Research Policy 52 (2023) 104668

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Academics engaging in knowledge transfer and co-creation: Push causation and pull effectuation?

Muthu De Silva [a,b,*], Omar Al-Tabbaa [c], Jonathan Pinto [d]

[a] Professor of Innovation and Entrepreneurship, Department of Management, Birkbeck, University of London, Malet Street, London WC1E 7HX, UK
[b] Vising Fellow, InnoLab, University of Vaasa, PB 700, 65101 Vaasa, Finland
[c] Associate Professor of International Business Strategy, Leeds University Business School, University of Leeds, UK
[d] Associate Professor of Organizational Behavior and Negotiations, Imperial College Business School, Imperial College London, SW7 2AZ, UK

ARTICLE INFO

Keywords:
Academic engagement
Knowledge transfer
Knowledge co-creation
Motivation
Effectuation
Causation

ABSTRACT

Although academics are increasingly engaging with businesses, some fundamental aspects of this phenomenon (i.e., their motivations, decision-making approaches, and the interplay between the two) remain understudied. We therefore conducted a qualitative inductive study comprising 68 interviews with academics who had engaged in two forms of activities—knowledge transfer and co-creation. Whereas the entrepreneurship literature offers a *resource-based* argument, we made an original contribution to the literature by introducing an *engagement-based* argument in order to offer a more accurate prediction of the motivations and decision-making approaches of academics engaged in knowledge transfer and co-creation activities. We found that when the *resource-* and *engagement-based* arguments offer different predictions of the interplay between the motivations and decision-making approaches adopted, the *cognitive proximity* between academics and business researchers, which reflects whether the partners are from the same/different disciplines, resolves the puzzle. We captured these situational contingencies by developing six propositions that indicate how the *engagement-* and *resource-based* arguments jointly offer a more comprehensive explanation of the interplay. We discuss the implications of our findings with regard to how universities could offer customized training, rewards, and support structures based on the four types of interplay between the motivation and decision-making approaches.

1. Introduction

Over the last couple of decades, university-business interactions have been the object of increasing scholarly attention (Lam, 2011; Shi et al., 2020). Besides the formation of spin-offs (e.g., Clarysse et al., 2011; Huyghe et al., 2016), knowledge transfer and co-creation have emerged as the two key and most common activities through which academics interact with businesses (De Silva et al., 2021, Klofsten et al., 2019). Whereas *knowledge transfer* involves the unidirectional transfer of knowledge from academics[1] to businesses, with the latter independently capitalizing on such knowledge (Siegel et al., 2007), *knowledge co-creation* involves the integration of the advanced and up-to-date knowledge held by academics with the market and industry know-how possessed by businesses to the end of jointly overcoming specific challenges and solving problems (De Silva and Rossi, 2018). Although the literature has discussed the motivations behind academics interacting with businesses (Azagra-Caro et al., 2017; Bozeman and Gaughan, 2011; van Rijnsoever et al., 2008) and has offered some insights into their decision-making approaches (e.g., Alexander et al., 2020), the interplay between these two critical dimensions has hitherto been overlooked. In particular, whereas the entrepreneurship literature has offered a *resource-based* argument regarding the interplay (Fisher, 2012; Jiang and Rüling, 2019), there is a lack of consideration of how it is affected by the specific interaction patterns of knowledge transfer and co-creation. The intrinsic differences between knowledge transfer and co-creation activities imply that the interplay between the motivation and decision-making approaches of the academics involved in the respective engagements may vary (McMullen et al., 2020). This study therefore aims to investigate the interplay between academic motivations and decision-making approaches and to unpack how *resource-* and *engagement-based* arguments could jointly offer a more accurate explanation regarding it.

Whereas motivations indicate intentions, decision-making

* Corresponding author at: Department of Management, Birkbeck, University of London, Malet Street, London WC1E 7HX, UK.
E-mail addresses: m.desilva@bbk.ac.uk (M. De Silva), busofoa@leeds.ac.uk (O. Al-Tabbaa), j.pinto@imperial.ac.uk (J. Pinto).

[1] As the focus of our study is on individual academics, we have used the term 'academics' in lieu of 'universities' for stylistic reasons.

https://doi.org/10.1016/j.respol.2022.104668
Received 23 February 2022; Received in revised form 2 November 2022; Accepted 8 November 2022
Available online 17 November 2022

approaches describe patterns of behaviour; thus, the exploration of the interaction between these two key dimensions can offer an in-depth understanding of the psychology of academics engaging with businesses (Balven et al., 2018). In effect, the interplay between these two individual-level dimensions significantly influences the shape and magnitude of the impact generated by academics (Siegel et al., 2007). Therefore, understanding this interplay is particularly important for better formulating the incentives and support structures that can yield effective interactions between academics and companies and the associated generation of business and social value (Perkmann et al., 2021).

The entrepreneurship literature has advanced a *resource-based* argument, positing that, in resource-constrained situations, push motives (i.e., those stemming from the need to overcome negative circumstances) and effectuation decision-making approaches (i.e., those focusing on the resources at hand) are dominant. Correspondingly, during resource-rich situations, pull motives (i.e., those elicited by attraction) and causation decision-making approaches (i.e., those focused on pre-defined objectives) will be dominant (see Table 1 for definitions) (Fisher, 2012; Jiang and Rüling, 2019). However, extending these insights to academics collaborating with businesses can be problematic. This is because these interactions can take on different forms (i.e., knowledge transfer and co-creation), which involve different objectives, practices, and outcomes (De Silva and Rossi, 2018; Rossi et al., 2022). Therefore, the *resource-based* argument presented in the entrepreneurship literature is likely to be inadequate with regard to predicting or explaining academics' behaviors, as there is a need to account for *engagement-based* (knowledge transfer versus knowledge co-creation) differences (Fini and Toschi, 2016; Balven et al., 2018).

More specifically, knowledge transfer, which involves unidirectional flows of knowledge (Grant and Baden-Fuller, 2004), could include relatively more specific goals with less vague outcomes than knowledge co-creation, which entails meshing two knowledge bases to develop new know-how (De Silva and Rossi, 2018; Rossi et al., 2022). Based on decision-making logic (Sarasvathy, 2001), it could be argued that although the clarity of knowledge transfer objectives may lead academics to adopt causation approaches, the relative vagueness of knowledge co-creation objectives may result in academics adopting effectuation ones. Thus, contrary to the *resource-based argument* (i.e., push effectuation and pull causation), push causation and pull effectuation may be adopted. This indicates that if the interaction between motivation and decision-making is considered with regard to the resource-based argument without factoring in the engagement-based one, a paradoxical situation will be created (Westenholz, 1993).

Therefore, in our study, we addressed this paradox by collecting and analyzing a unique dataset comprising 68 in-depth interviews with academics engaged in knowledge transfer and knowledge co-creation activities. First, although the *resource-based* argument predicts *push effectuation* in resource-constrained situations, we found that in resource-constrained situations, academics engaging in *knowledge transfer* may also adopt *push causation* (besides the expected *push effectuation*) in the presence of high *cognitive proximity* with their business partners (i.e., when their partners are from the same discipline). Second, whereas the resource-based argument predicts *pull causation* in resource-rich situations, our analysis shows that in resource-rich situations, academics engaging in *knowledge co-creation* may also adopt *pull effectuation* (besides the expected *pull causation*) when the *cognitive proximity* with their business partners is low.

We thus make an original contribution to the literature by introducing the *engagement-based* argument in order to offer a more accurate prediction of the motivations and decision-making approaches of academics engaged in knowledge transfer and co-creation activities. We find that when the *resource-* and *engagement-based* arguments offer different predictions of the interplay, the *cognitive proximity* between academics and business researchers resolves the puzzle. We capture these situational contingencies by developing six propositions indicating how the *engagement-* and *resource-based* arguments jointly offer a detailed explanation of the interplay. Thus, this paper sheds light on "*the knowledge structures that people use to make assessments, judgments or decisions*" (Mitchell et al., 2002, p. 97) and that hold the answers to critical questions pertaining to academics' collaboration activities.

From a practice standpoint, our study unveils the complex links among motivations and decision-making approaches, types of engagement, and individual resource statuses. Together, these differences suggest that 'one-size-fits-all' models are unlikely to be appropriate (Perkmann et al., 2021). Different incentives and support structures should be offered depending on the four different types of interplay between motivations and decision-making approaches (i.e., push effectuation, push causation, pull effectuation, and pull causation). We therefore provide recommendations with regard to how academic engagement with businesses should be supported, which is crucial for

Table 1
Key constructs: engagement, motivation, decision-making, and resource status.

Key constructs	Definitions
Types of academic engagement with business	*Knowledge transfer*: the transfer of academic knowledge to businesses, which the latter then capitalize on independently (De Silva and Rossi, 2018; Rossi et al., 2022). *Knowledge co-creation*: the integration of academic and business knowledge to address specific challenges (Bradley et al., 2013; D'Este and Perkmann, 2011).
Motivations	*Push motives*: any negative or constraining circumstances and situations driving engagement (Hughes, 2003; McGowan et al., 2012). *Pull motives*: any positive or attractive situations driving engagement (Amit and Muller, 1995, Ault and Spicer, 2020).
Decision-making approaches	*Causation approaches*: those that "*take a particular effect as given and focus on selecting between means to create that effect*" (Sarasvathy, 2001, p. 245). This involves initially deciding on the objectives and then looking into aligning resources to achieve them. *Effectuation approaches*: those that "*take a set of means as given and focus on selecting between possible effects that can be created with that set of means*" (Sarasvathy, 2001, p. 245). This involves initially looking at the available resources and then designing objectives based on the resource availability.
Individual resource statuses	*Resource-constrained situations*: those in which individuals possess relatively low levels of technological, social, and financial resources (Busch and Barkema, 2021). *Resource-rich situations*: those in which individuals possess relatively high levels of technological, social, and financial resources (Chitsaz et al., 2017; Fisher, 2012). Individual resource statuses may positively overlap with career stages (e.g., being a full professor or not). Yet, due to the greater significance placed on academic engagement with business over the last decade, academics in their early career stages and trained in this era are also likely be equipped with the required resources (Kraimer et al., 2019).
Cognitive proximity between academics and business researchers	*High cognitive proximity*: when the academic and business partners are from the same discipline. *Low cognitive proximity*: when the academic and business partners are from different disciplines (Brown and Duguid, 1998, Nooteboom, 2000, D'Este et al., 2013, Iammarino and McCann, 2006). Even though, in industry, the sectors are defined differently to allow for comparison, we focused on the expertise (i.e., disciplines) of individual academics and business researchers engaged in specific interactions.

academic research looking to generate both short- and long-term business and social benefits for the non-academic community (Rosli et al., 2018; Iorio et al., 2017).

The outline of this paper is as follows. In the next section, we discuss the two main types of academic engagement with business (i.e., knowledge transfer and knowledge co-creation). This is followed by the development of a conceptual framework that involves the resource- and engagement-based arguments of the interplay. In the subsequent two sections, we discuss the methodology and the findings of our study. Finally, in the discussion section, we summarize the contributions made by our study and their implications for both research and practice.

