**Title:** The micro-foundations of conflicts in joint university-industry laboratories

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**The micro-foundations of conflicts in joint university-industry laboratories**

**ABSTRACT**

Whilst extensive research has been conducted on the management research and development (R&D) alliances between universities and industrial firms, it has largely been concerned with macro-level phenomena such as innovation processes and institutional influences on collaboration. In this conceptual paper, we contribute to the growing research on the micro-foundations of the management of university-industry cooperation by developing a parsimonious theory to explain the origins of conflicts between R&D actors in joint university-industry research laboratories (joint UI labs). We mobilise a theoretical perspective new to this literature that accounts for a variety of individual interests within complex management contexts: multiple agency theory. By these means, we resolve the multitude of individual relationships within a joint UI lab into the interactions between "principals" (e.g., a lab manager) and "agents" (e.g., a scientist). We explain the origins of principal-agent conflicts within joint UI labs in terms of multiple identities; differences in temporal orientation; transcending relationships; claims to ownership of co-produced knowledge; and bargaining power asymmetry.  This micro-foundational focus allows us to recommend more nuanced management strategies for mitigating conflicts. We also discuss several potential avenues for future research.

**Keywords:** joint university-industry laboratories, university-industry collaborations, multiple agency theory, micro-foundations, conflicts

# **Introduction**

There is extensive literature on research and development (R&D) alliances involving universities and industrial firms (Compagnucci and Spigarelli, 2020; de Wit-de Vries et al., 2019; Miller et al., 2018; Perkmann et al., 2013). The major threads of this literature have been dominated by strategic or macro-level phenomena such as knowledge transfer (Miller et al., 2018), commercialisation processes (Perkmann et al., 2013), institutional collaborations (Etzkowitz and Leydesdorff, 2000) and technology upgrading dynamics of innovation systems (Fischer et al., 2019). Less consideration has been afforded to the micro-foundations (Adegbile et al., 2021; Barney and Felin, 2013) of these strategic phenomena. In this paper, we contribute the literature on micro-foundations of university-industry alliances by developing a theory to explain conflicts between R&D actors within joint university-industry laboratories (hereafter, joint UI labs).

At the macro-level of UI research partnerships, institutional logics (Thornton and Ocasio, 2008) have been invoked to explain the ways in which the enduring cultural norms and values of academic and commercial organisations are different (Hewitt-Dundas et al., 2019; Vallas and Kleinman, 2008). Specific cases of conflict may then be explained in the same conceptual terms (Murray, 2010). However, such explanations do not take account of the micro-strategic agency of individual actors. For example, Cardinale (2008) in his theorising of the micro-foundations of the institutional theory argues that actors’ own cognitive schema leads them to exhibit behaviours in their workplaces irrespective of whether such actions meet institutional expectations. Framing her research in relation to neo-institutional theory, Lam (2010) explains how scientists engage in boundary work in ways that allow them to maintain their academic identity whilst embarking on commercial roles. In a similar vein, Bjerregaard (2010) found a convergence of institutional logics displayed by researchers in R&D collaborations between universities and small and medium-sized enterprises. We observe that where such studies have taken place, they are dominated by explanations of the behaviour of one type of actor: university scientists.

Also, explaining the behaviour of joint UI lab actors in terms of the institutional norms of their employer is an over-simplification. Given the range of different roles (i.e., university faculty, managers, research students, industrial scientists, administrators and corporate executives, etc.) and variety of individuals’ motivations within joint UI labs, a more encompassing theoretical approach is justified: one that recognises that relationships between individuals may be influenced by a more complex web of interests.

There has been a growing interest in the micro-foundations of UI alliances that have adopted theoretical framings other than ones related to institutional theory. For example, Sarpong et al. (2017) adopt a micro-level discursive practices approach to theorise the challenges for creating a hybrid triple-helix model of collaboration. In this they draw attention to the different interpretative schema that exists within university, industry and government partners; and the ways these can hinder, or if managed carefully, can contribute to the strategic development of partnerships. More recently, in examining how human capital contributes to corporate collaboration between universities and industry Albats et al. (2020) propose a conceptual framework that relates human capital to different managerial roles. While the use of the human capital theory helps discuss how the capabilities of individual actors in UI collaborations affect collaboration performance, it ignores the role of relational dimensions and varying interests across different actors. In this paper, we probe the micro-foundations of conflict in joint UI labs by deploying a theoretical perspective new to this literature that accounts for a variety of interests and relational dynamics within complex management contexts: multiple agency theory (Hoskisson et al., 2012).

Agency theory has been extensively developed in the corporate governance literature and takes as its basic unit of analysis the contracting relationship that binds an "agent” to a "principal" (Jensen and Meckling, 1976). An example of such a relationship in an R&D context is that between a lab scientist (agent) and a lab manager (principal). We explain conflict within joint UI labs by accounting for the totality of principle-agent relations that can be discerned in this context. This includes not only the direct principal-agent relations associated with day-to-day lab work but the wider set of vested interests of stakeholders in these strategic initiatives. We then delineate the diverging objectives between R&D actors that lead to specific agency conflicts due to: multiple actor identities, transcending relationships, differing time horizons, the co-production of knowledge and bargaining power asymmetry between principals.

Joint UI labs are suitable contexts for this study because such ventures are strategic resources for all partners (Boardman et al., 2013), and this attracts the vested interests of a wider variety of institutional actors compared with modes of UI collaboration that operate within existing university and industry research facilities. Particularly, the level of investment necessary to create these labs invites the interest of government policymakers and other organisations (e.g., civil society organisations-CSOs) with connections to the research domain of the lab (Boardman and Gray, 2010; Dolan et al., 2019; Gray et al., 2001; Leonchuk and Gray, 2019), creating the conditions for multiple divergences of interests and not just academic or commercial logics. Thus, the possibilities for conflict is high in joint UI labs; yet, hardly any scholarly attention has been paid so far to study the micro-foundations of such conflicts.

In this paper, we make a number of contributions to the literature on the management of joint UI labs. First, we extend theoretical treatments of the micro-foundations of conflicts within joint UI labs specifically (and university-industry partnerships generally) by mobilising multiple agency theory to explain the totality of relational conflicts within an R&D alliance. To the best of our knowledge, this is the first study to apply multiple agency theory in this literature. Second, our micro-foundational focus on agency recognises the ways in which structure inclines actors "to settle on some actions out of the many that are made possible by structure" (Cardinale, 2008, p.133). Being sensitive to such conditioning of agency allows us to recommend more nuanced strategies at the level of the principals and agents to mitigate conflicts in joint UI labs. Third, applying multiple agency theory to the context of joint UI labs allows us to extend the theory itself by identifying agency conflicts not evident within a purely corporate governance setting.

The structure of this paper is as follows. We start by providing an overview of joint UI labs and elaborating the agency relationships in them. Building on this analysis, we next discuss sources of actor conflicts. We then consider how partners of joint UI labs might mitigate the impact of these agency conflicts. We conclude by suggesting the implications for managers and scientists associated with joint UI labs and discuss potential avenues for future research.

