Original Article

A Lewinian Approach to Managing Barriers to University–Industry Collaboration

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Calls are made by governments, university management and industry to increase university–industry (U–I) collaboration to find solutions for societal and economic problems that are too complex to be tackled within one sector alone. Researchers are often expected to realise these ideas, but when it comes to everyday research and knowledge development, individuals may encounter barriers to accomplishing this. The paper presents an empirical study of researchers' view on U–I collaboration. Our focus in the analysis, inspired by the Lewinian field theory, is on the hindering forces that might create barriers to collaboration from a researcher's perspective. Contrary to the previously used approaches taken in force field analysis, we perform a qualitative study, which might be better suited for this framework. In the literature on U–I collaboration, 'orientation-related' and 'transaction-related' barriers have been identified. In our analysis, we discuss hindering forces on the individual, intra- and interorganisational levels. In total, we find 18 key areas to identify possible hinders for collaboration and based on a Lewinian perspective, we suggest that removing hindering forces can benefit U–I collaboration. The paper recognises the need to regard universities as equal partners in U–I collaboration for sustainable knowledge production.
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Introduction

Contradictory and context-dependent results indicate that university–industry (U–I) collaboration is a complex phenomenon. Tensions and barriers that may hinder collaboration arise at various organisational levels. Bruneel *et al*. (2010) have identified two types of barriers at the interorganizational level: 'orientation-related' and 'transaction-related'. Following an examination of academics' perceptions, orientation-related barriers were more strongly perceived than transaction-related barriers, and previous experience and trust were identified as reducing barriers to U–I collaboration (Tartari *et al*., 2012). This paper continues to empirically explore academics' perceptions of barriers to collaboration. Lewin's classical field theory

provides guidance in understanding the tensions involved in patterns of interaction at various analytical levels. This theory has also been useful in understanding how to manage barriers in practice in order to develop organisations. To increase our knowledge about barriers at various levels of U–I collaboration, a Lewinian framework will therefore be used in the analysis.

The paper begins with an overview of the potential effects of U–I collaboration on firms, as well as their university partners. This is followed by an elaboration of the barriers to U–I collaboration and a presentation of the theoretical framework. Finally, the details of the empirical study and the results are presented.

U–I Collaboration

Governments, university management and industry share an interest in increasing U–I collaboration to support knowledge, learning and innovation. In many countries, U–I interaction is represented as a promising arena for future knowledge production. Several studies show positive effects on the part of collaboration, such as patents and the encoding of firm knowledge, but the effects vary by firm type (Chai and Shih, 2016). Publicly funded U–I collaboration had positive effects on UK firms' R&D employment (Scandura, 2016), and knowledge production with academic inventors increases the innovative performance of firms (Dornbusch and Neuhäusler, 2015). Individual scientific collaborations and R&D alliances may influence firms' future innovation focuses (Hohberger *et al.*, 2015). Collaboration increases invention quality, but its impact may vary depending on the stage of the innovation process (Walsh *et al.*, 2016). The assumption of institutional homogeneity must thus be questioned because institutions and markets evolve in different ways, and this influences how academic collaborations promote firms' innovation performance (Kafouros *et al.*, 2015). Furthermore, it is problematic to focus solely on the positive effects of U–I collaboration for firms because collaboration should provide value to all partners.

Studies that include the positive effects of collaboration for universities tend to consider publication behaviour or entrepreneurial behaviour. Senior tenured faculty can benefit from affiliation with a research centre in terms of higher publication rates (Sabharwal and Hu, 2013), but faculty with larger teaching or extension appointments produce fewer publications in the Thomson ISI Web of Science (Miller *et al.*, 2013). During collaboration, the number of publications can increase up to a certain point, but when faculty collaborate more than 30–40% of the time, research output declines (Banal-Estañol *et al.*, 2015). Collaborative networks of scientists involved in the production of scientific knowledge promote productivity and creativity, but not all collaborations are equally beneficial, and we must know more about the characteristics of such networks and their role in knowledge creation (Wang, 2016). National contexts should also be included to consider

potential differences in academics' interactions with private and public organisations (Zhang *et al*., 2017). The positive effects of collaboration on a lecturer's scientific production can, in fact, stem from the collaborating firm's capacity to provide financial resources (Callaert *et al*., 2015; Manjarrés-Henríquez *et al*., 2009). Incentives for scientists are negatively related to entrepreneurial activity (Markman *et al*., 2004), but this is contradicted by findings showing that entrepreneurial activity can coexist with or even reinforce productive publication behaviour (van Looy *et al*., 2006). The studies that have examined the positive effects of collaboration are thus inconclusive. Additionally, such effects should be understood as emerging in an environment characterised by barriers that arise due to tensions.