2. Theoretical background

2.1. Academic engagement in knowledge transfer and co-creation activities

Research has categorized academic engagement with businesses in multiple ways. Besides spin-off formation, the licensing or selling of *intellectual property* (IP) to businesses is a mode of interaction that has been widely discussed in the early literature on academic-business interactions. This involves the unidirectional transfer of academic knowledge to businesses—often for commercial reasons—and is considered a linear interaction channel (Bradley et al., 2013, Lam, 2011, D'Este and Perkmann, 2011). Further, a company's capitalization of the transferred knowledge occurs independently of the knowledge transfer process/interaction, and, typically, in knowledge transfer activities, academics and businesses play well-defined respective roles as producers and receivers of knowledge (Al-Tabbaa and Ankrah, 2019, De Silva and Rossi, 2018).

However, over time, more academic attention has been paid to research-oriented forms of interaction, such as joint projects (Bradley et al., 2013, D'Este and Perkmann, 2011). Any joint research that involves the co-creation of new knowledge by combining academic and business knowledge, often with research motives, is considered a non-linear, bilateral interaction channel (Lam, 2011, D'Este and Perkmann, 2011, Perkmann et al., 2013, Bradley et al., 2013). To this end, academics and businesses work closely together as they would be unable to produce this new knowledge independently (Etzkowitz and Leydesdorff, 2000). As summarized in Table 2, the differences between knowledge transfer (e.g., the licensing/selling of IP) and co-creation activities (e.g., joint research) imply that the interplay between the motivation and decision-making approaches of the academics involved in the respective engagements may vary (McMullen et al., 2020).

2.2. The motivations and decision-making approaches of academics engaging with businesses

The interplay between motivations and decision-making approaches has been discussed in the entrepreneurship literature. Academic engagement with businesses is often perceived "*as entrepreneurial since this occurs beyond the traditional academic roles of teaching and/or research, is innovative, carries an element of risk, and leads to financial rewards for the individual academic or his/her institution*" (Abreu and Grinevich, 2013, p. 408). However, the specific interaction patterns of knowledge transfer and knowledge co-creation imply that the interplay discussed in the entrepreneurship literature may not be applied directly. Yet, the entrepreneurship literature may offer a good theoretical foundation suited to the study of the specificities pertaining to academic engagement with businesses.

The entrepreneurship literature has categorized entrepreneurial motives into two types—'pull' and 'push' (Amit and Muller, 1995; Ault and Spicer, 2020). Whereas 'push' motives involve negative or constraining circumstances and situations driving entrepreneurial activity, 'pull' ones involve positive or attractive reasons that lead individuals to choose to be entrepreneurial (Gilad and Levine, 1986; Ault and Spicer, 2020). As such, academics may be 'pushed' to engage with businesses in order to overcome undesirable circumstances, such as insufficient personal income (Alstete, 2002; Basu and Goswami, 1999; Dunn and Holtz-Eakin, 2000), the absence of an industrial partner capable of commercializing academic research outputs (Eun et al., 2006), or a scarcity of institutional resources (van Dierdonck and Debackere, 1988). Conversely, academics may be 'pulled' toward engaging with businesses for positive outcomes, such as career development (Greenbank, 2001), the acquisition of industry-related knowledge and skills, access to industrial resources, and personal satisfaction and enrichment (D'este et al., 2010).

With regard to the decision-making approaches of entrepreneurs, Sarasvathy (2001) identified two forms—causation and effectuation—that have been applied in several disciplines, including Research and Development (R&D) project management (Brettel et al., 2012), economics (Dew et al., 2004), finance (Wiltbank et al., 2009), and marketing (Read et al., 2009). *Causation* is adopted when there are clear goals and readily available resources. Therefore, when taking a decision, entrepreneurs evaluate the means needed to achieve a set objective in an effort to maximize returns. *Effectuation* emerges when the objectives are less defined and the resources are limited, and entrepreneurs, therefore, try to generate value on the basis of risk minimization (Shepherd et al., 2015) (see Table 3).

In relation to applying these approaches to academics engaging with businesses, academics are likely to use effectuation when their individual resources are limited and causation when resources are abundant. Those academics who take a causation approach are more likely to view engagement as a planned activity. Therefore, causation decision-making could result in business engagements aimed at achieving specific sets of objectives defined by a university's strategic road map, whereas effectuation could lead to ad hoc interactions with less strategic planning. Effectuation is a "*general theory of decision-making in uncertain situations*" (Sarasvathy, 2009, p. 227), whereas causation "*follows a linear process that seeks to reach the project target as efficiently and with as few surprises as possible*" (Brettel et al., 2012, p. 169). This suggests that academics may adopt causation for planned, linear engagements with less uncertain outcomes in the presence of abundant individual resources, whereas they may adopt effectuation when engaging in activities characterized by greater outcome uncertainty and vagueness and under individual resource constraints.

2.3. The resource-based argument for the motivation/decision-making interplay

The entrepreneurship literature has discussed the correlation between entrepreneurs' access to resources and the interplay of motivations (Bosma and Harding, 2007) and decision-making approaches (Fisher, 2012; Jiang and Rüling, 2019). Individual resource scarcity has been argued to be a factor linked to the correlation between effectuation approaches and push motives, whereas individual resource richness has been identified as being related to that between causation approaches and pull motives. This correlation has also been discussed as being time sensitive. For instance, research conducted in the US found that those entrepreneurs who were in the early stages of their careers (i.e., nascent entrepreneurs) were significantly more motivated by 'push' factors than their 'mature' counterparts (Schjoedt and Shaver, 2007). Nevertheless, over time and with the development and acquisition of resources, entrepreneurs' motives may change from *push* to *pull* ones. With regard to decision-making approaches, emerging findings suggest that firms in the early stages of development often take effectuation approaches, later gradually shift toward mixed ones, and then, increasingly, toward dominant causation logics (An et al., 2017). Therefore, based on the entrepreneurship literature, it can be argued that, during the—usually resource-constrained—initial stages of an engagement, the push-effectuation combination could be dominant. Yet, with the improvement of resources, pull causation could take over.

Table 2
The key characteristics of knowledge transfer and co-creation.

	Knowledge transfer	Knowledge co-creation
Key objective	Transferring academic knowledge to businesses, which then use or capitalize on it	Integrating academic and business knowledge to address a specific challenge or opportunity
Role of the partners	Academics produce knowledge, and businesses receive it	Academics and businesses produce knowledge together
Nature of the knowledge	Mainly codified and embedded in artifacts or documents, although some tacit knowledge may be needed for transfer effectiveness	Tacit knowledge is crucial for the co-creation, although the co-created knowledge can become partly codified
Degree of interdependence	Low interdependence	High interdependence
Degree of complexity	Typically low	Usually high
Clarity of the outcomes	The outcomes and their beneficiaries are clearly identified prior to the interaction	Both the outcomes and their beneficiaries are dependent upon a 'ripple out' process that is unlikely to be predictable
Linearity of the interaction	A linear model of knowledge transfer	A non-linear, bilateral model of open innovation
Example	Licensing/selling IP; publications	Joint research; joint research labs

Source: Compiled and adapted from De Silva and Rossi (2018), Bradley et al. (2013), and D'Este and Perkmann (2011).

Table 3
The key differences between causation and effectuation logics.

	Causation	Effectuation
Logic	A decision-making logic that involves taking particular target effects as a given and focusing on the selection of means to bring about those effects	A decision-making logic that entails taking a set of means as a given and focusing on the selection of the possible effects that can be brought about with that set of means
Clarity of the goal	The goal is clear	The goal is less clear/only involves generalized aspirations
Availability of resources	An abundance of resources	Limited access to resources
Key decision-making criteria	The criteria for selecting among the means (usually the maximization of expected returns in terms of the predetermined goal)	The criteria for selecting among the effects (usually a predetermined level of affordable loss or acceptable risk related to the given means)
Example	An academic deciding to engage with businesses to be able to achieve strategic objectives set by the university. In this example, the interaction starts with an objective, and, subsequently, the resources to achieve that objective will be sourced.	An academic making the decision to engage with businesses to explore what they could achieve based on the resources that they have. In this example, the interaction starts with the resources they have, and the objectives to be achieved will be determined based on the resources.

Source: Compiled and adapted from (Nummela et al., 2014; Sarasvathy, 2001).

2.4. The engagement-based argument for the motivation/decision-making interplay

In addition to individual resource statuses, the specific interaction patterns of knowledge transfer and co-creation could be linked to the interplay between the motivations and decision-making approaches of academics engaging with businesses. Knowledge transfer activities, which involve a unidirectional flow of knowledge, could be aimed at relatively more specific goals with less vague outcomes than knowledge co-creation ones, which entail meshing two knowledge bases to develop new know-how. In the former, academics could use the structured communication mechanisms they already possess to disseminate knowledge (De Silva and Rossi, 2018, Sherwood and Covin, 2008). Businesses then capitalize on the transferred knowledge independently of the transfer process. Thus, from the start, businesses could have a clear vision and objectives regarding the type of academic knowledge/technology to be transferred (Al-Tabbaa and Ankrah, 2016). Due to the clarity of the goals and the linearity of and familiarity with the process, academics may take a causation approach (i.e., in line with the causation logic highlighted in Table 3) when deciding to engage in knowledge transfer. Therefore, even though, in resource-constrained situations, academics could adopt push-effectuation approaches based on the resource-based argument, the engagement-based one suggests that they may use push causation for knowledge transfer. We thus lack an understanding of how the resource- and engagement-based arguments unfold.

In resource-rich situations—and contrary to any expectations derived from the resource-based argument (i.e., pull causation)—the engagement-based argument suggests that academics could adopt pull effectuation for co-creation. As knowledge co-creation involves academics and businesses working closely together (Sjöö and Hellström, 2019) to integrate each other's knowledge in order to generate shared value (De Silva and Wright, 2019), its outcomes are less predictable than those of knowledge transfer. Therefore, academics could use effectuation (in line with the effectuation logic highlighted in Table 3) for co-creation, even in resource-rich situations. As such, the engagement-based argument suggests that academics could adopt pull effectuation in relation to their engagement in knowledge co-creation in resource-rich situations.

In line with the unique interaction patterns of knowledge transfer and co-creation, any cognitive proximity between academics and company researchers or labs could also play a role. When the academics and business researchers are from the same discipline,[2] their cognitive proximity is high, and when they are from different disciplines, it is low (D'Este et al., 2013, Iammarino and McCann, 2006, Nooteboom, 2000). On the one hand, greater cognitive proximity makes it likelier that collaborators have clear objectives because it increases their ability to absorb each other's knowledge (Brown and Duguid, 2002; Nooteboom et al., 2007). Therefore, high levels of cognitive proximity may favor the *causation* decision-making approach by academics. On the other hand, engaging in novel explorations requires the integration of diverse knowledge bases (Ernst and Bamford, 2005; Nooteboom et al., 2007; Vlaisavljevic et al., 2016). In such instances, low levels of cognitive proximity between collaborators are unavoidable and could therefore result in academics taking the *effectuation* decision-making approach.