# **2. Joint UI labs: Definition and Types**

In the literature, the terms “joint UI labs” (Mahdad et al., 2018; Tennenhouse, 2004), “UI research centres” (Santoro and Chakrabarti, 1999), “collaborative research centres” (Gibson et al., 2019; Thune and Gulbrandsen, 2011) and “cooperative research centres” (Garrett-Jones et al., 2013; Geisler et al., 1990; Gray and Walters, 1998) have been used interchangeably, and Gray and Walters (1988) define “cooperative research centres” as organisations between industry and universities that “involve the division of labour, leadership, communication systems, monitoring and control systems, etc.” (quoted in Mahdad et al., 2018, p.145). Joint UI labs are predominantly university-based boundary organisations (Boardman and Gray, 2010). For example, Telecom Italia, one of the largest Italian telecommunication companies, has established nine joint UI labs at five Italian universities– Polytechnic University of Turin, the University of Trento, the University of Catania, Sant’Anna School of Advanced Studies in Pisa and the Polytechnic University of Milan–to pursue joint research and development activities in big data analytics and internet of things (Woolley, n.d.). While a joint UI lab can be formed by multiple universities and companies (Boardman and Gray, 2010; Dolan et al., 2019), in this paper we only focus on joint UI labs involving a single university and a single company.

Although joint UI labs are established primarily to encourage joint research and development (R&D) projects between industry and universities by reducing geographical distance, an important barrier to industry-university collaborations (Borah et al., 2021); the use of joint UI labs to carry out less collaborative forms of R&D activities such as contract research, consulting and licensing activities (Perkmann et al., 2011) is not uncommon. However, in this paper, we consider only those joint UI labs that engage primarily in joint R&D projects and aspire for both scientific (e.g., publications) and applied research outputs (e.g., patents and prototypes).

Apart from universities and companies, some joint UI labs also encourage the involvement of government bodies and non-for-profit trusts as sponsors (Boardman and Gray, 2010; Gray et al., 2001; Leonchuk and Gray, 2019). Such organisations may provide grants to cover the initial costs for setting up the joint UI lab (Ahn, 1995; Colton, 1981). For instance, under the National Science Foundation (NSF) programme in the US in the 1980s, joint UI labs at several US universities including MIT and North Carolina State University received about $300,000 annually for the first three years to cover the capital and operational costs (Colton, 1981). Once the lab becomes fully operational, these organisations may involve in the lab by offering full funding or partial funding (also known as “matching funding”) for specific projects undertaken at the lab (Dolan et al., 2019).

On the other hand, the societal elements embedded in certain projects undertaken at joint UI labs present opportunities for civil society organisations (CSOs), such as NGOs, community organisations, activist groups, labour unions and faith-based groups, to get involved in the lab as beneficiaries. Companies are increasingly pressurised by government, international governmental organisations such as the United Nations and the World Health Organisations and CSOs to increase their contributions to corporate social responsibility (Shrivastava and Guimarães-Costa, 2017). In parallel, universities’ contributions to sustainability and community development (Bellandi et al., 2020) and more generally to the “third mission”, which is to achieve social impact through collaborations (Compagnucci and Spigarelli, 2020), are also seen as important indicators of success in universities. Therefore, companies and universities may use joint UI labs to develop unique technological solutions to address societal problems.

Thus, a joint UI lab may showcase double-helix, triple-helix and quadruple-helix structures. Innovation systems are built on four helices: university, industry, government and the public or civil society (Ivanova, 2014). Literature suggests that collaborative entities like joint UI labs can be called a) double-helix entities when organisations from any two helices collaborate, b) triple-helix entities when organisations from any three helices collaborate and c) quadruple-helix entities when organisations from all four helices collaborate (Bellandi et al., 2020; Carayannis et al., 2018; Etzkowitz and Leydesdorff, 2000; Ivanova, 2014; Ivanova and Leydesdorff, 2014). Most typical joint UI labs are double-helix entities formed by partner organisations from the university and industry helices. On the other hand, there may exist two types of triple-helix joint UI labs: one that involves university-industry-government collaborations and the other involving university-industry-CSO collaborations[[1]](#footnote-1). Lastly, quadruple-helix joint UI labs are built upon university-industry-government-CSO collaborations. Quadruple-helix structures often emerge in those joint UI labs that undertake government-funded social and environmental projects (Bellandi et al., 2020). Next, we explain the principal-agent relationships that exist in these different types of joint UI labs.

# **3. Principal-Agent Relationships in Joint UI labs**

Agency theory defines the principal-agent relationship, also known as the “agency relationship” (Gomez-Mejia and Balkin, 1992), as an arrangement where an agent is appointed by a principal to accomplish the expectations of the principal (Hoskisson et al., 2012). The most common example of the principal-agent relationship can be observed in corporations, where company managers are appointed as agents by the shareholders (principals) for achieving their economic objectives. Conflicts arise in agency relationships when the principal and the agent are driven by dissimilar interests and/or the actions of the agents are different to principals’ expectations (Arthurs et al., 2008; Gomez-Mejia et al., 2005). More specifically, the structure-agency literature (e.g., Cardinale, 2018; Creed et al., 2010) argues that while principals may develop structures in an organisation such as routines, processes and culture with the expectation that such structures may influence agents to achieve the interests of the principals, the agents may be driven by their innate desire and own capabilities “to act on the basis of [their own] choice" (Creed et al., 2010, p.1337). For instance, Cardinale (2008) claims that agents’ own cognitive schema can orientate them to show certain actions in their workplaces irrespective of whether such actions meet the expectations of the principals, resulting in conflicts.

Such agency conflicts are more likely to occur in multiple agency relationships and can be explained using the “multiple agency theory” (Hoskisson et al., 2012). In multiple agency relationships, two or more principals are involved, and they collectively employ one agent, and the common agent is expected to achieve the goals of multiple principals (Hoskisson et al., 2012). Agency conflicts are likely to be greater in multiple agency relationships that involve principals from different sectors, which are embedded in different institutional logics (Bjerregaard, 2010; Hewitt-Dundas et al., 2019; Vallas and Kleinman, 2008) and possess dissimilar expectations from the collaboration and the agent.

As mentioned earlier, most typical joint UI labs carry a double-helix structure and entail two principals: the university principal investigator (PI) and the company PI. We define university PI and company PI as the individuals responsible for supervising the joint UI lab from the university and company sides, respectively. In some studies (e.g., Geisler et al., 1990; Gray and Walters, 1998), the university PI and company PI have also been called “joint UI lab/centre Directors”. In a joint UI lab, the university PI serves two agency roles. First, the university PI is the agent of the university board of governors (or trustees)[[2]](#footnote-2) and therefore, is expected to work in the interest of the university, which is to contribute to universities’ teaching and research activities. Second, the university PI acts as the principal for the joint UI lab employees. Thus, the university PI acts as a “knowledge broker” (Kidwell, 2013), ensuring that the joint UI lab employees work in the interest of the university board of governors and contribute towards strengthening the universities’ teaching and research performance.

The second principal in a double-helix joint UI lab is the company PI. The company PI also serves two roles– agent of the company’s board of directors and principal of joint UI lab employees. In the former role, the company PI is entrusted with the responsibility to satisfy the economic objectives i.e., to drive revenues and profitability. In parallel, being the principal of the employees working at the joint UI lab, the company PI acts as a knowledge broker between the company’s board of directors and the joint UI lab employees, thereby ensuring that the joint UI lab employees contribute towards achieving the economic objectives of the shareholders (Santoro and Chakrabarti, 1999).

Additional principals may get involved if a joint UI lab employs a triple-helix and quadruple-helix structure. In the case of industry-university-government collaborations, apart from the university PI and company PI, there will be a third principal from government funding organisations that sponsor the projects at joint UI labs. Most external grants in joint UI labs are applied jointly by the company PI and the university PI, in which case both PIs become the agents of the funding organisation manager. If external funding is applied directly by the joint UI lab employees (e.g., PhD and postdoc grants, see Dolan et al., 2019), the respective employee who receives the grant becomes the agent of the funding organisation manager. In either case, the role of funding organisation managers as principals is project-specific. Funding organisation managers do not take part in the actual implementation of the projects, but they do monitor the progress of the projects through regular review meetings (Ahn, 1995).

