Enabling knowledge sharing in university-cross-industry competence centres

Abstract

University competence centres (UCCs) are created to enhance university-industry collaboration and knowledge sharing among collaborating partners. This study investigates the organisation of knowledge sharing among firms in UCCs through a qualitative case study of UCCs *with* or *without* a focus on research in their activities. Data collection was done through interviews and observations over a period of 24 months. While the findings indicate that both types of UCCs are non-neutral, they also reveal several different characteristics that appear primarily based on a strong tie either to the first (education) or the second (research) mission of academia. Although both types of UCCs act to build a common meaning among participating organisations, the focus on the first or the second mission leads to this meaning is primarily being constructed in the firm-to-firm or university-to-firm interfaces, respectively. Whereas cross-industry knowledge sharing is emphasised by both types of centres, it is thus more strongly emphasised by UCCs without a focus on research as it helps to avoid harmful effects of knowledge spillovers. The focus on the first mission also appears able to sustain the organisation of knowledge ecosystems created by UCCs without a focus on research in a prefigurative form, which is otherwise typically transient. Furthermore, the challenges to sustainability are different, with centres focused on research being pre-occupied with funding issues, while centres not focused on research leveraging on others means to maintain the interest of industry. The findings contribute to innovation management research and practice by refining current understanding of processes and practices of university-industry collaboration, and how they contribute to facilitate (cross-industry) collaboration and knowledge transfer. Given that university-industry collaboration is often promoted in national innovation policies to create value for society as whole, our findings

contribute towards enabling organisations, managers as well as governments to take more informed actions when engaging in such collaborations.

Keywords: University-industry collaboration, cross-industry innovation, knowledge sharing, university competence centres, innovation intermediaries, academic logic

Introduction

Industries regularly face disruption through the introduction of new technology or business models. As an example, electronics and software technology are today, to enable new functionality, being introduced into many products that have traditionally been purely mechanical (Törngren et al., 2017). To remain competitive, the industrial firms affected by a technology shift must acquire new skills and update their processes to incorporate new technology. This need to learn often prompts firms to reach out externally, for instance by creating strategic alliances with other firms (Niederkofler, 1991) or cooperating with academia (Ankrah & Omar, 2015). The underlying intent of these collaborations can typically be narrowed down to a few categories, such as the four university-industry collaboration activities of research support, cooperative research, knowledge transfer and technology transfer (Ankrah & Omar, 2015). However, these do not always capture the implications of the way these collaborations are structured, such as through research centres, practitioner networks, and standardisation bodies, to name a few possibilities.

One way to structure this collaboration is through intermediaries, i.e., organisations that bring together other organisations or knowledge to facilitate value creation or capture through knowledge sharing, funding, etc. Best known are perhaps knowledge brokers that facilitate innovation by bringing knowledge from one technological domain to another (Hargadon, 1998), but there are also intermediaries focusing on e.g., gatekeeping, validation, and commercialisation

(Howells, 2006). Acting as intermediaries, universities can sometimes fill surprising roles, such as becoming leaders of innovation ecosystems when technology is not yet mature enough for a firm to risk adopting it (Dedehayir et al., 2018; Dedehayir & Seppänen, 2015). However, although there is an increasing realisation that universities can facilitate value creation also when acting primarily as intermediaries between firms, rather than primarily as educators or researchers (Reichert, 2019), the implications of this for both the involved organisations and their attempts to innovate are understudied.

University competence centres (UCCs) are intermediary organisations that build a formal network between a university and industrial firms to establish collaboration to share, exchange and possibly co-create knowledge. UCCs present a context in which firms can increase their knowledge through both knowledge generation in close cooperation with universities and firm-to-firm knowledge sharing activities. This context has several traits that will combine to affect knowledge sharing, such as involving both structured and unstructured coordination activities, being organised according to a dominant (academic) logic (Perkmann et al., 2019) and involving several firms that might be competitors. Arguably, both the structure of university competence centres and the behaviour of the involved organisations might thus exhibit unique or rarely seen characteristics that act as preconditions to effective and sustainable knowledge sharing. The purpose of this study is to investigate practices that influence cross-industry knowledge sharing in university competence centres. This leads to two research questions: *How does university competence centres organise knowledge sharing among firms*, and *what are the associated implications for how knowledge sharing is carried out?*

Theoretical background

One fundamental reason for the existence and stability of firms is that they establish a shared understanding of knowledge among their employees (Nooteboom, 2000), which help overcome barriers to knowledge sharing between them (Szulanski, 2000). Still, Brunswicker and Hutschek (2010) point at the value to a firm in interacting with organisations even beyond its value chain, as it could lead to exploratory innovation by a re-combination of distant knowledge.