According to the discussion, whereas the entrepreneurship literature offers a resource-based argument on the interplay between motivations and decision-making approaches, the engagement-based one developed in this paper (i.e., knowledge transfer or co-creation and cognitive proximity) highlights the contradictions that affect it. These inconsistent

[2] Please note that, even though the term 'sector' is commonly used in relation to businesses, our focus on individual company researchers or labs supports the use of the term 'discipline,' as it aligns with its use in the academic context. The appropriateness of the use of the term discipline is further highlighted since our study focuses on the psychology of 'individual' academics and their interactions with business researchers.

conceptual derivations from the literature stress the need to investigate the complex interplay between the motivations and decision-making approaches of academics engaging with industry.

3. Methodology

For our study, due to the limited theoretical underpinnings and complex and context-bound nature of the motivations and decision-making approaches of academics interacting with businesses (Eisenhardt and Graebner, 2007), we adopted an inductive, qualitative approach. This approach provides a good platform to answer *why* questions (Yin, 2013) and to generate key insights from contextually rich qualitative data (Lincoln and Guba, 1985).

As the context within which to conduct our research, we chose Sri Lanka because it offered a chance to investigate the links between the psychology and individual resource statuses of academics. Research suggests that academics based in Sri Lanka start their engagements under conditions of extreme resource scarcity and that their continued engagement in these activities is evidence of the consequent improvements in their individual resource statuses over time. As the objective of our study was to understand how the interplay between motivations and decision-making approaches varies depending on individual resource statuses, it was important to explore the variation in such resource statuses. As our aim was not to compare engagement with non-engagement, we did not consider our selection of academics who had continuously interacted with businesses, as discussed in detail below, to be a potential source of bias (Rossi et al., 2022). Additionally, our strategy—to compare the psychology of the same academics when engaging in a specific type of activity in resource-constrained and resource-rich situations—increased the comparability between the situations. Finally, the selection of the Sri Lankan context was also driven by the authors' ease of access to the relevant data.

Overall, there are 13 universities in Sri Lanka. As no list of academics who had engaged in knowledge transfer and co-creation activities with businesses was publicly available, we contacted the universities' technology transfer offices (TTOs) to obtain the relevant information. The TTOs further validated the claim made by De Silva (2016) that, in this context, the initial engagement with businesses is predominantly motivated by the desire/need to overcome resource scarcities and that continued engagement reflects the consequent improvement of an individual's resource status, as academics would be unlikely to persevere with such activities otherwise. Therefore, in consultation with the TTOs, which seemed to have a good understanding of academic engagement, we decided to select academics who had started to engage in these activities and had then continued to do so during the previous five years (2017–2012). Interviews were conducted in 2017. We explained to the TTOs the difference between knowledge transfer and co-creation activities while also providing them with examples of IP licensing/selling and joint research projects. It should be noted that, during the interviews, in order to better articulate how the activities of our sample academics could be categorized as involving knowledge transfer or co-creation, we discussed their nature with a focus on engagement and psychology.

Although we were interested in interviewing any academics whose individual resource statuses may have worsened due to engaging in these activities, the TTOs confirmed that there was no evidence of this pattern. This was likely due to two reasons. First, if their resource statuses had not improved over time, the academics would not have continued to engage in these activities beyond the obligations dictated by their traditional academic duties, as they always had the option to only engage in traditional academic duties due to the permanent positions they held. Second, unlike spin-off formation, the risk of failing, or of not succeeding, at securing resources through knowledge transfer and co-creation was minimal as, often, the rewards/financial gains had been contractually agreed upon in advance. Selecting cases based on criteria pertinent to the achievement of research objectives is a strategy commonly adopted in inductive studies (De Silva and Wright, 2019). Thus, as ours was a qualitative study targeting a specific type of engagement over a specific time frame, it was considered appropriate to select a sample that matched its objectives. Based on the above-discussed specific selection criteria, we conducted interviews with 68 academics. Appendix 1.1 illustrates the demographic characteristics of the interviewees. Our sample academics were drawn from six universities in Sri Lanka (Appendix 1.1) and introduced to us by the TTOs. When selecting the 6 universities out of the 13 available ones, we used the age, size (i.e., number of academics and students), and location (i.e., urban versus rural and situated in the capital city of Colombo or not) of the universities as criteria for selection to provide an adequate representation of all the universities in Sri Lanka (i.e., the population) and to avoid sample selection bias. The percentage of female academics in our sample was found to be about 20 %, which is in line with the literature that has discussed significantly low levels of female academic engagement in the types of activities considered in this study (i.e., IP licensing/selling and joint research projects) (Corley and Gaughan, 2005; Halilem et al., 2022; Martin et al., 2015; Whittington and Whittington, 2011).

To the end of understanding psychological aspects at two different points in time, we performed the narrative analysis adopted in similar research (Hayter, 2016). During the interviews, with respect to each activity, we asked our sample academics to mention their motivations for engagement and the decision-making processes they had adopted. Rather than introducing dichotomous variables (i.e., push/pull or causation/effectuation), we encouraged our respondents to explain their motivations and decision-making processes in a narrative style with the aim of coding their responses after the interviews. This was carried out for two main reasons: (1) to gain a context specific and in-depth understanding of the interviewees' psychology and (2) to avoid any bias in relation to their ability to evaluate the distinctions between theoretically defined dichotomous variables. As our focus was on academics who had started to engage in these activities and had continued to do so during the previous five years, the data were comparable without the need to impose any strict and objective resource-level demarcations. Due to the inherent nature of the context in which our respondents had started their engagement—under conditions of resource scarcity—we probed them on how their individual resource statuses had changed over the course of their engagement, and on any changes in their motivations and decision-making approaches. The use of narrative analysis to understand changes in motivations, decision-making approaches, and individual resource statuses has been recommended in past research (Johansson, 2004; Gartner, 2007).

The interviews, which lasted between 45 and 90 min, were transcribed by the authors and reviewed and, where appropriate, corrected by the interviewees to improve accuracy (Huber and Power, 1985). They were then coded independently by two separate researchers, who discussed and agreed upon any differences in collaboration with a third researcher, thus reducing any potential bias. Table 4 illustrates the coding structure (Al-Tabbaa et al., 2022), with the first-order and second-order themes and associated representative quotations. Our use of the existing literature in the coding further improved our study's methodological rigor (Scandura and Williams, 2000).

Our analysis was additionally focused on whether there was evidence that either the respondents' motivations or decision-making processes had changed. These changes were analyzed based on any alignment with changes in individual resource statuses and in the specific characteristics of knowledge transfer and co-creation activities. We also looked at the effect of any additional factors potentially suited to explaining (1) why some academics may adopt push causation (the engagement-based argument), rather than push effectuation (the resource-based argument), to engage in knowledge transfer in resource-constrained circumstances and (2) why some academics may adopt pull effectuation (the engagement-based argument), rather than pull causation (the resource-based argument), to engage in knowledge co-creation in resource-rich circumstances.

Table 4
Coding structure.

Representative quotes	First-order themes	Second-order themes
We are a government funded university. I decided to sell Patent Y to Company X as it offered me extra income. [C 57]	Having insufficient personal income	Push motives
It was important to start somewhere. I was introduced to Company A by L [an alumnus]. *I had no direct links with A. This was the starting point.* [C 46]	Not having a business network	
We did not have enough lab facilities in my department. Collaborative projects with businesses helped us a lot. [C 63]	Having insufficient resources in the uni/department	
We had no government funding, but research-oriented companies were interested in offering us funds to conduct joint work. [C 65]	Not having a research income	
I sold my patent because I did not have the ability or a good network to commercialize it by myself or jointly. [C 58]	Not having an industrial partner capable of commercializing the new product/technology	
Licensing income and joint work with industry were good indicators of professional development. [C 6]	Aiming to achieve career development	Pull motives
Working with Business Z for a few years enabled me to better understand business needs, which I incorporated into my teaching too. [C 2]	Aiming to acquire new knowledge and skills	
Through my industry contacts, I learnt about the many other research opportunities available, which shaped my research trajectory. [C 9]	Aiming to capitalize on a perceived opportunity	
The companies with which licensing agreements were made were open to hiring our students. [C 15]	Aiming to provide a service to students (e.g., lab equipment, industry placements, employment, and other opportunities)	
The more we developed our resources and research base, the more we needed a large-scale research infrastructure to take our work forward. Working with industry on large-scale projects helped us with this. [C 19]	Aiming to make use of industrial resources	
The income generated was reinvested to further improve our resources. [C 24]	Aiming to further improve the resource status of a uni/department/lab	
Further enhancement of these activities offered extra income to the level that it even exceeded my university earnings. [C 23]	A desire for wealth	
As we have now overcome our more pressing needs, working with industry offers us a sense of pleasure and recognition. [C 12]	For personal satisfaction (e.g., networking with people outside the university, independence, social status, and challenge-seeking nature)	
During the initial stages of our third mission's activities, we were in a deprived situation. We had limited types of chemicals in our labs. We did not have the funding to hire a large pool of research assistants. So, when making the decision to work on a joint project with Company Z, we were looking at what was possible with what we had. [C 40]	The decision-making logic of taking a set of means as a given and focusing on the selection of the possible effects that could be brought about with that set of means	Effectuation
It was a multidisciplinary project. It was not clear what the final output would be. We were exploring many things. [C 47]	Less clear goals/having only generalized aspirations	
When we engaged with Company A in the very early stages, we mainly looked at the types of projects in which to engage with the handful of resources and expertise we had. [C 31]	Limited access to resources	
As Company X was from the medical equipment industry and our expertise was in electronics, we were looking at ways to best integrate our respective expertise. There was a lot of uncertainty … We were very careful at the proposal development stage as we wanted to make sure that our project would not fail. It was very important. [C 34]	Criteria for selecting between effects (usually a predetermined level of affordable loss or of acceptable risk related to the given means)	
We have a broader plan as to our expectations regarding our third mission's activities. When selecting a company with which to work, we always try to align with that road map. [C 49]	The decision-making logic of taking particular target effects as a given and focusing on selecting the means needed to bring about those effects	Causation
With licensing, what is required by the company is very clear. [C 27]	A clear goal	
Of course, we turned to this kind of strategic business engagement when we developed our lab facilities to a sufficient level. [C 7]	Abundant resources	
Well, we always check with a few businesses who are likely to enter into licensing agreements with us. We evaluate different options and then go for the company that offers us the highest financial and non-financial benefits. [C 10]	Criteria for selecting the means (usually the maximization of the expected returns in relation to a predetermined goal)	
As my university lacks resources, I tried to engage in joint research projects so that I could make use of industrial resources. [C 20]	Individual resource-constrained statuses	Individual resource statuses
We are a state university and offer undergraduate education free of charge. We did not have enough lab facilities, research funds, or research groups to conduct even our own research. We thus turned to industry. [C 5]		
Joint research projects resulted in improving our lab facilities, other equipment, such as laptops and tools, and access to data. We then increased the size of our team and offered more opportunities for our students to work with us. [C 3]	Individual resource-rich statuses	

(*continued on next page*)

Table 4 (*continued*)

Representative quotes	First-order themes	Second-order themes
The income generated from licensing helped us to buy an abundance of the chemicals, equipment, and other resources required to conduct high-quality research. [C 51]		

4. Results

Our results are presented in this section, initially in relation to how our sample academics discussed the changes in the statuses of their individual resources and, consequently, in their motivations. Then, the interplay between motivations and decision-making approaches is discussed in relation to how and under what circumstances resource- and engagement-based arguments explain it.

