpkin & Dess, 1996) in the MOOC context, we propose the following dimensions. Firstly, sensing capabilities represents the discovery/creation of an opportunity to assess existing or latent customer needs (Castiaux, 2012). It is linked to proactiveness in organizational behavior, characterized by taking new initiatives based on the identification/creation of opportunities (Lumpkin & Dess, 1996). Undoubtedly, scanning and monitoring courses/universities, and understanding the requirements and the evolution of the MOOC market allow a look at new opportunities or channels for innovative and up-to-date digital educational strategies. Secondly, transforming capabilities represents a continued renewal and aligning of assets (Teece, 2007). Therefore, these capabilities could be actioned by embracing favorable open innovation practices to develop, integrate, and coordinate skills/assets/knowledge transfer (Castiaux, 2012; Guerrero et al., 2019b; Miller et al., 2014). This is linked with innovative organizational behavior, characterized by engaging in practices that support the development of new technological/innovative ideas that capture or add economic value (Lumpkin & Dess, 1996; Guerrero & Peña-Legazkue, 2013; Guerrero et al., 2019a). In the digital context, universities also

develop collaborations/alliances with enterprises (e.g., Google, Microsoft, Android, etc.), agencies (e.g., research institutes, non-profit organizations, etc.), and other universities in the design/development of MOOC courses. This type of collaborative relationship produces benefits such as sharing risks and costs, transferring knowledge, and innovations and improvements in performance (Perkmann et al., 2013; Guerrero et al., 2019b). Moreover, in the MOOC market, a natural open innovation practice is associated with agreements with providers/platforms to act as an intermediary between the university and the learner. Thirdly, seizing represents the mobilization of resources to address an opportunity and to capture value from doing so (Teece, 2007). It means the design of the business model in terms of addressing opportunities through new products/services, designing architectures, defining target markets, and pricing strategies (Castiaux, 2012). It is linked with risk-taking and self-renewal; organizational behaviors are characterized by the assumption of affordable losses during the redesign and reformulation processes (Lumpkin & Dess, 1996; Guerrero & Peña-Legazkue, 2019). In the MOOC context, universities interested in entering this market do not just need to find a specific niche (a new course or similar course with some distinctions, avoiding overlapping with competitors) or develop alliances/collaborations with others, but they need, too, to redesign their offline learning business model. In this regard, universities redefine the allocation of resources to both online and offline courses, the pricing strategy for multiple online products (i.e., combining free/paid MOOCs, specialized certifications, credits, and degrees), and identify target markets (i.e., by areas of knowledge or language).

In the following section, we discuss our hypotheses and propose a conceptual framework to test the role of universities' intrapreneurial capabilities in the universities' outcomes that are associated with sustained competitive advantages in the digital market.

2.2 Research hypotheses

2.2.1 The strategic transition of universities' ordinary capabilities into universities' intrapreneurial capabilities for leveraging the opportunities of the digital economy

Given the nature and inertia in the development of universities' core activities (teaching and research), most universities are perhaps organizations with more ordinary resources/capabilities (rooted routines) than intrapreneurial capabilities (entrepreneurial actions) (Teece, 2012, 2018). Over the last three decades, universities have transformed routines into entrepreneurial actions considerably due to the emergence of the knowledge-based economy (Guerrero & Urbano, 2012, 2019a, 2019b; Klofsten et al., 2019). Entrepreneurial orientation is part of the evolution of universities that are interested in being key contributors to societal and economic development toward pro-active engagement in entrepreneurial innovation activities (Guerrero et al., 2015; Rothaermel et al., 2007). Therefore, entrepreneurial universities transformed their routines in teaching and research activities, emphasizing innovative and entrepreneurial orientations (Miller et al., 2012, 2014) and making the changes necessary to bolster their competitive advantage and enhance their long-term performance (Leih & Teece, 2016; Teece et al., 2016). In this vein, resource and capabilities orchestration is crucial to minimize internal conflict and to maximize complementarities inside/outside the university (Teece, 2012).

As a strategy for survival in environments of uncertainty, universities should be competitive simultaneously in their current markets (offline education) and in new digital markets (online education). Influenced by digital economy trends, university managers should adopt an entrepreneurial orientation to match the requirement for digital skills from students/employers, as well as to exploit the opportunities observed in the digital market to extend their presence across the globe (Becker, 2004; Girod & Whittington, 2017; Klofsten et al., 2019; Teece, 2007, 2012; Teece et al., 2016). In this reconfiguration, certain ordinary university capabilities should be transformed into intrapreneurial capabilities (Covin & Miles, 1999; Guerrero & Urbano, 2012, 2019a; Guerrero et al., 2016b, 2019a) to contribute to the development of innovative and attractive online courses (Miller et al., 2014; Teece, 2010), taking risks in their competition with top-ranked universities in the global digital market (Teece, 2018) and assuming proactive behavior in the open innovation practices required by MOOC platform providers to create value for stakeholders

(Chesbrough, 2006; Narayanan et al., 2009; Teece et al., 2016). Ordinary capabilities associated with the quality of universities' human capital (i.e., teachers, academics, and administrative staff), the quality of research resources, and the quality of administrative processes will contribute to the design and implementation of a MOOC orientation (Bedggood & Donovan, 2012; Zangouinezhad & Moshabaki, 2011).

In this vein, the quality of university human capital (university ordinary capability) contributes to the MOOC orientation by extending the teaching/administrative expertise toward new capabilities with the identification of potential opportunities of online learning products (Ospina-Delgado & Zorio-Grima, 2016). Similarly, the quality of research (university ordinary capability) contributes to the MOOC orientation by applying technological discoveries as part of the content or technical process of MOOC courses, as well as exploiting current research collaborations to extend MOOC strategic alliances with providers, platform developers, or international companies (Teece, 2018). Likewise, the experience of administrative staff (ordinary capability) is useful to facilitate the MOOC process but should be improved to capture value in the digital market (Castiaux, 2012; Teece, 2007). Assuming that a university's MOOC orientation is positively related to the transition of ordinary capabilities into intrapreneurial capabilities, we propose the following hypothesis:

H1: The development of a university's intrapreneurial capabilities (sensing, seizing, and transforming) is positively associated with the university's ordinary capabilities (teaching, research, and administrative quality).

2.2.2 The contribution of universities' intrapreneurial capabilities to the university's outcomes to achieve sustainability in the digital economy

Either explicitly or implicitly, any type of organization employs a business model architecture to create value and capture superior long-run business performance (Teece, 2010). In essence, the business model is the way in which organizations deliver value to clients, entice clients to pay for value, and convert these payments into profit (Teece, 2010). The business innovation model also

describes the rationale for creating value through the exploitation of entrepreneurial and innovative opportunities (Chesbrough, 2006; Huizingh, 2011). Conceptually, the main effect of digital market dynamism on the university's intrapreneurial capabilities is sustainability (Eisenhardt & Martin, 2000; Eriksson, 2014). Therefore, heterogeneity and intrapreneurial capabilities determine the sustainability of organizations in the digital era (Paluch et al., 2019). In this perspective, universities with intrapreneurial capabilities are intensely entrepreneurial organizations (Teece, 2010); consequently, their intrapreneurial capabilities contribute to improving the traditional university outcomes in the digital economy (Covin & Miles, 1999; Fonseca et al., 2019; Miller et al., 2014; Narayanan et al., 2009).

In terms of university outcomes, research has focused on measuring university outcomes in terms of inputs/outputs of the core activities of universities—teaching and research (Cave, 1997; Higgins, 1989; McKenzie & Schweitzer, 2001). Traditionally, university outcomes are measured in terms of graduation rates, employability, student and employer satisfaction, awards, international students, and the ratio of students to professors, among others (Bratti et al., 2004; Guerrero et al., 2015; Johnes & Taylor, 1990). Adopting the foundations of strategic management, intrapreneurial capabilities are determinants of university sustainability and excellence (Eriksson, 2014; Teece, 2012; Villar et al., 2014; Zhou et al., 2017). In this assumption, universities with a MOOC orientation are more likely to enhance the university's outcomes and sustainability by increasing (online) student recruitment, its visibility in the global arena, and positioning the university brand (Chapleo, 2011; Foroudi et al., 2019; Gavrilă & Ramirez, 2019; Olcay & Bulu, 2017). According to Leih and Teece (2016), the presence of leaders who marry strategic thinking and intrapreneurial capabilities development enhances the likelihood of a university's competitive fitness and long-term survival. Assuming that intrapreneurial capabilities are linked to the university's outcomes that contribute to gain sustained competitive advantage, we propose the following hypothesis:

H2: A university's intrapreneurial capabilities (sensing, seizing, and transforming) are positively associated with a university's sustained competitive advantage (teaching excellence, international outlook, and income).

2.2.3 The mediating role of universities' intrapreneurial capabilities

Recent academic debate recognizes the mediating effect of dynamic capabilities on the relationship between ordinary capabilities and organizational outcomes (Eriksson, 2014; Jiang et al., 2010; Lin & Wu, 2014; Schildt et al., 2012; Villar et al., 2014; Wu, 2007). Previous studies provide interesting insights into how open innovation practices enhance universities' outcomes when organizations reconfigure resources, managing their collaborations, and learn from these practices (proxies of dynamic capabilities as mediators) to obtain a larger return from developing new and competitive products (Jiang et al., 2010; Lin & Wu, 2014; Schildt et al., 2012). Similarly, Griffith et al. (2006, p. 60), using a sample of 269 small retailers, demonstrate how dynamic capability (market responsiveness) is an important mediator of knowledge resources (ordinary capabilities) and retailer performance (outcomes). Likewise, Hung et al. (2007, p. 1032) offer interesting insights into how dynamic capabilities are strongly associated with the organizational process (antecedents) and organizational performance (outcomes), and how organizational dynamic capability is easily a mediator for organizational process alignment to improve organizational performance.

According to Aguinis et al. (2017, p. 666), moderation refers to the conditions under which an effect varies in size, whereas mediation refers to the underlying mechanisms and processes that connect antecedents and outcomes. Although the empirical research on this mediating effect is scarce, the main reasoning is that mediation points to the presence of an intervening variable or mechanism (universities' intrapreneurial capabilities) that transmits the effect of an antecedent variable (universities' ordinary capabilities) on an outcome (universities' sustained competitive advantage). In this vein, it is understood that both ordinary capabilities and intrapreneurial

capabilities contribute to organizational outcomes (Eriksson, 2014; Zhou et al., 2017). Influenced by stakeholder trends, entrepreneurial universities nowadays simultaneously operate in the digital market, competing in online education using open source platforms with the lowest economic return but the highest penetration across continents (Banerjee & Duflo, 2014; Belleflamme & Jacqmin, 2015), and in non-digital markets, competing in local, regional, and international markets in offline learning programs (Hollands & Tirthali, 2015). This means that intrapreneurial capabilities directly contribute to the outcomes captured by the core teaching activities in digital markets (Guerrero & Urbano, 2012; Guerrero et al., 2015), but also mediate the contribution of certain ordinary capabilities that cross into intrapreneurial capabilities (Teece, 2018). Therefore, we believe that ordinary capabilities produce an effect on the university's outcome indicators, but this effect could be mediated when the university adopts a MOOC orientation that transforms some of those ordinary capabilities into intrapreneurial capabilities. Assuming that both ordinary and intrapreneurial capabilities are necessary to configure a sustainable competitive advantage, we propose the following hypotheses:

H3a: A university's ordinary capabilities (teaching, research, and administrative quality) are positively associated with a university's sustained competitive advantage (teaching excellence, international outlook, and income).

H3b: A university's intrapreneurial capabilities (sensing, seizing, and transforming) positively mediate the positive relationship between a university's ordinary capabilities (teaching, research, and administrative quality) and a university's sustained competitive advantage (teaching excellence, international outlook, and income).

2.3 Proposed conceptual framework

Figure 1 summarizes the proposed conceptual framework and hypotheses.