Unfortunately, as a firm becomes separate from its environment, it creates a boundary which knowledge found *externally* might have problems passing through. Searching for knowledge externally, beyond its core competencies, thus exposes the firm to challenges associated with cognitive distances (Enkel & Heil, 2014). This often necessitates the existence of specific mechanisms for facilitating knowledge sharing into a firm, e.g., mechanisms that help build a common meaning between collaborating organisations to facilitate cross-boundary knowledge transfer (Carlile, 2004).

The following three subsections discuss such mechanisms from the perspective of three discourses relevant to university competence centres (UCCs), as illustrated in figure 1. Firstly, from the perspective of how intermediaries can support innovation, as UCC is an intermediary aiming to actively facilitate knowledge transfer. Secondly, from the perspective of knowledge spillover, as an UCC could potentially enable knowledge transfer even without a conscious effort. Thirdly, from the perspective of university-industry collaboration, as an UCC is not just *any* organisation – its ties to an academic context implies that any knowledge sharing mechanism will be subject to specific motivations and limitations.

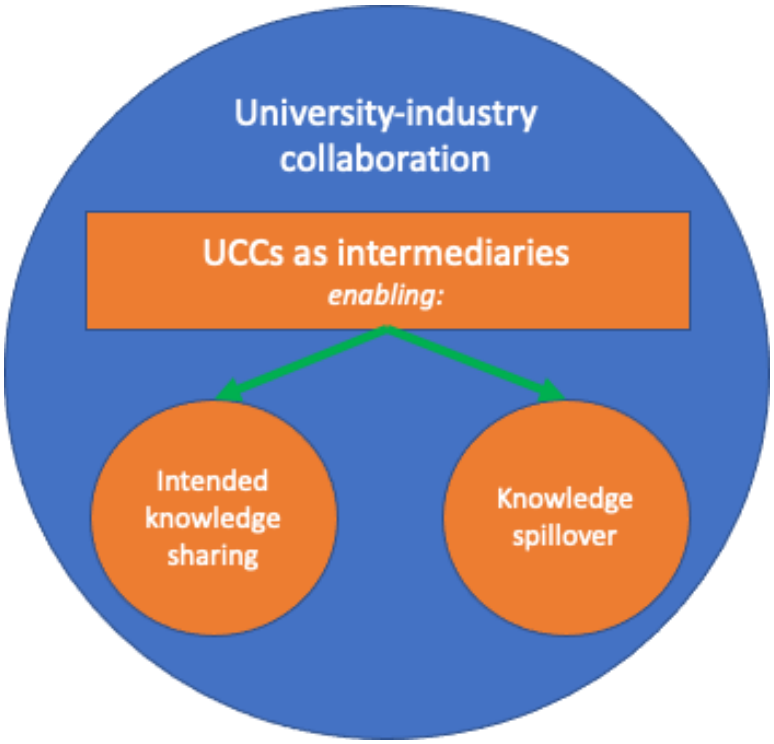

Figure 1 theoretical framework

Intermediaries

An innovation intermediary is essentially an organisation that acts as a broker between at least two other parties in any aspect of the innovation process (Howells, 2006). This has frequently been operationalised as organisations that have this brokering as their primary task (Klerkx & Leeuwis, 2009; Winch & Courtney, 2007), but are part of a larger organisation that has other primary tasks – such as the technology transfer offices and competence centres of universities. Two frequently discussed topics related to innovation intermediaries can then inform our understanding of university competence centres. Namely, the broad set of *activities* that innovation intermediaries can be involved in, and what decides their ability to *survive long-term*. Regarding the *activities* of intermediaries, given the importance of firms acquiring the right set of knowledge in contemporary economies (Pyka, 2002), knowledge brokering is a fundamental function of innovation intermediaries. Enkel and Gassmann (2010) found that cross-industry

innovation is primarily associated with radical innovation, and that intermediaries can perform this type of innovation as innovation multipliers, innovation leveragers and innovation broadeners (Gassmann et al., 2011). All of these intermediaries make use of knowledge brokering, but differ on whether they are experts in the industries between which innovations were transferred. Other basic functions include articulation of options and demand, alignment of actors and possibilities, and support of learning processes (Van Lente et al., 2003). Specifically, this implies that innovation intermediaries can take on leadership roles in networks related to e.g., management, policy and regulation (Klerkx & Aarts, 2013).