4.1. Improvements in the resource statuses of academics

The answers provided by our interviewees evidenced that they had started engaging in knowledge transfer and co-creation activities under conditions of heavy resource scarcity. For instance, some stated, "*we did not have enough chemicals in our labs*" [C 61] and "*as we offer undergraduate degrees free of charge, government funding was not enough for us to at least provide good quality teaching or research*" [C 1]. The analysis highlighted that our sample academics considered engaging in knowledge transfer and co-creation activities as a way of increasing their individual research statuses. In terms of resource statuses, it was interesting to observe that most of our sample academics held Ph.D.s from world-leading, reputable universities, which highlighted how the types of resources they had lacked during their initial engagements were often technological (e.g., lab facilities), financial (e.g., funding to conduct research), and social (e.g., the industry contacts required for commercialization).

Once they had begun to engage in knowledge transfer and co-creation activities, their resource statuses seemed to improve. For instance, they mentioned that "*the income generated from licensing helped us to buy an abundance of the chemicals, equipment, and other resources required to conduct high-quality research*" [C51]. In addition, one academic stated the following:

"*We have engaged in several joint research projects with Business X, with which we have a joint research lab in the university. As a result, we gained access to a lot of industrial personnel, research funding, and industrial-scale R&D facilities. This has helped us immensely in improving our teaching programs as well as in engaging in research, resulting in publications with business impacts.*" [C 41].

Further confirming the findings of De Silva (2016) and the initial ones gleaned from the TTOs, it also became apparent that our sample academics would not have continued to engage in these activities had their resource statuses not improved. Our interviewees mentioned, "*anyway, as academics, we have steady jobs. Therefore, unless we are offered an income, research funding, or access to other types of resources, we will not engage in these activities*" [C 37]. Our findings thus suggest that those academics who had engaged with businesses had persisted with their engagements, resulting in improvements in their resource statuses. These findings also highlight the appropriateness of our approach to the analysis of the changes in academic psychology that accompany improvements in individual resource statuses.

4.2. Changes in motivations with improvements in individual resource statuses

It was apparent that, under resource-constrained individual circumstances, our sample academics had initially been largely motivated by 'push' factors, regardless of whether they had engaged in knowledge transfer or co-creation. In regard to what had motivated them once their resource availability had improved, our sample academics predominantly mentioned 'pull' factors. This finding is interesting: while motivations have generally been conceived as 'static' in university-business interaction literature (Azagra-Caro et al., 2017; Barberá-Tomás et al., 2022; Bozeman and Gaughan, 2011), our analysis reveals the dynamic nature of motivations (i.e., clear evidence of change). We illustrate this change through the representative quotation presented below. Our interpretations are presented in parentheses for greater clarity.

"*My decision to engage in joint research projects with the industry was driven by* ***not having adequate resources in the university to conduct research*** [a push motive]. *Our resources were so limited* [resource scarcity]. *Therefore, we had no way of conducting research without interacting with businesses. We used the income generated from these activities* ***to improve our lab facilities***; *the engagement helped me to develop a* ***better network of contacts*** *as well as my knowledge of the industry* [achieving resource improvement] … ***With the improvement of our resource status*** [improved resources], ***further engagement was driven by the need to make use of my expertise*** *and to do something that would have a greater impact … I also feel that I now receive higher recognition* [pull motives]." [C 45].

Table 5 provides additional illustrative quotes that indicate how our sample academics' motivations for engaging in knowledge transfer and co-creation activities changed from 'push' to 'pull' factors with the greater availability of resources.

Our findings on the change in motivations shed light on the apparent contradiction found in the literature in relation to 'pull' and 'push' motives. Whereas some previous studies show that, in developing countries, such as the setting of our study, general entrepreneurs are mainly motivated by 'push' factors (Wright et al., 2004; Bosma and Harding, 2007), others found that they are motivated by a mix of 'pull' and 'push' ones (Morales-Gualdrón et al., 2009; Weatherston, 1993). Our findings on the shift from 'push' to 'pull' factors suggest that both types of motivations can exist, depending on individual resource statuses (as opposed to the resource status of a country). Our findings support the results of a few studies from the general entrepreneurship literature, which affirm that motivations may change over time (De Silva and Kodithuwakku, 2011). Yet, these studies did not refer to individual resource statuses. Accordingly, we make an original contribution to the university-business interaction literature by specifically outlining how the motivations to engage in knowledge transfer and co-creation activities change with improvements in individual resource statuses.

4.3. Knowledge transfer in the initial resource-constrained situations: contradictory resource-based and engagement-based arguments

In the initial, limited-resource stages of engagement in knowledge transfer activities, when all our sample academics had been motivated by push motives, some of them had taken effectuation approaches (70.6 %) and others causation ones (29.4 %) (Appendix 1.2).

Push effectuation – "*I just joined the faculty soon after completing my Ph.D. [in the US]. During my Ph.D., we had a lot of lab facilities.* ***But here it was different. I was struggling*** [a push motive]. *I had a meeting with my colleagues in the department, and we decided to find mechanisms to license or sell the technology that we had.* ***We performed some analyses to see which companies might benefit from it. We then approached a few*** [i.e., the decision-making logic of focusing on the selection of the possible effects that can be brought about with a set of means – effectuation]. *Initially, we did not have many positive responses. Yet, Company X decided to work with us on a small project.*" [C 21].

Push causation – "*We had been making huge efforts to develop Technology Z. We had clearly seen its potential for commercialization. Yet,* ***we did not have enough industrial scale resources*** [for

Table 5
Changes in the motivations of academics: illustrative quotes.

	Illustrative quotes: changes in motivations from push to pull factors (The emphasis and the information in parentheses were added by the authors for clarity)
Knowledge transfer activities. Transferring knowledge in the form of university-developed technologies or IP	"*We started developing these technologies by ourselves as there was no possibility of collaboration with industry … **No one knew us*** [a push motive, resource scarcity] *… We have now built our reputation and recognition … it's now very interesting to see the demand for what we develop. We now respond to the demand* [pull motives]." [C 44] "*We went from **having no contact with industry and few resources*** [resource scarcity, a push motive] ***to businesses contacting us to** license our Y* [patent] *during the last four years. These changes definitely resulted in us **changing our reasons for interacting** with businesses.*" [C 60]
Knowledge co-creation activities. Co-creating knowledge in joint research projects	"*As my **university lacks resources*** [resource scarcity]*, I try to engage in joint research projects so that I can make use of industrial resources* [a push motive] *… After my initial successes, later engagements were driven by my need to provide opportunities to students and to access industrial-scale resources* [pull motives]. *… joint research projects resulted in us **improving our lab facilities, other equipment, such as laptops and tools, and access to data*** [improved resources]. *We then increased the size of our team and **offered more opportunities** for our students to work with us* [pull motives]." [C 52] "***Our [university] labs were very poor*** [resource scarcity] *… we are a publicly funded university … we provide free education … we were lucky to get the opportunity to start this joint research lab … it was very small at the beginning. We use lab facilities to engage in joint research … over time, we have grown in terms of **size, resources*** [improved resources], *and output quality … the lab now provides us with the opportunity to develop our research profile … we provide an amazing service to our students* [pull motives] *… looking back, it's such a pleasure to see where we are now… funding from the government was not sufficient to maintain a lab. The joint research lab helped us to buy the **necessary chemicals, equipment, tools, and other resources** required to conduct high-quality research* [improved resources]." [C 68]

commercialization] [a push motive]. *Therefore, we thought of selling it to a company. Yet, we were very clear from the beginning that we would carefully select **a company with which we could develop long-term** collaborations. We knew how we would have liked things to evolve. Therefore, selling Technology Z was **just the first stage of the plan*** [decision-making logic of focusing on the selection of means to create a targeted effect – causation]." [C 26].

A further analysis of these two groups (i.e., those that had adopted push causation or push effectuation) revealed that the level of cognitive proximity between the academic and business researchers (i.e., whether or not they were operating within the same discipline) was a factor suited to explaining their different approach adoption choices. Even though knowledge transfer has clear goals and involves linear and familiar processes—suggesting push causation—during resource-constrained situations in which the cognitive proximity between partners is low, our sample academics were found to have taken a push-effectuation approach. When they and their company counterparts were from different disciplines, they had less understanding of the potential use of their licensed/sold technology; therefore, they had often entered into agreements based on effectuation logic (the decision-making logic of focusing on the selection of the possible effects that can be brought about with a set of means). An example of push effectuation is represented by the licensing of a patent held by an engineering faculty to a company in the medical sector.

> "*We* [the engineering faculty] *had Technology A, which had **potential applications in the medical industry*** [low cognitive proximity]. *As we **did not have the resources** needed to engage in research* [a push motive]*, we decided to sell it to Medical Company 'A' because its offer was conducive to **obtaining research funding and equipment that we were lacking*** [i.e., a push motive] … [when asked why they decided to sell the technology to Company A] *We simply looked at the technology that we had* [when prompted if academics looked into what the company could bring to them] *but **didn't consider any future value the company could bring to us.** Now, looking back, we did not have a goal in relation to the future development of the technology or of our interaction with Company A* [effectuation]… [when asked why] … *it was impossible because we did not have a good understanding of the medical industry, as we are an engineering faculty* [low cognitive proximity]." [C 56].

However, when cognitive proximity was high, our sample academics had adopted push causation to engage in knowledge transfer in resource-constrained situations. Despite resource scarcities, the clarity of the goal associated with knowledge transfer as well as the familiarity and linearity of the process had enabled our sample academics to use knowledge transfer to overcome negative circumstances (i.e., a push motive) in a more planned manner (i.e., causation). When deciding to engage in licensing agreements, those who had adopted push causation had often looked at the value that specific companies could bring to the individual and the organization. The engagement had been carefully evaluated and structured to be able to fulfil the strategic direction of the university.

> "*When I joined University Z after completing my Ph.D. from University Y* [a highly reputed university in the US]*, the **reality of the research funding and resources available here*** [Sri Lanka] ***was so depressing.** I could not continue my research. Therefore, I decided to enter into a licensing agreement with Company M* [a push motive] *… I adopted quite **an intensive process** when selecting a company with which to enter into the licensing agreement. Even though the immediate goal was to have some research income to continue my research* [a push motive]*, I wanted to make sure **that the agreement aligned with my future research ambitions**. I carefully evaluated different companies. In fact, I had to develop the technology further before entering into the licensing agreement with Company M* [causation] *… I think that I made the right decision as I still work closely with Company M. As we are **from the same field**, we found multiple mutually beneficial ways to continue our collaboration* [high cognitive proximity]." [C 13].

These results thus suggest that, in individual resource-constrained circumstances, academics engaging in knowledge transfer adopt either push effectuation or push causation depending on whether the level of cognitive proximity with their business partners is low or high, respectively. The literature on entrepreneurship has discussed how resource scarcity is linked to push effectuation (Gilad and Levine, 1986; Wiltbank et al., 2009) but not to push causation. Therefore, our study makes an original contribution by revealing the influence of the specific characteristics of knowledge transfer and cognitive proximity on the psychology of academics. Moreover, we make the following two propositions in

relation to the psychology of academics engaging in knowledge transfer during individual resource-constrained circumstances.