Barriers to Collaboration

The increased focus on U–I collaboration involved built-in tensions from the beginning. The main goal for universities is to create new knowledge and educate students, while the focus in industry is capturing knowledge and leveraging this for competitive advantage (Dasgupta and David, 1994).) U–I collaboration is usually understood as an interorganisational arrangement, and Bruneel *et al*. (2010) have examined two types of barriers to U–I collaboration: 'orientation-related barriers' and 'transaction-related barriers'. Below, these two types of barriers are described further.

Orientation-related barriers are those barriers that are related to the different institutional norms of the organisations, which influence how people perceive and perform their work (Bruneel *et al*., 2010). U–I collaboration is an alliance based on differing institutional norms (Dasgupta and David, 1994). While universities' mission is to create reliable, public knowledge and thus expand the pool of useful knowledge, the private sector seeks to capitalise on existing knowledge to gain a competitive advantage (Bruneel *et al*., 2010). Such barriers are often known to the actors involved in collaboration, especially the differences in universities' long-term orientation versus businesses' short-term orientation, and though such barriers remain substantial, they are characterised by less tension than transaction-related barriers.

There is, however, a reason to take a closer look at these barriers: there is an ongoing shift from the view of university knowledge as a public good to innovation models, in which identification, protection and exploitation are central (Hewitt-Dundas, 2012). One driving force is the change in how research is evaluated and rewarded, which represents a key mechanism of change in the norm system (Benner and Sandström, 2000). Performance-based research funding systems have been introduced in several countries (14 systems in 2010), and governments' rationales for this include knowledge economy, new public management and the

achievement of research excellence (Hicks, 2012). Universities with high research quality based on publications and citations will be more likely to be involved in knowledge transfer (Hewitt-Dundas, 2012), and in applied sciences, the solution of technical problems is a major concern (Meyer-Krahmer and Schmoch, 1998). There has been an increase in the share of external and industry funding (Auranen and Nieminen, 2010), and in the technology sector, where innovation and entrepreneurship are stressed as important mechanisms for development, a shift of orientation is a possibility. U–I collaboration is regarded as a necessity for national economic development and innovation (Abramo *et al.*, 2011), but the effects on the orientation of organisations should be taken into consideration to fully understand the changes being initiated.

Transaction-related barriers are those barriers that emerge when there is tension in the exchange between organisations involved in collaboration. Conflicts regarding intellectual property (IP) rights or administrative procedures can create barriers (Bruneel *et al.*, 2010). Firms may need to collaborate as technology becomes more complex, which may lead to a 'paradox of openness', in which opening up to outside sources weakens firms' ability to capture rents from shared sources of knowledge (Arora and Athreye, 2016; Laursen and Salter, 2014). Conflicts over IP are expected to increase, creating barriers to collaboration (Bruneel *et al.*, 2010). Efforts to make universities more entrepreneurial and to commercialise research, which may cause changes in the orientation of universities, have increased the tensions involved in transaction-related barriers to collaboration because they lead to more aggressive strategies concerning, for example, negotiations over IP. Concerning administrative procedures, rigid systems based on the requirements of central university rules can represent another barrier to collaboration. These include incentive systems that have been developed in line with external reward systems for research funding. Nielsen and Cappelen (2014) have pointed out the need to provide incentive structures that encourage interaction and collaboration with companies and to include students in ongoing research to promote knowledge transfer. Incentive systems are effective tools with which to influence behaviour within organisations. It is, however, difficult to find a straightforward mechanism leading from incentives to desired outputs. In some cases, incentives for researchers could have negative effects on entrepreneurial activity (Markman *et al.*, 2004). If there is too much emphasis on competition for research funding, this can reduce the time available for actually performing research (Auranen and Nieminen, 2010). Miller *et al.* (2013) found that if extension appointments exceed 40% or teaching appointments exceed 25% of total appointments, the number of research publications will be comparatively less, while their study reported positive effects on the part of the number of publications regarding grants and university funding (Miller *et al.*, 2013). A series of issues must be addressed when developing a performance-based research funding system. These range from ensuring equity and excellence to determining whether

performance-based research funding systems suppress novelty, innovation and intellectual diversity (Hicks, 2012). Incentive systems and collaboration structures can thus support or hinder collaboration (Mäkimattila *et al.*, 2015).

