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Unleashing intrapreneurial capabilities of educators: transforming sustainability education in higher education

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Abstract

Purpose – There is a lack of decision support models to assess sustainability education (SE) challenges in universities and educators' intrapreneurial capabilities. The purpose of this study is to develop a decision support model using the dynamic capability view to assess and choose an appropriate configuration based on data collected from Australia, China and Mexico.

Design/methodology/approach – This research design first identifies SE challenges and educators' intrapreneurial capabilities via a systematic literature review. Next, the most important SE challenges and intrapreneurial capabilities are determined by adopting the quality function deployment tool. Fuzzy set qualitative comparative analysis is used to establish the best pattern of intrapreneurial capabilities to address the SE challenges and thus enhance the sustainability educational practices of universities.

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Findings – The findings show SE challenges and educators' intrapreneurial capabilities vary across universities and countries. These variations play a crucial role in determining the performance of universities. This performance is shaped by the unique interactions amongst resources, processes, people-related SE challenges and the intrapreneurial capabilities associated with new venture behaviour, innovativeness, self-renewal and the proactiveness of educators.

Originality/value – This study offers important theoretical and managerial implications of how educators' intrapreneurial capabilities can address the challenges in resources, processes and people that influence SE, despite country-based heterogeneity.

Keywords fsQCA, Higher education, Sustainability education, SDGs, Dynamic capability view, Intrapreneurial capabilities

Paper type Research paper

1. Introduction

Human behaviour and activities significantly impact environmental and sustainability issues. The United Nations (UN) (2022) reported an 18 ppb increase in methane from 2020 to 2021 and a 10 mm sea level rise since January 2020. The International Panel on Climate Change (IPCC) (2018) urged immediate changes to address climate change. Skills, knowledge, attitudes and values are essential for sustainable development through individual and collective actions (Karatzoglou, 2013). Education is crucial for advancing environmental and sustainability outcomes (Cardiff *et al.*, 2024). The role of education in achieving the UN's 17 sustainable development goals (SDGs) has been emphasised in forums like:

- *The Paris Agreement:* [United Nations Framework Convention on Climate Change (UNFCCC), 2015];
- *Transforming Our World: The 2030 Agenda for Sustainable Development* [United Nations (UN), 2015]; and
- *Education 2030: Incheon Declaration and Framework for Action* [United Nations Educational, Scientific and Cultural Organization (UNESCO), 2016].

Although it is recognised that education levels must advance sustainability education (SE) (Alcántara-Rubio *et al.*, 2022), progress is slow, and research on higher education institutions' (HEIs) roles is limited (Trott *et al.*, 2023).

Environmental and SE (or education for sustainable development) is defined as "a lifelong learning process and an integral part of quality education that enhances cognitive, social and emotional and behavioural dimensions of learning" United Nations Educational, Scientific and Cultural Organization (UNESCO) (2020, p. 8). Literature highlights the challenges HEIs face in developing and implementing SE (e.g. Ferguson, 2020; Wals and Benavot, 2017). HEIs are bound by country- and industry-specific and institutional factors that affect their performance in SE [see Al-Raeei, 2023; Gamage and Sciulli, 2017; Jia *et al.*, 2019; Liu and Gao, 2021; Ralph and Stubbs, 2014; Secretariat of Environment and Natural Resources (SEMARNAT), 2023]. Research has found that HEI educators' intrapreneurial capabilities can address these challenges (Guerrero *et al.*, 2020; Valka *et al.*, 2020). Using these capabilities, educators can design sustainable curricula to help learners understand environmental and sustainability issues and develop impactful actions (Parris and McInnis-Bowers, 2017). However, a lack of HEI educators' intrapreneurial capabilities impedes progress in achieving the SDGs (Burkholder *et al.*, 2016). Increasing attention is being paid to developing intrapreneurial capabilities to enhance HEIs' performance in SE (Parris and McInnis-Bowers, 2017). Hence, an international analysis in Australia, China and Mexico is used to understand institutional and country heterogeneity to address:

- Do HEIs in different countries face different challenges related to SE?
- Do HEI educators' intrapreneurial capabilities differ across countries?
- How do different configurations of challenges and educators' intrapreneurial capabilities affect HEIs' performance in SE?

This study investigates challenges faced by HEI educators and determines their SE-related intrapreneurial capabilities to manage SE challenges. Based on the dynamic capability view (DCV) (Teece, 2007), arguments are developed to identify a configuration of HEI educator challenges and intrapreneurial capabilities that affect their performance in SE. Specifically, the interaction between the explanatory factors is examined because challenges and intrapreneurial capabilities are not identical across institutions. This is to avoid any results that lead to inappropriate decision-making. The methodology develops a decision support model based on the "sensing", "seizing" and "reconfiguring" elements of DCV (Teece, 2007). First, the literature identifies HEI educators' intrapreneurial capabilities and their country-specific challenges. Second, the quality function deployment (QFD) tool is used to verify and rank the most important challenges and educators' intrapreneurial capabilities. Next, fuzzy set qualitative comparative analysis (fsQCA) is used to identify the optimal configuration by examining the interactions between educators' challenges and intrapreneurial capabilities that maximise HEIs' performance in SE.

Results show challenges related to resources, processes and people significantly impact HEI performance in SE, with effects varying across countries, supported by the literature (Ferguson, 2020; Wals and Benavot, 2017). Results also show educators' intrapreneurial capacities can address these challenges and influence SE performance (Guerrero *et al.*, 2020; Valka *et al.*, 2020). In Australia, China and Mexico, educators' new venture behaviour, innovativeness, self-renewal and proactiveness affect SE development, despite differences in resources, processes and people. Without intrapreneurial capacities, HEIs may struggle to develop SE initiatives. This study offers managerial implications for HEI governance and policymaking to foster intrapreneurial capabilities in educators. In addition, there is a need for national initiatives and socio-economic developments to align with HEIs' strategies to optimise resources, processes and people through cross-sector and international collaborations.

The paper is organised as follows. Section 2 presents the study background and literature review, followed by the research model. Section 3 describes the methodology, followed by results and application of a decision support model. Discussions and implications, limitations and future directions and conclusion are presented at the end.

2. Background of the study

First, the education systems of Australia, China and Mexico, focusing on their distinct approaches to SE, are analysed. SE in Australia has evolved and driven by global environmental awareness. Environmental courses began in the 1970s and 1980s. By the 21st century, Australia strengthened its commitment to sustainability through green practices, renewable energy and conservation initiatives (Angus, 2018). The country's adaptive responses to global environmental challenges demonstrate its dedication to fostering a sustainable future (Bergquist and Näsman, 2023).

China has also transformed its SE approach, integrating environmental education across sectors. SE was introduced in 1970s through specific courses, expanding into various disciplines by the 1990s. In the 2000s, top-down policies, including the National Outline for Medium- and Long-Term Education Reform and Development 2010–2020, institutionalised support for sustainable development (Li, 2013). This commitment has cultivated a culture of sustainability (Xie *et al.*, 2023).

Mexico faces unique challenges as an emerging economy experiencing industrial growth and nearshoring trends. Higher education institutions (HEIs) are crucial in advancing sustainability knowledge. By fostering innovation and building educators' capacities, Mexico can address waste management challenges and enhance community awareness (Herrera *et al.*, 2018).

3. Literature review

SE challenges and intrapreneurial capabilities of SE educators in the three countries are outlined below.

3.1 Sustainability education challenges

HEIs encounter challenges to implementing sustainability practices, including leadership style and skills (Walter *et al.*, 2020), institutional strategies, governance and values (Ananda and Andréa, 2020), technology development, training and development, policymaking, talent recruitment and curriculum, financial and administrative support (Hinduja *et al.*, 2023). Institutional factors are vital in creating a concerted thinking framework, commitment and approach to achieving goals and overcoming obstacles to developing SE (Melles, 2019). This study focuses on HEIs' resources, processes and people to gain a holistic perspective of the interplay between institutional factors. SE challenges vary across nations. In Australia, universities serve as key change agents through specialised courses, policies and regulations (Gamage and Sciulli, 2017; Ralph and Stubbs, 2014). In China, universities prioritise technical initiatives and green campuses but encounter obstacles such as timetabling constraints and regional variations in student perceptions (Liu and Gao, 2021; Jia *et al.*, 2019). Mexican universities struggle to embed sustainability within communities and curricula, necessitating streamlined administrative processes. These challenges hinder the SE performance of HEIs (Ferguson, 2020).

3.1.1 Resources. Resource-related challenges encompass inadequate access to technology, insufficient funding and problematic workload models. Significant transitions in funding models affect SE operational frameworks within universities across Australia, China and Mexico (Holgaard *et al.*, 2016; Holm *et al.*, 2015; Marcos-Iga and Shaw, 2011). Insufficient funding restricts access to essential resources and expertise and leads to a scarcity of SE specialists to support academics (Holgaard *et al.*, 2016; Holm *et al.*, 2015; Juárez-Nájera *et al.*, 2006). Poor workload models are evident in Australian, Chinese and Mexican universities (e.g. Kenny and Fluck, 2014; Liu and Onwuegbuzie, 2012). Deficient technical infrastructure makes it arduous for educators to effectively incorporate and develop SE practices within their teaching methodologies (Kenny and Fluck, 2014; Liu and Onwuegbuzie, 2012). Thus, addressing these multifaceted challenges is imperative to foster a conducive environment that cultivates and advances SE capabilities within HEIs.

3.1.2 Process. Sustainability curriculum practices are often underemphasised among educators in Australia, China and Mexico (e.g. Holgaard *et al.*, 2016; Holm *et al.*, 2015; Juárez-Nájera *et al.*, 2006). HEIs must address sustainability concerns within their curricula and establish cross-institutional networks and mentorships. However, collaboration among HEIs in these countries remains rare (e.g. Holgaard *et al.*, 2016; Holm *et al.*, 2015; Miquelajauregui *et al.*, 2022). Governance issues and unclear environmental policies further hinder efforts, making it difficult for educators to integrate sustainability issues into curricula. The absence of sustainability programmes can demotivate academics, slowing SE progress (e.g. Holgaard *et al.*, 2016; Holm *et al.*, 2015; Miquelajauregui *et al.*, 2022).

3.1.3 People. Educators in Australian, Chinese and Mexican universities may disengage from SE development due to a lack of awareness of sustainability curricula (e.g. Holgaard *et al.*, 2016; Holm *et al.*, 2015; Juárez-Nájera *et al.*, 2006). Opportunities for sustainability

training are limited in these countries (e.g. Holgaard *et al.*, 2016; Holm *et al.*, 2015; Juárez-Nájera *et al.*, 2006). Educators' sustainable citizenship can foster SE, but a weak sustainability culture in HEIs complicates SE practices (e.g. Holgaard *et al.*, 2016; Holm *et al.*, 2015; Juárez-Nájera *et al.*, 2006). Educators often fail to engage with key stakeholders in SE efforts (e.g. Holgaard *et al.*, 2016; Holm *et al.*, 2015; Juárez-Nájera *et al.*, 2006). Therefore, HEIs struggle to integrate SE practices into their curricula.

Table 1 presents the SE challenges within HEIs by resources, people and processes, using Schneier's (1999) model.

3.2 Intrapreneurial capabilities to address sustainability education challenges

An enterprise staff member's intrapreneurial capabilities can help address external challenges (Klofsten *et al.*, 2021). These capabilities (new venture behaviour, innovativeness, self-renewal and proactiveness) include the ability to transform traditional practices into entrepreneurial actions to address SE challenges (Antoncic and Hisrich, 2001). Entrepreneurial intentions vary by country. The Global Entrepreneurship Monitor (GEM), 2022 report shows Mexico (17.51) outperformed Australia (13.22) and China (6.39) in entrepreneurial intentions. Therefore, educators' intrapreneurial capabilities are expected to differ across Australian, Chinese and Mexican HEIs and contribute to SE challenges in different ways.

3.2.1 New venture behaviour. New venture behaviour is a crucial capability in reshaping SE (Pellegrini *et al.*, 2019). Redefining HEI courses with an SE focus involves revising existing concepts and exploring new areas based on sustainability principles (Pellegrini *et al.*, 2019). This capability depends on expert support, effective training and SE-related programmes (Sanchez-Carrillo *et al.*, 2021). Poor workload models can limit it (Kenny and Fluck, 2014; Liu and Onwuegbuzie, 2012). In countries like Australia and China, educators play a key role in reinforcing traditional practices and driving environmental entrepreneurship (e.g. Maritz *et al.*, 2019; Zhang and Price, 2020). In Mexico, educators with new venture experience can bridge the environmental awareness gap (Juárez-Nájera *et al.*, 2006).