Proposition 1A. *Academics who are in individual resource-constrained environments adopt push effectuation when engaging in knowledge transfer with cognitively distant business partners.*

Proposition 1B. *Academics who are in individual resource-constrained environments adopt push causation when engaging in knowledge transfer with cognitively proximate business partners.*

4.4. Knowledge transfer in the ensuing resource-rich situations: aligned resource-based and engagement-based arguments

Once the academics' access to resources had improved, their motivations changed to being determined by 'pull' factors. In these later stages characterized by better access to resources, almost all our sample academics seemed to take causation approaches when engaging in knowledge transfer activities. It became evident that, over time, those academics had organized themselves into large groups and had evaluated means to engage in knowledge transfer activities on the basis of the ability of these to generate future value, socio-economic impacts, opportunities for students, career developments for themselves, etc., as shown in the representative quotation below (emphasis by the authors for clarity):

> "*As a result of our continuous engagement, our income increased, we were able to buy resources for our lab, and, of course, I gained more knowledge and skills.* ***Unlike in the initial stages, when I was struggling with limited lab facilities, I can now target specific companies*** [with which to arrange licensing agreements/sell IP]. ***Now, I always look at the return on investment*** [causation] … *As academics, we need to have immediate impacts on society … I am also keen to secure opportunities for my students* [pull motives]." [C 16].

The analysis suggests that when academics acquire sufficient resources they only engage strategically in further knowledge transfer activities. Hence, this evidence suggests that pull motives and causation approaches align well once an academic's access to resources has improved. This transition from effectuation to causation is aligned with Sarasvathy's (2001) argument that although, during the early stages, entrepreneurs may adopt effectuation approaches, they are then likely to adopt causation ones with the development of their ventures. Our study, in addition to the resource-based arguments offered in the literature, provides an engagement-based motive. Under resource-rich circumstances, the clarity of one's goals and linearity and familiarity with knowledge transfer (i.e., an engagement-based argument) and resource richness (i.e., a resource-based argument) both suggest pull causation. Therefore, when there is no inconsistency between engagement- and resource-based arguments, cognitive proximity does not play a role. This leads to our third proposition.

Proposition 1C. *Academics in individual resource-rich environments adopt pull causation when engaging in knowledge transfer.*

4.5. Knowledge co-creation in the initial resource-constrained situations: aligned resource-based and engagement-based arguments

In the initial stages, when access to resources was limited, our sample academics' engagement in knowledge co-creation activities was motivated entirely by push factors and their decision-making approach was based on effectuation. As knowledge co-creation involves the establishment of close working relationships, our sample academics mentioned that, when their resources were extremely limited, their engagements had been entirely shaped by such limitations. This can be seen in the representative quotation below (emphasis by the authors for clarity):

> "*Carrying out joint research projects requires a lot of resource commitments from us.* ***Companies were not interested in collaborating with us if they could not be expected to obtain significant value.*** *It is a major commitment for companies as well. Therefore, companies did not want to engage in joint work with us unless we were seen as being strong. The only way we had of conducting our own research was by engaging with a company. Therefore, in joint research projects, we tried to decide on our engagement on the basis of the* [limited but strong] ***resources we had*** [push effectuation]. *During the initial stages, the main resource we had was our expertise.*" [C 29].

As, inherently, knowledge co-creation has relatively less precise goals compared to knowledge transfer, resource scarcity and the complexity of the knowledge co-creation process result in academics making decisions in accordance with effectuation logic (i.e., focusing on the selection of the possible effects that can be brought about with a given set of means) in order to overcome any negative circumstances (a push motive). The psychology of academics engaging in knowledge co-creation under resource-constrained circumstances aligns with the entrepreneurship literature, which has discussed how resource scarcity is linked to push effectuation (Gilad and Levine, 1986; Sarasvathy, 2001; Wiltbank et al., 2009). Yet, we contribute to the literature by unveiling the effect of the complexity and vague goals of the knowledge co-creation process, compared to knowledge transfer (i.e., an engagement-based argument), on their psychology to adopt push effectuation. This leads to our next proposition.

Proposition 2A. *Academics who are in individual resource-constrained environments adopt push effectuation when engaging in knowledge co-creation.*

4.6. Knowledge co-creation in the ensuing resource-rich situations: contradictory resource-based and engagement-based arguments

Having acquired the resources they needed, some of our participants had shifted toward pull causation (77.9 %), while others had adopted pull effectuation (22.1 %) (Appendix 1.2). This finding—that, even after having acquired sufficient resources and being motivated by 'pull' factors, some of the sample academics engaged in knowledge co-creation had still taken effectuation approaches to decision-making—intrigued us. Further analysis revealed that those who had changed to pull causation had engaged with business researchers with high cognitive proximity, while those who had adopted pull effectuation had engaged with business researchers with low cognitive proximity. While resource-richness and pull motives had generated room for more planned and strategic co-creation with businesses, low levels of cognitive proximity between academic and business partners meant that they had still been relying on effectuation approaches. As they both had a lack of understanding of the possibilities in each field, the integration of their respective knowledge had occurred in a more exploratory manner, without clearly specified goals. Hence, these engagements had tended to be long-term ones aimed at making breakthrough discoveries; decisions had thus been made through inductive, iterative, and incremental processes or, in other words, by taking a pull-effectuation approach, as illustrated below (emphasis by the authors for clarity):

> "*I* [an engineering academic] *work with Company X* [a company in the medical industry]. *But, as you may imagine, it takes a very long time to get any output. We are very keen to collaborate with them as we gain access to industrial level resources …* ***There are a lot of opportunities*** *to use our expertise to develop new technologies of value to the medical industry* [a pull motive]. *But we* [the company and the university/ academics] *are both patient and* ***keep on experimenting*** *…* ***it involves a bit of trial and error*** *…* ***and, of course, it is dependent upon the resources that we have*** *…* ***that is the nature of this type of work*** [effectuation]." [C 11].

However, despite the complexity of knowledge co-creation, those

partners who had high levels of cognitive proximity seemed to have adopted a pull-causation approach. Cognitive proximity had resulted in them having a greater mutual understanding of the potential outcomes of their projects and, thus, in them being able to engage in the planned activities. The inherent vagueness of knowledge co-creation had been reduced through cognitive proximity. A representative quotation is illustrated below (emphasis by the authors for clarity):

> "*Company Z and our team* [both involved in computer engineering – high cognitive proximity] *decided to engage in this joint research project as we saw the potential of combining our expertise and resources to resolve a major industrial challenge. As the project was research oriented, we also* ***had the opportunity to publish papers. As you know, this is crucial for achieving recognition in the field*** [a pull motive]. *We had worked with each other previously, and our strengths were complementary … When making the decision to engage in the joint project, we evaluated its potential in terms of it resulting in a joint research lab being established on our premises. This was an ambition that we had had for a very long time. When deciding the scope of the joint project, we made sure that the project consisted of specific dimensions that* ***could be scaled up in the form of a joint research lab*** [causation]." [C18].

Our results thus suggest that, under individual resource-rich circumstances, academics engaging in knowledge co-creation adopt either pull effectuation or pull causation depending on whether the level of cognitive proximity with their business partners is low or high, respectively. While the literature on entrepreneurship has discussed how resource richness is linked to pull effectuation (Gilad and Levine, 1986; Sarasvathy, 2001; Wiltbank et al., 2009), our study makes an original contribution by outlining the influence of specific characteristics of knowledge co-creation and cognitive proximity on the psychology of academics (i.e., an engagement-based argument). We thus present the following two propositions in relation to the psychology of academics engaging in knowledge co-creation under individual resource-rich circumstances.

Proposition 2B. *Academics who are in individual resource-rich environments adopt pull causation when engaging in knowledge co-creation with cognitively proximate business partners.*

Proposition 2C. *Academics who are in individual resource-rich environments adopt pull effectuation when engaging in knowledge co-creation with cognitively distant business partners.*

To summarize (see Table 6 and Fig. 1), academics engaging in knowledge transfer under individual resource-constrained circumstances adopt either push effectuation or pull causation, depending on whether the level of cognitive proximity with their business partners is low or high, respectively. When engaging in knowledge co-creation in individual resource-rich environments, academics adopt either pull effectuation or pull causation depending on whether the level of cognitive proximity with their business partners is low or high, respectively. Regardless of cognitive proximity levels, in individual resource-constrained situations, academics adopt push effectuation for co-creation, and, in individual resource-rich ones, they adopt pull causation for knowledge transfer.

5. Discussion and conclusions

5.1. Theoretical implications

Despite the growing body of literature on the motivations of academics to interact with businesses (Azagra-Caro and Llopis, 2017, Bozeman and Gaughan, 2011, van Rijnsoever et al., 2008, Lam, 2011, D'Este and Perkmann, 2011), there is a lack of focus on the study of the interplay between their motivations and decision-making approaches. Whereas motivations indicate intentions, decision-making approaches define behaviors; thus, the interaction between these two key dimensions offers an in-depth understanding of the psychology of academics collaborating with businesses (Balven et al., 2018).

Notably, the entrepreneurship literature has offered a *resource-based* argument in terms of explaining the correlation between entrepreneurs' motivations (Bosma and Harding, 2007) and decision-making approaches (Fisher, 2012; Jiang and Rüling, 2019). However, merely extending these insights to the idiosyncratic interactions between academics and business researchers would be an oversimplification that could yield incorrect predictions. This is because different types of engagement (i.e., knowledge transfer versus knowledge co-creation) entail differences in the objectives, involvement, and outcomes (De Silva and Rossi, 2018, Rossi et al., 2022) that likely influence the interplay (Fini and Toschi, 2016; Balven et al., 2018). Further, even though the psychology of academics engaging with businesses has been studied fundamentally through a rather static lens (Perkmann et al., 2013), it has been argued that both motivations and decision-making approaches may change along the entrepreneurial journey (Schjoedt and Shaver, 2007, Sarasvathy, 2001, Shane et al., 2003). The question of how the interplay between them may change when academics' circumstances change from resource-constrained to resource-rich ones still lacks an adequate answer (cf., Hayter et al., 2018).

By addressing the above complexity, we have made an original contribution to the literature by introducing a new *engagement-based* argument—in conjunction with a *resource-based* one—suited to offering a more accurate prediction of motivation and decision-making approaches. In doing so, we were able to identify various situational contingencies (comprising multiple alternatives for the effects of individual resource status and engagement types) that we articulated in a set of propositions. Together, our conceptualization and accompanying propositions provide a solid conceptual framework that demonstrates how the *engagement-* and *resource-based* arguments can jointly explain the interplay of the motivations and decision-making approaches of academics engaging with businesses.

Table 6
The discrepancy in the interplay between motivation and decision-making: a summary.