Coherence between systems on various levels highlights the need to connect the interorganisational level to the intra-organizational and individual levels. Within an organisation, one may find tensions based on the different views among faculty and administrators (Daza Campbell and Slaughter, 1999). In a collaborative project, it is therefore important to recognise how specific activities contribute to the university's goals, as well as to completing the individual researcher's tasks (Bjursell, *et al.*, 2016). Including the individual level is important in understanding barriers to knowledge transfer (Tartari *et al.*, 2012; Sun and Scott, 2005). To learn more about potential barriers to collaboration, this paper aims to identify the forces that hinder collaboration from academics' perspectives. As a framework for understanding these forces, we present the Lewinian field theory.

Theoretical Framework: Field Theory

Kurt Lewin is an important researcher who has enhanced the understanding of human behaviour during change. One of the many theories he developed focuses on the field in which individuals and groups act. Many researchers and consultants have used his ideas in their own practice and further developed and sometimes simplified his theories into various rational methods of force field analysis. This carries a risk of disregarding Lewin's dynamic view of the field. Therefore, a field theory renaissance is called for. Humans construct their views of themselves and their environment and live in a state of dynamic dependency on their environments, which is why studies on humans cannot be performed outside of their environments. Change occurs based on individuals' awareness of what affects them and thus affects their perceptions of themselves and their environment (Burnes and Cooke, 2013).

Individuals and groups never act in isolation. Rather, they exist within an environment of interdependency. Individuals and groups are both affected by the conditions of the environment in which they operate, and they, in turn, affect their environments. An individual or a group is dependent on and tightly bound to its field; therefore, fully perceiving the conditions of the field may be difficult. The group or individual operates out of a given life-space, meaning the physical environment, cognitive structures and emotional approaches (conscious or unconscious) that the individuals or groups perceive about themselves and the environment within the framework of the field. According to Lewin, a life-space is in a state of constant change due to transformations in the environment (Lewin, 1997). Lewin's ambition was to increase the individual's awareness about his or her

life-space and about the powers operating in the field, allowing change to occur (Grundel, 2013).

Development and change occur in relation to someone's intention (goal) within a force field that includes both driving and restraining forces. The driving forces can be viewed as kinetic energy that creates movement (Lewin uses the term 'locomotion'), while the hindering forces break, restrain or push in a different direction. Sometimes, different driving forces block one another, leading to choices, conflicts or psychological tensions. According to Lewin, these forces regulate the field, allowing it to reach what he calls quasi-stationary equilibrium. One can choose to study how these powers strive towards equilibrium, but one can also choose to study how the powers strive towards an individual's intention or towards change (Lewin, 1997).

Even if the field theory and especially the idea of the life-space of individuals and groups differ from systems theory, they have similarities in terms of how they view equilibrium. Agazarian (1997) has, with the help of Lewin's field theory, developed methods of reducing resistance to change. She argues that when the hindering powers are stronger than the supporting powers, the barriers to change become even more powerful within the system. By reducing the hindering powers, the energy of the supporting powers is increased. In addition, researchers such as Schein (1996) and Argyris (1990, 1997) have been inspired by Lewin, and described change as a painful form of learning and found that stability in human behaviour is based on this equilibrium. If supporting powers are stimulated, the system will strive towards equilibrium by increasing the hindering powers.

> For change to occur, this force field had to be altered under complex psychological conditions because, as was often noted, just adding a driving force toward change often produced an immediate counterforce to maintain the equilibrium. This observation led to the important insight that the equilibrium could more easily be moved if one could remove restraining forces since there were already driving forces in the system. (Schein, 1996, 28)
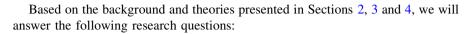
Psychological resistance appears in the form of a defensive patterns (defensive routines) and can be viewed as traps we build for ourselves, which can be difficult to make visible and affect (Argyris, 2010).