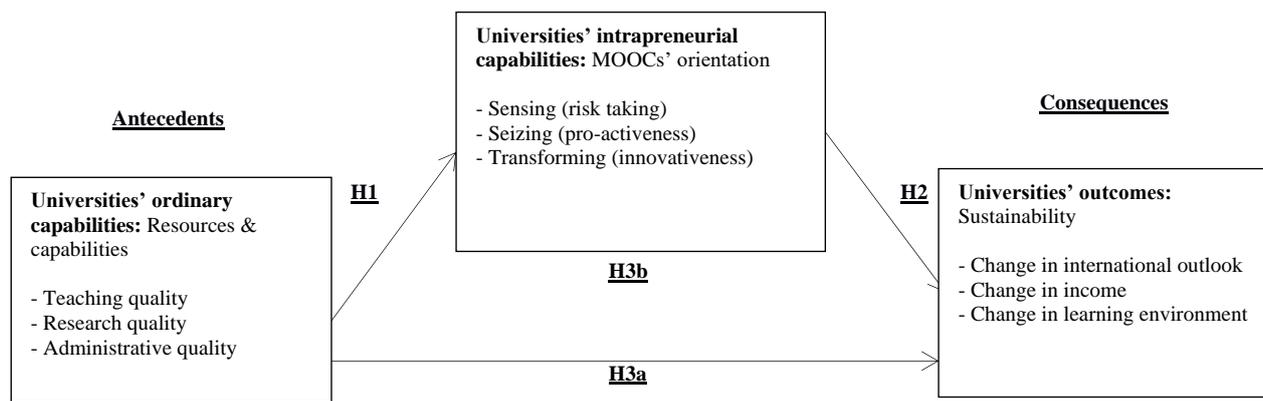


Figure 1: Proposed Conceptual Model

Sustainable and competitive universities in digital markets simultaneously act in online and offline learning environments. This strategy implies the adoption of an entrepreneurial orientation that is understood in this study as a MOOC orientation (Guerrero & Urbano, 2012, 2019a; Klofsten et al., 2019; Teece, 2018; Teece et al., 2012).

Our first assumption is that universities experiment with the transition of existent routines toward new entrepreneurial actions (Teece, 2012). In this logic, H1 discusses the contribution of a university's ordinary capabilities (teaching, research, and administrative quality) to the development of the university's intrapreneurial capabilities (sensing, seizing, and transforming) that are crucial for executing a MOOC orientation (Guerrero & Urbano, 2012; Hollands & Tirthali, 2015).

Our second assumption is that universities expect to obtain returns, capture value, and gain sustainability by implementing a MOOC orientation (Chesbrough, 2006; Covin & Miles, 1999; Guerrero & Urbano, 2019a; Miller et al., 2014; Narayanan et al., 2009; Teece, 2010; Teece et al., 2012). In this vein, H2 discusses the positive contribution of universities' intrapreneurial capabilities (sensing, seizing, and transforming) to university outcomes (teaching excellence, international outlook, and income) associated with long-term sustainability (Drnevich & Kriauciunas, 2011; Hollands & Tirthali, 2015; Lee & Park, 2012).

Our third assumption is the mediating effect of universities' intrapreneurial capabilities that transmits the effect of ordinary capabilities to universities' sustainability (Aguinis et al., 2017;

Eriksson, 2014; Zhou et al., 2017). On this point, H3a discusses the contribution of universities' ordinary capabilities into university outcomes, while H3b discusses the mediating effect of universities' intrapreneurial capabilities on the relationship between ordinary capabilities and university outcomes.

3. Methodology

3.1 Data collection

According to Class Central (2017b), 6,850 MOOC courses were offered by 786 universities and taken by 58 million students from 2012 to 2017. Considering these numbers as our population, we built a dataset with 145 universities around the world that offered 67 percent of the MOOCs (4,590 courses) during the period (see Appendix 1). Taking into account the important role of time/experience in the evolution/development of dynamic capabilities, outcomes, and sustainability (Eisenhardt & Martin, 2000; Guerrero & Peña-Legazkue, 2019; Teece et al., 1997; Zollo & Winter, 2002), the criteria for the selection of these universities were: (a) universities with at least nine MOOC courses—in other words, above the mean per university (8.7) during the period of analysis; and (b) universities that have offered nine or more courses at least twice. The information about universities and courses was collected from several secondary sources: university websites, MOOC aggregators (Class Central¹), MOOC platforms/providers (Coursera, EdX, FutureLearn, CanvasNetwork, NPTEL, Independent, MiríadaX, Udacity, France Université Numerique, iversity, etc.), university rankings (Times Higher Education, QS University Rankings), and other well-recognized sources (Financial Times, etc.).

3.2 Description of variables

Table 2 describes the variables used in this study.

Table 2: Description of variables

Dimension	Description	Editions ^a	Source	Previous studies
Ordinary capabilities: Resources & capabilities	Teaching quality	The average in the measure that captures the faculty reputation (teaching quality in terms of meaningful access to lecturers and tutors) of each university obtained during the last four editions of the QS ranking.	2015 to 2018	
	Research quality	The average in the measure that captures academic reputation obtained during the last four editions of the QS Higher Education experts' survey.	2015 to 2018	QS World University Ranking
	Administrative quality	The average in the measure that captures employer reputation (valuable preparation, competences, innovativeness and effectiveness of graduates for the employment market), collected during the last four editions of the QS Employer Survey.	2015 to 2018	
Intrapreneurial capabilities: MOOCs' orientation	Sensing: Risk-taking	First movers of MOOCs identified by the year of the first edition of the courses where the university was involved.	2012 to 2017	
	Seizing: Pro-activeness	Adoption of new teaching business models measured by: – The number of courses with certification vs. non-certification (paid vs. free courses) per university – Multidisciplinary in terms of the number of areas of knowledge covered per university – Diversification in target markets based on the diversity in languages of the courses provided per university	2012 to 2017	Class Central and MOOCs platforms (Coursera, Edx, FutureLearn, CanvasNetwork, NPTEL, Independent, MirfadaX, Udacity, France Université Numerique, iversity, etc.)
	Transforming: innovativeness	Open innovation practices measures by: – Number of agreements with MOOCs providers – Number of alliances with other universities or enterprises	2012 to 2017	
University outcomes: Sustained competitive advantage	Changes in a learning environment	Captures the change in the perception of prestige in teaching in the sense of how the university is nurturing the next generation of academics/employees as well as a broad sense of the infrastructure and facilities available to students and staff. It is calculated by the change in teaching perception in the year in which the university develops the first offering of a MOOC (t0) respect to the current year (t2017).	2012 to 2018	
	Changes in international outlook	Captures the change in the ability of a university to attract undergraduates, postgraduates and faculty from all over the planet as the key to its success on the world stage. It is calculated by the change in the ability of the year in which the university develops the first edition of MOOC (t0) respect to the current year (t2017).	2012 to 2018	Times Higher Education, World University Ranking
	Changes in university income	Captures the change in knowledge-transfer activity by looking at how much research income an organization earns from industry (adjusted for PPP), scaled against the number of academic staff it employs. It is calculated by the change in the ability of the year in which the university develops the first edition of MOOC (t0) respect to the current year (t2017).	2012 to 2018	

Note: ^a Usually, University Rankings are retarded at least one year. For example, University Ranking 2018 was estimated using data from 2017. This explains why data used from university rankings include until 2018.

In terms of ordinary capabilities, universities possess several resources (human capital, financial, physical, and commercial) and capabilities (status and reputation) that bring technical and

operational excellence (Guerrero & Urbano, 2012, 2019a). However, universities tend to adopt routine mechanisms that allow the adequate use of scarce resources according to their priorities (research, teaching, and programmatic activity), control risks, and achieve performance (Leih & Teece, 2016). Assuming that MOOCs were consolidated in the 2014/2015 edition (Ho et al., 2014), we used the universities' reputation metrics provided by QS World University Ranking since 2015 to capture three metrics of resources and capabilities associated with teaching university outcomes. Ordinary capabilities involve the quality of administrative, operational, and governance-related functions that are (technically) necessary to accomplish tasks (Teece, 2014, p. 328). Firstly, teaching quality is measured by the average of the measure that captures the faculty's reputation (teaching quality in terms of meaningful access to lecturers and tutors) obtained in the last four editions of the QS ranking. Annually, teaching quality assesses the extent to which institutions are able to provide students with meaningful access to lecturers and tutors, recognizing that a high number of faculty members per student will reduce the teaching burden on each individual academic. In the digital market, the quality of teaching (ordinary capability) should contribute to the seizing of business models when it crosses into teachers' pro-activeness (intrapreneurial capability) that is crucial to the MOOC courses' definition (content, multidisciplinary area, diversified languages) and commercialization (fees/paid modalities) (Hollands & Tirthali, 2015). MOOCs' students could conduct benchmarking based on teaching quality (Bedggood & Donovan, 2012), but their final selection is also determined by a range of factors like the content and attractiveness of MOOC courses. Secondly, research quality is measured by the average of the measure that captures the research reputation collected during the last four editions of the QS Higher Education experts' survey. Annually, academic reputation is the collation of the expert opinions of over 70,000 individuals in the higher education space regarding research quality at the world's universities. In the digital market, the quality of research (ordinary capability) should contribute to the transformation of MOOC business models when it crosses into researchers' innovativeness (intrapreneurial capability). It is crucial in collaborations/alliances to offer

specialized MOOCs to research market segments (research centers or technological enterprises), as well as capturing highest returns from own platforms instead of the providers' platforms (Hollands & Tirthali, 2015; Zangoueinezhad & Moshabaki, 2011). Thirdly, administrative quality is measured by the average of the measure that captures employer reputation (valuable preparation, competences, innovativeness, and effectiveness of graduates for the employment market) per university collected during the last four editions of the QS Employer Survey. The assessment of employer reputation is based on over 30,000 responses to the QS Employer Survey, asking employers to identify those institutions from which they source the most competent, innovative, and effective graduates. In the digital market, administrative quality (ordinary capability) should contribute to the transformation of MOOC business models when it crosses into risk-taking (intrapreneurial capability) (Hollands & Tirthali, 2015). To assume the highest risks, market reputation is crucial for the first MOOC movers (Alraimi et al., 2015).

Intrapreneurial capabilities data come from the detailed information from the 4,590 MOOC courses obtained from Class Central (2017b), MOOC providers, and university websites. Hollands and Tirthali (2015) find that the major cost drivers in MOOC are faculty, production process, technical support, and platform fees. Given the difficulties in obtaining those variables, we followed the three entrepreneurial orientation dimensions proposed by Covin and Miles (1999), and the dynamic categories adopted by Teece (2007, 2010, 2012) and operationalized by Castiaux (2012), Hollands and Tirthali (2014, 2015), and Zhou et al. (2017). Firstly, sensing (risk-taking) is measured by the first movers of MOOCs and calculated based on the year of the first edition of MOOCs when the course was provided by each university. Secondly, transforming (innovativeness) is measured by the number of agreements celebrated by universities during the period of analysis with providers of courses, and alliances with other universities/companies to develop a MOOC course together. Thirdly, seizing (pro-activeness) is measured during the period of analysis by: (a) the number of courses with certification vs non-certification (paid vs free courses) per university; (b) the multidisciplinary in terms of the number of areas of knowledge

covered per university; and (c) diversification in target markets based on the diversity of languages of the courses provided per university.