On the other hand, in triple-helix joint UI labs involving industry-university-CSO collaborations, the role of the third principal is played by the CSO manager. We specify the role of the CSO managers as the *beneficiary-only-principals* because unlike the other principals described above CSO managers do not make any capital investments in joint UI labs. Their involvement as principals is also project-specific and driven by the fact that they are a beneficiary of social and environmental projects undertaken at the joint UI lab. Lastly, in quadruple-helix joint UI labs, four principals get involved– company PI, university PI, funding organisation manager and CSO manager.

In any joint UI lab, the agents are the personnel employed at joint UI lab, referred to in this paper as the “joint UI lab employees” which usually comprise the participating company’s scientists and university’s scientists including faculty, PhDs and post-doctoral fellows (Leonchuk and Gray, 2019). Often, joint UI lab employees are recruited to maintain a high degree of disciplinary variety and strengthen the lab’s capability in pursuing interdisciplinary projects (Gray et al., 2001; Leonchuk and Gray, 2019). The university and company scientists are usually assigned to the lab on a part-time basis (Boardman and Gray, 2010; Garrett-Jones et al., 2013).

Figure 1 shows the agency relationships in double-, triple- and quadruple-helix joint UI labs.

University PI

Company PI

Fund. Org. Mgr.

Funding Org. Donors

Joint UI lab employees

University PI

Company PI

Joint UI lab employees

CSO Mgr.

Community

University PI

Company PI

Joint UI lab Employees

University PI

University Board of Governors

Company PI

CSO Mgr.

Community

Joint UI lab Employees

Fund. Org. Mgr.

Funding Org. Donors

Double-helix joint UI labs

Triple-helix joint UI labs (funding organisation manager as the third principal)

Triple-helix joint UI labs (CSO manager as the third/beneficiary principal)

Quadruple-helix joint UI labs

Company Board of Directors

University Board of Governors

University Board of Governors

Company Board of Directors

Company Board of Directors

University Board of Governors

Company Board of Directors

**Figure 1** Agency relationships in joint UI labs; dotted line refers to agency relationship with beneficiary-only-principals

Transcending relationships in a principal-agent framework refer to the agency relationships that are maintained by the agents (joint UI lab employees) with actors other than the main principals (company PI, university PI, funding organisation manager and CSO manager) (Hoskisson et al., 2012; Rivera-Santos et al., 2017). Depending upon the original affiliation of the joint UI lab employees the nature of transcending relationships varies. For university scientists involved in joint UI labs, two forms of transcending relationships exist– a) with their own departments, and b) with external organisations (e.g., with other universities, companies, funding organisations and CSOs). On the other hand, most company scientists involved in the joint UI lab are required to maintain only one transcending relationship, which is with their R&D department within the company.

Although joint UI labs operate separately from academic departments (Gray et al., 2001), university scientists remain active members of their respective departments (Garrett-Jones et al., 2013). They are formally hired by such departments, and their promotions depend largely on their performance in fulfilling the responsibilities expected of all university academics. In these internal transcending relationships, the head of the department acts as the principal. In addition university scientists are increasingly pressurised to acquire external funding (Degl’Innocenti et al., 2019), and this may require them to maintain simultaneous agency relationships with external organisations outside the joint UI lab, such as other universities, companies, funding organisations, and CSOs. In such cases, the head of the respective department of the external organisation will become the transcending principal of the university scientist.

On the other hand, company employees in joint UI labs maintain transcending relationships mainly with their departmental heads (e.g., the head of R&D), which requires them to participate in departmental activities. Unlike their university peers, company scientists in joint UI labs are unlikely to possess external transcending relationships. This is because, unlike universities, companies do not usually provide autonomy to their employees to engage in independent R&D projects with external organisations. The responsibility of developing external R&D collaborations often lie with the head of R&D. Figure 2 shows all these transcending agency relationships in joint UI labs.

University PI

University Board of Governors

Company PI

CSO Mgr.

Community

Fund. Org. Mgr.

Funding Org. Donors

University Dept. Head

T

External Collaborators

T

Company Board of Directors

T

R&D Head

University Scientists

Company Scientists

**Figure 2** Transcending agency relationships in joint UI labs; ‘T’ refers to transcending relationships; dotted line corresponds to agency relationship with beneficiary-only-principals

# **4. Agency Conflicts in Joint UI labs**

Multiple agency theory has been developed to explain relationships in the context of corporate governance (e.g., Hoskisson et al., 2012). However, it has proved generative in explaining the agency conflicts that can ensure in other contexts that also involve multiple principal-agent relationships. For example, Rivera-Santos et al. (2017) analysed the agency relationships that exist in alliances between for-profit firms and non-governmental organisations (NGOs). In doing so, they were able to explain conflicts within the management of the alliance in terms of different types of agency conflicts and suggest strategies to mitigate them. Such agency conflicts are defined as scenarios in which the agent acts in ways that diverge from the expectations of the principal (Eisenhardt, 1989; Rivera-Santos et al., 2017). Business-NGO alliances are analogous to those in joint UI labs as much as the primary purposes of each partner are different but overlap to some degree within the organisational goals of the alliance. These prior studies have elaborated on three sources of agency conflicts–multiple identities, temporal differences and transcending relationships. In this section, we identify these conflicts in a joint UI lab setting but also explain two other agency conflicts relevant for this context; which are claims to ownership of co-produced knowledge and bargaining power asymmetry between the principals.

## **4.1 Conflicts arising from multiple identities**

The first conflict we consider relates to the varied nature of the outputs from a joint UI lab, and the different emphases placed upon them by different actors. Consider the following scenario that might operate in a joint UI lab with a quadruple-helix structure. A joint UI lab may develop a technology that is key to the function of a new product, whose operation delivers environmental benefits. The focal collaborative effort that develops technology could involve original research from university scientists in addition to more market-oriented research from the company scientists. In addition to direct laboratory work, partners from an environmental organisation (perhaps an NGO) and officers from a Government department holding an environmental brief might be expected to bring their own agendas to bear on the technology's development.

Multiple identities lead to agency conflicts because actors have varied roles as agents to two or more different principals (Hoskisson et al., 2012). The joint UI lab employees are the focal agents and serve different principals each of which might place different emphases on the innovation value chains possible in this quadruple-helix scenario. In other words, the lab employees may identify with multiple agendas and this can lead to tensions across the variety of principals with whom they work. A number of principal-agent relations are evident within this network of joint UI lab collaborations (cf. Figure 1). The university PI might seek to maximise the generation of new scientific knowledge (e.g. journal articles and PhD completions) that underpins the technology. The company PI might maximise the financial returns that accrue from the commercialisation of the product. The CSO manager might emphasise the performance attributes of the technology/product that deliver maximum environmental benefit. And depending on their particular policy agenda, the governmental funding manager might want to maximise any of the above, but they could also have a different goal (e.g., the creation of new enterprises).

Identity conflicts emerge for joint UI lab employees if there are differences between the four principals in the specific goals or priorities of a particular project. Each principal might seek to influence the direction of a particular project in support of their own priorities. Whilst it is possible for goals to be complementary, there is more probability for conflict arousal. These differences between principals are a reflection of the varied types of intrinsic value evident in the output from joint UI labs (i.e., new knowledge, shareholder value, environmental benefit and economic development).