> Unfortunately restraining forces were harder to get at because they were often personal psychological defences or group norms embedded in the organizational or community culture. (Schein, 1996, 28)

The above quotes support our decision to focus on the hindering forces that researchers encounter in U–I collaboration. The identified hindering forces can also be used to suggest actions that can be taken to reduce these hindering forces and thus empower supporting forces.

Based on the background and theories presented in Sections 2, 3 and 4, we will answer the following research questions:

RQ1: What barriers to U–I collaboration can be identified in academic organisations?
RQ2: How do these barriers relate to various levels in and between organisations?
RQ3: Adopting a Lewinian perspective, how can barriers be understood and managed?

Method

A context-determined phenomenon, such as academics notions of U–I collaboration, is best studied through an in-depth qualitative case study. The case study provides a setting for exploring the processes and characteristics of a phenomenon in detail (Bryman, 2011; Merriam, 1988). In-depth interviews (Kvale, 1997) will be used to provide a deeper understanding of individuals' experiences of working in collaborative ventures as part of teaching and research. The scientific approach adopted in this paper thus recognises knowledge as experiential. These experiences stand in relation to a given context and have a social character (Morgan, 2014). There is reason to take an interest in individuals' experiences because these experiences, according to the constructionist view, create behavioural rules for future actions. Previous experiences with U–I collaboration will influence how an individual chooses to engage in future U–I collaboration projects. This means that finding generalisations is not as interesting as reflecting on differences and concrete examples of collaboration in context. The reader should be reminded that the information in this study comes from only one organisation and that there may be vast differences between organisations, individuals and cultures. Still, it is those particularities in which we are interested, and to engender a broader discussion about general tendencies in academia, our paper offers a detailed report of the conditions and views that one may find in an academic organisation.

Data collection and analysis

In total, 16 interviews with research group leaders in Sweden were performed (see Table 1). They worked at a higher education institution oriented towards collaborative research, and they were approached because they had long-term experience in research and because as a group, they are involved in research in the form of U–I collaboration, as well as being involved in other research settings. In addition, they are involved in several ongoing research projects as leaders of their scientific areas. The interviews followed a structured interview guide that was developed in a larger national project about U–I collaboboration.

Table 1 Faculty, science areas and number of interviewees

Faculty	Science areas	Number of interviewees
Health (HEA)	Gerontology, healthcare sciences, quality improvement and disability research	4
Education (EDU)	Media and communication science, education, special education and organisation theory	3
Business (BUS)	Business administration, economics, informatics, commercial and tax law and statistics	5
Technology (TEC)	Product development, materials and manufacturing, industrial production, computer science and informatics	4

The interviews lasted 1 h on average and were conducted face-to-face in the native language of the interviewees. The interviewees were chosen because they represent a variety of science areas within technology (TEC), health care (HEA), education (EDU) and business (BUS). As research group leaders, they have extensive experience in academic work and receive continuous input from their research groups.

The interviews were transcribed *in extenso*, and the analysis was performed following an inductive, interpretative approach that was in line with grounded theory. This way of working means recognising that the researcher may have a flexible and undogmatic approach to interpreting, understanding and explaining the empirical data, influencing the mechanisms and results that emerge (Danermark *et al*., 2003). We are also inspired by Haig (2008), who argued that social science research requires more such explanatory inferences and reasoning regarding causation, or 'inference to the best explanation' (Haig, 2008, 10). The analysis was performed in two main steps. First, the material was coded and clustered into groups based on similar content. Second, the categories derived from the first analysis were connected to the framework of levels in and between organisations (e.g. Beeby and Booth, 2000; Crossan *et al*., 1999; Sun and Scott, 2005). In the discussion, we included Lewin's field theory, as well as earlier research on barriers to connect the clusters of hindering forces to the ongoing discussion of U–I collaboration.

Result: Barriers to Collaboration Identified in Academic Organizations

In this section, the empirical material is presented in the form of the categories that were derived from the inductive analysis of the interviews about academics' perspectives on collaboration in higher education. These hindering forces may influence the propensity to participate in U–I collaboration. We identified six

categories of hindering forces, which are related to competence, concepts, performance, resources, systems and value.

Competence-related barriers

Competence-related barriers concern the ability of the individual to perform in collaborative ventures. Several of the interviewed researchers pointed out the importance of having 'the right people' involved in collaborative activities. Being interested, motivated and friendly is a basic requirement. If people are uninterested or uninspired, they will drain energy from projects, which can be challenging because a collaborative project is demanding enough as it is.