Mode of interaction	Individual resource status	Cognitive proximity	Interplay between motivation and decision-making	Related proposition no.
Knowledge transfer	Resource constrained	Low	Push effectuation	1A
		High	Push causation	1B
	Resource rich	Not applicable	Pull causation	1C
Knowledge co-creation	Resource constrained	Not applicable	Push effectuation	2A
	Resource rich	High	Pull causation	2B
		Low	Pull effectuation	2C

Grey shade indicates the interplay of motivation and decision-making and associated propositions.

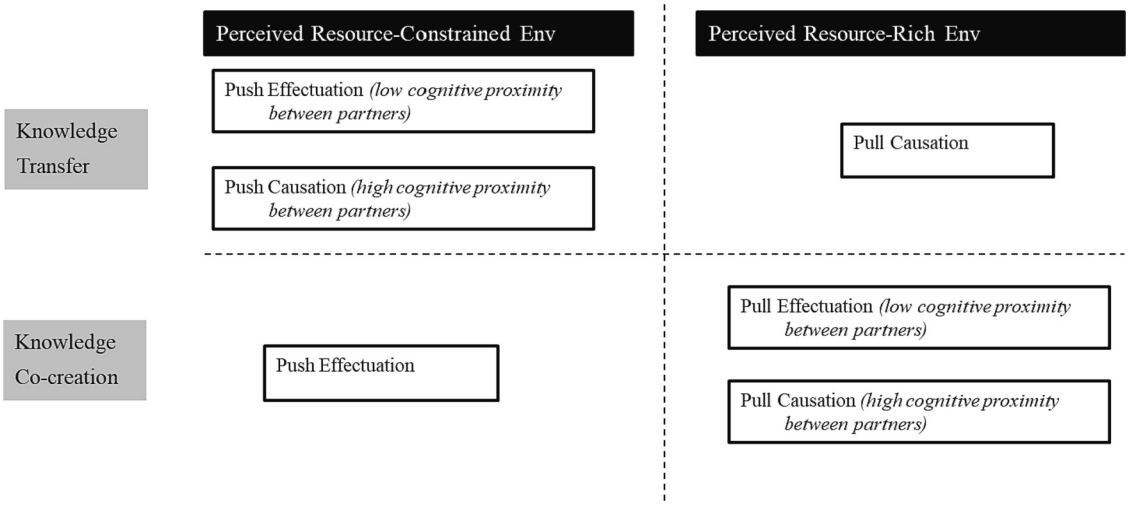

Fig. 1. Key findings on the interplay between motivation and decision-making.

More specifically, although the entrepreneurship literature has argued that push motives and effectuation decision-making will be dominant in resource-constrained situations and that pull motives and causation decision-making will be superior in resource-rich ones (Bosma and Harding, 2007; Fisher, 2012; Jiang and Rüling, 2019), we offer important deviations in relation to the uniqueness of university-business interactions. First, although the *resource-based* argument predicts push effectuation in resource-constrained situations, we highlight how the effect of the clarity of the objectives of knowledge transfer activities and the cognitive proximity of academic and business partners (an engagement-based argument) offers a more comprehensive understanding of that prediction. Accordingly, in individual resource-constrained situations, academics engaging in knowledge transfer also adopt push causation (besides the expected push effectuation) when the level of cognitive proximity with their business partners is high. Second, whereas the resource-based argument predicts pull causation in resource-rich situations, we highlight how the relative vagueness of the objectives of knowledge co-creation activities and the cognitive proximity of academic and business partners (an engagement-based argument) offer a more accurate prediction. Accordingly, in individual resource-rich situations, academics engaging in knowledge co-creation also adopt pull effectuation (besides the expected pull causation) when the cognitive proximity with their business partners is low. These two deviations from the entrepreneurship literature arise due to inconsistencies between the resource- and engagement-based arguments. In such instances, the cognitive proximity between academics and business researchers provides a solution.

However, when the resource- and engagement-based arguments align, we found no deviations from the entrepreneurship literature. For instance, in individual resource-constrained situations, academics use push effectuation for co-creation. This is because both the lack of resources (a resource-based argument) and the relative vagueness of co-creation objectives (an engagement-based argument) suggest push effectuation. Similarly, in individual resource-rich situations, academics adopt pull causation for knowledge transfer due to the resource richness (a resource-based argument) and the clarity of the objectives of knowledge transfer (an engagement-based argument). Accordingly, the key original contribution made by our study to the university-business interaction literature lies in its identification of how the interplay between the motivations and decision-making approaches of academics engaged in interactions with businesses varies based on the type of interaction (i.e., knowledge transfer or co-creation) and on the level of cognitive proximity with their business partners.

5.2. Practical and policy implications

The consideration of the motivations and decision-making approaches of academics engaging with businesses opens up a policy-oriented discussion that goes beyond offering purely economic incentives and standardized support. The differences in relation to the interplay between the two suggest that a 'one-size-fits-all' model is unlikely to be appropriate (Perkmann et al., 2021). In this section, in an attempt to offer implications for public institutions who are keen to optimize university-industry interactions and build on the micro-foundations (Jain et al., 2009), we thus consider the circumstances under which each type of interplay is most likely to occur (Fischer et al., 2019) and the different ways in which engagement should be supported under distinct circumstances. Accordingly, we discuss below the implications of our findings with regard to how universities could offer customized training, rewards, and support structures based on four types of interplay between motivation and decision-making approaches (i.e., push effectuation, push causation, pull effectuation, and pull causation).

First, *push effectuation* is dominant in *resource-constrained* situations when academics engage in (A) *knowledge transfer* with *cognitively distant* business partners (e.g., an engineering academic offering a licensing contract to a medical sector business/lab) and (B) *knowledge co-creation* regardless of cognitive proximity (e.g., joint research projects under conditions of resource scarcity). Under these circumstances, it is important to offer (1) support structures that minimize the risk of failure (as effectuation increases the risk) and (2) training in effectuation-type engagement (e.g., action-oriented research suited to effectuation). As push effectuation is unlikely to result in strategically planned actions—as it involves the exploration of objectives based on available resources—it is the overcoming of resource scarcities by academics (a push motive) that should be rewarded. Also, universities could help academics in identifying any possible applications of their existing technologies to other multiple disciplines (i.e., effectuation in the transfer of knowledge with cognitively distant partners) and joint projects based on the resources at hand (i.e., effectuation in the co-creation of knowledge).

Second, *push causation* is evident when academics in *resource-constrained* situations engage in *knowledge transfer* with *cognitively proximate* businesses partners (e.g., an academic specializing in electronics selling a license to a business lab within the same discipline). Therefore, when knowledge and technologies are transferred to company researchers/labs operating within the same discipline, academics should be supported and encouraged to take a strategic approach by looking at the potential future value of possible business partners and aligning such

interaction with the broader engagement plans of the department and university. Therefore, universities operating in resource-constrained environments could devote greater efforts to engaging in knowledge transfer toward business labs operating in pertinent disciplines as a tool suited to overcoming any resource scarcities.

Third, pull effectuation is likely to occur when academics in *resource-rich* situations engage in *knowledge co-creation* with *cognitively distant* business partners (e.g., academics in medicine engaging in a joint project with a business lab in mechanical engineering). Under such circumstances, the offering of rewards and support suited to enabling them to satisfy pull motives, such as opportunities for career growth, personal satisfaction, and upscaling, would encourage the engagement. Support aimed at mitigating risks (i.e., as effectuation carries high risk) and developing skills in action-oriented (i.e., the types of skills required for effectuation], multidisciplinary (i.e., due to cognitive distance) research is also required. As effectuation is involved when research councils make decisions on funding dedicated to knowledge co-creation, it is important to recognize the potential vagueness associated with the related research proposals.

Fourth, academics in *resource-rich* situations adopt *pull causation* when engaging in (A) *knowledge co-creation* with *cognitively proximate* business partners (e.g., academics and business researchers from electrical engineering engaging in a joint project) and (B) *knowledge transfer* regardless of cognitive proximity (i.e., academics selling IP to business labs from the same or different disciplines). Hence, under such circumstances, it is of paramount importance to support academics in aligning their engagements with departmental and university strategic road maps (i.e., as causation allows planning). Therefore, the rewards should be based on the extent to which academics support the achievement of these strategic directions. Academics should be encouraged to evaluate the future value of potential partners and select engagements that have the potential to increase the return on investments (i.e., a characteristic of causation decision-making).

As such, when incentivizing and supporting university-business interactions, it is important to enact university policies and practices that consider the influence of the type of interaction, individual resource status, and cognitive proximity level of the academic and business partners on the interplay between motivations and decision-making approaches.

5.3. Limitations and future research

Our study is not without limitations. First, it focused on a single-country setting; thus, similar research in other contexts is needed to achieve rigorous theory development. Second, the findings of our study, which were based on a narrative analysis, could be further validated through longitudinal research. Third, while we looked at broader categories of motivations and decision-making approaches and at some individual characteristics, a more comprehensive analysis could be performed by focusing on specific elements of motivation and other independent variables at the institutional and macro levels. Fourth, we looked at changes in resource statuses that had occurred over a five-year period, and the development of such statuses may thus have overlapped with career advancement stages. We tried to minimize such influences by selecting academics who had started their engagements under conditions of resource scarcity and had persevered with them owing to improvements in these conditions. Moreover, Sri Lankan academia does not operate a tenure system, and lecturers are appointed on a permanent basis. Additionally, in our findings section, we offered quotations that clearly explained the link between changes in individual resource status and those in motivation and decision-making approaches. Nevertheless, future quantitative studies could control for the influence of career development on individual resource statuses. Fifth, we offer a foundation upon which future studies could perform a detailed analysis of the psychology of academics engaging with businesses. Considering the significance of generating business and social value from academic research, it is important to build on our work to the end of uncovering how explicitly psychological factors should be taken into consideration by academic institutions when making crucial decisions on academic training, rewards, promotions, and support for research and engagement. Finally, and more importantly, the core finding of our study in relation to explaining how resource- and engagement-based arguments jointly offer a more accurate explanation of the interplay between motivations and decision-making approaches could be tested in several other domains (e.g., the entrepreneurship literature) in order to offer a more accurate explanation of the psychology.

CRediT authorship contribution statement

Muthu De Silva: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition. **Omar Al-Tabbaa:** Conceptualization, Methodology, Writing – review & editing. **Jonathan Pinto:** Conceptualization, Methodology, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

Acknowledgement

We would like to convey our heartiest gratitude to the editor Prof Ben Martin and three anonymous reviewers, whose comments have significantly improved the paper. We also gratefully acknowledge the funding offered by the Birkbeck School of Business, Economics and Informatics to conduct this project.

Appendix 1.1. The demographic characteristics of the interviewed academics

University A- 9 academics; University B- 21 academics; University C- 15 academics; University D- 12 academics; University *E*- 6 academics; University F- 5 academics.

