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Exploring the co-creation-innovativeness paradox: distance as an ecosystem characteristic of university spin-offs

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Abstract

Through empirical investigations into university spin-offs (USOs), we discovered innovativeness benefits derived from maintaining both academia and business partners at a distance. Distance should not be misconstrued as isolation; rather, it emphasises specific attributes where partners are maintained at arm's length, affecting co-creation. Consequently, this paper explores how distance impacts the co-creation and innovativeness of USOs. It presents a longitudinal case study of a Swedish USO and conceptualises various types of distances, including actor-type, industry, supply-chain, geographical and knowledge-related distances. We explore the interplay between these different distance types as antecedents to USOs' innovativeness and co-creation activities. The paper contributes to the existing literature by introducing the concept of distance as a critical characteristic affecting innovativeness and co-creation. By delineating various types of distances, it refines previous research on the characteristics of firm connections within university and business ecosystems.

Keywords: Co-creation, Distance, Ecosystem, Innovativeness, University spin-off

Introduction

In the current research landscape, there is a growing emphasis on the co-creation among parties, with the expectation that such joint endeavours will yield results surpassing the capabilities of individual parties (Shah et al., 2021). This underscores the perceived positive correlation between co-creation and innovativeness (Ranjan & Read, 2016), the capacity to generate and exploit novel ideas that address or create new market needs (Adler & Shenhar, 1990).

In the context of university spin-offs (USOs), which are firms established to commercialise research findings (Mustar et al., 2006), co-creation encompasses engagements with both academic and business actors (Clarysse et al., 2014). While previous research has stressed the importance of USOs' connections and co-creation with other entities, our argument pivots on the notion that these connections do not inherently favour co-creation or enhance the innovativeness of USOs. While co-creation is assumed to necessitate close connections among parties (Shah et al., 2021), we argue that academic and business partners should rather be at a certain distance to facilitate

ongoing innovativeness and even co-creation. Our focus is on partner selection, specifically USOs' decisions regarding whom to connect with and for what reasons. We explore how this notion of distance influences the co-creation and innovativeness of USOs. Distance as a concept emphasises the presence of connections with other parties but with these being kept on arm's length. It is different from unrestrained freedom, sometimes described as important for radical or disruptive innovation, as such freedom means that innovations are developed away rather than as part of established connections (Zhou & Verburg, 2020).

We can, thereby, understand distance as a dimension of a connection's atmosphere, where it, compared to competition, short-termism and distrust, can still uphold positive values, though on the condition of not bringing other parties too close. Given that USOs are often embedded in both university and business ecosystems, or aspire to transition from academia to the business realm (Clarysse et al., 2014), this concept of distance extends across various ecosystem types and applies to connections with researchers, incubators, and science parks in university ecosystems and suppliers, customers, and collaborative partners within the business ecosystem. Previous research has linked distance to the aforementioned atmosphere (Gadde, 2004) but has not extensively explored its various types or its impact on co-creation.

USOs possess unique characteristics compared to fully established firms but are frequently recognised as drivers of entrepreneurship and growth, playing a pivotal role in the commercialisation of research findings (Mathisen & Rasmussen, 2019) and thereby making it important to understand what mechanisms facilitate their innovativeness. By focussing on different types of distance, the aim of this paper is to explore how distance impacts the co-creation and innovativeness of university spin-offs. To accomplish this, we address the following questions:

- How does distance impact the innovativeness of USOs?
- How does distance influence co-creation?
- What factors mediate the impact of distance on USOs' innovativeness and co-creation?

In the paper, we empirically trace and theorise various types of distances as antecedents to innovativeness and co-creation. This theorising of various types of distances related to innovativeness and co-creation provides new insights to research on USOs and their connections to other firms and academia. The paper thereby advances past knowledge on USOs and their ecosystem connections (Clarysse et al., 2014). Past research has described the mechanisms of USOs transfer from university to business ecosystems, co-creation in ecosystems, USOs' struggle to connect with other parties, but not focused on *characteristics* of connections with other parties. Research in contexts beyond USOs has indicated a positive relation between co-creation and innovativeness (Ranjan & Read, 2016). Meanwhile, we can, based on past research, also envision a paradox between innovativeness-fostered freedom, and co-creation by closeness among parties (Zhou & Verburg, 2020) and the literature often focuses on innovativeness and co-creation separately, underscoring the need to explore their interrelationship more thoroughly. Understanding the interplay between co-creation and innovativeness offers

valuable insights into their combined impact, particularly regarding USOs as drivers of new ideas and their intricate connections with university and business ecosystems.