Kant and Kanda (2019) identified four factors that affect an intermediary's ability to *survive long-term*, i.e., neutrality, technological context, shared consensus, and internal value creation. With regard to neutrality, studies has shown that it can be important to be independent from others and not advocate for specific technological solutions to engender trust, thus paving the way for collaboration and positive outcomes – and that intermediaries are well suited for this neutrality (Klerkx & Leeuwis, 2009). However, other studies have shown that this neutrality might be illusionary, and that intermediaries are just as likely to *champion* specific agendas (Matschoss & Heiskanen, 2017). This might for instance be influenced by funding coming with expectations to promote certain political decisions, or the need to pursue private funding requiring a rapid selection among choices (Mignon & Kanda, 2018). Indeed, articulating visions and actively working to align stakeholders has been shown to be a critical ability of intermediaries who work at the network level (Kivimaa, 2014).

Knowledge Spillover

Knowledge might transfer across organisational boundaries even without an intentional effort by organisations or individuals. Alliances with other firms, workforce mobility, and geographical

co-location can all lead to knowledge spillover (Almeida et al., 2003). This is often perceived as negative, as spillovers can allow competitors to imitate one's innovations. This means that lead firms that strive for collaborations with other firms, i.e., try to benefit from intentional knowledge sharing but have a lot to lose from unintentional knowledge sharing, are more likely to protect themselves through e.g., patenting (Arora et al., 2016). However, spillovers can also have positive effects on e.g., firm productivity, as they complement investment in research and development activities to enable firms' integration of external tacit knowledge (Audretsch & Belitski, 2020).

Regarding the determinants for spillovers and its effects, structured interactions between firms have been shown to lead to spillovers regardless of the size of the involved firms (Almeida et al., 2003). However, it does matter which type of organisation that organises the interactions. The greater spillovers in networks dominated by public research organisations mean innovation is positively affected for all network members regardless of their centrality, while networks dominated by private entities will only have a positive effect on innovation for centrally placed stakeholders (Owen-Smith & Powell, 2004). The effects of geographical distance on the implications of spillover are more complicated as it varies strongly across industries (Kekezi et al., 2022). The network structure, a reliance on a small set of key individuals, the need to collaborate across disciplines, and which type of organisations are co-located (i.e., private or public) can all influence how and whether spillover in turn lead to the creation of novel knowledge.

University-Industry Collaboration

As discussed in the previous sections, universities can be critical in enabling intentional and unintentional knowledge sharing between firms by taking on different intermediary roles.

However, the relationship is often not frictionless, as the culture of and type of work outputs emphasised by firms and academia usually differ substantially (Cyert & Goodman, 1997; Siegel et al., 2003). Arguably, this implies that the motivations by firms and academia for engaging with each other, and thus often for sustaining their relationship, are important. Ankrah and Omar (2015) used necessity, reciprocity, efficiency, stability, legitimacy, and asymmetry to categorise motivations for academia and firms to engage with each other. Universities can engage with firms for legitimacy, e.g., for enhancing the organisational image or to contribute to the regional/national economy. Universities can also, for efficiency reasons, engage with firms for financial gain. However, for universities the motivations are mostly tied to the first and second missions of a university, i.e., the education and research functions (Drennan et al., 2013; Hoehle & Teichler, 2013). The education function can e.g., benefit through aligning with employment opportunities, exposing students to relevant problems, and insights into curricula development. The research function can e.g., benefit from access to additional resources/infrastructure, more funding, following policy and the elicitation of relevant problems.

For firms the underlying motivation across most categories are tied to preparing or realising value capture (Ankrah & Omar, 2015). However, differences in a firm's strategy towards these goals can still have a substantial impact on how it engages with a university centre. Isaeva et al. (2022) differed between firms focused on developing specific innovation solutions and firms that mostly wanted to develop and explore new knowledge, and structured (i.e., pre-planned and often formal) and unstructured (i.e., not determined in advanced and often informal) coordination activities (Claggett & Karahanna, 2018) within research centres (Isaeva et al., 2022). The former type of firm focused on steering the centre towards its own specific goals in the structured coordination activities during the formation of the centre, while the latter type of firm focused its

participation mainly on unstructured coordination activities during operations (Isaeva et al., 2022). Järvi et al. (2018) projected two forms of organisation for knowledge ecosystems. On the one hand, a prefigurative organisation that is less structured, has more informal interaction, and is open to seeking knowledge in more than one knowledge domain. On the other hand, a form of partial organisation that the prefigurative organisation can evolve into. Here the knowledge ecosystem is working on a pre-determined knowledge domain in a more structured format with strict funding rules that imply more control and coordination of activities.