University outcomes are associated with sustained competitive advantage. The measurement of university outcomes is focused on the core university activities (teaching and research). At the academic level, performance/excellence indicators include employability, graduate satisfaction, and the attraction and retention of talent, among others (Guerrero et al., 2015; Higgins, 1989; Hollands & Tirthali, 2014, 2015). Given the restricted access to sensitive information, we identify some proxies for MOOC returns from 2012 to 2018 in the Times Higher Education World University Ranking. In this respect, Moed (2017) argues that the current ranking systems provide finalized and seemingly unrelated indicator values for coverage, performance, and normalization methods. Translated into the MOOC context, we selected three measures that could reflect the influence of intrapreneurial capabilities on university outcomes to gain a sustained competitive advantage (Chapleo, 2011; Christensen et al., 2019; Foroudi et al., 2019). As a sustained competitive advantage is a dynamic phenomenon that demands time, we adopted a lagging criterion in our university outcomes measurements (Epstein & Roy, 2001; Guerrero et al., 2015; Kuik et al., 2019; Wibbens, 2019). Inspired by previous studies, our university outcome measures capture the change in each indicator from the first edition of MOOC (t_0) of each university with respect to the last year that we have available information (t_{2018}). Consequently, our three measurements allow us to capture the potential effect of MOOC orientation on university outcomes without affecting the most recent universities that adopted this orientation. Firstly, change in the learning environment represents the change in the perception of prestige in teaching in the sense of how the university is nurturing the next generation of academics/employees, as well as a broad sense of the infrastructure and facilities available to students and staff. It is calculated by the change in teaching perception in the year in which the university developed the first edition of MOOC (t_0) compared to the current year (t_{2018}). Students' perception of universities is one of the most common mechanisms to evaluate university performance (Bedggood & Donovan, 2012). In

the digital era, university rankings are also adapting to these metrics (Foroudi et al., 2019) to capture the value of organizations as a brand (Christensen et al., 2019). As a result, these indicators are used by potential students' decisions to select MOOC courses. Appendix 1 shows us how the higher number of MOOCs and most in-demand courses are associated with top-ranked universities. Future metrics should consider the online students' evaluation that will be registered in social media in real time. Secondly, change in international outlook represents the change in a university's ability to attract undergraduates, postgraduates, and faculty from all over the planet as the key to its success on the world stage. It is calculated by the change in the ability in the year in which the university developed the first edition of MOOC (t0) compared to the current year (t2018). In the digital era, this indicator could be a consequence of an increase in students' participation across the globe (Hollands & Tirthali, 2015). Therefore, online visibility of a university allows the highest penetration in all continents and could also motivate physical students' mobility (Christensen et al., 2019). Thirdly, change in university income represents the change in knowledge transfer activity by looking at how much research income an institution earns from industry (adjusted for PPP), scaled against the number of academic staff it employs. It is measured by the change in the ability in which the university developed the first edition of MOOC (t0) compared to the current year (t2018). In the digital era, this indicator could be a consequence of an increase in reputation in the labor and research market, with the possibility of extending digital alliances and collaboration agreements with enterprises and research centers located in different countries and continents.

Considering that the variable 'time' is relevant in the configuration of ordinary/dynamic capabilities and performance, higher MOOC orientation helps us to control in our sample those universities that evidence strong experience in developing MOOCs compared with those universities that have lower experience. Concretely, this variable was built based on the number of MOOCs per year/university from 2012 to 2017, where the value 1 is ascribed to those universities with more than five years' experience and that have developed MOOCs above the

total average number of MOOCs during the period, and the value 0 otherwise. Finally, we also consider some structural control variables such as size, measured by the number of students per university; age, measured by number of years since the university's foundation; university type, or whether the university is public or private, based on its income structure; ratio of students per faculty member; international students, measured by the percentage of foreign students; followers, measured by the number of individuals that follows the university's MOOC on the digital platforms; rating, measured on a scale from 1 (low) to 5 (high) for satisfaction and achievement of the participants' expectations per MOOC course; university research, or whether the university is auto-categorized as a research university; location, or whether the university is located in North America; and higher MOOC orientation, indicating if the university has more than the average of the total number of MOOCs.

3.3 Data analysis

We adopted structural equation modelling (SEM) to analyze the simultaneous relationships proposed in the conceptual model at the university level (Guerrero et al., 2015, 2016; Lin & Wu, 2014). This statistical technique has been widely used in behavioral sciences during the last decade (Shook et al., 2004), because it allows the examination of a set of relationships between one or more independent or dependent variables, either continuous or discrete (Tabachnick & Fidell, 1996). This statistical technique also allows observation of the weight of each variable, and therefore the direct and indirect contribution, to explain the relationships among the constructs as well as testing potential mediating effects (Cheung & Lau, 2008; Fox, 1980; Sobel, 1982). To perform the SEM, we corroborated the correlations, reliability, and validity of the constructs using confirmatory factor analysis and Cronbach's alpha (Appendix 2). These analyses showed acceptable parameters between 0.6 and 0.7. Additionally, we tested the correlation between determinants' constructs, and found no significant covariance. Robustness tests are included in Appendix 3. To test the mediating effect (Aguinis et al., 2017; Baron and Kenny, 1986), we ran a

preliminary test to confirm the following three conditions: (i) the explanatory variable (ordinary capabilities) is a significant predictor of both the dependent variable (outcomes) and the mediator variable (intrapreneurial capabilities); (ii) the mediator variable (intrapreneurial capabilities) is a significant predictor of the dependent variable (outcomes); and (iii) the effect of the independent variable on the dependent variable (ordinary capabilities) is influenced when the mediator (intrapreneurial capabilities) is added to the regression model. If the effect of the explanatory variables is no longer significant when the mediator is added, then the effect is fully mediated; if the effect of the explanatory variables is reduced but significant, then the effect is partially mediated. Finally, we tested the conceptual model using the entire sample (Model I) and splitting the sample by status—public/private (Model II); by orientation—research/MOOC (Model III); and by location—North America/other (Model IV).

4. Results

4.1 Descriptive statistics

Table 3 shows the main descriptive statistics. On average, the sample is characterized by 157-year-old public universities (77%) very oriented to research (89%) with 14,764 students (20% international). Concerning the MOOC characteristics, on average, the number of courses offered by the sample has been 31 courses for at least three years, and with more than 14,764 followers that rated them very positively (at least four out of five). At least 35 per cent of the universities have the highest MOOC orientation. Moreover, their main providers/platforms are Coursera (50.3%), EdX (26.6%), FutureLearn (8.4%), and others. The main areas covered by the MOOCs are business, humanities, and science. In terms of diversification, the majority of the MOOC courses are offered in English, Chinese, Spanish and French. By geographic location, the sample is distributed between North America (37%), Europe (30%), Asia (14%), Australia (8%), Latin America (6%), Russia (3%), and Africa (2%). Concerning university reputation, on average, the sample evidenced very satisfactory rates for teaching quality (52.5%), research quality (63.5%),

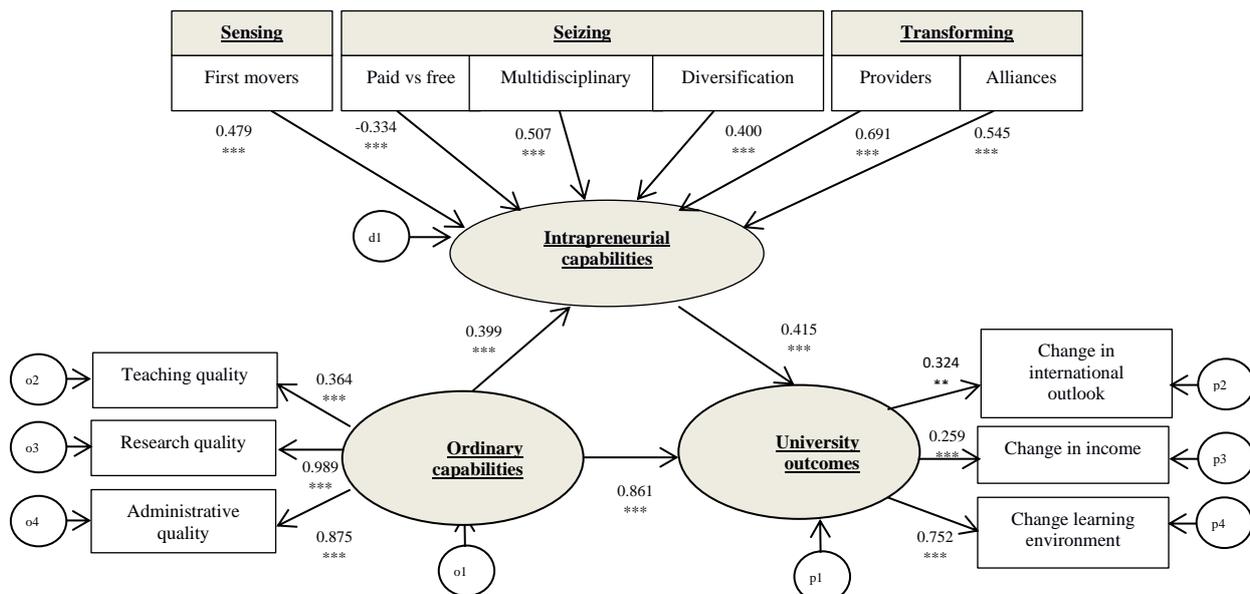
and administrative quality (60.8%). In terms of evolution, the average for the indicators of university performance evidences considerable growth in internationalization outlook (20.19), followed by income (9.21) and learning environment (3.58).

Table 3: Descriptive statistics

	Dimension	Minimum	Maximum	Mean	Std. Deviation
Ordinary capabilities: Resources & capabilities	Teaching quality (average)	1.00	100.00	52.47	32.87
	Research quality (average)	1.00	100.00	63.47	31.21
	Administrative quality (average)	1.00	100.00	60.80	31.33
	Sensing: risk taking (first mover)	0.00	5.00	3.12	1.170
	Seizing: Pro-activeness				
Intrapreneurial capabilities: MOOCs' orientation	paid vs free courses (ratio)	0.00	1.00	0.78	0.26
	Multidisciplinary (areas)	1.00	13.00	7.24	2.58
	Diversification (languages)	1.00	6.00	1.50	0.78
	Transforming: innovativeness				
	Providers (number)	1.00	6.00	1.70	0.93
	Alliances (number)	0.00	14.00	0.59	1.38
University outcomes: Sustained competitive advantage	Changes in learning environment	-19.34	51.95	3.58	13.85
	Changes in international outlook	-17.89	87.12	20.19	18.50
	Changes in university income	-40.70	215.11	9.21	31.44
	Age (years)	25.00	842.00	157.86	123.16
	Size (number of students)	126.00	145024.00	24857.97	17347.98
	Students per faculty (ratio students/faculty)	0.03	0.58	0.16	0.89
	International students (percentage of abroad students)	0.01	0.55	0.19	0.11
	University type (university based on public funding)	0.00	1.00	0.77	0.42
Control variables	Followers (number of MOOCs' followers per university)	13.00	157566.00	14764.30	23833.50
	Rating (the evaluation of the achievement of the MOOCs' expectations per participants 1-5 Likert)	1.00	5.00	4.04	0.70
	Research university (full research orientation)	0.00	1.00	0.89	0.31
	Location (if the university is located in North America)	0.00	1.00	0.37	0.49
	Higher MOOC orientation (universities over the average of the total number of analysed MOOCs)	0.00	1.00	0.35	0.48

4.2 Analysis of the results

Figure 2 shows the main results according to the proposed conceptual model.



[Standardized estimates; CMIN/DF 2.40; GFI 0.841; CFI 0.811; RSEA 0.050]
Level of statistical significance: *** $p \leq 0.001$, ** $p \leq 0.05$, * $p \leq 0.10$.

Figure 2: SEM Regression Weights [General Model]

Concerning the specifications, the model presents an adequate fit according to the established standards (Shook et al., 2004). More concretely, the specifications were the chi-squared (2.40) test of the model and the independence, GFI (0.84) shows good model testing the portion of the variance in the sample variance/covariance matrix, CFI (0.81) indicates a good fit, and RSEA (0.50) estimates an adequate fit compared to the saturated model. Concerning the relationships between the main latent variables, the main components show a positive and significant effect. Table 4 shows the direct, indirect, and total effects among the variables for tested model and the related robustness tests (Appendix 3).