The rest of the paper is structured as follows: we begin by providing a context for our research, drawing on previous studies related to USOs, innovativeness, and co-creation. To illustrate the concept of distance and its impact on the co-creation and innovativeness of USOs, we employ a case study research design. The conclusions, derived from our case study analysis, address the research questions. The paper concludes with theoretical contributions, managerial implications, and suggestions for future research.

Theoretical foundation

University spin-offs, innovativeness and co-creation

USOs emerge as a result of students and researchers founding companies to commercially exploit their research findings or inventions (Theeranattapong et al., 2021). Typically, they are embedded in structures that foster scientific development and academic knowledge (La Rocca et al., 2016). These inventions often represent technological advancements (Mathisen & Rasmussen, 2019). Support systems, including incubators and science parks (Grimaldi et al., 2021), frequently facilitate technological knowledge creation, along with providing access to financial support for nascent ideas (Kulkov et al., 2020). However, despite their access to support for technological development, USOs frequently encounter challenges in establishing connections with market actors, making it difficult for them to access potential customers (Clarysse et al., 2014). Additional complexities arise when their technology does not align with existing structures, leading to resistance from market actors (Aaboen et al., 2016).

Given that the long-term viability of a company is closely tied to its revenue-generating capacity, many USOs struggle and often fall short of their growth ambitions (Paradkar et al., 2015). They become ensnared in a cycle of seeking financial support and attracting short-term investors focussed on immediate returns rather than building a sustainable company for the long run (Lee et al., 2001; Wennberg & Sandström, 2022). Furthermore, the researchers who initially founded these companies may not possess the necessary skills to effectively manage them over the long term, even though their competencies are essential for driving innovation within the firm (Löfsten & Lindelöf, 2002). Establishing connections between USOs and established companies, beyond generating revenue, provides valuable insights into business strategies, idea commercialisation, and their integration into existing solutions (Aaboen et al., 2016; Wang & Hu, 2020). Unfortunately, these opportunities often remain elusive for USOs.

In terms of innovativeness, as the abilities to continuously produce and exploit new ideas that meet or create new market needs (Adler & Shenhar, 1990), it underscores the importance of firms not resting on their laurels but consistently evolving their operations, offerings, and market positioning. Within the framework of co-creation (Ranjan & Read, 2016), such evolution occurs in collaboration with complementary actors who jointly contribute to the development of novel ideas (Ganguly et al., 2019; Gassmann & Enkel, 2004). In this co-creation context, various actors provide resources for refinement and commercialisation purposes (Rampersad et al., 2010). USOs' collaboration with academia significantly facilitates their technological development (Bolzani et al., 2021) and often does so in the development of radical or disruptive ideas albeit past research has

described the necessity of freedom to accomplish such inventions. However, successful co-creation requires that USOs possess the ability to assess, establish, and nurture connections with various parties and as claimed in this paper: consider how different connections and their characteristics impact the co-creation and innovativeness of the USO.

Partner selection and distance

Partner selection entails the process by which firms decide whom to connect with and in what capacity (Wilkinson et al., 2005). It is essential to recognise that these selections are not unilateral decisions but require commitment from both parties to connect, influencing the subsequent development of collaborations. Additionally, other parties play parts in partner selections and subsequent developments. When a company chooses a partner, it must, therefore, consider how that choice impacts its existing connections and how one connection may exert either positive or negative effects on others, enmeshing partner selection with competition, tensions, entrepreneurship and visions of various parties (Öberg et al., 2020). Previous literature suggests that partners are typically sought among organisations known to the company, based on the partners' capabilities and their potential to complement existing resources (Anderson & Narus, 1991), or as a result of aligning goals and interaction purposes (Öberg & Shih, 2014).

However, the formation of connections with other organisations goes beyond merely establishing or not establishing them; it encompasses the characteristics of these connections and how co-creation unfolds within them. These characteristics cover various dimensions, including the frequency of interaction, the duration of the connection from inception to termination, the influence of social ties among individuals involved, the complexity of shared operations, and whether the connection is balanced or characterised by one party making greater concessions than the other (Halinen & Tähtinen, 2002; Norgan, 1994; Pfeffer & Salancik, 1978; Ritter et al., 2004). The concept of "atmosphere" is a useful framework for encapsulating these diverse characteristics (Gadde, 2004), which can be understood along dimensions such as power/dependence (Emerson, 1962), the state of conflict/cooperation, mutual expectations, and the closeness/distance of the connection between firms (Håkansson, 1982). In this paper, we specifically focus on the closeness/distance dimension while extending our examination to connections with academia (Clarysse et al., 2014), identify various types of distance and how partner selection based on the premises of distance impact co-creation and innovativeness of USOs.