This difference in the underlying motivations of academia and firms typically require a large effort to handle through several mechanisms. For university research centres, this requires efforts to align activities with the dominant (academic) motivations and to identify further opportunities for firms to benefit from work adhering to these academic motivations, but also that researchers in academia accept and adjust their approach to these activities with regard to the minority (industrial) motivations (Perkmann et al., 2019). In fact, it typically requires continuous effort by senior researchers in academia to shield their junior colleagues, so their activities are not steered too much towards fulfilling the motivations of the minority.

Method

This section starts with describing and motivating our case study approach. It then describes the associated case, the data collection, and the analysis in detail.

Research design

This paper is based on multi-unit case study research of university competence centres that consist of different industrial firms collaborating with academia to share, exchange and possibly co-create knowledge (Gerring, 2004; Yin, 2003). This approach is considered particularly

suitable when the boundary between the phenomenon of interest and the context is not clearly evident and when the intention is to capture features, context and processes of a phenomenon (Scholz & Tietje, 2002). The study consists of three units that can be grouped as a) university-industry collaboration without research activities in the "Zeta" competence centre, and b) university-industry collaboration with research activities in the "Omega" and "Epsilon" competence centres. Omega is a spin off competence centre from "Zeta", which makes it interesting for investigating how university-industry collaboration has evolved over time. Epsilon is independent centre that is studied for triangulation purposes of competence centres with research activities. Each competence centre consists of partners from academia and industry, which collaborate around one or more knowledge domains. In the studied centres there is no focal innovation, but partners rather collaborate around common areas of interest within the knowledge domain. Networking and knowledge exchange between partners are examples of key activities in all of the centres, while knowledge co-creation is also important in the centres that conduct research.

Case description

The selected competence centres are based in Sweden and differ in age, source of funding, and main activities. They focus on knowledge domains in areas that attract the interest of different industrial firms, such as sensor informatics, embedded systems, edge computing, and systems control. Some of these knowledge domains overlap between centres. Each of the centres consists of small and medium-sized enterprises, large industrial organisations, and an academic actor in the form of a university.

The *Zeta competence centre* was established in 2008. Its main activities focus on education and networking. The main funding stream coming from partners' membership fees. The centre

organises competence groups in which several partners from different industrial domains interact on mutual topics of interest. Another form of group in Zeta is called a working group. These also have cross-industry participation, but on topics that partners come up with in e.g., competence groups and decide to interact around in more depth. The centre management structure is made up of a *chairman*, a *board*, and a *director*. The chairman comes from one of the industrial firms, while the board representatives come from several industrial firms and academia. The director is a networker with good connections to industry, but who does not have a background in research.

The *Omega competence centre* is a spin off from the Zeta centre. It was established in 2020. The idea was born in a working group at Zeta centre, when several partners from different industrial backgrounds found a common area that was worthwhile to investigate further. They worked jointly in applying for public funding to establish the new competence centre Omega. Therefore, the main source of finance is public funding. The main activities are research, education, and networking. Omega centre has several structural and organisational practices that support knowledge sharing between projects that include companies from different industrial backgrounds. The centre is structured in three main focus areas. In each area there are several sub-projects, and firms can be part of several sub-projects across different focus areas. Omega is chaired by an industrial representative from the founding partners. The board consists of representatives from different industrial backgrounds. The director of the centre is a professor who is an expert in the centre's knowledge domain.

The *Epsilon competence centre* was established in its current format in 2017. Prior to that a collaboration existed that involved the majority of the industrial partners, but it had a different name and focus. The main source of financing is public funding. The main activities include research, education, and networking. Similar to the Omega centre, several structural and

organisational practices take place in Epsilon centre to enhance knowledge sharing between different projects. The centre is structured as a matrix organisation with four main high-level application areas meeting five of the centre's main core competencies. In the application areas industrial firms are grouped with academic experts, so that academics and industrial partners can work jointly in small groups within the application areas. The centre is chaired by an industrial representative and the board consists of other industrial representatives coming from different industrial backgrounds. The director of the centre is a professor who is an expert in the centre's knowledge domain. Epsilon is located in a different university and region than Zeta and Omega.

Data collection

Data was collected through 15 semi-structured interviews involving the centres' directors, industrial representatives from different firms, academics engaged in the centres, and industrial PhD students from different organisations (see table 1). The questions were open-ended, such as "How does the participation of different organisations work at the centre?" and "How does the centre management facilitate the collaboration?". The probing in the interviews were supported by document analysis and field observations over a period of 24 months that covered meetings, seminars, and workshops to enrich the contextual understanding of activities and interactions within the centres.