Case number	Faculty	Department	Position	Gender	University
1	Faculty of Engineering	Department of Civil Engineering	Lecturer	Female	C
2	Faculty of Agricultural Sciences	Department of Agribusiness Management	Lecturer	Female	E
3	Faculty of Information Technology	Department of Information Technology	Lecturer	Female	B
4	Faculty of Medicine	Department of Clinical Medicine	Lecturer	Female	D

(*continued on next page*)

(*continued*)

Case number	Faculty	Department	Position	Gender	University
5	Faculty of Science	Department of Plant Science	Senior Lecturer	Female	A
6	Faculty of Engineering	Department of Civil Engineering	Senior Lecturer	Female	B
7	Faculty of Dental Sciences	Division of Microbiology	Senior Lecturer	Female	C
8	Faculty of Agricultural Sciences	Department of Export Agriculture	Senior Lecturer	Female	E
9	Faculty of Livestock Fisheries and Nutrition	Department of Food Science & Technology	Senior Lecturer	Female	F
10	Faculty of Engineering	Department of Electronics and Telecommunication Engineering	Professor	Female	B
11	Faculty of Engineering	Department of Computer Science and Engineering	Professor	Female	B
12	Faculty of Engineering	Department of Computer Science and Engineering	Professor	Female	B
13	School of Computing	Department of Computation and Intelligent Systems	Lecturer	Male	A
14	School of Computing	Department of Information Systems Engineering	Lecturer	Male	A
15	Faculty of Engineering	Department of Electrical Engineering	Lecturer	Male	B
16	Faculty of Engineering	Department of Mechanical Engineering	Lecturer	Male	B
17	Faculty of Agriculture	Department of Animal Science	Lecturer	Male	C
18	Faculty of Engineering	Department of Computer Engineering	Lecturer	Male	C
19	Faculty of Science	Department of Physics	Lecturer	Male	D
20	Faculty of Agriculture	Department of Biotechnology	Lecturer	Male	F
21	Faculty of Agricultural Sciences	Department of Livestock Production	Lecturer	Male	E
22	Faculty of Medicine	Department of Community Medicine	Senior Lecturer	Male	F
23	Faculty of Engineering	Department of Electronics and Telecommunication Engineering	Senior Lecturer	Male	B
24	Faculty of Medicine	Department of Clinical Medicine	Senior Lecturer	Male	A
25	Faculty of Science	Department of Plant Science	Senior Lecturer	Male	A
26	School of Computing	Department of Information Systems Engineering	Senior Lecturer	Male	A
27	Faculty of Engineering	Department of Civil Engineering	Senior Lecturer	Male	B
28	Faculty of Engineering	Department of Civil Engineering	Senior Lecturer	Male	B
29	Faculty of Engineering	Department of Computer Science and Engineering	Senior Lecturer	Male	B
30	Faculty of Agriculture	Department of Agricultural Economics and Business Management	Senior Lecturer	Male	C
31	Faculty of Agriculture	Department of Agricultural Engineering	Senior Lecturer	Male	C
32	Faculty of Agriculture	Department of Agricultural Extension	Senior Lecturer	Male	C
33	Faculty of Engineering	Department of Civil and Environmental Engineering	Senior Lecturer	Male	D
34	Faculty of Engineering	Department of Electronic and Electrical Engineering	Senior Lecturer	Male	C
35	Faculty of Science	Department of Physics	Senior Lecturer	Male	C
36	Faculty of Agriculture	Department of Biotechnology	Senior Lecturer	Male	F
37	Faculty of Agriculture	Department of Agricultural Economy	Senior Lecturer	Male	D
38	Faculty of Engineering	Department of Civil and Environmental Engineering	Senior Lecturer	Male	D
39	Faculty of Veterinary Medicine and Animal Science	Department of Veterinary Pathobiology	Senior Lecturer	Male	D
40	Faculty of Science	Department of Chemistry	Senior Lecturer	Male	D
41	Faculty of Agricultural Sciences	Department of Agribusiness Management	Senior Lecturer	Male	E
42	Faculty of Agricultural Sciences	Department of Livestock Production	Senior Lecturer	Male	E
43	Faculty of Agricultural Sciences	Department of Livestock Production	Senior Lecturer	Male	E
44	School of Computing	Department of Computation and Intelligent Systems	Senior Lecturer	Male	A
45	School of Computing	Department of Information Systems Engineering	Senior Lecturer	Male	A
46	Faculty of Medicine	Department of Community Medicine	Senior Lecturer	Male	F
47	Faculty of Medicine	Department of Clinical Medicine	Professor	Male	A
48	Faculty of Medicine	Department of Community Medicine	Professor	Male	A
49	Faculty of Architecture	Architecture	Professor	Male	B
50	Faculty of Architecture	Architecture	Professor	Male	B
51	Faculty of Engineering	Department of Electronics and Telecommunication Engineering	Professor	Male	A
52	Faculty of Engineering	Department of Civil Engineering	Professor	Male	C
53	Faculty of Engineering	Department of Civil Engineering	Professor	Male	B
54	Faculty of Engineering	Department of Civil Engineering	Professor	Male	B
55	Faculty of Engineering	Department of Civil Engineering	Professor	Male	B
56	Faculty of Engineering	Department of Computer Science and Engineering	Professor	Male	B
57	Faculty of Engineering	Department of Electrical Engineering	Professor	Male	B
58	Faculty of Engineering	Department of Electrical Engineering	Professor	Male	B
59	Faculty of Engineering	Department of Textile and clothing technology	Professor	Male	B
60	Faculty of Agriculture	Department of Agricultural Engineering	Professor	Male	C
61	Faculty of Agriculture	Department of Soil Science	Professor	Male	C
62	Faculty of Engineering	Department of Civil Engineering	Professor	Male	B
63	Faculty of Science	Department of Chemistry	Professor	Male	C
64	Faculty of Science	Department of Chemistry	Professor	Male	C
65	Faculty of Veterinary Medicine and Animal Science	Department of Veterinary Pathobiology	Professor	Male	C
66	Faculty of Agriculture	Department of Agricultural Economy	Professor	Male	D
67	Faculty of Agriculture	Department of Agricultural Engineering	Professor	Male	D
68	School of Computing	Department of Information Systems Engineering	Professor	Male	A

Appendix 1.2. Statistics on the interplay between motiation and decision-making approaches

	Perceived resource constrained environment	Perceived resource rich environment
Knowledge transfer	Push Effectuation (70.6 % – N-48) Push Causation (29.4 % – N-20)	Pull Causation (100 % – N-68)
Knowledge co-creation	Push Effectuation (100 % – N-68)	Pull Effectuation (22.1 % – N- 15) Pull Causation (77.9 % – N-53)

References

Abreu, M., Grinevich, V., 2013. The nature of academic entrepreneurship in the UK: widening the focus on entrepreneurial activities. Res. Policy 42, 408–422.

Al-Tabbaa, O., Ankrah, S., 2016. Social capital to facilitate 'engineered'university–industry collaboration for technology transfer: a dynamic perspective. Tech. Forcasting Soc. Chang. 104, 1–15.

Al-Tabbaa, O., Ciulli, F., Kolk, A., 2022. Nonprofit entrepreneurial orientation in the context of cross-sector collaboration. Br. J. Manag. 33, 1024–1053.

Al-Tabbaa, O., Ankrah, S., 2019. 'Engineered'university-industry collaboration: a social capital perspective. Eur. Manag. Rev. 16, 543–565.

Alexander, A., Martin, D.P., Manolchev, C., Miller, K., 2020. University–industry collaboration: using meta-rules to overcome barriers to knowledge transfer. J. Technol. Transf. 45, 371–392.

Alstete, J.W., 2002. On becoming an entrepreneur: an evolving typology. Int. J. Entrep. Behav. Res. 8, 222–234.

Amit, R., Muller, E., 1995. "Push" and "pull" entrepreneurship. J. Small Bus. Entrep. Region. Dev. 12, 64–80.

An, W., Rüling, C.-C., Zheng, X., Zhang, J., 2017. Configurations of effectuation, causation, and bricolage for firm performance: a fsQCA study. Acad. Manag. Proc. 2017, 15599.

Ault, J.K., Spicer, A., 2020. The formal institutional context of informal entrepreneurship: a cross-national, configurational-based perspective. Res. Policy 104160.

Azagra-Caro, J.M., Llopis, O., 2017. Who do you care about? Scientists' personality traits and perceived impact on beneficiaries R&D Management, 48 (5), 566–579.

Azagra-Caro, J., Barberá-Tomás, D., Edwards-Schachter, M., Tur, E., 2017. Dynamic interactions between university-industry knowledge transfer channels: a case study of the most highly cited academic patent. Res. Policy 42, 463–474.

Balven, R., Fenters, V., Siegel, D.S., Waldman, D., 2018. Academic entrepreneurship: the roles of identity, motivation, championing, education, work-life balance, and organizational justice. Acad. Manag. Perspect. 32, 21–42.

Barberá-Tomás, D., Azagra-Caro, J., D'Este, P., 2022. Dynamic perspectives on technology transfer: introduction to the special section. J. Technol. Transf. 47, 1299–1307.

Basu, A., Goswami, A., 1999. South Asian entrepreneurship in Great Britain: factors influencing growth. Int. J. Entrep. Behav. Res. 5, 251–275.

Bosma, N., Harding, R., 2007. Global Entrepreneurship. GEM 2006 Summary Results. Babson College & London Business School, Babson, MA and London.

Bozeman, B., Gaughan, M., 2011. How do men and women differ in research collaborations? An analysis of the collaborative motives and strategies of academic researchers. Res. Policy 40, 1393–1402.

Bradley, S.R., Hayter, C.S., Link, A.N., 2013. Models and methods of university technology transfer. Found. Trends Entrep. 9, 571–650.

Brettel, M., Mauer, R., Engelen, A., Küpper, D., 2012. Corporate effectuation: entrepreneurial action and its impact on R&D project performance. J. Bus. Ventur. 27, 167–184.

Brown, J., Duguid, P., 1998. Organizing knowledge. Calif. Manag. Rev. 40, 90–111.

Brown, J.S., Duguid, P., 2002. Local knowledge: innovation in the networked age. Manag. Learn. 33, 427–437.

Busch, C., Barkema, H., 2021. From necessity to opportunity: scaling bricolage across resource-constrained environments. Strateg. Manag. J. 42, 741–773.

Chitsaz, E., Liang, D., Khoshsoroor, S., 2017. The impact of resource configuration on Iranian technology venture performance. Technol. Forecast. Soc. Chang. 122, 186–195.

Clarysse, B., Tartari, V., Salter, A., 2011. The impact of entrepreneurial capacity, experience and organizational support on academic entrepreneurship. Res. Policy 40, 1084–1093.

Corley, E., Gaughan, M., 2005. Scientists' participation in university research centers: what are the gender differences? J. Technol. Transf. 30, 371–381.

D'Este, P., Guy, F., Iammarino, S., 2013. Shaping the formation of university–industry research collaborations: what type of proximity does really matter? J. Econ. Geogr. 13, 537–558.

D'este, P., Mahdi, S., Neely, A., 2010. Academic entrepreneurship: what are the factors shaping the capacity of academic researchers to identify and exploit entrepreneurial opportunities?. In: Paper Presented at the DRUID Working Paper No. 10-05.

D'Este, P., Perkmann, M., 2011. Why do academics engage with industry? The entrepreneurial university and individual motivations. J. Technol. Transf. 36, 316–339.

De Silva, M., 2016. Academic entrepreneurship and normal academic duties in a resource constrained environment: symbiosis or rivalry? High. Educ. Stud. 41 (12), 2169–2183.