Several of the interviewed researchers revealed that they had met individuals who were difficult to work with: 'When you collaborate with other universities and colleges, but also with companies, you sometimes meet a person that can be quite tricky' (BUS2).

> Different actors have different views on collaboration […], and we choose to work with those who are collaboration-oriented. Pragmatic. It would not work otherwise. (HEA3)

Another researcher described a tendency among younger researchers to hide from practice and noted that younger colleagues were sometimes afraid to even make phone calls: 'It becomes a problem when students are afraid and they feel that it is unpleasant to make a phone call and they run from it' (BUS1). This can be understood as a lack of interaction competence and is something for research leaders to address when they include inexperienced researchers in collaborative projects. When a research project begins, established personal relationships are crucial for collaboration.

> It is difficult to bring in someone else to do the work, because it is built on personal contacts and meetings. It is built on trust. (TEC1)

According to the interviewed researchers, successful collaboration is based on being able to create and uphold personal relationships.

Concept-related barriers

Concept-related barriers are related to how collaboration is defined and understood. The interviewed researchers, especially those working in applied sciences, emphasise that collaboration is an integral part of their regular activities: 'We work with collaboration at all times. It is like the air we breathe' (HEA3). Another interviewee was critical of that view and understood collaboration as merely a tool.

> It depends on what the product will be. [Collaboration] is simply a tool. It's like asking 'do you have any problems with the hammer?' Of course, you can't use the hammer all the time. (HEA2)

The interviewees mentioned that one potential reason researchers and teachers do not engage in collaboration is that there is a tradition of working alone so that the researcher has full control over the process. This is difficult in collaborative efforts: 'If you can't get off your high horse, the problems start'. (EDU3). Also, the distance between academia and the community increases if people avoid situations in which they feel uncomfortable. There is thus a need for different arenas with different purposes.

> We have networks and conferences for practitioners, but we cannot spend too much time on that since the interaction and exchange with other scientists is essential for progress. (EDU3)

Respondents involved in technology development recognised the need to improve communication between the university and industry: 'We need an understanding of the rules of the game for research funding' (TEC4). Some of the interviewees from the technical department suggested matchmaking to bridge the gap between researchers and companies.

Performance-related barriers

Performance-related barriers concern what is expected and what is rewarded. The interviewed researchers described the current performance-based research funding system as follows: 'We get money to the research group depending on how much we produce — how much money we get and how many articles we publish' (HEA2). 'Currently, we are measured on publications and external funding — those are two central dimensions' (TEC3). 'We are expected to attract research funding and to publish. We are rewarded based on this, and it is a reward system that has been developed both at the national level and also here at the university' (EDU3).

The allocation principles yield different results within the university depending on publication traditions and working methods. In some areas, it may be counterproductive to engage in collaborative projects: 'There are no incentives to engage in collaborative projects. […] They take huge amounts of time and yield very little in terms of scientific publications' (EDU1).

> We get mixed messages within the academy. You get more research funding if you publish in highly ranked journals, and as a scientific leader, I must support this since it is the basis for the careers of many researchers. […] so I cannot emphasise collaboration.' (EDU3)

The interviewees are not in agreement, however, regarding the role of collaboration in the reward system. One of the interviewees believed that collaboration was 'a prerequisite for conducting our activities because we get money through collaboration. If we don't have that, we cannot publish' (TEC1). Another interviewee argued that 'we might need to review this enormous pressure on scientific publishing because what we reward is what people will do' (EDU1). One of the interviewees reflected on whether an increase in salary could be a way to reward collaboration activities: 'If you take on new tasks and responsibilities and collaborate, that should be one of the criteria in salary negotiations' (HEA4). However, others believed that external rewards could split the group:

> The satisfaction of doing a good job is the ultimate reward. That's how I see it. It's not about giving people gold stars or diplomas. That stuff is a waste of time because it leads the operations in the wrong way. To reward individuals alienates us from collaboration'. (HEA1)

For many researchers, inner satisfaction is the only reward for engaging in collaboration today: 'I do not know if there are other rewards today than satisfaction' (BUS2). Controlling behaviour through a reward system was also described as difficult because the preconditions in an academic organisation are quite different between subjects and groups. These differences in requirements, assumptions and traditions across departments and subjects must be considered when setting up a reward system.