Table 4: Direct and Indirect Effects

No standardized estimates															
H	Relationships	Model I. Entire Sample		Model II. University Type				Model III. University orientation				Model IV. University location			
				Public		Private		Higher Research orientation		Higher MOOC orientation		North America		Rest of the World	
		Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
H1	Ordinary → Intrapreneurial	0.019 ***		0.022 **		0.036 **		0.020 **		0.016 *		0.022 *		0.006 *	
H2	Intrapreneurial → Outcomes	3.978 ***		3.785 **		6.493 **		2.092 *		4.614 *		6.610 **		0.067	
H3	Ordinary → Intrapreneurial → Outcomes	0.390 **	0.074 **	0.478 *	0.082 **	0.294 *	0.232 **	0.273	0.043 *	0.390	0.073 *	0.642 **	0.040	0.483 *	0.001

Standardized estimates															
H	Relationships	Model I. Entire Sample		Model II. University Type				Model III. University orientation				Model IV. University location			
				Public		Private		Higher Research orientation		Higher MOOC orientation		North America		Rest of the World	
		Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
H1	Ordinary → Intrapreneurial	0.399 ***		0.365 **		0.616 **		0.401 **		0.400 *		0.686 *		0.150 *	
H2	Intrapreneurial → Outcomes	0.415 ***		0.293 **		0.700 **		0.442 *		0.395 *		0.267 **		0.004	
H3	Ordinary → Intrapreneurial → Outcomes	0.861 **	0.165 **	0.628 *	0.107 **	0.546 *	0.432 **	1.136	0.177 *	0.843	0.158 *	0.989 *	0.040	0.678 **	0.003

Note: Level of statistical significance: *** $p \leq 0.001$, ** $p \leq 0.05$, * $p \leq 0.10$.

Regarding the transition of routines into intrapreneurial capabilities, Model I shows the positive and significant contribution of ordinary capabilities to the development of intrapreneurial capabilities [0.399; $p < 0.001$]. In particular, this transition is positively influenced by the teaching quality of the lectures, content, and professors [0.275; $p < 0.100$]; by the research quality captured in the transferred technical knowledge and reinforced by the existent collaboration agreements [0.217; $p < 0.100$]; and by the administrative quality that is able to manage several multidisciplinary

strategies at the same time [0.202; $p < 0.100$]. Models II and III also confirm the highest contribution of our ordinary capabilities' measures to the development of intrapreneurial capabilities, particularly, when the university is categorized such as private [0.616; $p < 0.001$] and with a research focus [0.401; $p < 0.001$]. Model IV also shows the highest effect of ordinary capabilities on intrapreneurial capabilities in universities located in North America [0.686; $p < 0.100$]. The results support H1.

Concerning university outcomes, Model I shows a positive and significant contribution of intrapreneurial capabilities to university outcomes [0.415; $p < 0.001$]. More concretely, this positive contribution is generated by the effect of transforming and seizing capabilities in learning environments [0.312; $p < 0.100$]; reinforcement of the international outlook [0.134; $p < 0.100$]; and improvement in income [0.107; $p < 0.100$] in the period of analysis. Models II and III also evidence the highest effect of these proxies in private universities [0.700; $p < 0.001$] and with a research orientation [0.442; $p < 0.001$]. A significant direct contribution of intrapreneurial capabilities is observed to the learning environment in public and private universities [0.556; $p < 0.100$ and 0.557; $p < 0.100$, respectively], as well as to international outlook just in private universities [0.503; $p < 0.100$]. Model IV shows the highest effect when the university is located in North America [0.267; $p < 0.050$]. The results support H2.

In relation to the mediating role of intrapreneurial capabilities, Model I shows the positive/significant direct effect [0.861; $p < 0.05$] and indirect effect [0.165; $p < 0.05$] of ordinary capabilities on university outcomes. More concretely, an indirect effect is seen on the learning environment [0.722; $p < 0.050$], the change in international outlook [0.332; $p < 0.100$], and the change in income [0.266; $p < 0.100$]. Regarding university status, Model II evidences a higher direct effect of ordinary capabilities when the university is public [0.628; $p < 0.100$] than when private [0.546; $p < 0.100$]. Model IV evidences the highest effect when the university is located in North America [0.989; $p < 0.050$]. However, the highest indirect effect is observed in private universities [0.432; $p < 0.050$]. In this case, the main contribution of ordinary capabilities is observed in relation

to the learning environment [0.777; $p < 0.100$] and international outlook [0.702; $p < 0.100$]. In this sample, the main characteristics of private universities are maturity (179 years old) with high teaching quality (64.4%), high research quality (73.0%), high administrative quality (63.9%), characterized as first MOOC movers, adopting a MOOC business model based on revenues from certified courses (81.05%), with the highest number of followers, and with very positive reviews from users. Based on these results, Models I and II present a partial moderation effect of intrapreneurial capabilities, because both direct and indirect effects of ordinary capabilities on university performance are statistically significant. This type of mediation is more common in previous literature, in which case the mediator (dynamic capabilities) only mediates part of the effect of the intervention (ordinary capabilities) on the outcome (sustainability)—that is, the intervention has some residual direct effect even after the mediator is introduced into the model (Cheung & Lau, 2008; Fox, 1980; Iacobucci et al., 2007; Sobel, 1982; Zhou et al., 2017). By orientation, Model III shows a non-significant direct effect of ordinary capabilities on university outcomes. However, there is a positive and significant indirect effect for both universities with a research orientation [0.177; $p < 0.100$] and those with a MOOC orientation [0.158; $p < 0.100$]. Model II presents a full mediation of intrapreneurial capabilities, because we find a non-significant direct effect and significant indirect effects of ordinary capabilities on university outcomes. In other words, the effect is fully mediated by intrapreneurial capabilities—that is, in the presence of this mediator, the pathway connecting the intervention (ordinary capabilities) to the outcome (sustained competitive advantage) is completely broken so that the intervention has no direct effect on the outcome (Cheung & Lau, 2008; Fox, 1980; Iacobucci et al., 2007; Sobel, 1982; Zhou et al., 2017). The results support H3a and H3b.

5. Discussion

5.1 Implications to theory

This study contributes to the strategic management and entrepreneurship literature in two ways. Conceptually, the study contributes with a proposed conceptual model focused on the role and the impacts of a new typology of dynamic capabilities called intrapreneurial capabilities, used to exploit entrepreneurial opportunities that ensure universities' sustainability in the digital economy. The advent of increased competition and disruptive digital technology in higher education offers a stronger reason than ever for university leaders to seek to strengthen the capabilities of their institutions for greater operational efficiency and sustainability (Girod & Whittington, 2017; Ho et al., 2014; Parr, 2015; Teece, 2012, 2017, 2018). In our study, intrapreneurial capabilities are connected to a MOOC orientation that helps universities to confront the uncertainty surrounding new technologies and prioritize resource allocation to favor the future. As a consequence, our contribution enhances the discussion in current academic debates on how universities are transforming themselves into more innovative, entrepreneurial, and digital organizations (Al-Atabi & DeBoer, 2014; Daly, 2017; Eom et al., 2006; Eom & Ashill, 2016; Klofsten et al., 2019), as well as how universities are adopting new strategies and developing new capabilities to compete simultaneously in online and offline teaching markets (Burd et al., 2015; Crossan & Apaydin, 2010; Ghemawat, 2017; Lyons, 2017). From the strategic management point of view, as a university strategy, a MOOC orientation is an example of the potential productivity effect of digital technologies to deliver university-level content to tens of thousands of students worldwide simultaneously (Teece, 2018, p. 98). From the digital entrepreneurship point of view, as a university business model, a MOOC orientation is an example of the intersection of digital technologies and entrepreneurship developed by universities to shape entrepreneurial pursuits in the digital economy (Nambisan, 2017, p. 1029). These two academic debates are relevant because most universities are often too rigid, and they should be fluid in the digital environment to develop entrepreneurial and innovative initiatives (Teece, 2018). Consequently, the research agenda should be oriented to adopt conceptual approaches that provide a better understanding of the digital and entrepreneurial transformation of universities from diverse multidisciplinary angles. For instance,

an extension of this study is to reinforce the conceptualization of intrapreneurial capabilities using approaches such as digital entrepreneurship and stakeholder theory at the organizational level, as well as institutional intermediaries and digital ecosystems at the environmental level.

Methodologically, the study contributes a proposed methodological design to operationalize universities' intrapreneurial capabilities in the digital economy by combining metrics used in strategic management to capture dynamic capabilities (i.e., sensing, seizing, and transformation) with metrics used in entrepreneurship to capture intrapreneurship (i.e., risk-taking, innovativeness, and proactiveness). Our insights are consistent with ongoing academic debates on the continuous reconfiguration of routines into innovative and entrepreneurial actions in dynamic environments (Bareto, 2010; Girod & Whittington, 2017; Guerrero et al., 2016b; Klofsten et al., 2019). Moreover, the study includes some metrics to analyze how intrapreneurial capabilities enhance university outcomes. In this sense, the study also contributes to insights into the impact of intrapreneurial capabilities through the transformation of the university's ordinary capabilities and contribution to university outcomes. The evolution towards MOOCs' intrapreneurial capabilities combined with offline educational patterns enhances entrepreneurial orientation, competitive fitness, and long-term survival in the digital economy context (Bratti et al., 2004; Cave, 1997; Guerrero et al., 2015; Hollands & Tirthali, 2014; Johnes & Taylor, 1990; Lee & Park, 2012; Leih & Teece, 2016; McKenzie & Schweitzer, 2001). In this vein, the study also provides empirical evidence of how intrapreneurial capabilities partially mediate the contribution of ordinary capabilities to university outcomes. Therefore, our insights enhance the current academic debate in strategic management about the mediating effect of dynamic capabilities (Eriksson, 2014, pp. 18–19). The results also further debate on advancing strategic management theory/practice about the mechanisms/processes that connect antecedents and outcomes in the context of the digital economy (Aguinis et al., 2017, p. 666). In this vein, the research agenda should be oriented to explore the diverse roles that could assume intrapreneurial (dynamic) capabilities during the strategic and digital transformation of universities, and to propose objective/subjective metrics to

capture the effect of intrapreneurial capabilities on university outcomes. A natural extension of this study is the development of longitudinal case studies of MOOCs implemented within an entrepreneurial university to analyze in depth the evolutionary process of intrapreneurial capabilities, exploring robust metrics and identifying potential patterns.

5.2 Implications for practice

The study also contributes to university managers and MOOCs providers. For university managers, our insights provide evidence of how to take advantage of digital technologies using new free tuition educational business models that provide learning content, and to satisfy the demands of different student segments across continents. Concretely, for entrepreneurial universities' managers interested in nurturing successful MOOCs, several strategic decisions should be considered.

Firstly, the current generational cohorts are looking to satisfy multiple educational needs based on the market requirements and time restrictions (UK Department of Education, 2014), as well as improve professional careers/salaries (Class Central, 2017a). In this regard, university managers should understand the most up-to-date higher education trends (e.g., monitor the digital learning market), as well as identify stakeholder needs and students' digital behaviors (e.g., ensure high quality content/experience from an online instructor at much lower prices) to be an active player in the digital economy.

Secondly, strengthening dynamic capabilities requires institutional introspection, cultural change, the development of effective processes to diagnose problems and reach decisions, and coordination/integration with existing MOOC providers (Teece, 2017, p. 101). Therefore, managers should know how to manage the most valuable/unique resources/capabilities that will be transformed into value added in digital learning markets (e.g., famous professors, recognized researchers, successful subjects, technological tools such as virtual reality or artificial intelligence, and collaboration agreements with other universities/enterprises). In addition, managers should

possess knowledge/criteria to evaluate MOOC investments (e.g., develop their own MOOC infrastructures or participate in the existing MOOC platforms), and coordinate and integrate existing resources with the development of new intrapreneurial capabilities.