An additional complication arises when it is considered that the principals mentioned above are themselves an agent to another principal. For example, the company PI whilst being a principal of lab employees is themselves the agent of the company board. The latter will behave in line with their own obligations to deliver shareholder value as the executive-shareholder obligation represents a further principal-agent relation. The company PI might agree with the university PI on the value of generating more research data. However, he/she may face pressure from executives who do not appreciate the subtleties of the research process but rather want to see progress in commercialisation. Returning to the focal agents, we would expect that the joint UI lab employees would have personal motivations that did not align exactly with their employer. A company scientist employed in the joint UI lab would certainly want their research to lead to commercial success, but they might also desire to seek environmental performance maximised.

In related studies, Lam (2011) has drawn attention to the primacy of the self-motivation of university scientists in engaging in commercially-oriented projects (e.g., joint UI labs). She finds that the reputational benefits of a successful commercial project and the intrinsic satisfaction of solving scientific puzzles are not inconsistent with traditional academic rewards. Jain et al. (2009) found that university scientists' engagement in commercialisation activity involves role identity modification. However, the sticky nature of extant identity influences modification initiatives. A hybrid identity emerges that privileges academic identity using mechanisms of “buffering” (conscious preservation of key academic values) & “delegating” (creating appropriate interfaces).

## **4.2 Conflicts arising from transcending relationships**

If joint UI lab employees have commitments to other relationships beyond their main principal-agent relationship, then this can lead to agency conflicts. These commitments are known as transcending relationships, and they can be a particular source of conflict if the lab employees have strong reasons for prioritising their demands. As we argued in section 3, university scientists in the joint UI lab may have a range of such relationships that follow from their position as university employees. Such transcending relationships could develop with their university department head as well as with external stakeholders.

It is well-established within the research literature covering UI alliances that cultural norms of university departments can influence academics engagement with commerce (e.g., Kenney and Goe, 2004). There are enduring cultural features of universities and industry that make collaborations more complicated than can be solved by procedural routines. The obligations felt by university scientists in joint UI labs to their departmental head are likely to be significant because it defines their position and prospects within the overarching university hierarchy. Such departmental heads, and not the academic PI of the joint UI lab, may be responsible for the incentive structures of lab employees (Boardman and Corley, 2008). University scientists in joint UI labs are often employed on fixed-term contracts and they will be conscious of who holds responsibility for hiring decisions for full-time positions. Such permanent jobs are likely to be allied to university programmes beyond the scope and funding structure of a particular joint UI lab. Analogous long-term career prospects may also be influential for company scientists in joint UI labs if they report to the company R&D head and not the company PI (see Figure 2).

In addition to transcending relationships allied to full-time employment, university scientists in a joint UI lab are likely to pursue collaborations with scientists outside the boundaries of the lab. Science-science collaborations have been shown to influence the development of academic careers to a greater extent than science-industry collaborations (van Rijnsoever et al., 2008). Therefore, university scientists in joint UI labs wanting to advance in their careers are likely to attend to the transcending relationships with other academics. This influence is more nuanced in the case of PhD researchers who are at an earlier stage in their development and have yet to make a commitment to a university career. Personal networks for UI alliances are important, and indeed may be more significant than contractual relationships (Siegel et al., 2004). As a consequence, PhD researchers are likely to be keen to develop networks with industrial firms and managers. Chiang (2011) noted that the training of PhD researchers varies depending upon the industrial involvement in supervision and the extent of academic freedom allowed the students. In those cases where PhD researchers are allowed sufficient latitude, they may pay attention to transcending relationships with industry managers if they think this holds out the prospect of a full-time job in a private firm. However further complications may arise from transcending relationships with external collaborators if they provide a medium for unwanted knowledge spillovers from the joint UI lab (Bruneel et al., 2010; Lee, 2000).

## **4.3 Conflicts arising from temporal differences**

Some of the differences of identity and organisational proximity to the joint UI lab that we have noted above may also be manifest in terms of temporal differences between UI alliance actors. Agency conflicts can then arise when the agent acts based on a different temporal perspective to the principals (including those in transcending relationships).

The first of these temporal differences concerns the time horizons over which project progress is understood across the alliance. In their direct involvement with laboratory work, joint UI lab employees (agents) will have a day-to-day perspective on projects where PI’s (principals) will view progress in terms of milestones spread over a longer period. There could also be differences between principals themselves with university PIs and company PIs having overarching objectives from a joint UI lab project that are realised over different timescales. Such differences might be exacerbated by transcending relationships. For example, The R&D head (with a transcending relationship claim on company scientists in the joint UI lab) may face a problem that requires the delivery of results within a shorter timescale than those that pertain to the main collaborative project with the university. This main project will involve the time-consuming generation of research data with the rigour and comprehensiveness required for publication in top journals. However, the R&D head might need to respond to an urgent problem from a customer. For example, Mannak et al. (2019, p.3) found that “university researchers attempt to extend the consortium period for the R&D work to ensure they achieve the research quality required for scientific publication, whereas the industry partner is looking for what the university has available off the shelf, readymade for commercialisation.”

These differences in time horizons over which actors seek to achieve their goals can lead to priority conflict on research work. In their study of how firms evaluate success in UI alliances, Perkmann et al. (2011) argued that different time horizons of partner objectives and the length of time taken to realise benefits from such alliances create challenges for measuring success. These differences may hold implications for the funding of the joint UI lab itself. In the case of the Cambridge-MIT Institute, Acworth (2008) found that during the early years of UI alliances when programme funding is available, the search for longer-term funding is not a priority. This leads to tensions in balancing the short-term objectives of projects, with the longer-term funding requirements to ensure the sustainability of the joint UI lab. Research has shown that if some R&D actors perceive the joint UI lab as a temporary organisational form (Burke and Morley, 2016) then this creates particular project management challenges (Lindner and Wald, 2011).

A second source of temporal difference can arise because of subjective, as well as objective, orientations towards time within organisations (Clark, 1990). An objective orientation towards time views project management to be a series of tasks against a background of linear time intervals; whereas subjective time is a socially constructed perspective informed by an actor’s values, customs and practices (Clark, 1985). Innovation actors holding an objective perspective on time will view project progress in terms of the “clock-time” of dates, whereas those working with a subjective perspective will view progress in relation to the achievement of “events” (Jacques, 1982).

Differences in such temporal perspectives within a given R&D project can lead to conflict. For example, in a pharmaceutical R&D context, Dougherty et al. (2013) found that research scientists and marketing managers held differing views on the speed with which R&D goals had been achieved. These authors argue that a clock-time pacing mechanism should be applied to strategic issues whereas at the project level progress is better managed by “event-time” mechanisms (Dougherty et al., 2013, p.258). We expect similar differences in clock-time/event-time orientations will exist within joint UI labs. Principals (direct or transcending) have a strategic perspective on the UI alliance as a whole and in this role are advised (cf. Dougherty et al., 2013) to adopt a clock-time orientation to temporal progress. However, if this temporal perspective is brought to bear in their relations with agents in the lab (working with an event-time orientation) then conflict is likely.

## **4.4 Conflicts arising from** **knowledge co-production**

The generation of project outputs within joint UI labs is realised through collaborative work. Such collaboration is informed by the expertise of all actors (principals and agents) and is spread out across multiple time frames (cf. conflict 3 above). These entanglements of expertise and time lead to conflicts of opinion regarding who contributed what and when to project outcomes, and how rewards should be distributed. Agency conflicts arise when the agent acts on the basis of a different opinion about contribution than principals.