3.2.2 Innovativeness. Educators play a crucial role in shaping sustainability courses within HEIs (Pellegrini *et al.*, 2019). Unlocking their innovativeness for SE requires adequate funding, academic collaboration and a culture of sustainability. In Australia, SE is integrated into various innovative strategies and action plans, providing tailored solutions to regional challenges and reinforcing universities' transformational roles (Maritz *et al.*, 2019; Gamage and Sciulli, 2017). In China, HEIs are introducing innovative sustainability programmes and cross-disciplinary initiatives (Jia *et al.*, 2019). Mexico's education framework embeds innovation through open innovation, continuous improvement and knowledge transfer, addressing challenges such as waste control and sustainable entrepreneurship (SEMARNAT, 2023).

3.2.3 Self-renewal. Educators with self-renewal capabilities can transform traditional approaches into SE programs by reorganising and injecting fresh perspectives into established frameworks (Valka *et al.*, 2020). They actively engage in training and experimental efforts, driving the continuous evolution of educational practices (Holgaard *et al.*, 2016; Holm *et al.*, 2015). Effective training, funding and an innovative culture encouraging SE-related experimentation all foster this capability (Sanchez-Carrillo *et al.*, 2021). In Australia, China and Mexico, strategic renewal capabilities are crucial for adapting and enhancing educational practices to meet evolving sustainable future (e.g. Maritz *et al.*, 2019; Zhang and Price, 2020; Guerrero *et al.*, 2020).

3.2.4 Proactiveness. Proactive capabilities enable educators to make bold decisions relevant to HEIs (Pellegrini *et al.*, 2019). However, this is closely linked to institutional policies and practices (Holgaard *et al.*, 2016; Holm *et al.*, 2015). By raising awareness and

Table 1. Sustainability education challenges

C	Specific factors	References
Resources	C1 Insufficient funding for environmental and sustainability projects	Holgaard *et al.* (2016); Holm *et al.* (2015); Marcos-Iga and Shaw (2011)
	C2 Lack of environmental and sustainability expertise to support the academy	Holgaard *et al.* (2016); Holm *et al.* (2015); Juárez-Nájera *et al.* (2006)
	C3 Workload model not suited	Kenny and Fluck (2014); Liu and Onwuegbuzie (2012)
	C4 Weak technical infrastructure	Kenny and Fluck (2014); Liu and Onwuegbuzie (2012)
Processes	C5 Lack of focus on environmental and sustainability curriculum practices	Holgaard *et al.* (2016); Holm *et al.* (2015); Juárez-Nájera *et al.* (2006)
	C6 Lack of governance for environmental and sustainability policies	Holgaard *et al.* (2016); Holm *et al.* (2015); Miquelajauregui *et al.* (2022)
	C7 Absence of environmental and sustainability programmes to motivate the academy	Holgaard *et al.* (2016); Holm *et al.* (2015); Miquelajauregui *et al.* (2022)
	C8 Shortage of environmental and sustainability academic collaboration	Holgaard *et al.* (2016); Holm *et al.* (2015); Miquelajauregui *et al.* (2022)
People	C9 Lack of awareness towards environmental and sustainability curriculum	Holgaard *et al.* (2016); Holm *et al.* (2015); Juárez-Nájera *et al.* (2006)
	C10 Lack of environmental and sustainability training to curriculum development	Holgaard *et al.* (2016); Holm *et al.* (2015); Miquelajauregui *et al.* (2022)
	C11 Poor composition of environmental and sustainability culture	Holgaard *et al.* (2016); Holm *et al.* (2015); Miquelajauregui *et al.* (2022)
	C12 Lack of participation in environmental and sustainability issues	Holgaard *et al.* (2016); Holm *et al.* (2015); Miquelajauregui *et al.* (2022)

Note(s): "C" denotes challenges
Source(s): Authors' own creation/work

providing relevant materials and technical support, educators' proactive capabilities are developed (Holm *et al.*, 2015; Juárez-Nájera *et al.*, 2006). Institutional support and environmental literacy are crucial in shaping Australian, Chinese and Mexican educators into proactive agents in addressing SE challenges (e.g. Maritz *et al.*, 2019; Zhang and Price, 2020; Guerrero *et al.*, 2020).

Table 2 presents four intrapreneurial capabilities – venture behaviour, innovativeness, self-renewal and proactiveness to manage SE challenges.

4. Theoretical lens and research model

Aligned with DCV (Teece *et al.*, 1997; Teece, 2007), this study argues that HEI educators in Australia, China and Mexico must develop effective intrapreneurial capabilities to address SE challenges. By leveraging these capabilities, educators can seize opportunities to manage SE issues and achieve HEIs' SE goals.

The study asserts that SE challenges compel HEIs to cultivate intrapreneurial skills among educators to overcome the challenges and improve sustainability practices. Many HEIs are reluctant to adopt SE, making DCV essential in examining the role of educators' intrapreneurial capabilities in addressing challenges related to resources, processes and people. The components of intrapreneurial capabilities – new venture behaviour, innovativeness, self-renewal and proactiveness – are interrelated and must function together. HEIs can enhance sustainability practices by integrating these elements to effectively address escalating SE challenges.

Intrapreneurial capabilities are crucial assets for HEIs in Australia, China and Mexico for adapting to changing environmental forces and improving performance (Guerrero *et al.*, 2020). However, in dynamic contexts like emerging SE, intrapreneurial capabilities alone may not suffice. By applying DCV, educators' capabilities can be reconfigured to address emerging SE challenges (Klofsten *et al.*, 2021). We propose a research model (see Figure 1) to explore this further.

Figure 1 displays three different configurations. The first configuration, denoted by the arrow labelled C, illustrates the impact of SE challenges (of resources, processes and people) on HEI performance. This performance is measured in terms of student satisfaction, the HEI's image, excellent teaching and learning and income (Khan *et al.*, 2023). In configuration 2, the arrow labelled I represents how intrapreneurial capabilities such as new venture behaviour, innovativeness, self-renewal and proactiveness can influence HEI performance. In configuration 3, denoted by the arrow labelled C*I, the focus shifts to the combined effect of SE challenges and intrapreneurial capabilities on HEI performance. This configuration attempts to capture how these two factors interact and impact various aspects of HEI performance. By considering both the challenges faced by the HEI and its entrepreneurial capabilities, a more comprehensive understanding of the drivers of performance can be attained.

5. Methodology

Figure 2 presents the research overview. The multimethodology approach enables researchers to effectively address real-world problems (Mingers and Brocklesby, 1997). This approach leverages the strengths of different methodologies, including precision, validity and reliability (Creswell *et al.*, 2003). The systematic framework involved three key steps to construct the decision model. First, a comprehensive literature review on HEIs' SE challenges and educators' intrapreneurial capabilities is conducted. Through thematic analysis, a validated inventory of SE challenges (resources, people and processes) and educator capabilities (new venture behaviour, innovativeness, self-renewal and proactiveness) is created

Table 2. Intrapreneurial capabilities to manage challenges

I	Specific factors	References
New venture behaviour	I1 Pursue new environmental and sustainability courses	Pellegrini *et al.* (2019); Maritz *et al.* (2019); Zhang and Price (2020); Juárez-Nájera *et al.* (2006)
	I2 Find new environmental and sustainability niches for courses in the market	Pellegrini *et al.* (2019); Maritz *et al.* (2019); Zhang and Price (2020); Juárez-Nájera *et al.* (2006)
	I3 Enter new environmental and sustainability courses by offering new courses	Pellegrini *et al.* (2019); Maritz *et al.* (2019); Zhang and Price (2020); Juárez-Nájera *et al.* (2006)
Innovativeness	I4 Focus on developing only new environmental and sustainability courses	Pellegrini *et al.* (2019); Maritz *et al.* (2019); Gamage and Sciulli (2017); Jia *et al.* (2019); SEMARNAT (2023)
	I5 Emphasise modifying courses related to environmental and sustainability issue	Pellegrini *et al.* (2019); Maritz *et al.* (2019; Gamage and Sciulli (2017); Jia *et al.* (2019); SEMARNAT (2023)
	I6 Focus on innovation related to environmental and sustainability courses development	Pellegrini *et al.* (2019); Maritz *et al.* (2019); Gamage and Sciulli (2017); Jia *et al.* (2019); SEMARNAT (2023)
	I7 Emphasise creating proprietary environmental and sustainability courses	Pellegrini *et al.* (2019); Maritz *et al.* (2019); Gamage and Sciulli (2017); Jia *et al.* (2019); SEMARNAT (2023)
Self-renewal	I8 Reorganise courses to increase environmental and sustainability focus	Valka *et al.* (2020); Maritz *et al.* (2019); Zhang and Price (2020); Guerrero *et al.* (2020)
	I9 Coordinate activities among courses to enhance environmental and sustainability issue	Valka *et al.* (2020); Maritz *et al.* (2019); Zhang and Price (2020); Guerrero *et al.* (2020)
	I10 Participate training related to environmental and sustainability course development	Valka *et al.* (2020); Maritz *et al.* (2019); Zhang and Price (2020); Guerrero *et al.* (2020)
	I11 Use resources for experimental environmental and sustainability courses	Valka *et al.* (2020); Maritz *et al.* (2019); Zhang and Price (2020); Guerrero *et al.* (2020)
Proactiveness	I12 Seek to be first in introducing new environmental and sustainability courses	Pellegrini *et al.* (2019); Maritz *et al.* (2019); Zhang and Price (2020); Guerrero *et al.* (2020)
	I13 Undertake bold, wide-ranging acts related to environmental and sustainability courses	Pellegrini *et al.* (2019); Maritz *et al.* (2019); Zhang and Price (2020); Guerrero *et al.* (2020)
	I14 Undertake bold and aggressive decision-making related to environmental and sustainability courses	Pellegrini *et al.* (2019); Maritz *et al.* (2019); Zhang and Price (2020); Guerrero *et al.* (2020)

Note(s): "I" denotes intrapreneurial capabilities
Source(s): Authors' own creation/work

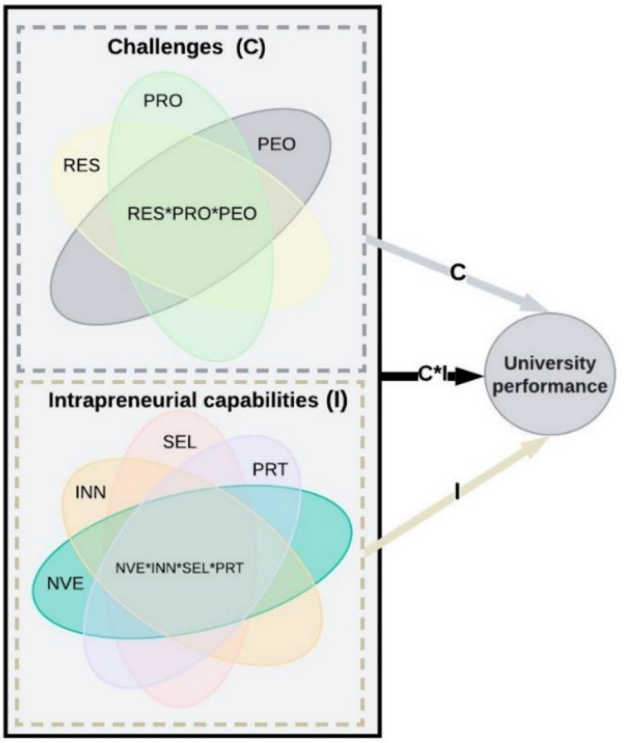

Figure 1. Research model
Note(s): RES = resource; PRO = process; PEO = people; NVE = new venture behaviour; INN = innovativeness; SEL = self-renewal; PRT = proactiveness
Source(s): Authors' own creation/work

(see Tables 1 and 2). These themes were validated using Krippendorff's (2009) alpha. Next, a QFD-based design method is used to quantitatively assess, prioritise and validate these elements, building on prior studies. Finally, fsQCA is applied to identify the most effective combination of SE challenges and educator capabilities for enhancing HEI performance (Pappas and Woodside, 2021).