Thirdly, there are numerous reasons of transformation when drivers are oriented toward furthering the university's mission (teaching, research, and commercialization) by the creation of new value for stakeholders (Jiang et al., 2010; Lin & Wu, 2014; Schildt et al., 2012; Villar et al., 2014; Wu, 2007). Therefore, managers should ensure high-quality pedagogy for digital and scalable faculty-student interactions and implement mechanisms to certificate MOOC courses as a part of degree programs or long-life learning programs (e.g., offer unique digital learning packs for free or with cost, depending on the students' expectations).

Furthermore, based on the MOOC learners' survey, universities' reputation is a sign that top-ranked universities are the first movers and winners in the implementation of MOOCs (Class Central, 2017a; Shah, 2017). This fact explains the higher number of followers observed in elite private universities. Therefore, managers should understand the benefits of open innovation business models with platforms/providers and enhance their alliances with global partners. This understanding not only allows the creation of value, but also the value created to be captured as economic returns, global position, and competitive advantage (e.g., building alliances with strategic partners to gain position and reputation in the digital market).

Finally, quantity does not ensure quality in the digital context where students are influenced by multiple social media conditions. Therefore, for long-term sustainability, more diversification and independence are needed among big MOOC providers (considering that they receive at least 50 percent of the income for each certificated course). This could explain why some universities offer successful MOOCs by developing platforms that combine (off)online courses, initial investment, and better control of resources, products, competition, and revenues.

For MOOCs' providers, workplaces are configured by diversity in terms of generational cohorts of employees, cultures, values, and beliefs (UK Department of Education, 2014; Guerrero et al.,

2019a). Moreover, digital workplaces are a rising tendency in new/existing organizations, demanding new digital skills/knowledge (OECD, 2018). In this sense, there is labor market recognition and legitimacy of MOOCs as a new educational trend, and a need to adapt new jobs according to (non-)digital experiences, knowledge, skills, and ways to learn (Pappano, 2012). In this sense, our study highlights the relevance of providers' partnerships with elite and private universities. The main implication for MOOC providers is an open window to build profitable, recognized, and trusted collaborations with all universities, not only with elite/private universities. The MOOC market offers multiple opportunities and diverse portfolios of products/services such as free courses, certifications, degrees, corporate learning plans, scholarships, and other support. The implementation of win-win agreements between providers and universities, defining specific digital long-life learning programs for interested employers, or the development of specific content for digital university-industry projects involving different researchers across the globe (e.g., Google's and Microsoft's strategic alliances with professors from top-ranked universities to offer MOOC courses).

5.3 Implications for policy

The prerequisite for the success of MOOCs is the establishment of enough foundations: capabilities, resources, and content. In this regard, our study suggests at least three challenges for policymakers associated with the new digital educational paradigm. The first challenge is ensuring delivery of the appropriate digital skills demanded by the labor market. The government and higher education agencies should coordinate the regulation of curricula with the active participation of academic and non-academic institutions, employers, and stakeholders. A successful example is the generation of online platforms that offer skill certification schemes to help people to achieve the digital labor market requirements. Skill certifications generate benefits to the society such as updating the skills/knowledge of the older generation, migrants, or minority groups. Nevertheless, Kässä and Lehdonvirta (2019) demonstrate that obtaining these types of certificate is a signaling

device that increases earnings but does not necessarily increase productivity. Therefore, higher education systems should establish and regulate digital education schemes.

In this regard, the second challenge is the regulation of digital education in terms of the official recognition of digital certifications, digital training programs, and digital higher education programs. Recognition by the higher education system also implies specific controls to avoid falsifications/modifications. The dramatic expansion of digital educational opportunities to underserved populations will require political movements that change the focus, funding, and purpose of higher education systems; it will not be achieved through new technologies alone (Reich & Ruipérez-Valiente, 2019, p. 131). Therefore, the third challenge is the business regulation of platforms that provide MOOCs, as well as indirect providers that emerge in digital learning submarkets. Any disruptive innovation business model in the digital economy starts to operate across the globe within a regulatory gap (e.g., Uber, Airbnb, Netflix, etc.). Therefore, it is crucial to regulate/evaluate the business component in the digital learning market (Guerrero & Urbano, 2019a).

6. Conclusions

This paper sheds some light on the role and the impact of universities' intrapreneurial capabilities during the adoption of a MOOC orientation to take advantage of the digital economy. Based on a sample of 145 universities around the world that developed 67 percent of MOOCs from 2012 to 2017, this study finds that universities' intrapreneurial capabilities play a significant role in the digital higher education market through MOOCs. Our findings are applicable to the analyzed sample, which restricts their generalization.

Although this study makes significant theoretical and empirical contributions, it has some limitations that at the same time open up avenues for future research. Firstly, this study focuses on MOOC orientation as an approximation of entrepreneurial universities' strategies to be active players in the online learning market. Although MOOCs have yet to gain the traction that many

anticipated, a new wave of innovative teaching techniques has arrived, and academics are exploring new methods of teaching that are underpinned by digital technologies (PWC, 2018, p. 4). Therefore, future research may explore new mechanisms such as digital campuses, with interactive communication on students' devices, or telepresence education, where artificial intelligence is via the web or phone—in other words, exploration of the mechanisms associated with the digital extension of entrepreneurial universities' core activities such as online learning courses, e-research, or e-entrepreneurship (Guerrero & Urbano, 2012, 2019a; Klofsten et al., 2019).

Secondly, the main methodological limitation in this paper is associated with the lack of detailed information about human capital, infrastructures, networks, quality, and performance indicators linked with the MOOC courses at each university. Using several sources of data, we identify the best proxies to test our proposed conceptual framework. A natural extension will be to analyze the longitudinal evolution and performance of MOOCs through multiple case studies or doing a follow-up of universities with higher/lower MOOC orientation. Therefore, there is a very good opportunity to debate the quality versus the quantity of MOOCs, and to test the associated signaling effect that produces top-ranked universities in the digital market (Colombo et al., 2019; Geissinger et al., 2018).

Finally, unanswered questions in this research could also promote debate on universities' entrepreneurial strategies in the digital market. More concretely, the following would be some of the main questions: (i) how are MOOC providers/universities working to support/manage intrapreneurial processes through the digitalization era? (ii) How are MOOCs transforming the status quo of universities? (iii) How are universities combining online and offline teaching offerings? (iv) How are MOOCs transforming the university business model and open collaboration practices, and what are the social, technological, and economical returns from MOOCs among universities and countries?

Endnotes

- 1 Class Central is a free online site, aka MOOC aggregator website that curates MOOC listings and reviews from students who have taken MOOCs. The following articles are streamed live from Class Central's "MOOC Report" which offers news articles, interviews and analysis related to MOOCs (Massive Open Online Courses).

References

- Aguinis, H., Edwards, J. R., & Bradley, K. J. (2017). Improving our understanding of moderation and mediation in strategic management research. *Organizational Research Methods*, 20(4), 665-685.
- Al-Atabi, M., & DeBoer, J. (2014). Teaching entrepreneurship using massive open online course (MOOC). *Technovation*, 34(4), 261-264.
- Alraimi, K. M., Zo, H., & Ciganek, A. P. (2015). Understanding the MOOCs continuance: The role of openness and reputation. *Computers & Education*, 80, 28-38.
- Antoncic, B., & Hisrich, R. D. (2001). Intrapreneurship: Construct refinement and cross-cultural validation. *Journal of business venturing*, 16(5), 495-527.
- Antoncic, B., & Hisrich, R. D. (2003). Clarifying the intrapreneurship concept. *Journal of small business and enterprise development*, 10(1), 7-24.
- Banerjee, A. V., & Duflo, E. (2014). (Dis) Organization and success in an economics MOOC. *The American Economic Review*, 104(5), 514-518.
- Baron, R.M., & Kenny, D.A., (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J. Personal. Soc. Psychol.*, 51(6), 1173-1182.
- Barreto, I. (2010). Dynamic capabilities: A review of past research and an agenda for the future. *Journal of management*, 36(1), 256-280.
- Becker, M. C. (2004). Organizational routines: a review of the literature. *Industrial and corporate change*, 13(4), 643-678.
- Bedggood, R. E., & Donovan, J. D. (2012). University performance evaluations: what are we really measuring?. *Studies in Higher Education*, 37(7), 825-842.
- Belleflamme, P., & Jacqmin, J. (2015). An economic appraisal of MOOC platforms : business models and impacts on higher education. *CESifo Economic Studies*, 62(1), 148-169.
- Bratti, M., McKnight, A., Naylor, R., & Smith, J. (2004). Higher education outcomes, graduate employment and university performance indicators. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 167(3), 475-496.
- Brynjolfsson, E., & Kahin, B. (2002). *Understanding the digital economy: data, tools, and research*. MIT press.
- Burd, E.L., Smith, S.P. & Reisman, S. (2015). Exploring business models for MOOCs in higher education. *Innovative Higher Education*, 40(1), 37-49.
- Castiaux, A. (2012). Developing dynamic capabilities to meet sustainable development challenges. *International Journal of Innovation Management*, 16(06), 1240013.
- Cave, M. (1997). *The use of performance indicators in higher education: The challenge of the quality movement*. Jessica Kingsley Publishers.
- Chapleo, C. (2011). Exploring rationales for branding a university: Should we be seeking to measure branding in UK universities?. *Journal of Brand Management*, 18(6), 411-422.
- Chesbrough, H. W. (2006). The era of open innovation. *Managing innovation and change*, 127(3), 34-41.
- Cheung, G. W., & Lau, R. S. (2008). Testing mediation and suppression effects of latent variables: Bootstrapping with structural equation models. *Organizational Research Methods*, 11(2), 296-325.
- Christensen, G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E.J. (2013). *The MOOC phenomenon: Who takes massive open online courses and why? US*: University of Pennsylvania Press.

- Christensen, T., Gornitzka, Å., & Ramirez, F. O. (2019). Reputation Management, Social Embeddedness, and Rationalization of Universities. In *Universities as Agencies* (pp. 3-39). Palgrave Macmillan, Cham.
- Class Central (2017a). Learners survey 2017. <https://www.class-central.com/report/class-central-learner-survey-2017/>
- Class Central (2017b). List of MOOC courses per university. <https://www.class-central.com/universities>
- Colombo, M. G., Meoli, M., & Vismara, S. (2019). Signaling in science-based IPOs: The combined effect of affiliation with prestigious universities, underwriters, and venture capitalists. *Journal of Business Venturing*, 34(1), 141-177.
- Covin, J. G., & Miles, M. P. (1999). Corporate entrepreneurship and the pursuit of competitive advantage. *Entrepreneurship: Theory and practice*, 23(3), 47-47.
- Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of management studies*, 47(6), 1154-1191.
- Daly, P. (2017). Business apprenticeship: a viable business model in management education. *Journal of Management Development*, 36(6), <https://doi.org/10.1108/JMD-10-2015-0148>
- Drnevich, P.L., & Kriauciunas, A.P. (2011). Clarifying the conditions and limits of the contributions of ordinary and dynamic capabilities to relative firm performance. *Strategic Management Journal*, 32(3), 254–279.
- Eesley, C., & Wu, L. (2015). Entrepreneurial adaptation and social networks: Evidence from a randomized experiment on a MOOC platform. Available at SSRN, 2571777.
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they?. *Strategic management journal*, 1105-1121.
- Eom, S. B., & Ashill, N. (2016). The determinants of students' perceived learning outcomes and satisfaction in University online education: An update. *Decision Sciences Journal of Innovative Education*, 14(2), 185-215.
- Eom, S. B., Wen, H. J., & Ashill, N. (2006). The determinants of students' perceived learning outcomes and satisfaction in university online education: An empirical investigation. *Decision Sciences Journal of Innovative Education*, 4(2), 215-235.
- Epstein, M. J., & Roy, M. J. (2001). Sustainability in action: Identifying and measuring the key performance drivers. *Long range planning*, 34(5), 585-604.
- Eriksson, T. (2014). Processes, antecedents and outcomes of dynamic capabilities. *Scandinavian journal of management*, 30(1), 65-82.
- Ferguson, R., Scanlon, E. and Harris, L., 2016. Developing a Strategic Approach to MOOCs. *Journal of Interactive Media in Education*, 2016(1), p.21. DOI: <http://doi.org/10.5334/jime.439>
- Fonseca, G. L., Anunciação, P. F., & Penalver, A. J. B. (2019). The Role of Dynamic Capabilities as Influencers of Organizational Intelligence. In *Handbook of Research on Business Models in Modern Competitive Scenarios* (pp. 138-149). IGI Global.
- Foroudi, P., Yu, Q., Gupta, S., & Foroudi, M. M. (2019). Enhancing university brand image and reputation through customer value co-creation behaviour. *Technological Forecasting and Social Change*, 138, 218-227.
- Fox, J. (1980). Effects analysis in structural equation models. *Sociological Methods and Research*, 9, 3–28
- Gavrila, S. G., & Ramirez, F. O. (2019). Reputation Management Revisited: US Universities Presenting Themselves Online. In *Universities as Agencies* (pp. 67-91). Palgrave Macmillan, Cham.
- Geissinger, A., Laurell, C., Sandström, C., Eriksson, K., & Nykvist, R. (2018). Digital entrepreneurship and field conditions for institutional change—Investigating the enabling role of cities. *Technological Forecasting and Social Change*. <https://doi.org/10.1016/j.techfore.2018.06.019>