To dig into the various types of distance discussed in prior research on co-creation and innovativeness, Schulze and Brojerdi (2012) examined knowledge distance. According to their findings, the technological knowledge distance exhibits an inverted U-shaped relationship with innovation performance due to knowledge complementarity (cf. Öberg, 2016). Small knowledge distance concerning managerial knowledge is associated with better performance, while excessive distance hampers knowledge transfer between firms. In a conceptual framework, Boschma (2005) explored the concept of proximity as the antonym of distance. He argued that geographical proximity facilitates interactive learning, providing a foundation for innovation, but excessive proximity can have negative effects due to lock-in effects. Boschma suggested that the problem of both too little and too much proximity could be resolved by enhancing effective coordination and control while ensuring openness and flexibility. Ahn et al. (2009) conducted a study of

leading biotechnology firms and found that the number of technology and product alliances was twice as important as geographic proximity in influencing firm performance, indicating how various distances (or proximities) may interact with each other. Regarding USOs, Isaksen and Karlsen (2010) pointed out how the mode of innovation impacts the importance of proximity to a university, while Pouder and St. John (1996) indicated that companies located in geographically concentrated areas of highly innovative firms may lose their innovation capabilities over time because managers become overly focused on local competitors rather than the broader industry. Maietta (2015) concluded that geographical proximity to a university positively affects product innovation but negatively impacts codified knowledge. Bolzani et al. (2021) highlighted how a USO's proximity to its parent university positively affected the USO's performance.

Overall, existing literature predominantly emphasises proximity as the antonym of distance, particularly concerning knowledge and geographical location, while also mentioning social, cognitive, organisational, and institutional proximity (cf. Geldes et al., 2015; Villani et al., 2017). Typically, research focuses on one type of proximity (or distance) at a time, even though various types may be interconnected, and they may apply differently to various parties. Additionally, the literature seldom adopts the perspective of USOs and has not explored the connection between distance and partner selection. Addressing these gaps, this paper offers a comprehensive understanding of the concept of distance by exploring various types and their potential interconnections or associations with different parties. Importantly, it investigates these distances as antecedents to co-creation, innovativeness, and the relationship between co-creation and innovativeness within the context of USOs.

Research design

To in-depth explore various types of distance and their impacts on the co-creation and innovativeness of USOs, it was essential to employ a methodology capable of uncovering the interrelationships among different variables, contextualising them, and deriving meaningful insights. Furthermore, given the exploratory nature of investigating various distance types, the methodology needed to be flexible enough to emerge organically from practical observations. Consequently, a case study approach was deemed appropriate. The case studies serve as valuable methods for situating knowledge within specific contexts and extracting theoretical insights that can be transferred to a broader context (Easton, 2004; Hirschman, 1986; Siggelkow, 2007). The backside of it, and specifically as in this paper: of a single case study, is how knowledge generated cannot be seen as generalisable, hence transferability (Guba & Lincoln, 1989) and through the identification of relations among items, the outline of causal claims as antecedent impacts to be tested in future research is the ambition with the case study.

The case is a matter of 'a case that found us'. In our interest in USOs and their developments, we came across the case of Innovative AB (anonymised case), which captured our attention due to its distinctive approach within the university and business ecosystem. Innovative AB focuses on integrating artificial intelligence into automobiles. What we refer to as "partner selection based on the premise of distance" reflects Innovative AB's strategy of connection with other entities in technological development and commercialisation efforts. For the USO, this approach entailed working with partners located

beyond their immediate proximity, which had been the more conventional choice (e.g. connecting with a different university after separating from their parent university or partnering with a German car manufacturer despite Sweden's strong tradition in car manufacturing).

Innovative AB's inception stemmed from advanced research in artificial intelligence linked to sensor technology at an east-Swedish university. Before its establishment, a group of researchers had taken an interest in sensor control technology and began exploring potential application areas for their solutions. While their parent university was situated in a region with a concentration of high-tech IT firms and defence industries, offering a logical fit for their technology, the emerging USO deliberately sought application areas elsewhere. Such decisions—opting not to select partners in close proximity to the USO but rather one step removed—became a recurring pattern for the USO. It was not solely geographic factors that created these distances but also various other types of distances.