De Silva, M., Gokhberg, L., Meissner, D., Russo, M., 2021. Addressing societal challenges through the simultaneous generation of social and business values: a conceptual framework for science-based co-creation. Technovation 104, 102268.

De Silva, M., Kodithuwakku, 2011. Pluriactivity, entrepreneurship, and socio economic success of farming households. In: Alsos, G.A., Carter, S., Ljunggren, E. (Eds.), Handbook of Research on Entrepreneurship in Agriculture and Rural Development. Edward Elgar, Cheltenham.

De Silva, M., Rossi, F., 2018. The effect of firms' relational capabilities on knowledge acquisition and co-creation with universities. Technol. Forecast. Soc. Chang. 133, 72–84.

De Silva, M., Wright, M., 2019. Entrepreneurial co-creation: societal impact through open innovation. R & D Manag. 49, 318–342.

Dew, N., Sarasvathy, S.D., Venkataraman, S., 2004. The economic implications of exaptation. J. Evol. Econ. 14, 69–84.

Dunn, T., Holtz-Eakin, D., 2000. Financial capital, human capital and the transition to selfemployment: evidence from intergenerational links. J. Labor Econ. 18, 282–305.

Eisenhardt, K., Graebner, M., 2007. Theory building from cases: opportunities and challenges. Acad. Manag. J. 50, 25–32.

Ernst, D., Bamford, J., 2005. Your alliances are too stable. Harv. Bus. Rev. 83, 133–141.

Etzkowitz, H., Leydesdorff, L., 2000. The dynamics of innovation: from national systems and "mode 2" to a triple helix of university–industry–government relations. Res. Policy 29, 109–123.

Eun, J.-H., Lee, K., Wu, G., 2006. Explaining the "university-run enterprises" in China: a theoretical framework for university–industry relationship in developing countries and its application to China. Res. Policy 35, 1329–1346.

Fini, R., Toschi, L., 2016. Academic logic and corporate entrepreneurial intentions: a study of the interaction between cognitive and institutional factors in new firms. Int. Small Bus. J. 34, 637–659.

Fischer, B.B., Schaeffer, P.R., Vonortas, N.S., 2019. Evolution of university-industry collaboration in Brazil from a technology upgrading perspective. Technol. Forecast. Soc. Chang. 145, 330–340.

Fisher, G., 2012. Effectuation, causation, and bricolage: a behavioral comparison of emerging theories in entrepreneurship research. Entrep. Theory Pract. 36, 1019–1051.

Gartner, W.B., 2007. Entrepreneurial narrative and a science of the imagination. J. Bus. Ventur. 22, 613–627.

Gilad, B., Levine, P., 1986. A behaviour model of entrepreneurial supply. J. Small Bus. Manag. 24, 45–54.

Grant, R., Baden-Fuller, C., 2004. A knowledge accessing theory of strategic alliances. J. Manag. Stud. 41, 61–84.

Greenbank, P., 2001. Objective setting in the micro-business. Int. J. Entrep. Behav. Res. 7, 108–127.

Halilem, N., de Silva, M., Amara, N., 2022. Fairly assessing unfairness: an exploration of gender disparities in informal entrepreneurship amongst academics in business schools. Technol. Forecast. Soc. Chang. 174, 121295.

Hayter, C., 2016. Constraining entrepreneurial development: a knowledge-based view of social networks among academic entrepreneurs. Res. Policy 45, 475–490.

Hayter, C.S., Nelson, A.J., Zayed, S., O'Connor, A.C., 2018. Conceptualizing academic entrepreneurship ecosystems: a review, analysis and extension of the literature. J. Technol. Transf. 43, 1039–1082.

Huber, G.P., Power, D.J., 1985. Retrospective reports of strategic-level managers: guidelines for increasing their accuracy. Strateg. Manag. J. 6, 171–180.

Hughes, K.D., 2003. Pushed or pulled? Women's entry into self-employment and small business ownership. Gender Work Org. 10, 433–454.

Huyghe, A., Knockaert, M., Obschonka, M., 2016. Unraveling the "passion orchestra" in academia. J. Bus. Ventur. 31, 344–364.

Iammarino, S., McCann, P., 2006. The structure and evolution of industrial clusters: transactions, technology and knowledge spillovers. Res. Policy 35, 1018–1036.

Iorio, R., Labory, S., Rentocchini, F., 2017. The importance of pro-social behaviour for the breadth and depth of knowledge transfer activities: an analysis of Italian academic scientists. Res. Policy 46, 497–509.

Jain, S., George, G., Maltarich, M., 2009. Academics or entrepreneurs? Investigating role identity modification of university scientists involved in commercialization activity. Res. Policy 38, 922–935.

Jiang, Y., Rüling, C., 2019. Opening the black box of effectuation processes: characteristics and dominant types. Entrep. Theory Pract. 43, 171–202.

Johansson, A.W., 2004. Narrating the entrepreneur. Int. Small Bus. J. 22, 273–293.

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. Technol. Forecast. Soc. Chang. 141, 149–158.

Kraimer, M.L., Greco, L., Seibert, S.E., Sargent, L.D., 2019. An investigation of academic career success: the new tempo of academic life. Acad. Manag. Learn. Educ. 18, 128–152.

Lam, A., 2011. What motivates academic scientists to engage in research commercialization: 'gold', 'ribbon'or 'puzzle'? Res Policy 40, 1354–1368.

Lincoln, Y.S., Guba, E.G., 1985. Naturalistic inquiry. Sage Thousand Oaks, CA.

Martin, L., Wright, L., Beaven, Z., Matlay, H., 2015. An unusual job for a woman? Female entrepreneurs in scientific, engineering and technology sectors. Int. J. Entrep. Behav. Res. 21, 539–556.

McGowan, P., Redeker, C.L., Cooper, S.Y., Greenan, K., 2012. Female entrepreneurship and the management of business and domestic roles: motivations, expectations and realities. Entrep. Region. Dev. 24, 53–72.

McMullen, J.S., Brownell, K.M., Adams, J., 2020. What makes an entrepreneurship study entrepreneurial? Toward a unified theory of entrepreneurial agency. Entrep. Theory Pract. 45, 1197–1238.

Mitchell, R.K., Busenitz, L., Lant, T., McDougall, P.P., Morse, E.A., Smith, J.B., 2002. Toward a theory of entrepreneurial cognition: Rethinking the people side of entrepreneurship research. Entrep. Theory Pract. 27, 93–104.

Morales-Gualdrón, S.T., Gutiérrez-Gracia, A., Dobón, S.R., 2009. The entrepreneurial motivation in academia: a multidimensional construct. Int. Entrep. Manag. J. 5, 301–317.
Nooteboom, B., 2000. Learning and Innovation in Organizations and Economies. OUP, Oxford.
Nooteboom, B., van Haverbeke, W., Duysters, G., Gilsing, V., van den Oord, A., 2007. Optimal cognitive distance and absorptive capacity. Res. Policy 36, 1016–1034.
Nummela, N., Saarenketo, S., Jokela, P., Loane, S., 2014. Strategic decision-making of a born global: a comparative study from three small open economies. Manag. Int. Rev. 54, 527–550.
Perkmann, M., Salandra, R., Tartari, V., McKelvey, M., Hughes, A., 2021. Academic engagement: a review of the literature 2011–2019. Res. Policy 50, 104114.
Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., Fini, R., Geuna, A., Grimaldi, R., Hughes, A., Krabel, S., Kitson, M., Llerena, P., Lissoni, F., Salter, A., Sobrero, M., 2013. Academic engagement and commercialisation: a review of the literature on university–industry relations. Res. Policy 42, 423–442.
Read, S., Dew, N., Sarasvathy, S.D., Song, M., Wiltbank, R., 2009. Marketing under uncertainty: the logic of an effectual approach. J. Mark. 73, 1–18.
Rosli, A., de Silva, M., Rossi, F., Yip, N., 2018. The long-term impact of engaged scholarship: how do SMEs capitalise on their engagement with academics to explore new opportunities? Int. Small Bus. J. 36, 400–428.
Rossi, F., de Silva, M., Baines, N., Rosli, A., 2022. Long-term innovation outcomes of university-industry collaborations: the role of 'bridging' vs 'blurring' boundary-spanning practices. Br. J. Manag. 33, 478–501.
Sarasvathy, S., 2001. Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. Acad. Manag. Rev. 26, 243–263.
Sarasvathy, S.D., 2009. Effectuation: Elements of Entrepreneurial Expertise. Edward Elgar Publishing.
Scandura, T.A., Williams, E.A., 2000. Research methodology in management: Current practices, trends, and implications for future research. Acad. Manag. J. 43, 1248–1264.
Schjoedt, Shaver, 2007. Deciding on an entrepreneurial career: a test of the pull and push hypotheses using the panel study of entrepreneurial dynamics data. Entrep. Theory Pract. 31, 733–752.
Shane, S., Locke, E.A., Collins, C., 2003. Entrepreneurial motivation. Hum. Resour. Manag. Rev. 13, 257–279.
Shepherd, D.A., Williams, T.A., Patzelt, H., 2015. Thinking about entrepreneurial decision making: review and research agenda. J. Manag. 41, 11–46.
Sherwood, A.L., Covin, J.G., 2008. Knowledge acquisition in university–industry alliances: an empirical investigation from a learning theory perspective. J. Prod. Innov. Manag. 25, 162–179.
Shi, X., Wu, Y., Fu, D., 2020. Does university-industry collaboration improve innovation efficiency? Evidence from Chinese firms. Econ. Model. 86, 39–53.
Siegel, D.S., Wright, M., Lockett, A., 2007. The rise of entrepreneurial activity at universities: organizational and societal implications. Ind. Corp. Chang. 16, 489–504.
Sjöö, K., Hellström, T., 2019. University–industry collaboration: a literature review and synthesis. Ind. High. Educ. 33, 275–285.
van Dierdonck, R., Debackere, K., 1988. Academic entrepreneurship at Belgian Universities. R&D Manag. 18, 341–353.
van Rijnsoever, F.J., Hessels, L.K., Vandeberg, R.L.J., 2008. A resource-based view on the interactions of university researchers. Res. Policy 37, 1255–1266.
Vlaisavljevic, V., Cabello-Medina, C., Pérez-Luño, A., 2016. Coping with diversity in alliances for innovation: the role of relational social capital and knowledge codifiability. Br. J. Manag. 27, 304–322.
Weatherston, J., 1993. Academic entrepreneurs. Ind. High. Educ. 7, 235–243.
Westenholz, A., 1993. Paradoxical thinking and change in the frames of reference. Organ. Stud. 14, 37–58.
Whittington, K.B., Whittington, K.B., 2011. Gender, motherhood, and scientific work across employment sectors: Commercial patenting in academia and industry. Work. Occup. 38, 417–456.
Wiltbank, R., Read, S., Dew, N., Sarasvathy, S.D., 2009. Prediction and control under uncertainty: outcomes in angel investing. J. Bus. Ventur. 24, 116–133.
Wright, M., Birley, S., Mosey, S., 2004. Entrepreneurship and university technology transfer. J. Technol. Transfer. 29, 235–246.
Yin, R., 2013. Case Study Research, Design and Methods. Sage, Thousand Oaks, US.