Firstly, there are well-researched organisational conflicts related to ownership of intellectual property that can arise if the agent and principal are in different institutions. For example, there is clear evidence to support the argument that industry sponsorship delays and jeopardises public disclosure of academic research (Czarnitzki et al., 2015). As a consequence, a university scientist may argue and act for the early publication of research findings when the company PI would prefer that ownership of intellectual property is settled first (Bruneel et al., 2010).

However, even when there is an agreement of pursuing a patenting-first strategy, the terms of patents themselves can be a source of conflict if they place restrictions on future academic research (Murray, 2010). These scenarios are further complicated if principals in transcending relationships (e.g., university technology transfer offices or company R&D heads) have particular interests in returns on intellectual property. Markman et al. (2008) examined the conditions under which university scientists bypassed institutional mechanisms and “sold” intellectual property directly to the market. They observed less bypassing if there was an autonomous licensing office and royalty sharing with faculties. In contrast, they found more bypassing in universities with large patent portfolios, ready access to resources and lots of entrepreneurial activity on campus.

## **4.5 Conflicts arising from bargaining power asymmetry**

Bargaining power in a collaboration refers to the relative power or influence of one partner over the others (Inkpen and Beamish, 1997; Yan and Gray, 1994). Partners with high bargaining power can exert pressure on the other partners to use the resources of the collaboration for the achievement of their own goals and objectives (Yan and Gray, 1994). Thus, in a joint UI lab, bargaining power asymmetry between the principals may lead their agents to work predominantly fulfilling the expectations of the most powerful principal.

Bargaining power is “determined primarily by what each partner brings to the venture” (Inkpen and Beamish, 1997, p.183). In a double-helix joint UI lab, unbalanced bargaining power would arise between the company PI and university PI if the investments of one partner overshadows the other. If the bargaining power shifts towards a specific principal, the agents (lab scientists) might find themselves in a position to give preference towards satisfying the expectations of the powerful principal over the common objectives of the joint UI lab. The bargaining power conflict is likely to occur in triple-helix and quadruple-helix joint UI labs, where CSO managers are involved. As shown in Figure 1, CSO managers act mainly as beneficiary principals and do not make significant resource investments in the lab. Therefore, they may hold only limited bargaining power relative to all the other principals, and as a result may find it difficult to convince the agents (lab scientists) to work towards satisfying their social and environmental objectives.

Bargaining power asymmetry can also be invoked by the differences in capabilities. Studies suggest that knowledge asymmetries can also lead to bargaining power asymmetries (Coff, 2010), that is, individuals holding key knowledge and capabilities which is vital for a collaboration’s success may hold more bargaining power than others. Consider a situation, where the university PI is a world-renowned scientist and has the expertise that is unique to the lab. In such a case, by default, the university PI may hold more bargaining power than the other principals.

Table 1 presents a summary of all five agency conflicts in joint UI labs.

**Table 1** A summary of agency conflicts in joint UI labs

|  |  |  |
| --- | --- | --- |
| **Conflict** | **Mechanisms of conflict** | **Consequences for the joint UI lab and actors** |
| Conflict arising from multiple identities | * Agent having two or more main principals, with each holding different expectations. | * Differences in project priorities and long-term trajectory of lab. * Added pressure on the agents which impacts their performance. |
| Conflict arising from transcending relationships | * Transcending principal (internal or external) leverages influence for agendas outside the joint UI lab. | * Agents show less priority to completing lab activities and output quality is reduced. * Leakage of IP from the lab. * Career prospects of agents harmed. * Conflicting demands from transcending and lab principals could create more pressure on the agents, affecting their performance. |
| Conflict arising from temporal differences | * Objective and subjective perceptions of passage of time held by different actors. | * Differences in opinion on how well projects are progressing * Disagreement over project priorities |
| Conflicts arising from knowledge co-production | * Actor's perception of their contribution to joint UI lab outputs. * Entanglement of expertise during research process. | * Disputes over who owns the IP * Disputes over whether to share or protect IP * Denied ownerships of IP and constraints on sharing IP could harm career prospects of agents |
| Conflicts arising from bargaining power asymmetry | * Some partner organisations invest more resources than others. * Some principals have significantly higher capabilities than others. | * Deviation from their overall joint UI lab goals and serving of dominant partner's interests. |

# **5. Mitigation Strategies for Agency Conflicts in Joint UI labs**

We draw mitigation strategies based on the structure-agency framework proposed by Cardinale (2018). This framework suggests that the actions of an individual actor in an organisation are determined by two factors­: social structures in the actor’s current workplace and the actor’s‘habitus’i.e., cognitive frames derived from their prior experience. Cardinale (2018) argues that these social structures and habitus drive actors’ actions by ‘enabling’ or unfolding possibilities for actions, orienting actors to “settle on some possibilities out of these” (p.137) and constraining their engagement in other possibilities.

By anchoring on Cardinale’s (2018) structure-agency framework we contend that agency conflicts in joint UI labs can be mitigated by a) modifying social structures in joint UI labs to orientate principals and agents towards prioritising the overall objectives of joint UI labs over individual objectives of the labs' partners, and b) leveraging individual habitus or prior experience of principals and agents, by which they recognise achieving the overall objectives of joint UI labs as a “self-evident action”, i.e., without reflecting on whether their actions comply with the lab’s existing social structures. Below, we explain how social structures in joint UI labs might be modified and actor experience leveraged for mitigating agency conflicts.

## **5.1 Modifying social structures in joint UI labs**

The structures of joint UI lab can enable and/or constraint the actions of principals and agents employed in the lab, i.e., making it clear to the actor what type of actions are “are desirable, proper or appropriate within some socially constructed system [in the lab]” (Suchman, 1995, p.574, quoted in Garud et al., 2007). Thus, principals and agents may feel obliged to demonstrate such actions in order to achieve legitimacy in the lab (Garud et al., 2007). In this section, we discuss four ways in which the social structures in joint UI labs can be altered to mitigate agency conflicts: a) setting up the boundaries of the expectations and contributions of the principals and agents; b) implementing an incentive structure that motivates agents to contribute towards achieving the overall objectives of the lab; c) setting up of an independent governing body to regularly review the progress of the projects and the behaviour of the principals and agents in line with the agreed boundaries; and d) integrating different temporal perspectives.

### **5.1.1 Setting the boundaries**

Appropriate setting of boundaries between the principals, and between principals and agents in relation to research scope, objectives, commitment and investments from each partner organisation, research outcomes and their ownership and temporal dimensions (Bäck and Kohtamäki, 2015; Fowler, 1982) could help joint UI labs to reduce agency conflicts. First, boundaries need to be drawn between the principals so that there exists no ambiguity regarding the objectives, ownership of outputs and time horizon issues. Also, the principals and agents should agree on the type and level of resources that each principal and agent must contribute to the lab. This will eliminate the chances of opportunistic behaviour of principals and agents (Dant and Gundlach, 1999) as well as restrict principals from investing more resources and acquiring more bargaining power. Further, setting boundaries between the joint UI lab principals (e.g., university PI) and their principals (e.g., university board of governors) is important for deciding the degree of autonomy of the joint UI lab principal. High autonomy will enable the joint UI lab principals to take decisions in favour of the lab, e.g., setting and pursuing goals that benefit all the joint UI lab principals.