Resource-related barriers

Resource-related barriers concern the resources needed to enable collaborative activities: 'I think it is important to provide opportunities for collaboration' (HEA4). 'An individual that is driven and talented should be given the resources and space to work with it' (HEA1). The interviewees repeatedly mentioned time and financing as critical resources needed to engage in collaboration: 'There are two types of support you need. One is money, and the other is time' (HEA1).

Time is a critical resource when committing to the extensive involvement that collaboration often requires: 'The organisation must ensure that the time and resources needed are available if people are expected to be involved in collaboration' (EDU1). 'One should not underestimate the effort required to build and nurture a relationship' (TEC1).

Time is also an issue for collaborating firms. Slim organisations do not have the time to engage in collaborative developmental activities.

> We sent an application (for research funding), and the companies were interested in the topic, but now they do not have time to participate. (TEC3)

Funding can create time for collaboration, but funding is often associated with a research project. When this project is finished, there are no further funds to support engagement in collaboration.

Financing is not only important for large projects. Smaller amounts of money, for example, can be used to pay for travelling: 'Funds so that the whole group could meet' (BUS5). 'Seed money to create opportunities to meet and discuss ideas or to appoint a project manager to keep it together' (HEA3). 'Being able to cover the [travel] costs that arise when you work together' (BUS1). There is existing funding for collaboration in education:

> We have important support for international teaching, which is an excellent way to facilitate collaboration. It's only travel money, and you stay there four or five weeks, and you have your regular salary. Sometimes, that's all needed. (BUS1)

Funding to write applications or to maintain a network is rare or nonexistent.

System-related barriers

System-related barriers concern organisational systems and how they frame what is possible and what is not possible. One problem involves the compability between organizational administration systems.

> Our internal structures [are not consistent with the project requirements]. Sometimes, you wonder if the support functions are there for the operation or if the operation is there to follow the terms of the support organisation. (TEC4)

The question of support is a double-edged sword. Among the interviewees, there was scepticism towards people who only work with collaboration:

> I do not believe in support in the sense that a bureaucrat comes and talks about how to do this. We do not need that. However, what they could do is to loosen up the bureaucratic systems so that they do not hinder collaboration. (BUS)

Another barrier may be the ownership of the final results of a cooperative project. 'If you find something new and exciting and you want to patent that, then you can get into a discussion about who owns it' (TEC2).

Value-related barriers

Value-related barriers refer to hindering forces connected to individuals' notions of the researcher's identity and mission, as well as the values connected to these. U–I

collaboration is, according to the researchers, about strengthening research and education. This may sound obvious, but according to the interviewees, it is important to emphasise this point.

> Research and teaching are the University's core missions. We should not become consultants or business developers. […] Our management says: 'We are going to get the region's industry on its feet.' But I do not think that it is our task to do this. I think we can educate people that can get the region's industry on its feet. But as researchers and teachers, we cannot do everything. Research and teaching are already two tasks. (EDU1)

There are various ways to collaborate. How experience is valued and expressed can also differ across organizations. One collaboration option is to offer adjunct positions to people in industry, but this can clash with the internal requirements for employment at a university.

> According to our instructions, [adjunct professors] are to be examined in the same way as an ordinary professor. But most industry people do not even have a Ph.D. They can have a lot of experience and knowledge that could be very useful, but you cannot give them the title because it does not work with our own internal guidelines. (TEC3)

The meritocratic system in an academic organisation is an important part of academic culture. Another important aspect of this culture is the publication tradition. The interviewees had clear ideas about what they do and what is valued in their work. At the same time, these ideas should be challenged to determine whether there is need for changes that can improve working methods.

> I think that universities have a long journey towards value creation in and together with society. The idea is still that one sits in a house and delivers knowledge to others. (HEA3)

One of the interviewees who had experience with many universities saw that the approach to U–I collaboration may depend on the size and orientation of the university as well.

Barriers to collaboration at various levels in and between organisations

To further clarify the various levels involved in the key areas presented above, we summarise the barriers to collaboration within each category at three levels: individual, intraorganisational and interorganisational. This summary provides an overview of key areas within the categories at various levels, as well as the relationships between levels across categories (see Table 2).