- Ghemawat, P. (2017). Strategies for higher education in the digital age. *California Management Review*, 59(4), 56–78.
- Girod, S. J., & Whittington, R. (2017). Reconfiguration, restructuring and firm performance: Dynamic capabilities and environmental dynamism. *Strategic Management Journal*, 38(5), 1121-1133.
- Griffith, D. A., Noble, S. M., & Chen, Q. (2006). The performance implications of entrepreneurial proclivity: A dynamic capabilities approach. *Journal of Retailing*, 82(1), 51—62.
- Guerrero, M., & Peña-Legazkue, I. (2013). The effect of intrapreneurial experience on corporate venturing: Evidence from developed economies. *International Entrepreneurship and Management Journal*, 9(3), 397-416.
- Guerrero, M., & Peña-Legazkue, I. (2019). Renascence after post-mortem: the choice of accelerated repeat entrepreneurship. *Small Business Economics*, 52(1), 47-65.
- Guerrero, M., & Urbano, D. (2012). The development of an entrepreneurial university. *The journal of technology transfer*, 37(1), 43-74.
- Guerrero, M., & Urbano, D. (2019a). A research agenda for entrepreneurship and innovation: the role of entrepreneurial universities. In Audretsch, D. B., Lehmann, E. E., & Link, A. N. *A Research Agenda for Entrepreneurship and Innovation*. Edward Elgar Publishing.
- Guerrero, M., & Urbano, D. (2019b). Effectiveness of technology transfer policies and legislation in fostering entrepreneurial innovations across continents: an overview. *The Journal of Technology Transfer*, 44(5), 1347-1366.
- Guerrero, M., Amorós, J. E., & Urbano, D. (2019a). Do employees' generational cohorts influence corporate venturing? A multilevel analysis. *Small Business Economics*, <https://doi.org/10.1007/s11187-019-00304-z>.
- Guerrero, M., Cunningham, J. A., & Urbano, D. (2015). Economic impact of entrepreneurial universities' activities: An exploratory study of the United Kingdom. *Research Policy*, 44(3), 748-764.
- Guerrero, M., Herrera, F., & Urbano, D. (2019b). Strategic knowledge management within subsidised entrepreneurial university-industry partnerships. *Management Decision*, 57(12), 3280-3300.
- Guerrero, M., Urbano, D., & Fayolle, A. (2016a). Entrepreneurial activity and regional competitiveness: evidence from European entrepreneurial universities. *The Journal of Technology Transfer*, 41(1), 105-131.
- Guerrero, M., Urbano, D., Fayolle, A., Klofsten, M., & Mian, S. (2016b). Entrepreneurial universities: emerging models in the new social and economic landscape. *Small Business Economics*, 47(3), 551-563.
- Hardy, C., Langley, A., Mintzberg, H., & Rose, J. (1983). Strategy formation in the university setting. *The Review of Higher Education*, 6(4), 407-433.
- Higgins, J. C. (1989). Performance measurement in universities. *European Journal of Operational Research*, 38(3), 358-368.
- Ho, A. D., Reich, J., Nesterko, S., Seaton, D. T., Mullaney, T., Waldo, J., & Chuang, I. (2014). *HarvardX and MITx: The first year of open online courses (HarvardX and MITx Working Paper No. 1)*.
- Hollands, F. M., & Tirthali, D. (2014). *MOOCs: expectations and reality*. Full report. Center for Benefit- Cost Studies of Education, Teachers College, Columbia University, NY. Retrieved from: http://cbcese.org/wordpress/wp-content/uploads/2014/05/MOOCs_Expectations_and_Reality.pdf
- Hollands, F. M., & Tirthali, D. (2015). *MOOCs in Higher Education. Institutional Goals and Paths Forward*. US: Palgrave Macmillan.
- Huizingh, E. K. (2011). Open innovation: State of the art and future perspectives. *Technovation*, 31(1), 2-9.
- Hung, R. Y., Chung, T., & Lien, B. Y. (2007). Organizational process alignment and dynamic capabilities in high-tech industry. *Total Quality Management & Business Excellence*, 18(9), 1023—1034.

- Iacobucci, D., Saldanha, N., & Deng, X. (2007). A meditation on mediation: Evidence that structural equations models perform better than regressions. *Journal of Consumer Psychology*, 17(2), 139-153.
- Jantunen, A., Puumalainen, K., Saarenketo, S., & Kyläheiko, K. (2005). Entrepreneurial orientation, dynamic capabilities and international performance. *Journal of International Entrepreneurship*, 3(3), 223-243.
- Jiang, R. J., Tao, Q. T., & Santoro, M. D. (2010). Alliance portfolio diversity and firm performance. *Strategic Management Journal*, 31(10), 1136–1144.
- Johnes, J., & Taylor, J. (1990). Performance indicators in higher education: UK universities. Open University Press and the Society for Research into Higher Education.
- Kässi, O. & Lehdonvirta, V. (2019). Do digital skill certificates help new workers enter the market?: Evidence from an online labour platform, OECD Social, Employment and Migration Working Papers, No. 225, OECD Publishing, Paris, <https://doi.org/10.1787/3388385e-en>.
- Klofsten, M., Fayolle, A., Guerrero, M., Mian, S., Urbano, D., & Wright, M. (2019). The entrepreneurial university as driver for economic growth and social change-Key strategic challenges. *Technological Forecasting and Social Change*, 141, 149-158.
- Kuik, O., Branger, F., & Quirion, P. (2019). Competitive advantage in the renewable energy industry: Evidence from a gravity model. *Renewable energy*, 131, 472-481.
- Lee, M., & Park, H. W. (2012). Exploring the web visibility of world-class universities. *Scientometrics*, 90(1), 201-218.
- Leih, S., & Teece, D. (2016). Campus leadership and the entrepreneurial university: A dynamic capabilities perspective. *The Academy of Management Perspectives*, 30(2), 182-210.
- Lin, Y., & Wu, L. Y. (2014). Exploring the role of dynamic capabilities in firm performance under the resource-based view framework. *Journal of business research*, 67(3), 407-413.
- Liyaganawardena, T. R., Adams, A. A., & Williams, S. A. (2013). MOOCs: A systematic study of the published literature 2008-2012. *The International Review of Research in Open and Distributed Learning*, 14(3), 202-227.
- Lopes, S. C. P., Lopes, H. E. G., Coleta, K. G., & Rodrigues, V. C. (2019). Dynamic Business Model: Capture of value and generation of sustainable competitive advantage. In *Handbook of Research on Business Models in Modern Competitive Scenarios* (pp. 99-116). IGI Global.
- Lyons, R.K. (2017). Economics of the ed tech revolution. *California Management Review*, 59(4), 49–55.
- McKenzie, K., & Schweitzer, R. (2001). Who succeeds at university? Factors predicting academic performance in first year Australian university students. *Higher education research & development*, 20(1), 21-33.
- Miles, M. P., & Arnold, D. R. (1991). The relationship between marketing orientation and entrepreneurial orientation. *Entrepreneurship theory and practice*, 15(4), 49-66.
- Miller, K. D., Pentland, B. T. and Choi, S. (2012). Dynamics of performing and remembering organizational routines. *Journal of Management Studies*, 49, 1536–58.
- Miller, K., McAdam, M., & McAdam, R. (2014). The changing university business model: a stakeholder perspective. *R&D Management*, 44(3), 265-287.
- Moed, H. F. (2017). A critical comparative analysis of five world university rankings. *Scientometrics*, 110(2), 967-990.
- Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, 41(6), 1029-1055.
- Narayanan, V. K., Yang, Y., & Zahra, S. A. (2009). Corporate venturing and value creation: A review and proposed framework. *Research Policy*, 38(1), 58-76.
- OECD (2018). Online work in OECD countries. Policy Brief on the future of work. http://www.oecd.org/els/emp/future-of-work/Online_Gig_Work.pdf
- Olcay, G. A., & Bulu, M. (2017). Is measuring the knowledge creation of universities possible?: A review of university rankings. *Technological Forecasting and Social Change*, 123, 153-16

- Ospina-Delgado, J., & Zorio-Grima, A. (2016). Innovation at universities: A fuzzy-set approach for MOOC-intensiveness. *Journal of Business Research*, 69(4), 1325-1328.
- Paluch, S., Antons, D., Brettel, M., Hopp, C., Salge, T. O., Piller, F., & Wentzel, D. (2019). Stage-gate and agile development in the digital age: Promises, perils, and boundary conditions. *Journal of Business Research*.
- Pappano, L. (2012). The Year of the MOOC. *New York Times*.
- Parr, C. (2015). Moocs: Fluctuating rates in online investment. *Times Higher Education World University Ranking*.
- Pentland, B. T., & Feldman, M. S. (2005). Organizational routines as a unit of analysis. *Industrial and corporate change*, 14(5), 793-815.
- Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., ... & Krabel, S. (2013). Academic engagement and commercialisation: A review of the literature on university–industry relations. *Research policy*, 42(2), 423-442.
- Peterson, R. T. (1989). Small business adoption of the marketing concept vs. other business strategies. *Journal of Small Business Management*, 27(1), 38.
- Porter, M. E. (2003). conducting business has become available, the fundamentals of competition remain unchanged". *Harvard Business Review*, 79(3), 62-78.
- PWC (2018). The 2018 digital university: Staying relevant in the digital age. <https://www.pwc.co.uk/assets/pdf/the-2018-digital-university-staying-relevant-in-the-digital-age.pdf>
- QS World University Rankings (2018). World University Rankings Methodology. <https://www.topuniversities.com/qs-world-university-rankings/methodology>
- Reich, J. and Ruipérez-Valiente, J.A. (2019). The MOOC pivot. What happened to disruptive transformation of education? *Policy Forum. Science*, 363(6423): 130-131
- Rerup, C., & Feldman, M. S. (2011). Routines as a source of change in organizational schemata: The role of trial-and-error learning. *Academy of Management Journal*, 54(3), 577-610.
- Rialti, R., Marzi, G., Ciappei, C., & Busso, D. (2019). Big data and dynamic capabilities: a bibliometric analysis and systematic literature review. *Management Decision*, <https://doi.org/10.1108/MD-07-2018-0821>
- Rothaermel, F. T., Agung, S. D., & Jiang, L. (2007). University entrepreneurship: a taxonomy of the literature. *Industrial and corporate change*, 16(4), 691-791.
- Schildt, H., Keil, T., & Maula, M. (2012). The temporal effects of relative and firm-level absorptive capacity on interorganizational learning. *Strategic Management Journal*, 33(10), 1154–1173.
- Shah, D. (2017). Class Central Learner Survey (2017): MOOC Users Highly Educated, Have Experienced Career Benefits. *Class Central*.
- Shook, C. L., Ketchen, D. J., Hult, G. T., & Kacmar, K. M. (2004). An Assessment of the use of structural equation modeling in strategic management research. *Strategic Management Journal*, 25, 397–404.
- Sirén, C., Hakala, H., Wincent, J., & Grichnik, D. (2017). Breaking the routines: Entrepreneurial orientation, strategic learning, firm size, and age. *Long Range Planning*, 50(2), 145-167.
- Sobel, M. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), *Sociological methodology* (pp. 290–312). San Francisco: Jossey-Bass.
- Tabachnick, B.G., Fidell, L.S., 1996. *Using Multivariate Statistics*. Harper Collins, New York.
- Teece, D. J. (2007). Explicating dynamic capabilities: the nature and micro-foundations of (sustainable) enterprise performance. *Strategic management journal*, 28(13), 1319-1350.
- Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, 43(2), 172-194.
- Teece, D. J. (2012). Dynamic capabilities: Routines versus entrepreneurial action. *Journal of Management Studies*, 49(8), 1395-1401.
- Teece, D. J. (2014). The foundations of enterprise performance: Dynamic and ordinary capabilities in an (economic) theory of firms. *Academy of Management Perspectives*, 28(4), 328–352.