5.1 Quality function deployment

Through thematic analysis, 12 SE challenges and 14 educator intrapreneurial capabilities are identified (see Tables 1 and 2). These informed the application of Quality Function Deployment (QFD) (Chan and Wu, 2005), a widely recognised tool for strategy development. The best–worst method (BWM) (Rezaei, 2016) was used to weight SE challenges, while QFD established links between challenges and educator capabilities, facilitating prioritisation. This process provided valuable insights into how educators' intrapreneurial capabilities can address SE challenges, enabling a systematic understanding of their interplay. In a case study, this approach was instrumental in identifying and prioritising key capabilities to address SE challenges effectively. Data collection involved

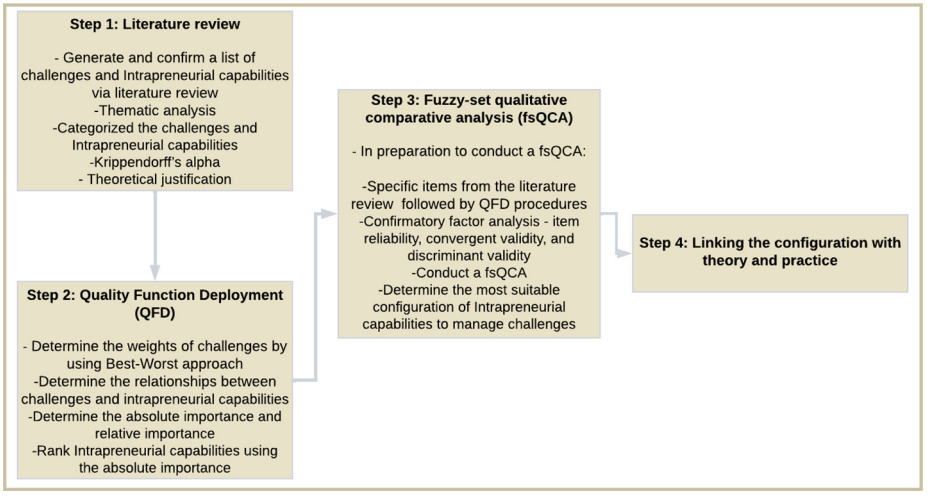

Figure 2. Overview of studies
Source(s): Authors' own creation/work

nine universities (three each from Australia, China and Mexico). HEI authorities identified key decision-makers (e.g. deans, course and unit coordinators and lecturers) engaged with SE challenges and educator capabilities. Appendix 1 details the participants' demographic profiles.

The BWM assessed the competitiveness of each option (Rezaei, 2016). Figure 3 depicts a QFD model, with the "WHATs" (SE challenges) on the left and the "HOWs" (educators' intrapreneurial capabilities) at the top. The relationship between "WHATs" and "HOWs" demonstrates how effectively intrapreneurial capabilities address these challenges. Respondents rated these relationships on a scale from 0 (no relation) to 9 (very strong relation). The roof matrix at the top outlines the interrelationships among intrapreneurial capabilities, offering further insights into their combined effectiveness in addressing SE challenges.

5.2 Fuzzy set qualitative comparative analysis

The QFD analysis ranked and validated SE challenges and educators' intrapreneurial capabilities, which were subsequently analysed using the fsQCA method (Fiss, 2011). fsQCA, a configurational approach, identifies causal conditions that lead to specific outcomes. This method investigates complex causal relationships between SE challenges and capabilities. Data were collected from universities in Australia, China and Mexico, with sample sizes of 43, 46 and 38, respectively, using structured questionnaires with a five-point Likert scale. These sample sizes are considered acceptable for fsQCA analysis (Greckhamer *et al.*, 2013).

A confirmatory factor analysis is conducted before applying fsQCA, confirming that all outer loading values exceeded 0.6 (Igbaria *et al.*, 1995), composite reliability (CR) values were above 0.7 (Hair *et al.*, 2011) and average variance extracted (AVE) values surpassed 0.5 (Appendix 2). Discriminant validity was established using the Fornell–Larcker Criterion (Fornell and Larcker, 1981) (Appendix 3).

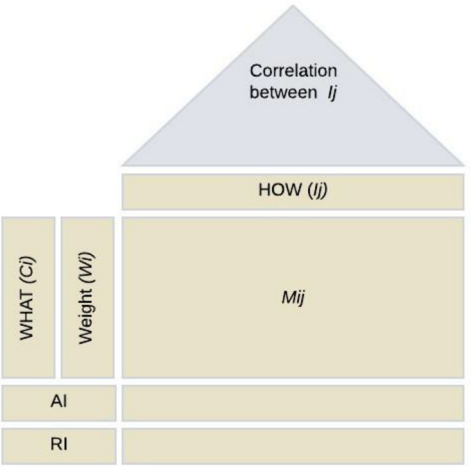

Figure 3. Quality function deployment (QFD)
Note(s): C_i = challenges; W_i = degree of importance of R_i's; Ij = intrapreneurial capabilities; M_{ij} = relationship matrix (i.e. the degree to which C_i is met by M_{ij}); AI = absolute importance of Ij's; RI = relative importance of Ij's
Source(s): Authors' own creation/work

Three steps were followed in fsQCA. First, we calibrated the data using qualitative anchors: 90th percentile (full membership), 10th percentile (full non-membership) and 50th percentile (crossover point) (Appendix 4). Second, a necessary condition analysis showed no factor met the necessary condition threshold (≥0.9) for SE challenges or intrapreneurial capabilities (Appendix 5). Third, a truth table to evaluate sufficient conditions, setting consistency at 80% and frequency at 1, was constructed (Ragin, 2008).

6. Results and the application of the decision support model

6.1 The quality function deployment case studies

The nine quantitative case studies, using QFD results for Australia, China and Mexico, are presented in Appendix 6 (see Figures A1–A9). According to the QFD analysis for Australia, C1 Insufficient funding for environmental and sustainability projects, C2 Lack of environmental and sustainability expertise to support the academy, C4 Weak technical infrastructure, C5 Lack of focus on environmental and sustainability curriculum practices, C7 Absence of environmental and sustainability programmes to motivate the academy, C8 Shortage of environmental and sustainability academic collaboration, C9 Lack of awareness towards environmental and sustainability curriculum and C10 Lack of environmental and sustainability training to curriculum development were the most important SE challenges. In terms of relative importance scores, we recognised several intrapreneurial capabilities relating to SE challenges: I1 Pursue new environmental and sustainability courses, I2 Find new environmental and sustainability niches for courses in the market, I3 Enter new environmental and sustainability courses by offering new courses, I6 Focus on innovation related to environmental and sustainability courses development, I7 Emphasise creating proprietary environmental and sustainability courses, I9 Coordinate activities among courses to enhance environmental and sustainability issue, I10 Participate training related to environmental and sustainability course development, I11 Use

resources for experimental environmental and sustainability courses, I13 Undertake bold, wide-ranging acts related to environmental and sustainability courses and I14 Undertake bold and aggressive decision-making related to environmental and sustainability courses.

For China, the most important SE challenges were C1 Insufficient funding for environmental and sustainability projects, C2 Lack of environmental and sustainability expertise to support the academy, C3 Workload model not suited, C6 Lack of governance for environmental and sustainability policies, C7 Absence of environmental and sustainability programmes to motivate the academy, C8 Shortage of environmental and sustainability academic collaboration, C9 Lack of awareness towards environmental and sustainability curriculum, C10 Lack of environmental and sustainability training for curriculum development and C11 Poor composition of environmental and sustainability culture. In accordance with SE challenges, our QFD analysis identified several intrapreneurial capabilities: I1–pursue new environmental and sustainability courses, I3 Enter new environmental and sustainability courses by offering new courses, I4 Focus on developing only new environmental and sustainability courses, I6 Focus on innovation related to environmental and sustainability course development, I7 Emphasise creating proprietary environmental and sustainability courses, I8 Reorganise courses to increase environmental and sustainability focus, I9 Coordinate activities among courses to enhance environmental and sustainability issues, I10 Participate in training related to environmental and sustainability course development, I11 Use resources for experimental environmental and sustainability courses, I13 Undertake bold, wide-ranging acts related to environmental and sustainability courses and I14 Undertake bold and aggressive decision-making related to environmental and sustainability courses.

For Mexico, the most important SE challenges were C1 Insufficient funding for environmental and sustainability projects, C2 Lack of environmental and sustainability expertise to support the academy, C5 Lack of focus on environmental and sustainability curriculum practices, C6 Lack of governance for environmental and sustainability policies, C7 Absence of environmental and sustainability programmes to motivate the academy, C10 Lack of environmental and sustainability training to curriculum development, C11 Poor composition of environmental and sustainability culture, C12 Lack of participation in environmental and sustainability issues. Similarly, our QFD results highlighted the top intrapreneurial capabilities: I2 Find new environmental and sustainability niches for courses in the market, I3 Enter new environmental and sustainability courses by offering new courses, I4 Focus on developing only new environmental and sustainability courses, I6 Focus on innovation related to environmental and sustainability courses development, I7 Emphasise creating proprietary environmental and sustainability courses, I8 Reorganise courses to increase environmental and sustainability focus, I9 Coordinate activities among courses to enhance environmental and sustainability issue, I10 Participate training related to environmental and sustainability course development, I11 Use resources for experimental environmental and sustainability courses, I12 Seek to be first in introducing new environmental and sustainability courses and I13 Undertake bold, wide-ranging acts related to environmental and sustainability courses.

In the nine quantitative case studies, educators' intrapreneurial capabilities and SE challenges were both rated low in several cases. The SE-related challenge C4 Weak technical infrastructure was rated low in China and Mexico. In Australia and China, the SE challenge C12 Lack of focus on environmental and sustainability curriculum practices, was also considered low priority. As for the intrapreneurial capabilities of educators, I5 Emphasise modifying courses related to environmental and sustainability issue and I14 Undertake bold and aggressive decision-making related to environmental and sustainability courses, were less prioritised. Using this approach, a list was developed for each country, consisting of key

SE challenges and intrapreneurial capabilities. An fsQCA approach was conducted using those lists.

6.2 The fuzzy set qualitative comparative analysis model

The fsQCA results for Australia, China and Mexico are presented in Appendix 7 (Tables A10–A12). Regarding SE challenges, a single solution was identified as being able to predict high HEI performance in all three countries, using Model 1a. Australia faces challenges related to resources, processes and people. In contrast, in China and Mexico, addressing low resources would be sufficient to increase HEI performance, despite the presence of process- and people-related challenges. In Model 1b, the solution for Australia indicates that HEI performance is significantly impacted by issues related to resources, processes and people. Solution 1 for China, however, indicates that resource-related challenges substantially hinder HEI performance, despite weak process-related challenges. In addition, solution 2 for China suggests that people-related challenges reduce HEI performance, despite poor process-related challenges. According to the solution, Mexico's universities suffer from resource-related challenges, despite weak process- and people-related challenges.

In Model 2a, two solutions were identified to predict high HEI performance in Australia, China and Mexico, based on the intrapreneurial capabilities of educators. For Australia, solution 1 suggests that HEIs can achieve HEI performance if educators demonstrate greater innovativeness and self-renewal capabilities, despite the lack of new venture behaviour and proactiveness. However, solution 2 suggests that HEIs can achieve HEI performance by assuring that educators have capabilities in new venture behaviour, innovativeness, self-renewal and proactiveness. This solution is like solution 2 for China. For China, solution 1 suggests that educators' proactiveness skills are crucial for HEI performance, despite the weakness of innovativeness, self-renewal and new venture behaviours. For Mexico, solution 1 indicates that educators' new venture behaviour and innovativeness are effective in enhancing HEI performance, while solution 2 suggests proactiveness and innovativeness. Model 2b identified a single and identical solution that predicted low HEI performance for all three countries by considering educators' lower-level capabilities in new venture behaviour, innovation, self-renewal and proactiveness. All the solutions suggest that educators' lower-level capabilities in new venture behaviour, innovation, self-renewal and proactiveness significantly deteriorate HEI performance.