Table 1 list of informants

Alias	Position	Centre affiliation	Duration
C-1	Competence centre director (Zeta)	Zeta	76
C-2	Competence centre director (Epsilon)	Epsilon	79
C-3	Competence centre director (Omega)	Omega	104

I-1	industrial representative (aeronautics)	Epsilon	87
I-2	industrial representative (assembly technique)	Zeta, Omega, Epsilon	124
I-3	industrial representative (assembly technique)	Epsilon	102
I-4	industrial representative (automotive)	Epsilon	61
A-1	Academic University 1	Epsilon	96
A-2	Academic University 2	Omega	63
A-3	Academic University 2	Zeta	84
P-1	industrial PhD student (assembly technique)	Omega	80
P-2	industrial PhD student (assembly technique)	Epsilon	92
P-3	industrial PhD student (assembly technique)	Omega, epsilon	101
P-4	industrial PhD student (healthcare)	Omega	100
P-5	industrial PhD student (healthcare)	Omega	104

Data analysis

The conducted qualitative data analysis followed the thematic coding procedure of transcribed interviews (Strauss & Corbin, 2008). The analysis process was reflexive, iterative, and comparative in relation to a data collection taking on different perspectives of centre management, industrial representatives, and industrial PhD students (Merriam & Tisdell, 2016). The process entailed developing informant-centric first codes coming from the raw data, which were refined into secondary codes and high-level categories. The secondary codes consisted of more interpretation through researcher-centric clustering of various first codes coming from different informants. Finally, high-level categories were identified by recombing and merging different groups and clusters. Additional sources of data, such as observations, participation in events and documents analysis, allowed for triangulation of surfaced findings during the process. The document analysis of the centres' websites and published material also helped in crafting the case description.

Findings

Our analysis surfaced common enablers to cross-industry knowledge sharing in all studied competence centres, such as a) creating fertile knowledge sharing environment, b) finding common ground for knowledge sharing and c) building and maintaining long-term sustainable relationships. However, on a closer look, there are differences. Competence centres *without* research activities seem to have a loose organisation that empowers industrial partners' representatives. Cross-industry knowledge sharing is facilitated by a university acting as an intermediary, but takes place informally rather than through formal channels. The education function of the involved university is emphasised, for instance to enhance the employability of students. Competence centres *with* research activities tend to have more structured organisation in which academia is leading groups and projects. Knowledge sharing across industrial actors is structured and channelled through several knowledge dissemination activities and practices organised by the centre leadership. While the involved universities also make sure to nurture education and seek to enhance the employability of their students, the emphasis is on research activities.

Creating fertile environment for knowledge sharing

In competence centres with and without research activities, collaborating across domains is seen as beneficial for firms because they share challenges in principle but do not compete. Therefore, bringing partners from different industrial backgrounds helps in lowering barriers related to competition and confidentiality. Omega centre director (C-3) indicated "companies saw a lot of benefits in collaborating with each other, especially across domain […] all companies are facing challenges with AI, machine learning, and cyber security involving autonomous systems". In Zeta centre that does not conduct research, the director (C-1) highlighted "when we bring

representatives from the industry members together, you many times see that they share similar challenges across the organisations. It seems like there is no end to how much networking could do because there's always new things to discover about each other".

The centres' management strive to provide a fertile environment where firms can share and exchange knowledge about common areas of interest and challenges without being worried about knowledge leaking to competitors. Omega competence director (C-3) explained "[Omega] is an open and neutral arena where you could try things. It might not be in your own domain, but can still be beneficial, because then you're going to evaluate new algorithms or software without being afraid of confidentiality". Competence centres are seen as a place that has less political influence that could make employees hesitant to share problems and talk more openly. A professor who is heavily involved in collaborating with industry (A-3) specified "What we offer [at Zeta] is a neutral ground, a neutral platform where it's OK to bring up problems, for instance where it's OK to talk to someone in a much more open way than you can do in your own organisation where you have to make sure that you're protecting your area and where things are political". Therefore, both types of centres (with and without research) work on creating an open environment that support knowledge sharing between different companies and between different collaborative projects.

Finding common ground for knowledge sharing

As all of the centres include partners from different industrial domains, several informants indicate the necessity of finding a common ground to enable interaction and knowledge sharing between organisations. Research leader (A-1) explained "[the centre's knowledge domain] has been like a common goal for most of the companies […] we're working with more spread over the companies rather than just directed towards a single product". Some informants contrasted

that companies are conservative about their products. However, at the centres, as they work more on tools that could be useful for different industrial applications, companies are willing to share and exchange knowledge. Research leader (A-1) illustrated "for example something that's common in robots, cars trucks, Cranes, aircraft and [assembly tools] is friction. So, working with friction, how to model friction and how to compensate for friction is something that all of these industries are working with. Then it's a more abstract theme but fertilizes different areas". There are several other examples of identified areas that gather different industrial actors, see table 2.