The individual level refers to issues that are related to the individual's abilities, expectations and work situation. The results highlight the barriers that appear to be a product of people's disinterest, low degree of motivation or even lack of collaboration skills. Barriers can, for example, appear when individuals prioritize publishing over collaboration because publishing boosts their careers. The individual researcher's identity and value system can be hindering factors if collaboration is regarded as an extracurricular activity, something to be performed in addition to research and education.

The intraorganisational level refers to the formal and informal structures within the organisation. The results regarding this level show the barriers that arose when the collaborating teams did not have the correct composition or when people came from research traditions emphasising individual efforts rather than collaboration. Administrative systems, such as reward systems or resource-allocating systems, that encouraged publishing rather than collaboration also created barriers. A lack of administrative support was also mentioned as a barrier.

The interorganisational level refers to the interaction between organizations. A lack of collaboration competence and also a lack of trust can represent barriers to collaboration between organisations. Other barriers might arise because of organisations speaking different professional 'languages', have competing needs or have incompatible administrative systems.

Table 2 Key areas that influence collaboration in six categories at three levels

	Individual level	*Intraorganisational level*	*Interorganisational level*
Competence-related key areas	Interest and motivation Collaboration skills	Composition of teams	Established networks based on trust
Concept-related key areas	Collaboration as a tool or an approach	Disciplinary traditions	Shared language
Performance-related key areas	Career incentives: expectations and rewards	Allocation principles in reward systems	Research funding structure
Resource-related key areas	Time and money	Resource distribution	Company's needed time University's needed money
System-related key areas	System interfaces	Administrative systems Support functions	Administrative systems
Value-related key areas	Professional identity research and teaching as core missions	Academic traditions in different subjects	Organisational orientation

Discussion: A Lewinian Perspective on How to Manage Barriers

In the empirical analysis of the researcher's perspective, we identify forces that may hinder collaboration at various levels. The previously identified 'orientation-related barriers' and 'transaction-related barriers' (Bruneel *et al.*, 2010) in various categories at an interorganisational level: concept- and value-related barriers correspond to 'orientation-related barriers', and competence-, performance-, resource- and system-related barriers correspond to 'transaction-related barriers'. As pointed out by Sun and Scott (2005), barriers to knowledge transfer through collaboration can also be found at the individual and group levels in an organisation. At the individual level, hindering forces can be difficult to identify because they are personal and psychological (Schein, 1996; Argyris, 2010). This is especially true of value-related barriers because they are connected to an individual's ideas about his/her role and how this role should be played. This corresponds to Lewin's idea of life-space and how individuals' notions about themselves, as well as about the field in which they operate, are embedded. Individuals must become aware of this embeddedness for change to take place.

In line with Tartari *et al.* (2012), our results indicate that a lack of collaboration skills and interest in collaboration represent hindering forces at the individual level. We agree that trust and experience are central to successful collaboration, but in line with the theoretical proposal to remove hindering forces, we would like to draw attention to efforts that support collaboration. According to the results of this study, barriers at the individual level seem to be intertwined with barriers at the organisational level. Barriers at the inter- and intraorganisational levels that arise because of incompatible resource allocation systems and a lack of administrative support could be overcome via changes in these systems that support collaboration on an individual level. This means that changes in organisations' formal and informal structures could be a way to remove hindering forces and thus encourage academics to collaborate. One example would be providing time for researchers to engage in collaboration rather than having to do so on top of their other commitments. An overview of the possible paradoxes inherent to incentive systems could increase our understanding of potential barriers. For example, if a lack of competence is a hindrance, the organisation could provide education and development activities to reduce such barriers. Every single effort to manipulate the system, with the goal of increasing U–I collaboration in this case, must, however, be understood as one of many interconnected forces in a complex field. Zhang *et al.* (2017) emphasise that collaboration is context-dependent in that it requires a profound understanding of both university and industry logic. This is in line with our results, and we emphasise the need to clarify expectations, needs and wants in U–I collaboration.

Within the framework of field theory, U–I collaboration is understood as a complex set-up of driving and hindering forces. In a situation in which the

hindering forces are stronger than the driving forces, adding a driving force towards change creates a barrier to rather than support for reaching the desired goal (Agazarian, 1997; Schein, 1996). The new driving force will evoke a counterforce as the system attempts to maintain equilibrium. Agazarian (1997) suggested making efforts to reduce hindering forces rather than stimulating driving forces. Reducing hindering forces can ease change within an organisation. In U–I collaboration, universities focus on innovation and entrepreneurship as potential ways of changing the orientation, but this must be handled with care because it implies institutional change from an orientation towards public good (Dasgupta and David, 1994) to innovation models.