When combining SE challenges with educators' intrapreneurial capabilities, Model 3a for Australia proposes that educators' ability to engage in new venture behaviour, innovation, self-renewal and proactiveness contributes to improved HEI performance, despite challenges in resources, processes and people. A very similar result was found in solution 2 for China. Further, for China, solution 1 implies that educators' higher-level capabilities in new venture behaviour, innovation, self-renewal and proactiveness result in higher HEI performance, despite the challenges related to people (even with low resource-related challenges). For Mexico, solution 1 recommends that educators' higher-level capabilities in new venture behaviour and innovation (even with lower-level proactiveness) lead to higher HEI performance, despite the low challenges related to resources, processes and people. Solution 2 implies that higher-level capabilities in innovation, self-renewal and proactiveness (even with lower-level new venture behaviour) contribute to higher HEI performance, despite challenges in resources, processes and people.

In Model 3b, solution 1 was identical for all three countries when combining SE challenges with educators' intrapreneurial abilities and predicting low HEI performance. As shown in solution 1, HEI performance is inhibited by low levels of challenges related to resources, processes and people, as well as educators' lower levels of competence in new

venture behaviour, innovation, self-renewal and proactiveness. Further, for Australia, solution 2 infers that having low levels of challenges related to resources, processes and people, with the presence of educators' capabilities in new venture behaviour, innovation, self-renewal and proactiveness, results in low HEI performance. Finally, for Mexico, solution 2 suggests that low levels of process-related challenges (even with the presence of resource-related challenges) and educators' low levels of capability in new venture behaviour, innovation, self-renewal and proactiveness significantly hinder HEI performance.

7. Discussion and implications

Based on our findings from Australia, China and Mexico data, reducing SE challenges (i.e. resources, processes and people) is a key factor in increasing HEI performance, which is also consistent with previous studies (e.g. Ferguson, 2020; Wals and Benavot, 2017). Our findings also indicate that the intrapreneurial capacities (i.e. new venture behaviour, innovativeness, self-renewal and proactiveness) of Australian, Chinese and Mexican educators are significantly correlated with HEI performance, as has been observed previously (e.g. Guerrero *et al.*, 2020; Valka *et al.*, 2020). According to our findings, new venture behaviour, innovativeness, self-renewal and proactiveness of educators are common in almost all countries' solutions. A comparison of several solutions by country also shows very similar results. For instance, a common solution (i.e. NVE*INN*SEL*PRT) based on Australian and Chinese data indicates that HEIs can achieve HEI performance by ensuring their educators have capabilities in innovation, self-renewal, proactive and new venture behaviours. The results of both countries support the importance of educators' new venture behaviour, innovation, self-renewal and proactive abilities and the importance of a focused and precautionary approach. Another example – in both Australia and China, an identical solution (i.e. RES*PRO*PEO*NVE*INN*SEL*PRT) indicates that educators' ability to engage in new venture behaviour, innovation, self-renewal and proactiveness contributes to improved HEI performance, despite challenges with resources, processes and people. There has been another similar solution (i.e. ~PRO*~PEO*~NVE*~INN*~SEL*~PRT) observed between all three countries. This result indicates that educators' low competence levels in new venture behaviour, innovation, self-renewal and proactiveness, along with lack of resources, processes and people, are inhibiting HEI performance.

Overall, our findings indicate that universities should pay close attention to all SE-related challenges and educators' lack of intrapreneurial capabilities. To achieve high HEI performance, educators must balance SE challenges with intrapreneurial capabilities, and only certain combinations of both attributes act as sufficient conditions.

7.1 Theoretical implications

Our research offers several key theoretical contributions. First, it addresses the shortage of empirical studies examining how HEI performance is linked to SE challenges and the intrapreneurial capabilities of educators at institutions in Australia, China and Mexico. Although SE has become a global priority, research in this area remains limited (Trott *et al.*, 2023). Our study broadens understanding of this complex issue and encourages further research into the relationship between SE challenges and educators' intrapreneurial capabilities.

Second, we apply the Dynamic Capabilities View (DCV) to explore how SE challenges and intrapreneurial capabilities affect HEI performance. This approach fills a gap in environmental research and demonstrates how the configuration of these factors can either enhance or hinder performance. Our findings from three countries confirm that DCV is a valuable framework for universities seeking to improve performance by adapting to SE challenges.

Third, we introduce a decision-making framework based on DCV that explains HEI performance in relation to SE challenges, using data from Australia, China and Mexico. This novel approach offers fresh insights into environmental management, reshaping how SE challenges and intrapreneurial capabilities are understood.

Finally, we recommend using fsQCA combined with QFD as an advanced methodological approach to more accurately model the complex interactions between SE challenges and educators' intrapreneurial capabilities. This nonlinear approach offers an alternative to traditional methods, such as regression analysis and structural equation modelling, providing a more nuanced understanding of how these factors influence HEI performance.

7.2 Managerial implications

Our research offers three practical implications for enhancing HEI performance by addressing SE challenges and leveraging the intrapreneurial capabilities of educators.

Firstly, as outlined in Model 1, decision-makers must understand how SE challenges impact HEI performance. These challenges, related to resources, processes and people, differ across countries. In China and Mexico, universities can improve performance despite limited resources, though challenges in processes and people persist. In contrast, Australian universities face challenges in all three areas – resources, processes and people – that must be addressed for performance improvement. For example, in China, resource limitations hinder performance even when process challenges are absent, while in Australia, all three areas must be tackled. Understanding these differences allows decision-makers to create strategies tailored to the specific challenges faced by universities in each context.

Secondly, Model 2 highlights the importance of recognising educators' intrapreneurial capabilities, which significantly affect HEI performance. Key capabilities include innovativeness, self-renewal, proactiveness and new venture behaviour. These traits vary in importance across countries. In China, educators' proactiveness plays a pivotal role in boosting performance, even without other intrapreneurial traits. In Mexico, new venture behaviour and innovativeness are essential, while in Australia, innovativeness and self-renewal drive performance. By understanding the specific intrapreneurial capabilities needed in each country, decision-makers can tailor strategies that foster innovation and excellence in their institutions.

Finally, Model 3 provides guidance on combining the management of SE challenges with enhancing educators' intrapreneurial capabilities. A comprehensive strategy that addresses both challenges and capabilities has proven more effective than focusing on one aspect alone. For instance, in Australia, enhancing educators' capabilities in new venture behaviour, innovativeness and self-renewal can improve performance, even when facing SE challenges. In China, fostering educators' intrapreneurial capabilities can mitigate the impact of people-related challenges despite resource limitations. This highlights the need for a holistic approach that addresses both SE challenges and intrapreneurial capabilities to optimise HEI performance.

In summary, our research offers three key implications for improving HEI performance. First, decision-makers must address SE challenges in resources, processes and people, recognising that these challenges vary by country. Second, understanding educators' intrapreneurial capabilities – such as innovativeness, self-renewal and proactiveness – is crucial for fostering success. Finally, a holistic approach that addresses both SE challenges and educators' capabilities simultaneously will drive optimal performance.

By applying these insights, decision-makers can make informed choices that improve HEI performance, tailored to the unique challenges and capabilities of each country. This approach ensures institutions are better equipped to navigate SE complexities while maximising the potential of their educators.

8. Limitations and future directions

Our research has several limitations. Firstly, while we identified SE challenges and educators' intrapreneurial capabilities within the context of HEIs, there may be other factors affecting HEI performance that were not explored. Secondly, our study focused on Australia, China and Mexico, so the findings may not be generalisable to other countries. However, the decision model we developed can be applied in various contexts, and future research could examine SE challenges and intrapreneurial capabilities in other developed and developing countries. Thirdly, our emphasis on the DCV may limit its applicability to other theoretical perspectives. The decision framework could be enhanced by incorporating additional theories, such as the natural resource-based view, stakeholder theory or institutional theory. Finally, applying system dynamic modelling in future research could offer further insights into SE challenges and educators' intrapreneurial capabilities from a systems behavioural perspective.

9. Conclusion

We developed a decision support model that used data from Australia, China and Mexico to achieve our research objective. It provides a discipline-based approach to investigate SE challenges and intrapreneurial capabilities of educators and how to improve the SE practices of HEIs. The results of our investigation imply that HEI performance is not impacted by any single SE-related challenge nor any single educator intrapreneurial capability. This suggests that it is configurations of settings, rather than any single element, that contribute to HEI performance. Our work should encourage researchers and decision-makers to develop a guideline for improving educators' intrapreneurial capabilities to deal with SE challenges. Over time, the SE challenges faced by HEIs and the intrapreneurial capabilities of educators will undergo continuous evolution. As circumstances change in the future, it will become imperative for educators in higher education to adapt and redesign their existing methodologies. This entails incorporating new factors and measures that align with the evolving needs and demands of the field.

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Appendix 1

Table A1. Demographic profile of QFD participants

Country	Case study no.	Participants	Position	Gender	Area of expertise	Experience (years)
Australia	1	A	Department head	M	Management and marketing	19
		B	Unit coordinator	F	Management	6
		C	Course coordinator	M	Bachelor of business	8
	2	D	Unit coordinator	M	Supply chain	5
		E	Lecturer	F	Bachelor of laws	11
		F	Course coordinator	M	MBA	9
	3	G	Department head	F	Accounting and economics	23
		H	Unit coordinator	M	Information system	10
		I	Lecturer	F	Accounting	7
China	1	A	Department head	M	Literature	12
		B	Course coordinator	M	Literature	10
	2	C	Department head	F	Business administration	9
		D	Course coordinator	M	Law	8
	3	E	Unit coordinator	M	International relationship	14
		F	Course coordinator	F	Economics	7
Mexico	1	A	Staff	M	Operations	25
		B	Professor	M	Human factors	7
		C	Professor	F	Project developer	10
	2	D	Department head	M	Quality and production systems	25
		E	Department head	M	Logistics and data analyst	12
		F	Professor	M	Product and operation	30
	3	G	Unit coordinator	M	Quality and continuous improvement	24
		H	Professor	M	Manufacturing and project development	14

Source(s): Authors' own creation/work

Appendix 2

Table A2. Psychometric property of measurement items

(Factors/items)	Items loading			AVE			CR		
	Australia	China	Mexico	Australia	China	Mexico	Australia	China	Mexico
Resources				0.758	0.651	0.668	0.904	0.847	0.858
Insufficient funding for environmental and sustainability projects – C1	0.922	0.823	0.840						
Lack of environmental and sustainability expertise to support the academy – C2	0.820	0.869	0.785						
Workload model not suited – C3	(-)	0.721	0.827						
Weak technical infrastructure – C4	0.867	(-)	(-)						
Process				0.815	0.686	0.708	0.930	0.867	0.879
Lack of focus on environmental and sustainability curriculum practices – C5	0.906	(-)	0.858						
Lack of governance for environmental and sustainability policies – C6	(-)	0.843	0.884						
Absence of environmental and sustainability programmes to motivate the academy – C7	0.902	0.792	0.778						
Shortage of environmental and sustainability academic collaboration – C8	0.900	0.848	(-)						
People				0.848	0.588	0.745	0.918	0.810	0.898
Lack of awareness towards environmental and sustainability curriculum – C9	0.894	0.701	(-)						
Lack of environmental and sustainability training to curriculum development – C10	0.947	0.827	0.898						
Poor composition of environmental and sustainability culture – C11	(-)	0.768	0.801						
Lack of participation in environmental and sustainability issues – C12	(-)	(-)	0.888						
New venture behaviour				0.807	0.687	0.900	0.926	0.814	0.948
Pursue new environmental and sustainability courses – I1	0.861	0.779	(-)						
Find new environmental and sustainability niches for courses in the market – I2	0.885	(-)	0.955						
Enter new environmental and sustainability courses by offering new courses – I3	0.947	0.876	0.942						
Innovativeness				0.828	0.700	0.808	0.935	0.875	0.926
Focus on developing only new environmental and sustainability courses – I4	(-)	0.776	0.883						
Emphasise modifying courses related to environmental and sustainability issue – I5	0.855	(-)	(-)						
Focus on innovation related to environmental and sustainability courses development – I6	0.951	0.847	0.934						
Emphasise creating proprietary environmental and sustainability courses – I7	0.921	0.883	0.878						
Self-renewal				0.814	0.623	0.892	0.929	0.868	0.971
Reorganise courses to increase environmental and sustainability focus – I8	(-)	0.822	0.930						
Coordinate activities among courses to enhance environmental and sustainability issue – I9	0.866	0.856	0.954						
Participate training related to environmental and sustainability course development – I10	0.931	0.696	0.973						
Use resources for experimental environmental and sustainability courses – I11	0.908	0.774	0.919						