Table 2 Examples of common areas between different industries

Examples of cross-industry mutual interests
"The combustion engine nowadays going into electrical engines to the wheels, the whole chain, combustion after treatment, gearbox, shaft, etc. And that is what you can find in Products from [assembly industry] as well. In these fastening tools you have a driveline, you have an electrical motor, you have gears etc., therefore, several of these aspects that you find in the driveline of truck you can find in the driveline of the fastening tool" (C-3)
"A very rapidly expanding area is electrification with batteries and all kinds of aspects around that. And there are a couple of projects have been started were [Epsilon] is the hub […] for example, battery systems" (C-3) – Note: this battery project works on battery diagnostics which made it possible for different companies to collaborate regardless of their end-application of different battery voltages e.g., high, medium, and low voltage batteries for trucks, robots, drones, and assembly tools.

However, competence centres with and without research work differently towards finding a common ground between different partners.

In centres that conduct research, academics have an active leading role in deciding areas and topics in the centre. Omega centre director (C-2) justified "people are extremely busy already

and there is so much noise, so you need to be clear about the messages and you need delivered them on the right channels". Centres that conduct research illustrate a structured organisation with pre-identified areas of collaboration. For instance, Epsilon identified four application areas and Omega identified three main focus areas that serve as common ground for collaborating partners from different domains. Having research activities entail the necessity to generate publishable results, which imply an academic logic to the work. Therefore, industrial partners do not have complete freedom in bringing in new ideas or creating new knowledge domains of interest. Epsilon centre director (C-3) indicated "I mean what we are discussing now is actually one of the trickier things when running a competence centre to have this because in order to generate publishable results in the suitable journals and conference, it has to be very specific".

The Epsilon centre director gave as an example of a common area between different partners "for example, optimisation is used in, and I would say most or all application areas, to spread the knowledge in that way would fertilizes different or several Projects". Therefore, the centre endeavours to organise several knowledge dissemination activities within each main area and across collaboration areas. For instance, workshops, posters sessions, and meetings are examples of structured activities that facilitate and enhance knowledge sharing across different collaborations within the centre. The Epsilon centre director (C-2) indicated that "we try various methods to have this knowledge transfer […] One activity is the annual workshop […] a poster session where PhD students and post-docs present what they're doing. At poster sessions, people can look around and discuss and that is one way for a person, say, from [automotive industry] to learn more about what's going on in [aeronautics] project and vice versa". Hence, PhD students are quite involved in the knowledge dissemination processes in the centre as they constitute the main knowledge vessels of the conducted research. The other form of activities induce

interaction between industrial representatives through knowledge sharing at the centre management level. Centre director (C-2) highlighted “We have one of the items on the agenda for the board meetings what's called project reports […] where area coordinators give update and a summary of what is going on in that application area e.g., new publications, new ideas, new recruitments. That often leads to discussions about issues that can be of common interest”.

Accordingly, knowledge sharing in these centres is well structured and channelled by the centre management. Furthermore, public funding agencies have started to include requirements for knowledge dissemination across different domains. Such directives drive academics to facilitate and structure channels for knowledge dissemination. The Omega centre director (C-3) indicated “[the funding agency] told us very clearly: they don't like silos! They don't like this project here and then another project here and there is no interaction”.

In the Zeta competence centre, without research activities, academics have less presence and less influence on knowledge sharing activities in groups. They rather have an intermediary role that facilitate knowledge sharing between industrial partners from different backgrounds. The centre director (C-1) explains “What we have been back in the days one way communication, it has been very much about making activities that goes from [university] to the members of different kinds. What we are now adding is more member-to-member activities”. Second cycle students, master level, are more present than researchers and PhD students. Unlike PhD students in research centres, master students are less constrained by the academic logic. Moreover, the Zeta centre facilitates several activities to connect master students with different companies leading to summer jobs and master thesis projects.

Organisationally, at Zeta, academics are stepping back and delegating the leading roles in running groups to industrial representatives. The Zeta centre director (C-1) underlined “one of

the parts in the remake of the competence groups is that we have assigned one host or responsible person from the industry before it was more academic people". Such role delegation has been seen as an enabler to interaction and knowledge sharing between companies. A-3 highlighted "some of them [industrial representatives] are really active, in particular the ones who have leading roles on the board". Accordingly, more freedom is given to industrial partners to share knowledge informally and self-organise themselves into groups of interest. A-3 indicates "the networking itself is very important. Sometimes we don't have to be in between as academics. Sometimes the companies just need to get in touch with each other". Moreover, partners have the possibility to create a new working group topic in a mutual area of interest that several partners want to investigate in more depth. The competence centre Omega is born from cross-industry discussion in such a working group, when partners found common interest in the area and took it further to the point of writing a joint funding application.