Data collection

The data collection encompassed interviews and secondary data, with interviews involving representatives of the USO and various external parties serving as the primary data source. The interviews were conducted using an open-ended, non-standardised approach to allow for both specific and overlapping information across interviews, as well as to give due attention to aspects raised during interviews through follow-up questions (McCracken, 1988). The interview questions covered a range of topics, including the USO's development, its connections to other organisations (specifically, entanglements and disentanglements from the parent university, business partners, and owners), partner selection processes, their involvement in innovation endeavours, the development of innovativeness as a capability, and the consequences related to partner selection and co-creation. Additionally, the USO and the interviewed external parties were asked to characterise the nature of their connection with the USO. To complement the interview data, secondary data sources such as annual reports, press releases, and newspaper articles were utilised to triangulate information, verify data sources, and address potential post-rationalisation biases and temporal perceptions (Welch, 2000; Yin, 1994). This data collection spanned a 12-year period, enabling the adoption of a longitudinal and process-oriented approach to data collection and analysis (Pettigrew, 1997).

Data analysis

The data analysis process adhered to Pratt (2009) recommendations, involving empirical and axial coding to construct first-order constructs, second-order conceptualisations, and aggregated dimensions (cf. Gioia et al., 2013). In the first-order coding stage, the focus was on how both primary and secondary data conveyed information related to the establishment and continuity of connections between the USO and external counterparts, as well as details about the USO's development (e.g. results, revenues, ownership changes and inventions). This coding aimed to capture the evolution of Innovative AB and empirically explore its partner selection. In the second-order axial coding phase, each connection with another party was categorised based on criteria such as closeness/distance, impact on innovativeness, and co-creation. Distance was assessed as a relative

parameter, grounded in the USO's choices regarding the selection and deselection of partners: which partners were chosen, and what alternative choices were available? How did these different choices manifest in terms of their closeness or distance from the USO? What were the resulting consequences? By adopting a processual perspective (Pettigrew, 1997), the analysis aimed to elucidate how distance at one point in time influenced capabilities and co-creation at subsequent points in time.

Various types of distance were identified through multiple rounds of combining and recombining codes to conceptualise these different distance types. The consequences for innovativeness and co-creation were subsequently re-evaluated within the context of these distinct distance types: how did a particular type of distance impact co-creation and innovativeness, and what conclusions could be drawn regarding the connection between co-creation and innovativeness for each type? Such conclusions should be regarded as propositions based on the single case study design, to be tested in future research. As a concluding step of the analysis, the findings were compared to prior research to ensure the theoretical rationale and contribution of the paper. In line with the nature of qualitative research, additional connections and variables emerged beyond those initially considered. While analysing how various types of distance influenced co-creation and innovation, a disconnect was identified concerning two specific distances: geographical and supply-chain. Both contributed to USO freedom but did not seem lead to co-creation or enhanced innovativeness. An interesting finding in relation to past research was furthermore that this freedom did not enhance innovativeness.

The case of innovative AB

Early partner selection: finding application areas and financing

The foundation of Innovative stemmed from the interest of a group of researchers in artificial intelligence related to sensor solutions, a specialised field at their parent university. These researchers had colleagues working on inventions related to artificial sensory organs, specialising in each of the five senses. These inventions included artificial eyes for military espionage equipment and image interpretation. The focus of their work and often the commercialisation efforts, was directed towards military applications, reflecting the city's longstanding tradition as a pioneer in advanced military solutions, which also influenced the technological landscape of the university.

In the course of developing their solution, the founding researchers of Innovative decided to collaborate with an IT consultancy, rather than solely concentrating on sensor technology. This pivot represented a departure from the predominant research focus within their university. Instead of confining their work to the university, they actively sought a commercial collaboration partner. This decision also marked an exit from their core technology domain. Simultaneously, they initiated preliminary discussions with a representative from the automotive industry, a car manufacturer with a presence in the production of heavy vehicles, located in the western part of Sweden. This connection shifted the focus of Innovative's solutions toward automotive applications. Notably, this university–industry connection existed outside the ecosystem of the USO's parent university and involved a significant geographical distance. While the east-Swedish university typically collaborated closely with local industry partners, the automotive company, due to its location, had maintained a long-standing

partnership with a university in western Sweden. One of the founders of Innovative noted, “[The west-Swedish university] is often referred to as the University of [the car manufacturer]. We brought something different to the table, and in doing so, we also distanced ourselves from defence-oriented solutions and our colleagues’ close collaborations.”