(*continued*)

Table A2. Continued

(Factors/items)	Items loading			AVE			CR		
	Australia	China	Mexico	Australia	China	Mexico	Australia	China	Mexico
Proactiveness				0.876	0.827	0.919	0.934	0.905	0.958
Seek to be first in introducing new environmental and sustainability courses – I12	(-)	0.904	0.953						
Undertake bold, wide-ranging acts related to environmental and sustainability courses – I13	0.963	0.914	0.964						
Undertake bold and aggressive decision-making related to environmental and sustainability courses – I14	0.908	(-)	(-)						
University performance				0.809	0.593	0.644	0.944	0.849	0.877
Increase in student satisfaction	0.937	0.858	0.673						
Promotion of the university's image	0.875	0.611	0.856						
Provision of excellent teaching and learning	0.916	0.838	0.905						
Increase in income	0.868	0.820	0.754						

Note(s): CR = composite reliability; AVE = average variance extracted; (-) items were deleted during QFD process
Source(s): Authors' own creation/work

Appendix 3

Table A3. Fornell–Larcker Criterion – Australia

Construct	RES	PRO	PEO	NVE	INN	SEL	PRT	UPE
Resource (RES)	0.871							
Process (PRO)	0.735	0.903						
People (PEO)	0.799	0.786	0.921					
New venture behaviour (NVE)	0.082	0.068	0.177	0.898				
Innovativeness (INN)	0.123	0.104	0.241	0.707	0.910			
Self-renewal (SEL)	0.110	0.115	0.184	0.667	0.772	0.902		
Proactiveness (PRT)	0.124	0.172	0.215	0.595	0.532	0.576	0.936	
University performance (UPE)	0.156	0.112	0.248	0.446	0.458	0.485	0.237	0.899

Note(s): Squared correlations; the square root of AVE in the diagonal
Source(s): Authors' own creation/work

Table A4. Fornell–Larcker Criterion – China

Construct	RES	PRO	PEO	NVE	INN	SEL	PRT	UPE
Resource (RES)	0.807							
Process (PRO)	0.292	0.828						
People (PEO)	0.211	0.303	0.767					
New venture behaviour (NVE)	0.205	0.123	0.433	0.829				
Innovativeness (INN)	0.080	0.148	0.404	0.665	0.837			
Self-renewal (SEL)	0.093	0.212	0.308	0.396	0.491	0.789		
Proactiveness (PRT)	0.185	0.187	0.204	0.358	0.317	0.446	0.909	
University performance (UPE)	0.105	0.077	0.133	0.417	0.484	0.417	0.520	0.770

Note(s): Squared correlations; the square root of AVE in the diagonal
Source(s): Authors' own creation/work

Table A5. Fornell–Larcker Criterion – Mexico

Construct	RES	PRO	PEO	NVE	INN	SEL	PRT	UPE
Resource (RES)	0.818							
Process (PRO)	0.345	0.841						
People (PEO)	0.115	0.602	0.863					
New venture behaviour (NVE)	0.208	0.308	0.155	0.949				
Innovativeness (INN)	0.145	0.222	0.121	0.584	0.899			
Self-renewal (SEL)	0.286	0.369	0.192	0.683	0.833	0.944		
Proactiveness (PRT)	0.295	0.412	0.192	0.534	0.556	0.754	0.959	
University performance(UPE)	0.120	0.237	0.049	0.427	0.456	0.477	0.406	0.802

Note(s): Squared correlations; the square root of AVE in the diagonal
Source(s): Authors' own creation/work

Appendix 4

Table A6. Calibrated data table – Australia

RES	PRO	PEO	NVE	INN	SEL	PRT	UPE
0.14	0.07	0.14	0.5	0.11	0.32	0.5	0.39
0.05	0.04	0.05	0.05	0.04	0.01	0.05	0.01
0.14	0.26	0.5	0.5	0.5	0.32	0.5	0.5
0	0.01	0.01	0.27	0.26	0.5	0.18	0.39
0.05	0.03	0.05	0.05	0.17	0.1	0.18	0.29
0.5	0.5	0.23	0	0.01	0	0.01	0
0.35	0.84	0.5	0.5	0.5	0.18	0.32	0.39
0.99	0.97	0.95	0.99	0.95	0.95	0.95	0.95
0.14	0.07	0.35	0.27	0.88	0.73	0.05	0.95
0.82	0.37	0.5	0.5	0.95	0.73	0.02	0.95
0.99	0.5	0.95	0.95	0.5	0.5	0.5	0.95
0.01	0.07	0.05	0.27	0.17	0.1	0.05	0.29
0.99	0.5	0.95	0.99	0.95	0.95	0.95	0.07
0.5	0.37	0.14	0.05	0.26	0.5	0.32	0.29
0.5	0.11	0.14	0.27	0.26	0.32	0.05	0.95
0.23	0.5	0.35	0.5	0.73	0.5	0.5	0.29
0.82	0.26	0.35	0.01	0.04	0	0.05	0.02
0.35	0.5	0.35	0.95	0.5	0.88	0.5	0.73
0.5	0.97	0.5	0.82	0.5	0.95	0.82	0.73
0.82	0.84	0.5	0.95	0.5	0.5	0.95	0.95
0.03	0.04	0.05	0.12	0.26	0.05	0.32	0.39
0.14	0.07	0.14	0.5	0.37	0.1	0.5	0.21
0	0.01	0.01	0.99	0.95	0.95	0.95	0.04
0.08	0.11	0.14	0.05	0.17	0.1	0.18	0.1
0.23	0.37	0.14	0	0.04	0.01	0.05	0
0.82	0.37	0.35	0	0.02	0.05	0.05	0.29
0.5	0.84	0.5	0.5	0.73	0.73	0.95	0.39
0.5	0.97	0.35	0.5	0.73	0.95	0.82	0.5
0.82	0.84	0.5	0.82	0.88	0.95	0.95	0.73
0.82	0.97	0.95	0.82	0.88	0.5	0.95	0.95
0.95	0.5	0.5	0.82	0.95	0.73	0.82	0.73
0.82	0.5	0.5	0.82	0.88	0.88	0.82	0.5
0.95	0.5	0.95	0.95	0.5	0.73	0.5	0.88
0.95	0.5	0.5	0.82	0.88	0.95	0.5	0.88
0.95	0.84	0.95	0.95	0.73	0.95	0.82	0.73
0.95	0.5	0.5	0.95	0.95	0.88	0.95	0.88
0.5	0.5	0.95	0.95	0.73	0.5	0.82	0.88
0.99	0.37	0.5	0.82	0.95	0.73	0.95	0.73
0.82	0.5	0.5	0.5	0.88	0.73	0.5	0.95
0.82	0.5	0.5	0.95	0.73	0.5	0.5	0.88
0.95	0.5	0.35	0.27	0.26	0.32	0.5	0.29
0.82	0.5	0.35	0.82	0.37	0.5	0.5	0.5
0.82	0.97	0.5	0.95	0.88	0.95	0.82	0.73

Note(s): RES = resource; PRO = process; PEO = people; NVE = new venture behaviour; INN = innovativeness; SEL = self-renewal; PRT = proactiveness; UPE = university performance
Source(s): Authors' own creation/work

Table A7. Calibrated data table – China

RES	PRO	PEO	NVE	INN	SEL	PRT	UPE
0.01	0.01	0.51	0.95	0.95	0.96	0.95	0.96
0	0.12	0	0	0.01	0.18	0.05	0.31
0.05	0.12	0.02	0.5	0.5	0.05	0.5	0.69
0.98	0.95	0.95	0.82	0.73	0.01	0.5	0.17
0.51	0.12	0.51	0.5	0.5	0.18	0.18	0.17
0.73	0.5	0.82	0.5	0.5	0.5	0.5	0.5
0.98	0.99	0.99	0.95	0.95	0.96	0.95	0.96
0.51	0.5	0.51	0.5	0.5	0.5	0.5	0.69
0.18	0.27	0.27	0.82	0.5	0.69	0.18	0.69
0.95	0.5	0.51	0.5	0.5	0.83	0.82	0.17
0.88	0.5	0.27	0.5	0.5	0.18	0.18	0.09
0.88	0.27	0.51	0.5	0.5	0.18	0.18	0.17
0.05	0.5	0.51	0.5	0.26	0.05	0.5	0.09
0.73	0.12	0.51	0.5	0.5	0.5	0.18	0.69
0.95	0.99	0.82	0.95	0.95	0.96	0.95	0.91
0.51	0.82	0.51	0.5	0.88	0.69	0.95	0.31
0.88	0.82	1	0.5	0.88	0.83	0.18	0.69
0.51	0.27	0.27	0.5	0.5	0.5	0.5	0.69
0.05	0.5	0.27	0.01	0	0.01	0.18	0.01
0.73	0.5	0.12	0.82	0.73	0.91	0.82	0.91
0.51	0.12	0.51	0.5	0.5	0.5	0.05	0.31
0	0.05	0.05	0.03	0.26	0.01	0	0.01
0.51	0.5	0.51	0.95	0.88	0.69	0.95	0.83
0.51	0.5	0.27	0.16	0.01	0.05	0	0.02
0.05	0.02	0.02	0.5	0.5	0.18	0.05	0.17
0.73	0.5	0.51	0.5	0.5	0.5	0.05	0.31
0.18	0.12	0.51	0.5	0.11	0.18	0.05	0.17
0.05	0.27	0.27	0.5	0.5	0.18	0.5	0.5
0.01	0.02	0.51	0.5	0.73	0.05	0.05	0.31
0.98	0.5	0.82	0.5	0.5	0.5	0.5	0.96
0.18	0.12	0.05	0.03	0.04	0.18	0.82	0.69
0.05	0.27	0.05	0.03	0.04	0.05	0	0.04
0.05	0.95	0.99	0.95	0.95	0.96	0.82	0.83
0.05	0.01	0.51	0.5	0.73	0.18	0.18	0.31
0.18	0.12	0.82	0.95	0.88	0.5	0.5	0.91
0.51	0.05	0.27	0.16	0.11	0.01	0.01	0.04
0.73	0.5	0.95	0.82	0.26	0.5	0.82	0.83
0.18	0.12	0.01	0.5	0.5	0.05	0.05	0.5
0.73	0.99	0.51	0.5	0.95	0.18	0.18	0.83
0.18	0.5	0.27	0.5	0.73	0.18	0.82	0.96
0.51	0.27	0.51	0.5	0.5	0.5	0.05	0.5
0.95	0.95	0.95	0.95	0.88	0.91	0.5	0.5
0.51	0.95	0.82	0.82	0.95	0.96	0.95	0.96
0.95	0.02	0.01	0.16	0.04	0	0.18	0.31
0.18	0.27	0.27	0.5	0.11	0.01	0.18	0.17
0.73	0.5	0.51	0.5	0.5	0.96	0.95	0.31

Note(s): RES = resource; PRO = process; PEO = people; NVE = new venture behaviour; INN = innovativeness; SEL = self-renewal; PRT = proactiveness; UPE = university performance
Source(s): Authors' own creation/work