Building and maintaining long-term sustainable relationships

Long-term relationships and trust between collaborating partners have been seen as vital to enable knowledge sharing in competence centres. Epsilon centre director (C-2) indicated "one very important aspect is that having a collaboration over many years, you get time to know each other and build up trust to each other, you learn how to collaborate, and also it takes time for academia to understand products and problems of the companies, and that is very valuable". Several informants considered funding as an important factor for collaboration stability, and competence centres that rely heavily on public funding could close down when the funding dries out. This challenge has a large impact on competence centres that conduct research, such as Omega and Epsilon, as they survive through public funding. A professor (A-3) explained "Funding is a factor of stability and long-term relationship building […] the discontinuity of

funding has been seen an impactful issue". At the Zeta centre, the funding challenge is mitigated by having a new business model with a membership scheme that is less dependent on public funding. The academic representative at Zeta (A-3) highlighted that "In [Zeta] the funding scheme is different and more sustainable than public funding that last for max 10 years".

Consequently, a relevant challenge that competence centres face is the lack of sustainability in the engagement of the people involved. For instance, some informants indicated that academics chase funding and could switch projects easily for that reason. That makes it hard to sustain the centre work at the operational level. The Zeta centre director (C-1) indicated "it's a little bit tricky to have this kind of everyday ongoing activities based on people that just could disappear from one day to another. I guess it relates to kind of incentives, and of course money is a very clear incentive". The delegation of leading roles to industrial representatives at Zeta is seen as providing more sustainability for the centre operations. C-1 highlighted "with that [the shift to industrial representative leadership] we do think that we will be able to generate a better and steadier outcome of the competence groups". However, several informants indicated that a mutual interest is an important incentive for industrial people to sustain their engagement.

Discussion

The results allow us to continue building on discourses relevant to knowledge sharing and innovation to define how university competence centres organise knowledge sharing among firms. Specifically, this section delves further into the associated implications for neutrality of university competence centres, the way academia enforces their motivations and needs on organisations they lead, and how this has implications for sustained collaboration.

Neutrality

The findings hold implications for the supposed neutrality of university competence centres, both regarding that of their activities and the way they present themselves.

Zeta organises companies around developing and exploring new knowledge, but not in ways that lend themselves toward developing specific innovation solutions. That the *common ground for knowledge sharing* was found in the unstructured activities within the competence groups then aligns with the results of Isaeva et al. (2022). The firms' goal with regard to knowledge sharing does not lead to the use of structured activities, and when firms active within Zeta identified a common interest towards more specific new knowledge domain this was not realised within the centre as e.g., a research project. Instead, Omega was spun off to organise structured activities, and give the firms involved a chance to set the goals of these activities during the preformation phase of this new centre. This implies that the involved firms are aware of the implications of knowledge spillover as a key function within Zeta, and thus that it is not neutral in the sense that bringing up problems cannot have business implications. The strategy of patenting to mitigate the negative aspects of open collaboration (Arora et al., 2016) is then less useful in Zeta, as the knowledge spillover might not be planned but is still desired. The firms accept that they can disclose knowledge of value to other firms in the Zeta activities without benefitting from it, but then expect to similarly receive knowledge of value to them – possibly even at some other time. Zeta has thus developed other strategies for protecting the participating firms from harmful effects of spillovers. Most obvious is the creation of a *fertile environment for knowledge sharing* by emphasising cross-industry knowledge transfer. If two firms are not competitors, the risk of harmful effects due to knowledge spillover decreases.

Similarly, even if Omega holds forth that it is an open and neutral arena to create a *fertile environment for knowledge sharing*, the main mechanism for knowledge sharing are structured

research projects involving PhD students. Even if the centre is thus supposedly technology neutral, it is not neutral with regard to the type of knowledge that the centre will primarily strive for. This knowledge has to align with the academic logic (Perkmann et al., 2019), and thus e.g., be novel enough and of enough quality to be publishable. So, as the activities at both centres that conduct research have an academic logic to their handling of knowledge, neither is going to be neutral in the sense that they will be highly conducive to non-academic exploration, such as recombination innovation.