The automotive company established this connection through a wholly owned venture firm that subsequently became a partial owner of Innovative, providing financial support to the USO. However, it was clear from the outset that the venture firm’s involvement with Innovative was temporary. This temporality became increasingly evident as the parent company of the venture firm divested its car manufacturing division to focus exclusively on heavy vehicles and sub-supply to other industries. Consequently, the partial ownership in Innovative lost some of its strategic relevance for both the car manufacturer and its venture firm. As one founder explained, “We knew this wouldn’t last, and perhaps this influenced our approach, continuously seeking other partners for collaborative projects, as well as customers.”

Suppliers as customers and being an odd bird in the industry

Innovative aspired to extend the reach of its solution beyond a specific automotive company and become self-sustaining. However, it recognised that its solution needed to integrate with hardware supplied by automotive component manufacturers. This made Innovative reliant on the design choices made by these hardware suppliers, while simultaneously making the emerging USO dependent on car manufacturers, as they were the entities responsible for implementing such solutions. At the time, there was a fierce competition between car manufacturers and their suppliers, as suppliers had assumed greater control over the technological components within automobiles. Nevertheless, Innovative embarked on a series of small-scale development projects for these suppliers. However, these projects did not reside at the core of the USO’s strategic focus. As one member explained, “While these projects generated revenue, they did not advance our core solution. Although they facilitated contact with suppliers, it was our general knowledge, rather than our solution, that took centre stage.” These projects were co-creational in nature but were of a temporary and limited scope. They allowed for connections with various individual parties but did not substantially contribute to the advancement of the USO’s primary solution, apart from generating some financial income.

To establish connections with car manufacturers, Innovative received invitations to deliver presentations for specific car manufacturers and visit a national association of automotive companies through a consultancy contact. During these meetings and presentations, Innovative was often perceived as an outlier due to its relatively small size. However, given that Innovative boasted staff with both academic and automotive industry backgrounds, along with an intriguing solution, it managed to garner the attention it sought. One member remarked, “We were too small to pique anyone’s interest, but our status as an outlier generated curiosity.” Despite discussions with several potential car manufacturers, Innovative soon realised that generating interest in the company and its technology was insufficient. The absence of secure long-term financial resources and collaboration partners led to concerns about the USO’s trustworthiness.

The pursuit of ownership

Concurrently with its efforts with suppliers of car manufacturers and endeavours to establish customer connections related to its core solution, the temporary ownership structure involving the venture firm prompted Innovative to seek new collaborative partners willing to invest in the USA. During this period, Innovative was jointly owned by the venture firm, the founders, and another venture capital company. However, both venture owners had intentions to divest their shares. As Innovative sought to establish customer connections with various automotive industry players, a German car manufacturer expressed interest in Innovative's solution, leading to the execution of several prototype projects. *"We engaged in some smaller projects for [the German car manufacturer]."*

In the quest for a new owner, this car manufacturer emerged as an appealing option for Innovative. The geographical distance and the expressed commitment to independence were key considerations. The venture firms subsequently sold their shares in Innovative to a venture firm associated with the German car manufacturer. Through the issuance of additional shares, this venture firm eventually acquired more than 90 percent ownership of Innovative, with the two founders retaining the remaining ownership stake. From the outset, the German car manufacturer communicated its long-term intentions for Innovative, which included obtaining access to the technology, expertise to develop other products, and revenues from other customers. Innovative recognised that this new owner's emphasis on innovation capabilities set it apart from its previous owners. *"This promised us both freedom and funding and aligned perfectly with our objectives."* The German car manufacturer stressed the importance of preserving Innovative's innovative spirit to generate novel ideas. Furthermore, it required Innovative to independently establish customer connections outside the car manufacturer's sphere and contribute to revenue generation while covering its own costs—objectives that resonated with Innovative's own ambitions. The new owner maintained Innovative's autonomy to minimise any adverse effects on its innovativeness. Nevertheless, some development tools were transferred from Innovative to the German car manufacturer, signifying a partial knowledge transfer from the acquired party to the acquirer.

Customer relationships and distancing in previous co-creation projects

Despite securing a more advantageous financial position with the new owner, Innovative witnessed a shift in its image among potential customers. It was no longer perceived as a trailblazing innovator but rather as an established company—just one among many competitors. Consequently, potential customers, including car manufacturers and their suppliers, began viewing Innovative as a rival entity. Reactions akin to "not invented here" underscored suppliers' reluctance to Innovative under the aegis of the German car manufacturer. *"Customers saw us as part of the [German car manufacturer]. Suppliers suddenly viewed our technology as competitive and initiated the development of alternative solutions."* As a result, co-creation projects with car manufacturers came to a halt. Only after concluding their development work with the new owner were these companies willing to re-establish contact and assess performance and value obtained, essentially resuming their roles as customers. To establish trustworthiness for Innovative, it

was imperative to demonstrate the owner’s long-term commitment. The focus shifted from concerns about the company’s long-term survival to apprehensions about the duration of its autonomy. The competitive dynamics between the car manufacturer and Innovative’s potential customers proved detrimental to the USO’s ability to forge external customer connections.