Table A8. Calibrated data table – Mexico

RES	PRO	PEO	NVE	INN	SEL	PRT	UPE
0.4	0.73	0.93	0.01	0	0.03	0.06	0.11
0.05	0.12	0.5	0.5	0.5	0.5	0.14	0.97
0.4	0.05	0.29	0.18	0.79	0.82	0.14	0.22
0.61	0.12	0.29	0.5	0.32	0.5	0.5	0.4
0.22	0.05	0.06	0.05	0.09	0.09	0.14	0.05
0.9	0.5	0.5	0.82	0.98	0.95	0.82	0.77
0.11	0.05	0.06	0.05	0.09	0.09	0.14	0.05
0.61	0.05	0.06	0.5	0.18	0.24	0.14	0.4
0.22	0.12	0.29	0.5	0.5	0.24	0.14	0.6
0.9	0.95	0.5	0.5	0.5	0.5	0.5	0.94
0	0.02	0.79	0	0.01	0.01	0	0
0.95	0.95	0.98	0.95	0.98	0.95	0.95	0.97
0.78	0.73	0.5	0.82	0.32	0.82	0.82	0.05
0.22	0.5	0.14	0.95	0.98	0.95	0.95	0.97
0.78	0.88	0.5	0.82	0.93	0.95	0.95	0.4
0.4	0.5	0.29	0.5	0.01	0.01	0.03	0.05
0.95	0.05	0.03	0.05	0.09	0.16	0.29	0.4
0.61	0.88	0.5	0.5	0.5	0.5	0.5	0.05
0.95	0.5	0.93	0.95	0.79	0.95	0.95	0.77
0.11	0.5	0.98	0.5	0.5	0.68	0.95	0.6
0.11	0.05	0.14	0.82	0.5	0.5	0.29	0.11
0.05	0.27	0.14	0.5	0.5	0.5	0.95	0.88
0.95	0.95	0.79	0.05	0.79	0.95	0.95	0.6
0.02	0	0	0.05	0.5	0.09	0.03	0.05
0.11	0.5	0.5	0.95	0.79	0.82	0.82	0.88
0.95	0.95	0.93	0.95	0.5	0.95	0.82	0.11
0.9	0.12	0	0.5	0.09	0.5	0.5	0.6
0.22	0.12	0.14	0.95	0.79	0.9	0.29	0.88
0.01	0	0	0	0.01	0.01	0.03	0
0.78	0.95	0.98	0.95	0.98	0.95	0.95	0.22
0.61	0.5	0.29	0.5	0.5	0.5	0.5	0.77
0.61	0.27	0.5	0.18	0.32	0.36	0.5	0.77
0.95	0.27	0.93	0.05	0.09	0.06	0.14	0
0.95	0.95	0.98	0.95	0.93	0.95	0.82	0.97
0.4	0.95	0.79	0.82	0.93	0.9	0.29	0.77
0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.88
0.11	0.5	0.5	0.05	0.09	0.09	0.14	0.6
0.78	0.95	0.93	0.5	0.5	0.5	0.29	0.4

Note(s): RES = resource; PRO = process; PEO = people; NVE = new venture behaviour; INN = innovativeness; SEL = self-renewal; PRT = proactiveness; UPE = university performance
Source(s): Authors' own creation/work

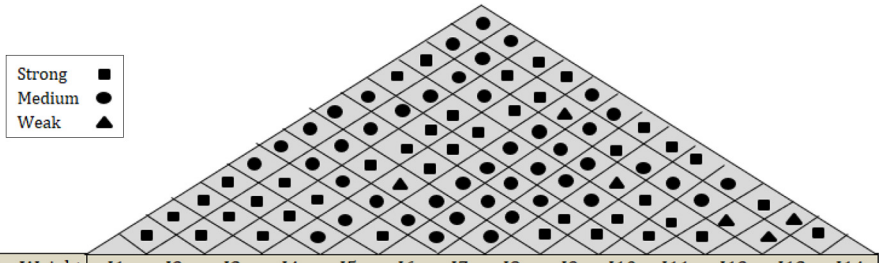
Appendix 5

Table A9. Analysis of necessary conditions – outcome variable: university performance

	Australia		China		Mexico	
Conditions tested	Consistency	Coverage	Consistency	Coverage	Consistency	Coverage
RES	0.787	0. 759	0.628	0.654	0.640	0.612
~RES	0.414	0.510	0.626	0.560	0.593	0.572
PRO	0.657	0.781	0.601	0.717	0.604	0.647
~PRO	0.575	0.571	0.648	0.523	0.595	0.519
PEO	0.680	0.867	0.683	0.708	0.623	0.626
~PEO	0.605	0.568	0.595	0.534	0.602	0.554
NVE	0.840	0.805	0.837	0.762	0.754	0.728
~NVE	0.404	0.502	0.529	0.541	0.506	0.484
INN	0.820	0.811	0.827	0.764	0.748	0.744
~INN	0.446	0.532	0.516	0.520	0.490	0.455
SEL	0.780	0.796	0.707	0.840	0.783	0.716
~SEL	0.452	0.519	0.581	0.471	0.453	0.459
PRT	0.741	0.778	0.709	0.828	0.716	0.729
~PRT	0.524	0.585	0.563	0.461	0.513	0.466

Note(s): RES = resource; PRO = process; PEO = people; NVE = new venture behaviour; INN = innovativeness; SEL = self-renewal; PRT = proactiveness; UPE = university performance
Source(s): Authors' own creation/work

Appendix 6. QFD results

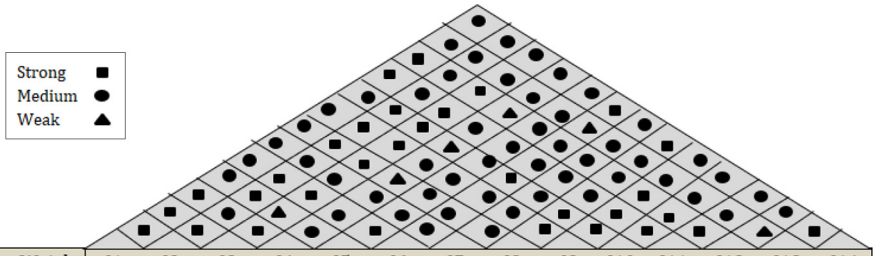


C/I	Weight	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
C1	0.15	0.89	0.89	0.78	0.44	0.67	0.89	0.56	0.56	1.00	0.89	0.89	0.44	0.56	0.44
C2	0.17	1.00	1.00	0.78	0.44	0.67	0.89	0.56	0.56	1.00	0.89	0.89	0.44	0.56	0.56
C3	0.04	0.11	0.11	0.11	0.11	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.56
C4	0.16	1.00	1.00	0.78	0.33	0.67	0.89	0.56	0.56	1.00	0.89	0.89	0.44	0.56	0.44
C5	0.15	0.89	0.89	0.78	0.33	0.67	0.89	0.56	0.56	1.00	0.89	0.89	0.56	0.44	0.56
C6	0.06	0.22	0.22	0.22	0.22	0.44	0.44	0.22	0.22	0.22	0.22	0.33	0.56	0.56	0.89
C7	0.14	0.33	0.67	0.67	0.56	0.67	0.67	0.44	0.44	0.44	0.44	0.33	0.56	0.89	0.78
C8	0.07	0.67	0.67	0.33	0.44	0.33	0.33	0.33	0.56	0.56	0.56	0.56	0.22	0.67	0.67
C9	0.11	0.67	0.56	0.67	0.67	0.56	0.44	0.67	0.67	0.44	0.44	0.56	0.33	0.33	0.33
C10	0.09	0.56	0.56	0.44	0.56	0.33	0.56	0.56	0.56	0.56	0.56	0.56	0.44	0.56	0.33
C11	0.03	0.22	0.33	0.33	0.33	0.33	0.33	0.33	0.11	0.11	0.11	0.22	0.44	0.67	0.56
C12	0.14	0.67	0.33	0.33	0.67	0.44	1.00	1.00	0.89	0.89	0.33	0.33	0.33	0.33	0.33
A.I		7.22	7.22	6.22	5.11	6.22	7.78	6.22	6.11	7.67	6.67	6.89	5.22	6.56	6.44
R.I		0.18	0.18	0.15	0.13	0.15	0.19	0.15	0.15	0.19	0.16	0.17	0.13	0.16	0.16
Rank		3	3	9	14	11	1	9	12	2	6	5	13	7	8

Figure A1. Quantitative case study 1 Australia

Note(s): C = challenges; I = intrapreneurial capabilities; AI = absolute importance; RI = relative importance

Source(s): Authors' own creation/work

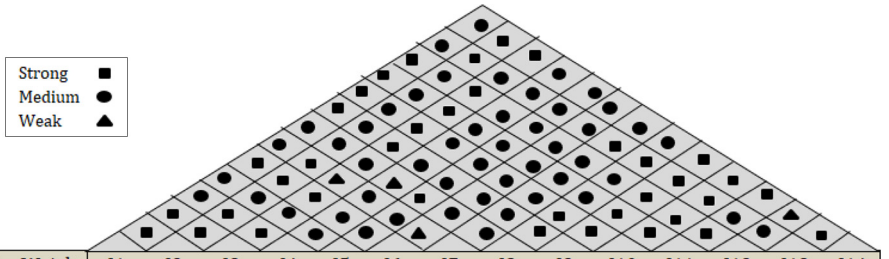


C/I	Weight	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
C1	0.25	0.89	1.00	0.78	0.33	0.67	0.89	0.56	0.44	0.89	0.89	0.89	0.44	0.78	0.89
C2	0.25	0.89	1.00	0.78	0.33	0.67	0.89	0.56	0.56	0.89	0.89	0.89	0.44	0.78	0.78
C3	0.07	0.11	0.11	0.11	0.22	0.11	0.33	0.33	0.44	0.44	0.44	0.33	0.22	0.44	0.44
C4	0.26	0.89	1.00	1.00	0.56	0.67	0.89	0.67	0.56	1.00	0.89	0.89	0.56	0.56	0.56
C5	0.20	0.78	0.89	1.00	0.56	0.67	0.89	0.56	0.56	1.00	0.89	0.89	0.56	0.56	0.56
C6	0.05	0.22	0.22	0.22	0.22	0.22	0.33	0.22	0.22	0.22	0.22	0.33	0.33	0.56	0.44
C7	0.15	0.33	0.67	0.67	0.44	0.67	0.67	0.44	0.56	0.33	0.33	0.33	0.33	0.67	0.78
C8	0.11	0.56	0.56	0.56	0.33	0.33	0.33	0.33	0.22	0.22	0.22	0.22	0.22	0.22	0.44
C9	0.14	0.89	0.56	0.67	0.44	0.56	0.44	0.33	0.33	0.33	0.33	0.44	0.56	0.44	0.44
C10	0.13	0.44	0.56	0.44	0.56	0.33	0.33	0.33	0.22	0.22	0.22	0.22	0.22	0.44	0.33
C11	0.10	0.22	0.22	0.22	0.33	0.44	0.44	0.33	0.22	0.22	0.22	0.22	0.22	0.44	0.44
C12	0.16	0.67	0.33	0.33	0.44	0.44	1.00	1.00	0.89	0.89	0.33	0.33	0.33	0.33	0.33
A.I		6.89	7.11	6.78	4.78	5.78	7.44	5.67	5.22	6.67	5.89	6.00	4.44	6.22	6.44
R.I		0.17	0.17	0.17	0.12	0.14	0.18	0.14	0.13	0.16	0.14	0.15	0.11	0.15	0.16
Rank		3	2	4	13	10	1	11	12	5	9	8	14	7	6

Figure A2. Quantitative case study 2 Australia

Note(s): C = challenges; I = intrapreneurial capabilities; AI = absolute importance; RI = relative importance

Source(s): Authors' own creation/work

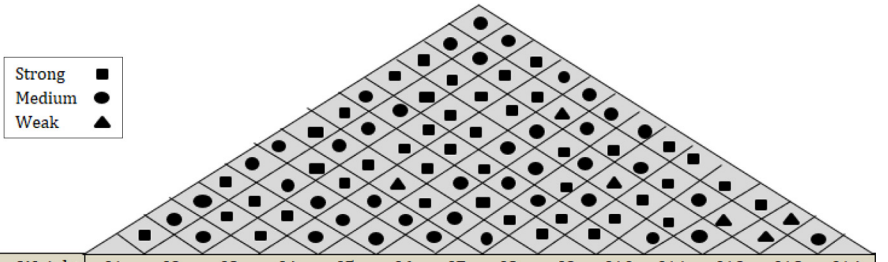


C/I	Weight	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
C1	0.24	0.88	1.00	0.75	0.38	0.75	0.88	0.75	0.63	1.00	0.88	0.88	0.50	0.75	0.88
C2	0.25	0.88	1.00	0.75	0.38	0.75	0.88	0.75	0.63	1.00	0.88	0.88	0.50	0.88	0.88
C3	0.07	0.63	0.25	0.38	0.25	0.38	0.38	0.25	0.38	0.38	0.38	0.25	0.50	0.63	0.50
C4	0.23	0.88	1.00	0.75	0.50	0.75	0.88	0.75	0.50	1.00	0.88	0.88	0.50	0.75	0.75
C5	0.19	0.88	1.00	0.75	0.50	0.75	0.88	0.75	0.50	1.00	0.88	0.88	0.50	0.50	0.63
C6	0.06	0.25	0.25	0.25	0.25	0.50	0.63	0.38	0.38	0.38	0.38	0.38	0.13	0.63	0.63
C7	0.15	0.38	0.63	0.63	0.63	0.75	0.63	0.38	0.38	0.38	0.38	0.63	0.63	0.88	0.63
C8	0.09	0.38	0.38	0.38	0.63	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.50	0.50
C9	0.11	0.63	0.63	0.38	0.50	0.75	0.63	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.50
C10	0.10	0.38	0.63	0.38	0.50	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.50	0.50
C11	0.06	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.50	0.38
C12	0.13	0.63	0.63	0.63	0.63	0.38	0.63	0.38	0.38	0.63	0.63	0.63	0.63	0.38	0.38
A.I		7.13	7.75	6.38	5.50	6.88	7.50	5.88	5.25	7.25	6.75	6.88	5.38	7.25	7.13
R.I		0.17	0.19	0.16	0.13	0.17	0.18	0.14	0.13	0.18	0.17	0.17	0.13	0.18	0.17
Rank		5	1	10	12	7	2	11	14	3	9	7	13	3	5