To reduce conflicts arising from internal transcending agency relationships of university scientists in joint UI labs, boundaries need to be set up between the university PI, university department head, and university scientists detailing the reporting requirements (Fowler, 1982). This will minimise confusion about the expectations of both university principals from the university scientists. For example, clear information should be provided on the university scientists’ department-related responsibilities and the working hours that need to be invested in fulfilling such responsibilities. Similarly, boundaries should be drawn among R&D heads, company PI, and the company scientists working in the lab in order to avoid conflicts due to dissimilar expectations of both company principals. Finally, clarifications should be provided regarding the level and type of engagements an actor (particularly, university scientists) can maintain outside the lab so that conflicts due to external transcending relationships could be reduced. Below, Vignette 1 reports an example of a joint UI lab opting for boundary setting to mitigate conflicts.

**Vignette 1: Setting the boundaries as a mitigation strategy**

In the case of an electron microscopy joint UI lab, there were three university departments that acted as principals for two university-appointed PIs (with academic and strategic responsibilities respectively). Conflicts arose between the principals (three departmental heads) and agents (two University PIs) in relation to the strategic development of the facility. The university PIs wanted to develop a unique state-of-the-Art capability, whereas the Departmental Heads wanted to ensure access to the existing capabilities for researchers in their departments. These conflicts were reduced by the creation of standard operating procedures for the lab that included principles and routines for managing time on the key instruments within the facility. A transparent distinction was drawn between the time for the strategic development of the capabilities of the centre's scientific instruments, and the time for university scientists (from all three departments) to use the existing facility for their current research projects.

Source: Ellwood (2015)

### **5.1.2 Incentives for agents**

Incentives can be used as an “extrinsic motivation” (Ángel and Sánchez, 2009) for agents to work with divergent objectives and time horizons, instead of pursuing individual goals and their preferred time horizons (Rivera-Santos et al., 2017). Currently, the tenure and promotions of university scientists are determined by their teaching and research productivity (Parker, 2008; Subbaye and Vithal, 2017), whereas a company scientist’s growth within a company is influenced by his/her contributions to commercial success. We contend that a common incentive mechanism for both university scientists and company scientists based upon the objectives of joint UI labs could help to stimulate agents to pursue collaborative goals instead of personal goals and follow the time horizons originally agreed between the principals. For instance, in a double-helix joint UI lab, incentives could be developed against performance in teaching, research and commercialisation. In a triple and quadruple-helix joint UI lab, further performance indicators could be inserted to measure agents’ success in achieving social and environmental impact. Studies (e.g., Longoni et al., 2014; Merriman et al., 2016) show evidence of environment-linked incentives driving employees’ contributions to sustainability at the workplace.

Such an incentive structure would also help to reduce transcending relationship conflicts among university scientists. As incentives are designed around the objectives of the joint UI lab, university scientists will not be required to develop external collaborations to enhance their research and teaching productivity outside the lab. Further, if the incentive structure is the same for both university scientists and company scientists, it would help establish a sense of homogeneity between the two agents and thereby reducing their multiple identity conflicts.

Usually, principals do not require additional extrinsic motivation to contribute to achieving the objectives of a joint UI lab, because they are the joint heads of the lab and the lab’s success would only bolster their reputation and CV. That being said, the performance of principals should be also monitored preferably by an independent body, as discussed next. Below, Vignette 2 reports an example of a joint UI lab designing different incentive structures for mitigating conflicts.

**Vignette 2: Incentives for agents as a mitigation strategy**

In the context of a joint UI Lab in the field of materials science, the industrial partner developed a range of incentives to encourage scientists to relocate from the company labs to the joint UI lab; a distance of approximately 25 miles. Some staff were keen to be in the new lab because it was in the heart of the university and was in amongst the buzz of the ‘knowledge quarter’ of the city. Another motivation was that they had access to state-of-the-art equipment and could do their work largely undisturbed, because they were all ‘off-site’ they would not be required to attend as many management meetings. However the uptake was slow amongst staff who had worked many years at the industrial labs, and the company developed a range of other incentives in order to populate the new joint UI lab.

Source: Horner (2019)

### **5.1.3 Independent governance structures**

The importance of robust governance structures in UI R&D alliances is well established (Bellandi et al., 2020; Derakhshan et al., 2020; Freitas et al., 2013; Sampson, 2004). We have mostly encountered them within our own research in partnerships that have involved substantial financial investments because there is a cost of maintaining the committee. Nonetheless, independent governance committees could be created with a brief to scrutinise the activity of joint UI labs and to monitor principals’ and agents’ performance in line with the agreed boundaries. In such matters, the committee should ensure that any formal governance mechanisms complement the informal (trust-based) operational practices within the joint UI lab (Ruangpermpool et al., 2020). For instance, the committee could conduct a timely review of the distribution of bargaining power among the principals and should intervene if there occurs a significant asymmetry.

It would be important to ensure that the independent governance committees’ own constitution does not create new principal-agent relations (including transcending relationships). In other words, the people on such committees would have no direct professional ties to any of the quadruple-helix partners involved in the joint UI lab (cf. Figures 1 and 2). Often, such independent governance structures can be seen in government-funded projects at UI labs. Many government funding bodies such as Innovate UK assign an independent “monitoring officer” to each project they fund, whose main responsibility is to carry out quarterly reviews to evaluate the performance of the project and each project partner (Hazrati, 2021).

This kind of idealised structure may be difficult to constitute in practice, and in a critical literature review, Geuna and Musico (2009) found that governance of UI collaborations is not straightforward. Complications can arise due to the existence of both formal mechanisms governed by institutionalised arrangements and personal contractual mode of interactions that emerge within joint UI labs, e.g., between university PI and company PI (Freitas et al., 2013). In respect of the coordination practices within UI projects, Morandi (2013) argued that initially, partners should devote themselves more to planning activities than to the R&D process itself. More recently, Derakhshan et al. (2020) framed their ethnographic study of a UI programme in terms of evolutionary governance theory. They concluded that "many micro-dynamics exist among actors and institutions inside the governance structure, co-evolving in parallel with the transition through the program’s phases" (ibid, p.480). Nonetheless, a mix of institutionalised regulation and personal trust between actors continued to inform these dynamics. Below, Vignette 3 reports one example of the governance structures observed by these authors.

**Vignette 3: Independent governance structures as a mitigation strategy**

In a large joint UI lab between the University of Minho, Portugal and Bosch to develop advanced car multimedia solutions conflicts arose due to institutional differences. For example, the industrial scientists were used to a teamwork culture and strict project management, and the university scientists were not. A governance system was created composed of a number of hierarchies, from a level constituted of managers of each partner to a senior governance committee imposed by the government funding agency. The latter resolved conflicts between participants through a cycle of strict annual audits. At the operational level, the role of program manager was created with responsibilities for selecting project leaders and conducting "alignment workshops". Responsible ultimately to the government funders for the delivery of the joint UI labs' objectives, the program manager worked with each partner PI to build mutual trust and get the partners working together.

Source: Derakhshan et al. (2020)

### **5.1.4 Integrating different temporal perspectives**

The resolution of temporal differences requires joint UI lab actors not only to recognise that differences in time horizons can raise barriers to success (Bruneel et al., 2010; Mannak et al., 2019) but take conscious steps to address the differences. Plewa et al. (2013) identified different types of interpersonal relations during the evolution of a UI partnership and made recommendations for building strong personal ties related to the stage of development. Whilst during the initiation phase of the partnership, R&D actors should concentrate on relating to each other’s different experiences and temporal norms. In the initial projects, there should be a conscious shift towards cooperative behaviour, whilst during the mature stage of the partnership, such behaviours should be institutionalised by maintenance work. As noted earlier temporal conflicts can arise from transcending relationships involving other research collaborations outside of the joint UI lab. Mannak et al. (2019) explained how with repeated collaborations industrial firms invariably pursue a “time compression” strategy with multiple parallel collaborations, while university scientists adopt a “time extension” strategy with sequential follow-on collaborations. In their research, these authors failed to discern a management solution to different “time compression” strategies. We suggest that in making efforts to become aware of the temporal expectations of research partners (cf. Plewa et al., 2013), consideration should be given to partner (temporal) obligations outside of the joint UI lab.