A breakthrough and new view on distance

While Innovative primarily operated within the European market in its quest for customers, owners, and potential car manufacturer suppliers, a significant shift occurred in the US market, opening up new opportunities for Innovative’s solution. Due to technological advancements in the United States, Innovative’s solution became a standard feature in automobiles.

Over the years, Innovative has maintained its focus on the original solutions it developed, garnering customers and global recognition. The USO’s headquarters have remained in the town where it was founded, deliberately maintaining a certain distance from its owner and major customer markets. This strategic approach has positioned the USO as a fully fledged company with a diverse customer base and the freedom to embark on new development projects.

Discussion

The case of Innovative provides insight into how a USO deliberately chose partners at a distance. This active selection of distant partners presents a departure from the prevailing emphasis in prior research, which often underscores the need to overcome distances, including geographical, cultural, or power-related distances (Chua et al., 2015; Lorentz et al., 2018; Moonen, 2017). Some scholars have used distance as a gauge for knowledge, suggesting that the difference between firms should neither be too small nor too large (Schulze & Brojerdi, 2012). Similar arguments have been posed related to geographical distance/proximity (Boschma, 2005). Concerning USOs, much attention has been devoted to the concept of proximity to the parent university (Bolzani et al., 2021). However, this case diverges from previous studies by highlighting how the USO managed various types of distances with multiple parties within both university and business ecosystems, underscoring the USO’s preference for maintaining an arm’s-length connection

Table 1 Distance as identified in the case

Distance	Description in case	Leading to
Actor-type distance	Choice not to work with university support system but look for industry partners	Knowledge complementarity
Industry distance	Choice of industry not part of regular ecosystem of the university (but part of another university’s ecosystem)	Broadened knowledge
Supply-chain distance	Choice of partners and owners from a different position in the supply chain	Operational freedom
Geographical distance	Choice of owners but also market far away from the company’s own location	Operational freedom
Knowledge distance	Technology difference to partners’ technologies (business as well as owners)	Knowledge complementarity. Sequential co-creation

with these entities. Table 1 below summarises the different distance types, which will subsequently be described, exemplified, and linked to past research.

Distance types

The *actor-type distance* pertains to how the USO deliberately selected partners that differed from its own type, defying conventional expectations based on its circumstances. In the case, the actor-type distance emerged as the USO opted to work with a consultancy firm and later with the Swedish automotive manufacturer. This strategic choice led to the USO's disengagement from incubator programs and research colleagues at the parent university. Its early connection with the automotive manufacturer in turn meant that the typical linear progression of idea development, delaying commercialisation until a later stage was not followed by the USO. The USO thereby resisted incubation support, despite being involved in cutting-edge artificial intelligence. There is an increasing concern about USOs becoming overly focussed on pitching ideas and developing technological specifications at the expense of commercialisation (Wennberg & Sandström, 2022). Working with industry partners introduced knowledge complementarity, allowing the consultant and automotive manufacturer to challenge the USO's solution.

The *industry distance* addresses how the USO distanced itself from industry actors connected to the university who dominated artificial intelligence solutions developed by research colleagues. Instead of aligning with the defence industry, the USO opted for the automotive sector, located near another university. This decision led to broadened knowledge for both the USO and the automotive manufacturer. This industry distance mirrors how breakthroughs often emerge from external actors in an industry (Antonio & Kanbach, 2023). Notably, the case suggests co-creation within the industry, rather than newcomers rendering existing industry players obsolete (cf. Christensen, 2006).

Supply-chain distance reflects how the USO chose partners situated at different positions within the potential supply chain compared to its own. The USO's solution occupied a unique position between car manufacturers and their suppliers, necessitating an unconventional approach. While establishing customer contacts was desirable, the power struggle between car manufacturers and suppliers, with suppliers dictating much of the agenda, made partnering with car manufacturers a peculiar choice. This was particularly true because suppliers held a knowledge advantage and, consequently, sway over their customers, the car manufacturers. Later, the suppliers developed competing solutions following the acquisition by the German car manufacturer. However, maintaining a supply-chain position, distinct from the owners, provided the USO with a degree of freedom and preserved its expertise.