Figure A3. Quantitative case study 3 Australia

Note: C = challenges; I = intrapreneurial capabilities; AI = absolute importance; RI = relative importance

Source: Authors' own creation/work

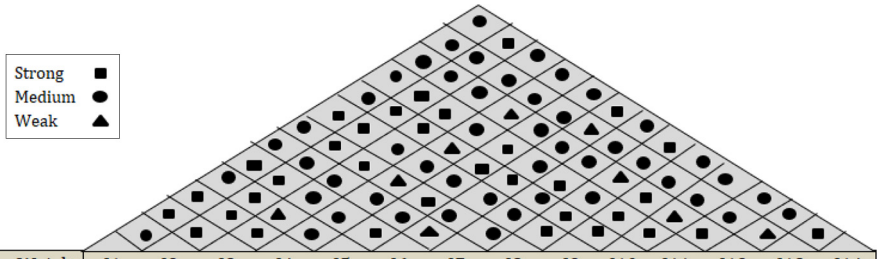


C/I	Weight	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
C1	0.06	0.38	0.63	0.25	0.63	0.63	0.88	0.88	0.38	0.88	0.38	1.00	0.63	1.00	1.00
C2	0.13	1.00	0.75	0.63	0.88	0.88	1.00	0.88	0.38	0.75	0.63	0.75	0.63	0.75	0.00
C3	0.20	1.00	0.63	1.00	1.00	0.63	1.00	0.38	1.00	1.00	1.00	0.63	0.63	0.75	0.00
C4	0.05	0.38	0.25	0.38	0.38	0.63	0.63	0.75	0.88	0.38	0.38	0.63	0.75	0.88	0.88
C5	0.04	0.25	0.25	0.25	0.25	0.25	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.00
C6	0.14	0.50	0.75	0.75	0.75	0.63	0.88	0.75	0.63	0.63	0.75	0.75	0.75	0.88	0.88
C7	0.22	0.75	0.63	0.75	0.88	0.50	0.88	0.88	0.38	1.00	0.88	0.88	0.75	0.75	0.88
C8	0.28	0.88	0.88	1.00	1.00	0.63	0.88	0.63	0.88	1.00	0.88	1.00	0.75	0.75	0.75
C9	0.31	0.88	1.00	1.00	1.00	0.88	0.63	1.00	1.00	0.88	1.00	1.00	1.00	0.88	0.88
C10	0.28	1.00	0.75	0.63	0.63	1.00	1.00	1.00	1.00	0.88	0.88	0.63	0.63	1.00	0.88
C11	0.24	0.75	0.88	0.88	0.88	0.75	0.63	0.88	0.88	0.75	1.00	0.63	0.75	0.75	0.75
C12	0.15	0.88	0.25	0.63	0.88	0.63	0.63	0.75	0.75	0.88	1.00	0.63	0.75	0.88	0.88
A.I		8.63	7.63	8.13	9.13	8.00	9.38	9.13	8.50	9.38	9.13	8.88	8.38	9.63	7.75
R.I		0.21	0.19	0.20	0.22	0.20	0.23	0.22	0.21	0.23	0.22	0.22	0.21	0.24	0.19
Rank		8	14	11	4	12	2	4	9	2	4	7	10	1	13

Figure A4. Quantitative case study 1 China

Note(s): C = challenges; I = intrapreneurial capabilities; AI = absolute importance; RI = relative importance

Source(s): Authors' own creation/work

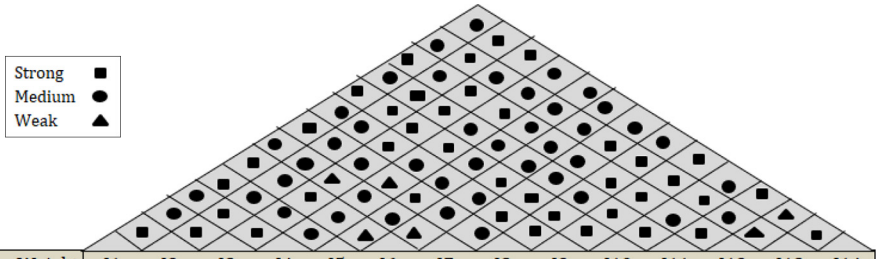


C/I	Weight	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
C1	0.17	0.50	0.38	0.63	0.88	0.50	1.00	0.75	0.63	0.88	1.00	0.75	0.50	0.88	1.00
C2	0.15	0.75	0.38	0.88	0.63	0.75	1.00	0.75	0.63	0.88	0.50	0.50	0.63	0.38	0.75
C3	0.08	0.25	0.25	0.38	0.25	0.50	0.50	0.25	0.63	0.63	0.50	0.63	0.38	0.25	0.25
C4	0.07	0.38	0.50	0.38	0.38	0.50	0.25	0.25	0.63	0.25	0.25	0.38	0.50	0.38	0.38
C5	0.16	0.75	0.50	0.88	0.75	0.50	0.63	0.63	0.63	1.00	0.88	0.63	0.38	1.00	0.75
C6	0.09	0.63	0.25	0.88	0.63	0.50	0.63	0.63	0.50	0.50	0.38	0.63	0.75	0.63	0.75
C7	0.16	0.75	0.63	1.00	1.00	0.38	0.88	0.88	0.75	0.75	0.63	0.50	0.38	0.63	0.75
C8	0.16	0.50	0.75	0.38	0.50	0.63	1.00	0.75	0.63	1.13	0.75	0.63	0.38	0.88	1.00
C9	0.12	0.88	0.25	0.50	0.63	0.38	0.75	0.50	0.88	0.75	1.00	0.38	0.75	0.63	0.50
C10	0.10	0.75	0.25	0.75	0.63	0.50	0.38	0.50	0.75	0.50	1.00	0.63	0.63	0.75	0.38
C11	0.10	0.63	0.50	0.38	0.38	0.38	0.75	0.63	0.88	0.50	0.63	0.38	0.88	0.88	0.63
C12	0.05	0.50	0.38	0.25	0.25	0.38	0.50	0.25	0.25	0.25	0.25	0.63	0.25	0.38	0.50
A.I		7.25	5.00	7.25	6.88	5.88	8.25	6.75	7.75	8.00	7.75	6.63	6.38	7.63	7.63
R.I		0.18	0.12	0.18	0.17	0.14	0.20	0.17	0.19	0.20	0.19	0.16	0.16	0.19	0.19
Rank		7	14	7	9	13	1	10	3	2	3	11	12	5	5

Figure A5. Quantitative case study 2 China

Note(s): C = challenges; I = intrapreneurial capabilities; AI = absolute importance; RI = relative importance

Source(s): Authors' own creation/work

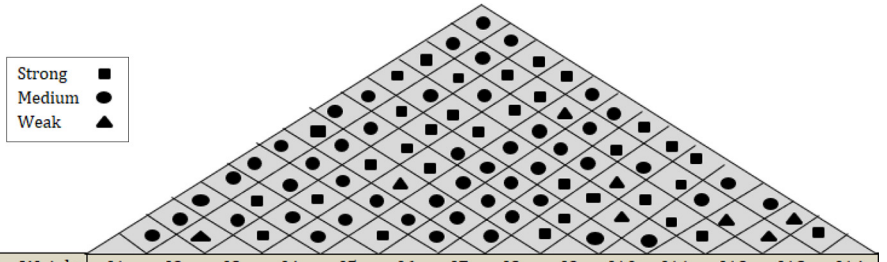


C/I	Weight	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
C1	0.19	0.78	0.78	0.78	0.89	0.67	0.78	0.56	0.44	0.67	0.89	1.00	0.67	0.67	0.33
C2	0.21	0.67	0.89	0.89	0.89	0.33	0.89	0.78	0.78	0.89	0.67	0.56	0.78	0.67	0.67
C3	0.08	0.44	0.44	0.44	0.56	0.67	0.56	0.44	0.67	0.67	0.56	0.44	0.44	0.78	0.33
C4	0.10	0.56	0.56	0.44	0.44	0.56	0.67	0.67	0.67	0.67	0.56	0.22	0.22	0.67	0.67
C5	0.07	0.22	0.22	0.33	0.33	0.33	0.22	0.22	0.33	0.33	0.33	0.56	0.44	0.33	0.33
C6	0.12	0.33	0.89	0.33	0.56	0.44	0.56	0.56	0.56	0.44	0.67	0.56	0.33	0.78	0.89
C7	0.13	0.67	0.67	0.67	0.78	0.33	0.78	0.56	0.67	0.67	0.56	0.56	0.56	0.33	0.44
C8	0.17	0.67	0.67	0.67	0.67	0.67	0.78	0.89	0.78	1.00	0.89	0.67	0.56	0.44	0.44
C9	0.14	0.78	0.78	0.56	0.56	0.56	0.56	0.89	0.56	0.56	0.56	0.56	0.89	0.78	0.33
C10	0.15	0.56	0.56	0.56	0.67	0.67	0.78	0.44	0.67	0.78	1.00	0.67	0.67	0.78	0.33
C11	0.16	0.78	0.67	0.67	0.78	0.56	0.78	0.56	0.78	0.67	0.56	0.56	0.78	0.78	0.33
C12	0.03	0.22	0.33	0.33	0.33	0.22	0.33	0.22	0.33	0.33	0.33	0.33	0.44	0.33	0.33
A.I		6.67	7.44	6.67	7.44	6.00	7.67	6.78	7.22	7.67	7.56	6.67	6.78	7.33	5.44
R.I		0.16	0.18	0.16	0.18	0.15	0.19	0.17	0.18	0.19	0.18	0.16	0.17	0.18	0.13
Rank		10	5	11	4	13	1	9	7	1	3	11	8	6	14

Figure A6. Quantitative case study 3 China

Note(s): C = challenges; I = intrapreneurial capabilities; AI = absolute importance; RI = relative importance

Source(s): Authors' own creation/work

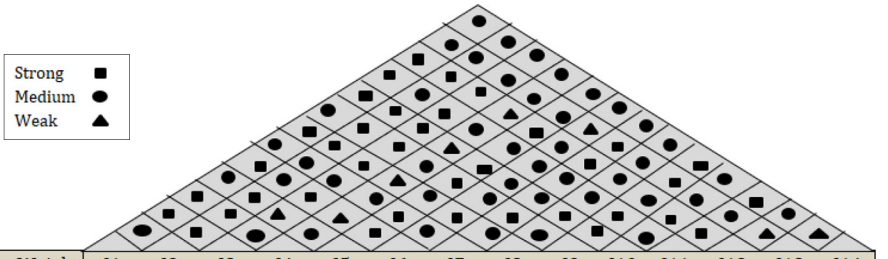


C/I	Weight	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
C1	0.15	1.00	0.78	0.78	0.56	0.56	0.33	0.78	0.56	0.78	0.33	0.78	0.56	0.33	0.00
C2	0.29	1.00	1.00	0.78	0.78	0.78	0.78	0.78	1.00	0.78	0.78	1.00	0.56	0.78	0.78
C3	0.13	0.78	0.56	0.56	0.56	0.78	0.78	0.78	0.78	0.56	0.33	0.33	0.33	0.33	0.00
C4	0.06	0.22	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.22	0.33	0.33	0.11
C5	0.24	0.56	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.56	0.78
C6	0.09	0.00	0.56	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.78	0.33
C7	0.18	0.00	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
C8	0.14	0.33	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.33	0.33	0.33	0.33	0.11
C9	0.14	0.56	0.78	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.11
C10	0.25	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
C11	0.19	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.11
C12	0.24	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.33
A.I		6.78	8.11	7.44	7.22	7.44	7.22	7.67	7.67	7.44	6.89	7.44	6.89	7.11	4.22
R.I		0.17	0.20	0.18	0.18	0.18	0.18	0.19	0.19	0.18	0.17	0.18	0.17	0.17	0.10
Rank		13	1	4	8	4	8	2	2	4	11	7	11	10	14