One premise of U–I collaboration is that the university and industry are complementary and that based on this, each partner provides something unique to collaborative projects. We would, however, like to see a further discussion of complementarity because differences in orientation create an asymmetric situation, one in which balance may not be possible. Potential changes in the orientation of universities, from public good to innovation and entrepreneurship, will also have consequences for collaboration. A change in orientation towards a more businesslike model at universities will reduce orientation-related barriers, but new tensions will emerge because universities/academics and businesses will become competitors. This has already happened regarding IP rights (Bruneel *et al.*, 2010). An alternative scenario is that universities come to function as R&D units for industry. Both scenarios could lead to the introduction of a short-term orientation, limiting broad, long-term knowledge development and neglecting a broader orientation towards knowledge creation, including knowledge for the public good. Wang (2016) points out that not all collaborations are equally beneficial in terms of knowledge creation, and based on the empirical results in the paper, universities must consider when and why collaboration is strategically important.

Conclusion

The paper identifies six categories of barriers that operate on three levels. This provides 18 key areas in which to identify forces that may hinder U–I collaboration. The empirical findings are discussed in a Lewinian framework, suggesting that the most effective way to support change is to remove hindering forces rather than adding driving forces. To fully understand the life-space of collaborating academics, various levels of hindering forces must be identified, and potential tensions between these levels must be considered in order to support U–I collaboration. Trust and openness regarding various parties' needs and goals may strengthen collaboration. Resource allocation and reward systems should also be discussed because they set the rules of the game.

Our findings provide contributions to the academic literature by (1) introducing Lewin's ideas to the discussion of U–I collaboration, (2) adding individual and intraorganisational barriers to the interorganisational barriers identified by Bruneel *et al*. (2010), (3) providing 18 key areas in which to identify forces that may hinder collaboration, (4) clarifying that barriers can be addressed at various levels within the same category and (5) recognising that although trust is critical, a restructuring of organisational systems may be needed to reduce barriers. The final conclusion is that (6) to engage in productive and sustainable U–I collaboration, universities should be regarded as equal partners, with their own logic regarding, interests in and goals for U–I collaboration. Specifically, universities tend to regard collaboration as a means to an end, not an end in itself.

Implications for policy and practice

Governments and other funding organisations are willing to finance U–I collaboration, and this has, according to previous research, had positive results in some respects (e.g. Scandura, 2016). We believe that more can be done in terms of enabling collaboration. Firstly, we find that little effort has been made to remove hindering forces, even though this is likely an effective way to support change. Removing the contradictory demands between publication pressure and the pressure to collaborate is a way of lowering such hindering forces. Secondly, because previous studies have shown that funding can have very different effects depending on contextual factors (e.g. Kafouros *et al*., 2015), we require more studies on U–I collaboration in various contexts. Thirdly, regarding our empirical case, as well as our country's funding for collaboration, there is limited funding for writing applications for U–I collaboration projects and maintaining networks with practitioners. It may be a question of prioritisation among governments and managers at universities, but network funding in particular can be valuable in supporting long-term relationships and U–I collaboration efforts. Finally, we must consider how to enable companies to contribute to long-term knowledge development rather than merely concentrating on problem-solving in a specific organisation.

Future studies

Many questions remain to be explored in future research. We identified hindering forces at various levels, but there are even more levels that could be explored to identify supporting and hindering forces. One example is the societal level. Current governmental efforts support both U–I collaboration and an increased focus on 'excellence' (publications and citations). These supporting forces are, to some extent, counterproductive, and this should be examined in detail to support U–I collaboration. The paper is based on a single case study, but the content, such as changes in reward systems, performance-based evaluations of research and

increased attention to U–I collaboration, is a current topic in several countries (Benner and Sandström, 2000; Hicks, 2012). Based on the ongoing changes in educational systems in several countries, we call for additional case studies in various countries and organisations. We would also like to see quantitative studies of hindering forces to identify the relationships between and strengths of various barriers. Finally, we would like to see studies that clarify the various gains due to U–I collaboration from universities' point of view, with a special focus on how collaboration contributes to teaching and long-term knowledge development.

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