Geographical distance, and thereby the antonym to the frequently described geographical proximity (e.g. Maietta, 2015, Bolzani et al., 2021), intersected with other types of distance in this case. The car manufacturer, located outside the parent university's ecosystem, also fell within a different geographical area. Furthermore, the new owner (following the acquisition) operated in a different country, despite Sweden's strong vehicle manufacturing tradition. Geographical distance, particularly related to ownership, granted operational freedom due to its dispersion of operations across various locations. Notably, the geographical distance did not serve to access customers elsewhere (primarily located in the USA) but rather as a mechanism to safeguard operational freedom.

Knowledge distance, as the final identified distance type, relates to the industry and actor-type distances and pertained to the USO’s choice to connect with partners and owners that did not interfere with its solution development, while these parties could not significantly contribute to the technological specification beyond providing user perspectives. Such usership, upheld by the early venture firm and suppliers, though had little to do with the artificial intelligence solution and more to do with its fit into current infrastructures. Past research has indicated an inverted U-shaped relationship between knowledge (Schulze & Brojerdi, 2012). However, the USO intentionally embraced knowledge distance to safeguard its solution development from external interference.

Connections among distance types, innovativeness and co-creation

As revealed from the case, various distances impacted the innovativeness and co-creation in different ways, despite how co-creation in past research is believed to follow from close collaborations, thus emphasising proximity and its link to innovativeness (Ranjan & Read, 2016). More specifically, knowledge distance emerged from industry and actor-type distances, positively influencing both co-creation and innovativeness. This points at how the knowledge development was indeed dependent on other parties but that these were thus not the closest available parties for the USO. In these co-creations, insights from the parties were the key facilitator for knowledge development, indicating a one-way knowledge transfer from external parties to the USO. This was though reversed as the USO provided its solution to the various parties. The co-creation process thus became *sequential* rather than collaborative, with the parties not working together on solutions but instead engaging in a relay-like exchange. Knowledge was transferred from one party to the other, developed independently, and then returned, rather than being collaboratively developed throughout the process, thus maintaining the distance between the parties. The sequential co-creation process broadened the USO’s knowledge, while the USO’s innovativeness led to ideas being facilitated to the other parties.

In contrast, geographical and supply-chain distances primarily fostered operational freedom but did not contribute to either innovativeness or co-creation. Previous research on creativity and radical or disruptive innovation has highlighted the importance of freedom (Amabile, 1988; Ekvall, 1996; Story et al., 2008), thereby connecting a specific type of innovations with lacking connections to others, while the present

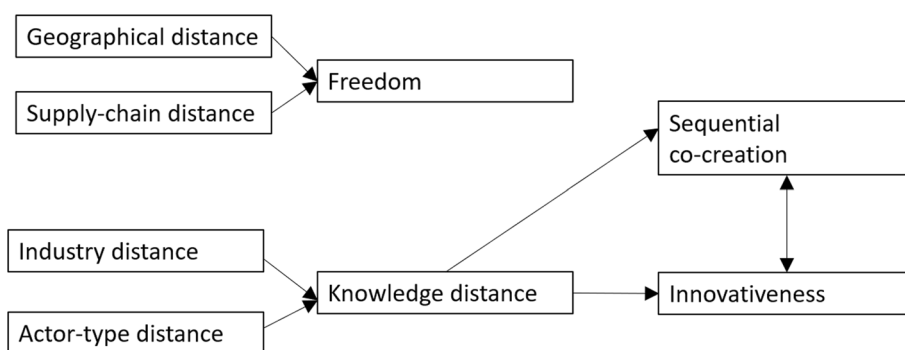


Fig. 1 Types of distance and impact on innovation capabilities and co-creation

case points at how freedom was achieved through distance but disconnected from innovativeness.

Figure 1 illustrates the various distance types, along with their impact on innovativeness and co-creation. Given that geographical and supply-chain distance are linked to freedom, this factor is also incorporated into the figure, thereby extending beyond the initial variables of the study. As depicted in the figure, the concept of freedom is detached from co-creation and innovativeness, while co-creation and innovativeness have a reciprocal impact on each other.

Notably, within the context of other parties and their interdependence, an intriguing pattern emerges concerning distance. In the early stages of development and when the USO engaged with the initial automotive manufacturer, these parties were perceived as distant parties among suppliers and other car manufacturers. Consequently, suppliers and car manufacturers were willing to connect with the USO, albeit on non-strategic development projects. However, the involvement of the German car manufacturer had a negative impact on these connections. Despite being even farther away geographically, other parties perceived the German car manufacturer as too closely connected to the USO for them to continue their connection with the USO. This highlights a mental rather than factual view on distance and how the mental notion of distance allowed the broader connections among what could be judged as competitors.