As we noted in section 4.3 some of the differences in temporal perspectives can be quite subtle and not captured solely in terms of time horizons. Thus, whilst greater clarity in the specification of project objectives may address varied positions on the time horizons of milestones, it is unlike to resolve subjective/objective differences in time pacing. Following Dougherty et al. (2013) assessments of progress at the level of research projects by agents (joint UI lab employees) will be informed by an "event-pacing" perspective. Whereas at the strategic level of resource allocation or capability development then a “clock-pacing” perspective should inform the principals' management of the joint UI lab itself. Agency tensions arise in cases in which the two perspectives are brought to bear on the same management challenge. Both temporal perspectives are inevitable, and it is necessary for all actors to develop operational routines that integrate them. Below, Vignette 4 reports an example of a joint UI lab integrating different temporal perspectives for mitigating conflicts.

**Vignette 4: Integrating different temporal perspectives as a mitigation strategy**

In the case of a new materials research centre, the original motivation for the joint UI labs was the economies of scale from the joint investment in specialist equipment. The lab housed both industrial and academic research teams which were kept strictly separated (for reasons of intellectual property governance) but who had equal calls (subject to availability) on specialist testing equipment. The secrecy implicit in this arrangement might have made for actor conflicts, especially because the academic and commercial projects operated to different timescales. The relative urgency for access to the instruments did not fall into a regular pattern, but conflicts resulting from competition for time on the instruments did not arise. The PIs of the labs made a virtue of the different types and timescales of the research projects. Their narrative was that both teams benefited from the improved capabilities of the equipment that resulted from the varied uses to which it was put.

Source: Campbell (2017)

## **5.2 Leveraging actors’ experience**

Along with social structures at the workplace, Cardinale (2018) argues that individual actors’ habitus, or in other words the cognitive schemas developed from prior experience particularly by integrating cognitive elements from their surrounding social settings (e.g., workplaces) and the positions they hold over time (e.g., specific job assignments), also dictate their actions in the workplace in both pre-reflective and reflective manner.

           To explain how individual habitus can drive the actions of principals and agents in line with the lab’s expectations and help mitigate agency problems in joint UI labs, let’s imagine the case of Samuel, a company scientist working in a double-helix joint UI lab ‘UIL-X’. Samuel has in the past worked in several collaborative projects with academia, social and environmental groups. These experiences have helped Samuel learn how such cross-sector collaborations can operate in ways that respect the divergent objectives and achieve their objectives with little conflict. For instance, in his previous academic collaborations, Samuel was invited as a guest lecture at the partner universities, co-author papers and supervise their doctoral students. Such opportunities could have helped Samuel appreciate the value of teaching and supervising graduates for the university partner and also for himself and his company[[3]](#footnote-3). As an example, Samuel might have recognised that the supervision roles actually facilitated attaining valuable leadership competencies necessary for career success in the long term[[4]](#footnote-4). Hence, when Samuel is allowed the opportunity to work at UIL-X, he would pre-reflectively look for engaging in teaching and supervising roles. A possibility of creating value solely for the company might not even cross his mind. Even if such a possibility comes to his mind, upon reflection, Samuel will understand that he can use his expertise of writing journal articles, supervising doctoral dissertations and guest lectures in his current role at UIL-X and achieve a much broader impact. Thus, despite being a company scientist, both pre-reflectively and reflectively Samuel would be inclined to contribute to achieving the objectives of both the university and company involved in UIL-X.

The same logic would also apply to other agents as well as principals in joint UI labs who have prior experience in working in cross-sectoral settings. Further, in the case of principals, prior experience of managing cross-sector collaborations could help them to foresee the agency conflicts that may occur in joint UI labs and plan and develop routines accordingly.

# **6. Discussion and Conclusion**

## **6.1 Contributions to research**

This study makes several contributions to the micro-foundations literature in the context of joint UI labs. First, the use of multiple agency theory helped us to unearth the micro-foundations of conflicts in joint UI labs, particularly the role of principals (university PI, company PI, funding organisation manager, and CSO manager), agents (university scientists and company scientists) and their relationships. This is a novel contribution considering that extant literature presents little discourse on the relational conflicts generated at the micro-level in UI collaborations, let alone joint UI labs.

Second, although more recently there have been a few studies exploring micro-level management of UI collaborations (e.g., Albats et al., 2020; Boardman and Ponomariov, 2014; Orazbayeva et al., 2020; Sarpong et al., 2017), these studies have predominantly focused on only one actor: the university scientists (Filippetti and Savona, 2017). We show through our helical categorisation of joint UI labs that actors from three other helices (industry, government, and CSOs) also participate in joint UI labs as principals and agents and can play a significant part in the arousal and mitigation of conflicts. Thus, we respond to Filippetti and Savona’s (2017) call for further research on “the role of individual characteristics, behaviour, incentives and constraints to engage in cooperation with other actors, most importantly the private sector [and other non-academic actors]” in UI collaborations.

Third, the application of Cardinale’s (2018) structure-agency framework enables us to recommend more nuanced strategies at the level of the principals and agents to mitigate conflicts in joint UI labs. In prior research, as conflicts were studied at a macro-level, mitigation strategies have also been discussed predominantly at the organisational level. For example, Bruneel et al. (2010) and Hewitt-Dundas et al. (2019) by drawing on the organisational learning literature, discussed the importance of the prior experience of universities and companies in UI collaborations in diminishing conflicts over IP issues, research objectives, deliverables, dissemination, and temporal aspects. In this paper, by drawing on Cardinale’s (2018) structure-agency framework, we propose that agency conflicts can be reduced in joint UI labs either by changing the social structure of the lab and/or by leveraging the experience of principals and agents. We argue that the implementation of certain social structures in joint UI labs (cf. section 5.1) can lead principals agents to prioritise achieving the lab’s collaborative objectives over their individual objectives, thereby reducing agency conflicts. On the other hand, we also maintain that the prior experience of individual principals and agents can play a vital role in mitigating conflicts in joint UI labs, which has so far been neglected in the literature. Prior experience of working in cross-sector collaborations develop cognitive schemas in principals and agents about how a joint UI lab should function, helping them achieve familiarity with the divergent values and objectives of joint UI labs and thereby reducing conflicts.

We also contribute to extending multiple agency theory in three aspects. First, to the best of our knowledge, this is the first application of agency theory in the context of joint UI labs. Even within the university setting, very few studies have applied the agency theory (e.g., Gomez-Mejia and Balkin, 1992; Kivistö, 2008), resulting in a limited understanding of the relationship dynamics and governance structures in universities. For example, Gomez-Mejia and Balkin (1992) assume that university faculty members share only one agency relationship which is with the university board of governors, where faculty members are their agents. In this paper, we contribute towards developing a more comprehensive understanding of the various kinds of agency relationships that university faculty share within and outside the university. We show that there exist at least two levels of agency relationships in universities–between the university board and university PI, and between university PI and university scientists. Other than the university PI, university scientists also possess parallel transcending relationships with the head of the department in the university and external collaborators, indicating that the governance of universities is indeed more complex than usually perceived, and therefore, require further academic attention.