- Teece, D. J. (2018). Managing the university: Why “organized anarchy” is unacceptable in the age of massive open online courses. *Strategic Organization*, 16(1), 92-102.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, 509-533.
- Teece, D., Peteraf, M., & Leih, S. (2016). Dynamic capabilities and organizational agility. *California Management Review*, 58(4), 13-35.
- Times Higher Education (2018). World University Rankings Methodology. Times Higher Education. <https://www.timeshighereducation.com/world-university-rankings/methodology-world-university-rankings-2018>
- UK Department of Education (2014). MOOCs: Opportunities for their use in compulsory-age education. Cairneagle Associates
- University of Tasmania (2018). Understanding Dementia MOOC. <http://www.utas.edu.au/wicking/understanding-dementia>
- Villar, C., Alegre, J., & Pla-Barber, J. (2014). Exploring the role of knowledge management practices on exports: A dynamic capabilities view. *International Business Review*, 23(1), 38-44.
- Wibbens, P. D. (2019). Performance persistence in the presence of higher-order resources. *Strategic Management Journal*, 40(2), 181-202.
- WOS (2017). MOOCs publications and statistics. Web of Science.
- Wu, L. (2007). Entrepreneurial resources, dynamic capabilities and start-up performance of Taiwan's high-tech firms. *Journal of Business Research*, 60(5), 549–555
- Zahra, S. A., Sapienza, H. J., & Davidsson, P. (2006). Entrepreneurship and dynamic capabilities: A review, model and research agenda. *Journal of Management studies*, 43(4), 917-955.
- Zangouinezhad, A., & Moshabaki, A. (2011). Measuring university performance using a knowledge-based balanced scorecard. *International Journal of Productivity and Performance Management*, 60(8), 824-843.
- Zhou, S. S., Zhou, A. J., Feng, J., & Jiang, S. (2017). Dynamic capabilities and organizational performance: The mediating role of innovation. *Journal of Management & Organization*, 1-17.
- Zollo, M., & Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization science*, 13(3), 339-351.

Appendix 1: List of universities included in the analysis

No.	University	Country	First MOOCs	MOOCs courses	No.	University	Country	First MOOCs	MOOCs courses
1	Stanford University	United States	2012	159	99	Curtin University	Australia	2015	14
2	Massachusetts Institute of Technology	United States	2013	151	100	California Institute of Technology	United States	2013	14
3	University of Pennsylvania	United States	2013	135	101	University of Parma	Italy	2016	14
4	University of Michigan	United States	2014	127	102	University of Glasgow	United Kingdom	2013	14
5	Harvard University	United States	2012	120	103	The University of Tokyo	Japan	2014	19
6	University of Illinois at Urbana-Champaign	United States	2013	117	104	University of Copenhagen	Denmark	2014	14
7	University of California, Irvine	United States	2013	105	105	Universidad Autónoma de Madrid	Spain	2014	14
8	Peking University	China	2013	103	106	Universidad de Chile	Chile	2016	14
9	Georgia Institute of Technology	United States	2013	97	107	University of Manchester	United Kingdom	2013	15
10	Ecole Polytechnique Fédérale de Lausanne	Switzerland	2013	89	108	Pennsylvania State University	United States	2013	13
11	Johns Hopkins University	United States	2013	86	109	Kyoto University	Japan	2015	13
12	Rice University	United States	2013	79	110	The University of Hong Kong	Hong Kong	2014	13
13	University of California, San Diego	United States	2013	74	111	Pontificia Universidad Católica de Chile	Chile	2015	13
14	Higher School of Economics	Russian Federation	2014	73	112	University of Rochester	United States	2013	13
15	Universitat Politècnica de València	Spain	2013	67	113	The University of North Carolina at Chapel Hill	United States	2013	13
16	The Open University	United Kingdom	2013	66	114	Universidad Politécnica de Madrid	Spain	2014	13
17	Delft University of Technology	Netherlands	2013	65	115	Georgetown University	United States	2013	12
18	Duke University	United States	2013	63	116	King's College London	United Kingdom	2013	12
19	Indian Institute of Technology Madras	India	2015	60	117	Cornell University	United States	2013	12
20	University of California, Berkeley	United States	2012	59	118	Universidad de Murcia	Spain	2015	12
21	Indian Institute of Technology Kanpur	India	2014	58	119	University of Zurich	Switzerland	2014	12
22	Universidad Nacional Autónoma de México	Mexico	2014	58	120	Macquarie University	Australia	2015	11
23	Arizona State University	United States	2015	56	121	Hong Kong Polytechnic University	Hong Kong	2015	11
24	Tsinghua University	China	2013	53	122	Case Western Reserve University	United States	2014	11
25	Columbia University	United States	2013	51	123	Xi'an Jiaotong University	China	2016	11
26	University of Washington	United States	2013	56	124	The University of Sydney	Australia	2016	11
27	University of Edinburgh	United Kingdom	2013	48	125	University of Cape Town	South Africa	2014	11
28	National Taiwan University	Taiwan	2013	48	126	Universidad de Navarra	Spain	2013	11
29	Moscow Institute of Physics and Technology	Russian Federation	2013	47	127	Technische Universität München	Germany	2013	11
30	University of Leeds	United Kingdom	2013	47	128	George Mason University	United States	2013	10
31	University of Virginia	United States	2014	46	129	George Washington University	United States	2014	10
32	Indian Institute of Technology, Kharagpur	India	2015	43	130	Hebrew University of Jerusalem	Israel	2014	10
33	University of California, Davis	United States	2015	41	131	Lancaster University	United Kingdom	2013	10
34	The Hong Kong University of Science	Hong Kong	2013	41	132	University of Bath	United Kingdom	2013	10
35	The University of British Columbia	Canada	2013	41	133	The University of Chicago	United States	2013	10
36	Tecnológico de Monterrey	Mexico	2013	39	134	Technical University of Denmark (DTU)	Denmark	2014	10
37	State University of New York	United States	2014	37	135	Universidad Austral	Chile	2016	10
38	University of Minnesota	United States	2013	35	136	Universidade Estadual de Campinas	Brazil	2014	10
39	University of Queensland	Australia	2013	35	137	University of Wisconsin–Madison	United States	2013	10
40	University of Maryland, College Park	United States	2013	34	138	The University of Nottingham	United Kingdom	2013	10
41	University of Geneva	Switzerland	2014	32	139	University of Pittsburgh	United States	2013	10
42	University of Colorado Boulder	United States	2014	31	140	Seoul National University	South Korea	2014	10
43	University of Melbourne	Australia	2014	31	141	RMIT University	Australia	2013	10
44	Vanderbilt University	United States	2014	30	142	Rutgers University	United States	2016	10
45	Purdue University	United States	2014	30	143	Dartmouth	United States	2014	10
46	Northwestern University	United States	2014	29	144	Lund University	Sweden	2014	10
47	Universitat Autònoma de Barcelona	Spain	2014	29	145	University at Buffalo	United States	2016	10
48	Yonsei University	South Korea	2015	29					
49	The University of Oklahoma	United States	2013	28					
50	Universidad de los Andes	Colombia	2015	28					
51	University of New South Wales	Australia	2014	27					
52	Princeton University	United States	2013	27					
53	Michigan State University	United States	2013	35					
54	The Pontificia Universidad Javeriana	Colombia	2015	25					
55	National Research Nuclear University MEPhI	Russian Federation	2015	25					
56	Leiden University	Netherlands	2013	24					
57	Emory University	United States	2013	24					
58	Ohio State University	United States	2013	24					
59	Yale University	United States	2013	24					
60	University of Toronto	Canada	2013	24					
61	Politecnico di Milano	Italy	2014	23					
62	Boston University	United States	2014	23					
63	Saint Petersburg State University	Russian Federation	2015	23					
64	University of East Anglia	United Kingdom	2013	23					
65	University of Modena and Reggio Emilia	Italy	2016	23					
66	The University of Texas at Austin	United States	2013	23					
67	University of Birmingham	United Kingdom	2013	22					
68	Indian Institute of Technology Bombay	India	2013	21					
69	Wageningen University	Netherlands	2014	20					
70	Shanghai Jiao Tong University	China	2013	19					
71	Tel Aviv University	Israel	2014	19					
72	University of Alberta	Canada	2014	19					
73	Université catholique de Louvain	Belgium	2014	25					
74	Indian Institute of Technology Roorkee	India	2016	18					
75	Queensland University of Technology	Australia	2015	18					
76	University of Reading	United Kingdom	2013	18					
77	Ecole Polytechnique	France	2014	18					
78	University of Florida	United States	2013	18					
79	Rochester Institute of Technology	United States	2016	18					
80	Universidad Carlos iii de Madrid	Spain	2014	18					
81	University of Southampton	United Kingdom	2013	18					
82	The University of Sheffield	United Kingdom	2013	18					
83	University of Adelaide	Australia	2015	17					
84	Fudan University	China	2015	17					
85	Australian National University	Australia	2014	16					
86	University of Amsterdam	Netherlands	2013	16					
87	Deakin University	Australia	2016	16					
88	University of Texas Arlington	United States	2015	16					
89	Universitat Pompeu Fabra	Spain	2014	16					
90	RWTH Aachen University	Germany	2013	15					
91	The Chinese University of Hong Kong	Hong Kong	2013	15					
92	Copenhagen Business School	Denmark	2013	15					
93	National University of Singapore	Singapore	2014	15					
94	University of Groningen	Netherlands	2014	15					
95	University of Barcelona	Spain	2014	15					
96	Monash University	Australia	2014	14					
97	Nanjing University	China	2015	14					
98	Goldsmiths, University of London	United Kingdom	2015	15					

Source: Based on Class Central (2018), Times Higher Education (2018), QS World University Ranking (2018) and Universities' Websites

Appendix 2: Correlation, reliability and validity analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(8)	(7)	(9)	(10)	(11)	(12)
1 Teaching quality (average)	1											
2 Research quality (average)	.346 ***	1										
3 Administrative quality (average)	.366 ***	.315 ***	1									
4 Changes in learning environment	-.126	-.140 *	-.085	1								
5 Changes in university income	.025	-.033	.003	.098	1							
6 Changes in international outlook	.002	.086	-.093	-.165 **	-.054	1						
7 Multidisciplinary (areas)	.266 ***	.154 *	.211 **	-.161 *	.016	.231 **	1					
8 Paid vs free courses (ratio)	.016	.020	-.070	.029	.092	-.036	-.049	1				
9 Diversification (languages)	.133	.173 **	.189 **	.176 **	.070	.157 **	.315 ***	-.136 ***	1			
10 First movers	.366 ***	.307 ***	.329 ***	-.217 **	.014	.282 ***	.327 ***	-.167 **	.095	1		
11 Providers	.248 **	.088	.276 ***	-.120 **	-.170 **	.161 **	.303 ***	-.380 ***	.285 ***	.231 **	1	
12 Alliances	.127	.156 *	.104	-.089	-.092	.200 **	.272 ***	-.057	.169 **	.228 **	.478 ***	1