Conclusions

This paper explored how distance impacts the co-creation and innovativeness of university spin-offs. At the outset, the paper posed three key questions: How does distance impact the innovativeness of USOs? How does distance influence co-creation? What factors mediate the impact of distance on USOs' innovativeness and co-creation?

The paper highlights how geographical and (vertical) supply-chain distances from USO owners contribute to operational freedom. This freedom becomes particularly important when the USO's core technology differs from that of its parent company, though it neither boosts innovativeness nor fosters co-creation. Actor-type distance emerges as a mechanism for acquiring complementary knowledge, while industry distance serves to broaden the USO's overall knowledge base. These various distance dimensions collectively give rise to what is referred to as knowledge distance.

The impacts of these distances on co-creation are multifaceted, resulting in a sequential rather than collaborative co-creation process. For USOs engaged in pioneering technology, sequential co-creation with external parties, which facilitates the broadening and complementary knowledge, becomes important for the USO to develop its invention. The distance furthermore allowed for connections with what would be regarded as competing parties to the owner and customer connections. This however was mediated by these parties' view on the distance, separating between a mental-notion and factual distance as mediating factors.

Theoretical contribution

This paper contributes to existing research by underscoring the role of distance as a defining characteristic of connections within ecosystems. Furthermore, it theorises various distance types and their intricate interconnections, elucidating their specific

relevance to co-creation and innovativeness within the context of USOs. This deepens our current comprehension of ecosystem connections by focussing on their inherent characteristics. Additionally, this paper challenges conventional approaches to USO commercialisation, which often rely on linear processes involving detachment from the university ecosystem and striving for acceptance in the business ecosystem (Clarysse et al., 2014). Instead, it advocates for a more balanced approach centered around co-creation and innovativeness. The paper's delineation of how various forms of distance influence innovativeness and co-creation, particularly the notion of sequential co-creation, sheds light on the co-creation-innovativeness paradox. Moreover, this paper enriches existing research by adopting the perspective of USOs regarding partner selection and its implications for innovativeness. This proactive stance empowers USOs in their commercialisation endeavours, moving beyond merely describing how they are influenced along the journey from invention to gaining acceptance in the business ecosystem (Laage-Hellman et al., 2020; Öberg, 2021).

Crucially, the paper unravels the relations among different types of distances, innovativeness, and co-creation, thereby disentangling freedom from distance—a common point of confusion in prior research. It also underscores the distinction between the mental conception of distance and its factual manifestation, a difference that assumes significance when considering how distance operates within interconnected ecosystem settings. Specifically, it elucidates how distance to one partner can facilitate co-creation with others, contingent on these parties perceiving the USO and the initial partner as distant entities.

Managerial implications

This research offers insights for both managers and organisations that support USOs, shedding light on how distance can manifest and influence the continuous innovativeness of USOs. These insights, in turn, carry implications for decision-making regarding which parties to establish connections with. This process should be rooted not only in the USO's supply-chain and knowledge positioning but also its geographical location.

For USO managers, partner selection involves addressing questions related not only to how various connections may impact each other but also how the relative distances affect the USO itself, its growth trajectory, and its potential for generating new ideas. For companies considering support for USOs, it is crucial to assess how their involvement influences the development of the USO and how to best structure work efforts between the USO and themselves.

Support systems for USOs, including incubators and science parks, should critically evaluate their impact on USOs, particularly their role in bridging the gap between university and business ecosystems and continuous involvement. They should also consider how to optimise co-creation activities in situations where distance implies involvement without hindering the USO's development.

Limits of the study and further research

The empirical part of this paper is based on a single case study, also meaning that conclusions should be regarded as propositions that possibly transfer into other cases. For further research, additional studies are prompted. Quantitative studies can test the

relations among various variables as outlined by this case study, and more case studies in different settings are warranted. Further research should thereby focus on testing the covariances among the different variables, including types of distance, innovativeness, and co-creation, to ascertain whether the claims made in this paper hold true in broader contexts. Comparative studies could furthermore explore differences between deep-tech and low-tech USOs, those in technological and medical fields, and USOs in diverse geographical contexts, such as developing countries or regions characterised by intensive market control.

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Availability of data and materials

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Declarations

Ethics approval and consent to participate

No sensitive information collected. Case is anonymised.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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