Conflicting Logics

The university competence centres with research *create a common meaning* within well-defined knowledge domains and have a *structured organisation* that favours formal, structured coordination activities in which collaborative academic research projects mainly disseminate findings to other industrial partners within the centre. These centres thus constitute knowledge ecosystems organised as a form of partial organisation working towards knowledge creation within a pre-determined knowledge domain (Järvi et al., 2018). The *common meaning*, or shared understanding (Carlile, 2004; Järvi et al., 2018), has clearly observable implications for shaping the knowledge search process. Specifically, a key implication is that the knowledge search adheres to the academic logic – novel problems and the possibility of publishable results are required for attention during the centres' activities. The efforts to create a *common meaning* were thus mostly targeted towards the interface between academia and industry.

By contrast, the university competence centre without research is apparently not as focused on creating a *common meaning*, but rather featured a *loose organisation* that increasingly favoured unstructured firm-to-firm interactions. Additionally, Zeta facilitates the pooling of master

students, who can interact and exchange knowledge with firms in the centre. This can potentially lead to the recruitment of master students for internships and master thesis projects. One of the main reasons of firms to provide internships and master thesis projects is the intention to explore knowledge domains that are unknown to them (Asplund & Flening, 2021), i.e., the intention is often to acquire a larger understanding of other industries. In other words, Zeta facilitates a *common meaning* between firms both through knowledge generation and networking activities, and specifically then a greater cross-industry understanding. Worth noting is how the *empowering of industrial representatives* through the transition of operational leading roles from academics to industrial partners facilitates unobliged probing (Järvi et al., 2018) among different industrial partners to self-group themselves around mutual areas of interest. Our observation of Zeta then suggests that it is an *organisational form* of university-industry collaboration that has up until now neither been noticed by the discourse on intermediaries (Gassmann et al., 2011), nor the discourse on knowledge ecosystems (Järvi et al., 2018). As an intermediary it is related to innovation broadeners, but it clearly has strong technological skills and is not itself the organisation that creates value by innovating. As a knowledge ecosystem, its form is more reminiscent of the prefigurative form of organisation discussed by Järvi et al. (2018), but it is not just an antecedent to a later form of university-industry collaboration focused on a more well-defined knowledge domain – it can even be sustainable after spinning off this type of collaboration as a new entity.

Sustainability

As expected, university competence centres with research leverage strongly on the second mission of universities, i.e., they compel researchers to engage through funding their research – albeit the researchers had to make compromises with the minority (industry) logic in the process

(Perkmann et al., 2019). This is problematic for building long-term relationships, as public funding typically has a clearly defined end date. By contrast, Zeta appears less vulnerable to loss of funding, but instead experience problems with establishing *long-term relationships* due to academic researchers disengaging to pursue or make good on promises related to received research funding. Engaging industrial partners is then an important, alternative way to increase the endurance of the centre's operations, but the challenge then becomes to sustain their interest to ensure they remain engaged. Interestingly enough, our observations suggest that university competence centres without research instead can rely on the first mission of academia, i.e., teaching, to strengthen sustainability. Many of Zeta's activities involve providing industry a way to interact with and potentially recruit master students before they graduate and left university.

Conclusions

To summarise, this study enhances our understanding of knowledge sharing among partner organisations, and important associated practices, at university competence centres.

At a theoretical level, our observations allow us to characterise university competence centres as non-neutral and strongly tied to either the first or the second mission of academia. This study thus contributes to the discourses on cross-industry innovation, intermediaries, university-industry collaboration, and knowledge ecosystems in the pursuit of our research questions.

Firstly, cross-industry knowledge transfer appears to be especially relevant and likely to occur in university competence centres without research, as it provides a strategy that both allows relevant knowledge sharing and protects the participating firms from harmful effects of spillovers.

Secondly, university competence centres act as intermediaries that enables knowledge sharing by the building of a common meaning among participating organisations. However, the focus on the

first or the second mission leads to this meaning primarily being constructed in the firm-to-firm or university-to-firm interfaces, respectively. Furthermore, by focusing on the first mission university competence centres without research can take on a prefigurative form as a knowledge ecosystem, but do not necessarily have to later transition to other forms – they can provide alternative benefits that allow them to be sustained over time.

Thirdly, building a sustainable university competence centre has different challenges for those centres that focus on research vs those which do not. The largest problem for the former will be to avoid public funding from drying up, while the latter will have to lean heavily on the first mission of academia and including industry in its organisational structure to maintain interest. Both university competence centres with and without research will thus have to clearly understand the motivations of universities to engage as a way to fulfil not only the third, but also either the first or second, mission, and that taking the industrial partners perspective with this in mind could help plan and organise the engagement of firms in competence centres.

Limitations and future research

This research was conducted in a Swedish context. The conducted analysis was at the organisational level. A recommendation for future research is to investigate and contrast with contexts in other countries. Analysis at the individual "personal" level could compliment with other factors influence cross-industry knowledge sharing in competence centres.

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