	Dimension	Internal validity	Confirmatory factor analysis	Reliability: Alpha Cronbach
Ordinary capabilities: Resources & capabilities	Teaching quality	0.576	KMO = 0.655 chi2 = 215.61 Sig ***	0.752
	Research quality	0.937		
	Administrative quality	0.928		
Intrapreneurial capabilities: MOOCs orientation	Sensing: risk taking	0.557	KMO = 0.629 chi2 = 123.91 Sig ***	0.654
	Seizing: Pro-activeness			
	paid vs free courses	0.924		
	Multidisciplinary	0.789		
	Diversification	0.524		
	Transforming: innovativeness			
University performance: Competitive advantage	Providers	0.618	KMO = 0.677 chi2 = 22.87 Sig ***	0.643
	Alliances	0.656		
	Changes in learning environment	0.803		
	Changes in international outlook	0.976		
	Changes in university income	0.843		

Appendix 3: Robustness tests

Standardized Regression Weights: MOOC General

Parameter	Bootstrap standard errors					Bootstrap Confidence Intervals					
	SE	SE-SE	Mean	Bias	SE-Bias	Estimate	Lower	Upper	P		
Intrapreneurial	<--	ordinary	0.102	0.005	0.400	0.001	0.399	0.245	0.595	***	
Performance	<--	ordinary	0.193	0.010	0.833	-0.029	0.014	0.861	0.511	1.160	**
Performance	<--	Intrapreneurial	0.113	0.006	0.421	0.006	0.008	0.415	0.267	0.608	***
Change in international	<--	perform	0.112	0.006	0.267	-0.056	0.008	0.324	0.046	0.415	***
Change in income	<--	perform	0.121	0.006	0.280	0.021	0.009	0.259	0.075	0.464	***
Change learning environment	<--	perform	0.158	0.008	0.790	0.038	0.011	0.752	0.563	1.124	***
Teaching quality	<--	ordinary	0.096	0.005	0.350	-0.014	0.007	0.364	0.184	0.496	***
Research quality	<--	ordinary	0.023	0.001	0.995	0.007	0.002	0.989	0.962	1.036	***
Administrative quality	<--	ordinary	0.029	0.001	0.871	-0.004	0.002	0.875	0.819	0.915	***
First movers	<--	Intrapreneurial	0.095	0.005	0.481	0.002	0.007	0.479	0.339	0.655	***
Paid vs free	<--	Intrapreneurial	0.112	0.006	-0.327	0.007	0.008	-0.334	-0.503	-0.130	***
Multidisciplinary	<--	Intrapreneurial	0.089	0.004	0.508	0.001	0.006	0.507	0.355	0.655	***
Diversification	<--	Intrapreneurial	0.154	0.008	0.392	-0.009	0.011	0.400	0.126	0.637	***
Providers	<--	Intrapreneurial	0.141	0.007	0.683	-0.007	0.010	0.691	0.437	0.886	***
Alliances	<--	Intrapreneurial	0.115	0.006	0.528	-0.017	0.008	0.545	0.323	0.704	***

Standardized Regression Weights: MOOC Public

Parameter	Bootstrap standard errors					Bootstrap Confidence Intervals					
	SE	SE-SE	Mean	Bias	SE-Bias	Estimate	Lower	Upper	P		
Intrapreneurial	<--	ordinary	0.152	0.008	0.36	-0.005	0.011	0.365	0.121	0.642	**
Performance	<--	ordinary	0.270	0.014	0.761	0.133	0.019	0.628	0.421	1.269	*
Performance	<--	Intrapreneurial	0.141	0.007	0.292	-0.001	0.010	0.293	0.092	0.526	**
Change in international	<--	perform	0.170	0.008	0.098	0.087	0.012	0.011	-0.15	0.359	***
Change in income	<--	perform	0.134	0.007	0.300	-0.050	0.009	0.350	0.060	0.507	***
Change learning environment	<--	perform	0.268	0.013	0.968	-0.078	0.019	1.045	0.582	1.457	**
Teaching quality	<--	ordinary	0.106	0.005	0.329	0.020	0.007	0.309	0.157	0.514	**
Research quality	<--	ordinary	0.026	0.001	0.995	-0.007	0.002	1.002	0.952	1.038	***
Administrative quality	<--	ordinary	0.037	0.002	0.864	0.002	0.003	0.861	0.801	0.918	*
First movers	<--	Intrapreneurial	0.141	0.007	0.446	-0.015	0.010	0.461	0.240	0.692	***
Paid vs free	<--	Intrapreneurial	0.138	0.007	-0.234	0.011	0.010	-0.244	-0.484	-0.01	**
Multidisciplinary	<--	Intrapreneurial	0.125	0.006	0.544	-0.018	0.009	0.562	0.306	0.739	**
Diversification	<--	Intrapreneurial	0.145	0.007	0.406	-0.001	0.010	0.407	0.168	0.63	**
Providers	<--	Intrapreneurial	0.148	0.007	0.502	0.003	0.010	0.499	0.259	0.752	**
Alliances	<--	Intrapreneurial	0.147	0.007	0.328	-0.011	0.010	0.339	0.046	0.581	**

Standardized Regression Weights: MOOC private

Parameter	Bootstrap standard errors					Bootstrap Confidence Intervals					
	SE	SE-SE	Mean	Bias	SE-Bias	Estimate	Lower	Upper	P		
Intrapreneurial	<--	ordinary	0.160	0.008	0.573	-0.043	0.011	0.616	0.282	0.813	**
Performance	<--	ordinary	0.327	0.016	0.641	0.095	0.023	0.546	0.316	1.007	*
Performance	<--	Intrapreneurial	0.330	0.017	0.610	-0.090	0.023	0.700	0.212	0.947	**
Change in international	<--	perform	0.104	0.005	0.694	-0.025	0.007	0.719	0.474	0.836	**
Change in income	<--	perform	0.124	0.006	0.357	0.020	0.009	0.337	0.130	0.565	**
Change learning environment	<--	perform	0.073	0.004	0.790	-0.005	0.005	0.795	0.669	0.883	**
Teaching quality	<--	ordinary	0.148	0.007	0.420	-0.008	0.010	0.428	0.169	0.650	**
Research quality	<--	ordinary	0.040	0.002	1.023	0.002	0.003	1.021	0.980	1.071	**
Administrative quality	<--	ordinary	0.072	0.004	0.842	-0.010	0.005	0.852	0.716	0.926	**
First movers	<--	Intrapreneurial	0.170	0.009	0.716	-0.080	0.012	0.797	0.364	0.903	***
Paid vs free	<--	Intrapreneurial	0.194	0.010	-0.296	0.006	0.014	-0.302	-0.562	0.081	**
Multidisciplinary	<--	Intrapreneurial	0.157	0.008	0.579	0.002	0.011	0.577	0.270	0.795	**
Diversification	<--	Intrapreneurial	0.283	0.014	0.353	-0.014	0.020	0.367	-0.166	0.803	**
Providers	<--	Intrapreneurial	0.195	0.010	0.661	0.020	0.014	0.641	0.325	0.967	**
Alliances	<--	Intrapreneurial	0.198	0.010	0.551	0.073	0.014	0.479	0.190	0.891	**

Standardized Regression Weights: MOOC orientation

Parameter	Bootstrap standard errors					Bootstrap Confidence Intervals					
	SE	SE-SE	Mean	Bias	SE-Bias	Estimate	Lower	Upper	P		
Intrapreneurial	<--	ordinary	0.123	0.006	0.414	0.014	0.009	0.400	0.092	0.624	**
Performance	<--	ordinary	0.192	0.010	0.891	0.048	0.014	0.843	0.395	1.166	**
Performance	<--	Intrapreneurial	0.16	0.008	0.366	-0.03	0.011	0.395	0.137	0.966	***
Change in international	<--	perform	0.100	0.005	0.503	-0.011	0.007	0.513	0.278	0.674	**
Change in income	<--	perform	0.127	0.006	0.228	0.018	0.009	0.210	0.040	0.500	**
Change learning environment	<--	perform	0.086	0.004	0.799	-0.016	0.006	0.815	0.666	1.044	***
Teaching quality	<--	ordinary	0.151	0.008	0.346	0.026	0.011	0.320	0.041	0.571	**
Research quality	<--	ordinary	0.034	0.002	0.961	-0.007	0.002	0.968	0.881	1.017	***
Administrative quality	<--	ordinary	0.054	0.003	0.859	-0.006	0.004	0.865	0.728	0.946	**
First movers	<--	Intrapreneurial	0.145	0.007	0.507	-0.027	0.010	0.534	0.249	0.799	**
Paid vs free	<--	Intrapreneurial	0.217	0.011	-0.503	0.010	0.015	-0.513	-0.840	0.104	*
Multidisciplinary	<--	Intrapreneurial	0.185	0.009	0.448	0.028	0.013	0.420	0.107	0.732	**
Diversification	<--	Intrapreneurial	0.243	0.012	0.338	0.001	0.017	0.337	-0.094	0.809	**
Providers	<--	Intrapreneurial	0.176	0.009	0.751	-0.034	0.012	0.785	0.262	0.979	*
Alliances	<--	Intrapreneurial	0.184	0.009	0.550	-0.041	0.013	0.592	0.123	0.836	**

Standardized Regression Weights: North America

Parameter	Bootstrap standard errors					Bootstrap Confidence Intervals					
	SE	SE-SE	Mean	Bias	SE-Bias	Estimate	Lower	Upper	P		
Intrapreneurial	<--	ordinary	0.182	0.009	0.143	-0.007	0.013	0.686	-0.190	0.601	*
Performance	<--	ordinary	0.160	0.008	0.652	0.014	0.011	0.989	0.412	1.157	**
Performance	<--	Intrapreneurial	0.121	0.006	0.253	-0.015	0.009	0.267	0.078	0.611	**
Change in international	<--	perform	0.130	0.007	0.106	0.025	0.009	0.081	-0.129	0.380	***
Change in income	<--	perform	0.116	0.006	0.434	-0.017	0.008	0.451	0.143	0.660	***
Change learning environment	<--	perform	0.201	0.010	1.108	0.017	0.014	1.091	0.664	1.636	***
Teaching quality	<--	ordinary	0.118	0.006	0.316	0.000	0.008	0.316	0.067	0.531	**
Research quality	<--	ordinary	0.029	0.001	0.997	0.000	0.002	0.997	0.957	1.091	***
Administrative quality	<--	ordinary	0.036	0.002	0.877	-0.003	0.003	0.880	0.799	0.937	*
First movers	<--	Intrapreneurial	0.165	0.008	0.322	-0.007	0.012	0.329	0.114	1.058	***
Paid vs free	<--	Intrapreneurial	0.165	0.008	-0.441	0.007	0.012	-0.448	-0.715	-0.021	**
Multidisciplinary	<--	Intrapreneurial	0.142	0.007	0.306	-0.022	0.010	0.328	0.062	0.596	**
Diversification	<--	Intrapreneurial	0.166	0.008	0.600	-0.025	0.012	0.625	0.220	0.912	***
Providers	<--	Intrapreneurial	0.185	0.009	0.558	0.024	0.013	0.534	0.037	0.878	**
Alliances	<--	Intrapreneurial	0.174	0.009	0.290	-0.009	0.012	0.299	-0.007	0.654	*