Figure A7. Quantitative case study 1 Mexico

Note(s): C = challenges; I = intrapreneurial capabilities; AI = absolute importance; RI = relative importance

Source(s): Authors' own creation/work

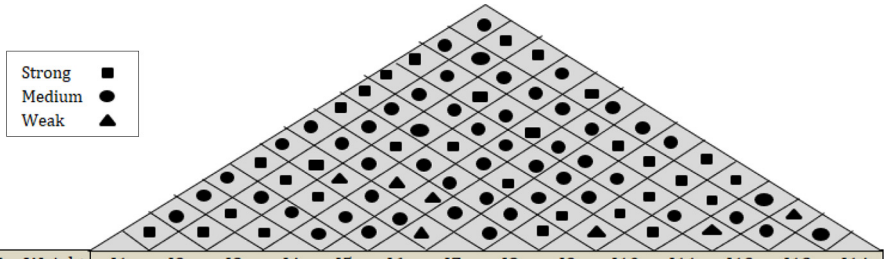


C/I	Weight	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
C1	0.18	1.00	0.56	0.33	0.33	0.22	0.78	1.00	0.78	0.56	1.00	1.00	0.78	0.78	0.78
C2	0.20	1.00	0.78	1.00	0.78	0.22	1.00	0.78	0.78	1.00	1.00	0.56	1.00	0.78	0.78
C3	0.11	0.78	0.56	0.33	0.56	0.22	0.33	0.33	0.33	0.56	0.56	0.78	0.33	0.78	0.33
C4	0.12	1.00	0.56	0.33	0.78	0.22	0.33	0.33	0.33	0.33	0.78	0.78	0.78	0.78	0.33
C5	0.06	0.33	0.78	0.33	0.33	0.11	0.11	0.11	0.11	0.33	0.33	0.11	0.78	0.78	0.11
C6	0.22	1.00	0.78	0.78	1.00	0.33	1.00	1.00	1.00	0.78	0.78	0.78	0.78	0.78	0.78
C7	0.09	0.33	0.33	0.33	0.56	0.33	0.56	0.33	0.33	0.78	0.33	0.33	0.33	0.78	0.33
C8	0.04	0.22	0.22	0.33	0.33	0.22	0.33	0.33	0.33	0.22	0.22	0.33	0.22	0.33	0.11
C9	0.03	0.22	0.33	0.33	0.33	0.33	0.22	0.33	0.33	0.22	0.22	0.33	0.22	0.11	0.11
C10	0.19	0.78	1.00	1.00	1.00	0.22	0.78	1.00	1.00	1.00	1.00	0.78	0.33	0.33	0.33
C11	0.14	0.78	0.33	0.56	0.78	0.33	0.56	0.78	0.78	0.78	0.56	0.56	0.33	0.33	0.78
C12	0.15	0.78	0.78	0.56	0.56	0.33	0.78	0.78	0.56	0.56	0.56	0.56	0.78	0.78	0.78
A.I		8.22	7.00	6.22	7.33	3.11	6.78	7.11	6.67	7.11	7.33	6.89	6.67	7.33	5.56
R.I		0.20	0.17	0.15	0.18	0.08	0.17	0.17	0.16	0.17	0.18	0.17	0.16	0.18	0.14
Rank		1	7	12	2	14	9	5	10	5	2	8	10	2	13

Figure A8. Quantitative case study 2 Mexico

Note(s): C = challenges; I = intrapreneurial capabilities; AI = absolute importance; RI = relative importance

Source(s): Authors' own creation/work



C/I	Weight	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	I13	I14
C1	0.18	0.78	0.00	0.78	0.56	0.00	0.33	0.78	0.33	0.33	1.00	1.00	1.00	0.56	0.56
C2	0.13	0.33	1.00	0.11	1.00	0.11	0.33	0.33	0.33	0.33	0.33	0.00	0.33	0.33	0.33
C3	0.20	0.56	0.56	0.56	0.56	0.56	0.33	0.89	0.56	0.56	0.89	0.56	0.89	1.00	1.00
C4	0.06	0.22	0.22	0.22	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.22	0.22	0.33	0.33
C5	0.11	0.22	0.22	0.22	0.22	0.22	0.56	0.33	0.33	0.44	0.44	0.56	0.33	0.33	0.33
C6	0.08	0.22	0.22	0.22	0.22	0.22	0.33	0.11	0.11	0.78	0.22	0.22	0.56	0.56	0.56
C7	0.25	0.78	0.78	0.56	0.56	0.78	0.78	0.78	0.78	1.00	1.00	1.00	0.78	0.78	0.78
C8	0.03	0.22	0.22	0.22	0.22	0.22	0.22	0.33	0.33	0.33	0.33	0.22	0.33	0.33	0.33
C9	0.21	0.33	0.56	0.56	0.56	0.56	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00
C10	0.23	0.11	0.11	1.00	1.00	1.00	1.00	0.56	0.56	1.00	1.00	0.56	0.78	0.78	0.78
C11	0.16	0.33	1.00	1.00	0.56	0.56	0.33	0.33	1.00	0.11	0.11	0.11	0.11	0.11	0.11
C12	0.19	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.78	0.78	1.00	1.00	1.00	1.00
A.I		4.44	5.22	5.78	6.11	4.89	5.89	6.11	6.00	7.00	7.44	5.78	6.67	6.44	7.11
R.I		0.11	0.13	0.14	0.15	0.12	0.14	0.15	0.15	0.17	0.18	0.14	0.16	0.16	0.17
Rank		14	12	10	6	13	9	6	8	3	1	10	4	5	2

Figure A9. Quantitative case study 3 Mexico

Note(s): C = challenges; I = intrapreneurial capabilities; AI = absolute importance; RI = relative importance

Source(s): Authors' own creation/work

Appendix 7: fsQCA results

Table A10. Configurations for improving university performance – Australia

Models for high UPE	RC	UC	C		Models for low UPE	RC	UC	C
Model1a: UPE = f(RES*PRO*PEO)					Model1b: ~UPE = f(RES*PRO*PEO)			
1. RES*PRO*PEO	0.567	0.567	0.903	1. RES*PRO*PEO		0.385	0.385	0.521
Solution coverage: 0.567					Solution coverage: 0.385			
Solution consistency: 0.903					Solution consistency: 0.521			
Model2a: UPE = f(NVE*INN*SEL*PRT)					Model2b: ~ UPE = f(NVE*INN*SEL*PRT)			
1. ~NVE*INN*SEL*~PRT	0.254	0.078	0.964	1. ~NVE*~INN*~SEL*~PRT		0.635	0.635	0.912
2. NVE*INN*SEL*PRT	0.609	0.433	0.844					
Solution coverage: 0.688					Solution coverage: 0.635			
Solution consistency: 0.859					Solution consistency: 0.912			
Model3a: UPE = f(RES*PRO*PEO*NVE*INN*SEL*PRT)					Model3b: ~ UPE = f(RES*PRO*PEO*NVE*INN*SEL*PRT)			
1. RES*PRO*PEO*NVE*INN*SEL*PRT	0.507	0.410	0.956	1. ~PRO*~PEO*~NVE*~INN*~SEL*~PRT		0.553	0.420	0.918
				2. ~RES*~PRO*~PEO*NVE*INN*SEL*PRT		0.221	0.088	0.892
Solution coverage: 0.594					Solution coverage: 0.642			
Solution consistency: 0.947					Solution consistency: 0.898			

Note(s): RC = raw coverage; UC = unique coverage; C = consistency; RES = resource; PRO = process; PEO = people; NVE = new venture behaviour; INN = innovativeness; SEL = self-renewal; PRT = proactiveness; UPE = university performance. RC >0.2 are reported

Source(s): Authors' own creation/work

Table A11. Configurations for improving university performance – China

Models for high UPE	RC	UC	C	Models for low UPE	RC	UC	C
Model1a: UPE = f(RES*PRO*PEO)				Model1b: ∼UPE = f(RES*PRO*PEO)			
1. ∼RES*PRO*PEO	0.320	0.320	0.834	1. RES*∼PRO	0.412	0.083	0.775
				2. ∼PRO*PEO	0.430	0.102	0.774
Solution coverage: 0.320				Solution coverage: 0.514			
Solution consistency: 0.834				Solution consistency: 0.751			
Model2a: UPE = f(NVE*INN*SEL*PRT)				Model2b: ∼ UPE = f(NVE*INN*SEL*PRT)			
1. ∼NVE*∼INN*∼SEL*PRT	0.319	0.095	0.893	1. ∼NVE*∼INN*∼SEL*∼PRT	0.650	0.650	0.904
2. NVE*INN*SEL*PRT	0.547	0.323	0.933				
Solution coverage: 0.642				Solution coverage: 0.650			
Solution consistency: 0.899				Solution consistency: 0.904			
Model3a: UPE = f(RES*PRO*PEO*NVE*INN*SEL*PRT)				Model3b: ∼ UPE = f(RES*PRO*PEO*NVE*INN*SEL*PRT)			
1. ∼RES*PEO*NVE*INN*SEL*PRT	0.315	0.038	0.969	1. ∼PRO*∼PEO*∼NVE*∼INN*∼SEL*∼PRT	0.571	0.571	0.914
2. PRO*PEO*NVE*INN*SEL*PRT	0.418	0.157	0.919				
Solution coverage: 0.569				Solution coverage: 0.571			
Solution consistency: 0.891				Solution consistency: 0.914			

Note(s): RC = raw coverage; UC = unique coverage; C = consistency; RES = resource; PRO = process; PEO = people; NVE = new venture behaviour; INN = innovativeness; SEL = self-renewal; PRT = proactiveness; UPE = university performance. RC >0.2 are reported
Source(s): Authors' own creation/work

Table A12. Configurations for improving university performance – Mexico

Models for high UPE	RC	UC	C	Models for low UPE	RC	UC	C
Model1a: UPE = f(RES*PRO*PEO)				Model1b: ∼UPE = f(RES*PRO*PEO)			
1. ∼RES*PRO*PEO	0.305	0.305	0.809	1. ∼RES*PRO*PEO	0.260	0.260	0.748
Solution coverage: 0.305				Solution coverage: 0.260			
Solution consistency: 0.809				Solution consistency: 0.748			
Model2a: UPE = f(NVE*INN*SEL*PRT)				Model2b: ∼ UPE = f(NVE*INN*SEL*PRT)			
1. NVE*INN	0.702	0.110	0.814	1. ∼NVE*∼INN*∼SEL*∼PRT	0.608	0.608	0.818
2. INN*PRT	0.633	0.042	0.794				
Solution coverage: 0.744				Solution coverage: 0.608			
Solution consistency: 0.802				Solution consistency: 0.818			
Model3a: UPE = f(RES*PRO*PEO*NVE*INN*SEL*PRT)				Model3b: ∼ UPE = f(RES*PRO*PEO*NVE*INN*SEL*PRT)			
1. ∼RES*∼PRO*∼PEO*INN*SEL*∼PRT	0.262	0.107	0.805	1. ∼PRO*∼PEO*∼NVE*∼INN*∼SEL*∼PRT	0.442	0.170	0.829
2. RES*PRO*PEO*∼NVE*INN*SEL*PRT	0.231	0.070	0.835	2. RES*∼PRO*∼NVE*∼INN*∼SEL*∼PRT	0.301	0.033	0.847
Solution coverage: 0.381				Solution coverage: 0.528			
Solution consistency: 0.800				Solution consistency: 0.848			

Note(s): RC = raw coverage; UC = unique coverage; C = consistency; RES = resource; PRO = process; PEO = people; NVE = new venture behaviour; INN = innovativeness; SEL = self-renewal; PRT = proactiveness; UPE = university performance. RC >0.2 are reported
Source(s): Authors' own creation/work