Second, multiple agency theory has been applied either in same-sector settings such as joint ventures, initial public offering (IPOs) and bankruptcy (Hoskisson et al., 2012) or in bi-sector collaborations such as business-NGO collaborations (Rivera-Santos et al., 2017). Rivera-Santos et al. (2017) urged future studies to “extend this (multiple agency theory) to such (NGO-government) types of cross-sector collaborations and possibly even to tri-sector (ﬁrm-NGO-government) collaborations” (p.872). We contribute to this research gap by using multiple agency theory to explore conflicts that exist in tri-sector collaborations (triple-helix joint UI labs) as well as four-sector collaborations (quadruple-helix joint UI labs).

Third, prior studies investigating multiple agency relationships have discussed mainly three agency conflicts– multiple identities, temporal and transcending relationships (Eisenhardt, 1989; Hoskisson et al., 2012; Rivera-Santos et al., 2017). We not only concur with the existence of these conflicts in a joint UI lab setting but also highlighted two other agency conflicts that may arise from the co-production of knowledge and bargaining power asymmetry between the principals in joint UI labs. Future research could examine the latter two conflicts in other empirical settings.

Finally, the classification of joint UI labs based on agency relationships expands the literature on the boundaries of joint UI labs. Studies examining the dynamics of joint UI labs have so far have focused largely on double-helix joint UI labs and triple-helix joint UI labs, where funding organisations act as the third principal and have completely ignored triple and quadruple-helix joint UI labs where CSO managers could be involved as a beneficiary principal.

## **6.2 Implications for practice**

Our study offers some important practical implications regarding the governance of joint UI labs. Based on the analysis presented in this paper, universities, firms, funding organisations and CSOs, interested in participating in joint UI labs, will be able to comprehend various principal-agent relationships that exist in joint UI labs and the conflicts that occur because of such relationships. While section 5 of this paper has already shed light on how these conflicts could be mitigated, below we provide some additional recommendations regarding the implementation of the five mitigation strategies in joint UI labs.

For effective boundary setting (cf. section 5.1.1), joint UI labs can take a formal approach by signing legally-binding contracts or standard operating procedures (SOPs) (Bäck and Kohtamäki, 2015) as prior studies report that implementations of formal contracts and their appropriate monitoring mitigate agency problems (Dant and Gundlach, 1999; Eisenhardt, 1989; Hoskisson et al., 2012; Rivera‐Santos et al., 2017). Joint UI labs must ensure that these boundary-setting documents include detailed terms of engagement agreed for the principals and agents and that legal actions are taken when such terms are violated by any actor. An independent governance committee could be set up, as we discussed in section 5.1.3 to oversee actors’ performance against the agreed terms of engagement. In addition, joint UI labs could consider implementing “relational contracts supported by trust” (Poppo and Zenger, 2002) as a complementary governance mechanism (Arranz and De Arroyabe, 2012). Particularly, relational contracts could be better suited for defining intangible boundaries, such as the degree of autonomy a university PI should receive from the university board of governors, as well as allowing the required flexibility to handle future uncertainties (Poppo and Zenger, 2002) surrounding the joint UI lab (if any).

In terms of implementing a special incentive structure (cf. section 5.1.2) for university and company scientists in joint UI labs that takes into account their performance in achieving the common objectives of the lab, we provide two recommendations. First, the university and the company should consider if formulating a special incentive structure for the university and company scientists employed in the joint UI lab would have any bearing on the other scientists who are employed outside the lab. Second, some performance indicators such as commercial success and social and environmental impact might be difficult to measure as it might take years for a product to be commercially successful and deliver visible social and environmental benefits (Van Tulder et al., 2016). In such cases, principals can adopt an “input-based incentive strategy” (Pepper and Gore, 2015) to monitor agents’ performance against their inputs to the lab’s commercial and social and environmental projects in terms of time, expertise and commitment.

Regarding the constitution of the independent governance committee (section 5.1.3) and to avoid any prejudice, all principals should jointly appoint its members; who should have no prior association with the principals and partner organisations in the lab. Such committee members might be drawn from professional associations related to the area of science and innovation. Alternatively, they might have no connection at all to the joint UI labs scientific or commercial interests but be experienced leaders of joint UI labs in a completely different scientific domain or commercial market. Further, these independent committees should possess the leverage to ensure the outcome of any scrutiny (e.g., recommendations) are acted upon by the principals of the joint UI lab. In order to allow this leverage, we propose that the work of such committees should be integrated within the system of operational contracts and SOPs agreed in advance by all joint UI lab partners.

The strategies to mitigate temporal conflicts (cf. section 5.1.4) require implementation plans that start from the first projects at the joint UI lab. Induction processes should involve all actors and include “getting-to-know” your collaborators networking events. Being conscious of different temporal orientations requires considered design of appropriate tools for recording project progress e.g., single Gantt chart style plan that privilege a clock-pacing perspective are fine for capability development activities but should not be used for research project planning.

Lastly, we recommend that prior experience of principals and agents (cf. section 5.2) should be considered while recruiting for joint UI labs. However, it might not be possible to hire all principals and agents with prior work experience in a cross-sector environment. In such cases, emphasis should be provided on selecting principals and agents whose “intrinsic motivations” (Ángel and Sánchez, 2009) are aligned with the overall objectives of the joint UI lab. For instance, preference should be given to selecting university scientists whose objectives are not only to publish but also to achieve commercialisation success and social and environmental impact. To cultivate intrinsic motivations, new principals and agents should also be trained on the expectations of the lab andwhy meeting such expectations could be valuable for their future career endeavours.

## **6.3 Future research avenues**

The conceptualisation proposed in this paper offers a platform to empirically examine the agency conflicts and the suitability of the mitigation strategies. Qualitative exploratory studies could be useful to develop a more in-depth understanding of the macro (institutional and organisational-level) and micro-level (individual employee-level) barriers (if any) that may hinder the adoption of each mitigation strategy, and how joint UI labs could overcome such barriers. Qualitative case studies could provide an appropriate research design considering the multi-faceted and multi-level aspects (Baxter and Jack, 2008; Yin, 2003) associated with the agency relationships in joint UI labs. On the other hand, quantitative studies can be carried out to compare the impact of different agency conflicts on the productivity of joint UI labs, and the moderating role of the mitigation strategies.

Our conceptual framework is built on joint UI labs where a single organisation from the four sectors (university, company, government and CSO) are involved. Future studies could also extend our conceptual framework to study more complex joint UI labs, where multiple organisations from each sector participate. Future research could consider some other complexities that may be present in joint UI labs. For instance, the organisations involved in a joint UI lab could share different countries of origin, which may add another layer of complexity in the form of institutional distance between the principals/agents. Exploration of such complexities will help to propose comprehensive mitigation strategies for managing “international” joint UI labs.

Also, while applying our conceptual framework, studies can consider those UI labs that predominantly undertake other types of collaborative R&D such as contract research, consulting and technology licensing. Future studies could examine whether the agency conflicts discussed in this paper affect these collaborations differently and whether more nuanced, collaboration type-specific mitigation strategies should be offered to tackle the agency conflicts.

Finally, agency conflicts may vary depending upon the type and interests of the university, investigation of which constitutes a promising research avenue. In this paper, we focused on the traditional universities only, which value both research and teaching. Future studies should investigate the validity of the agency conflicts and mitigation strategies in the context of joint UI labs involving teaching-only universities.

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1. University-industry-government collaborations can be seen in joint UI labs when they receive funding for projects that do not include any societal elements, whereas university-industry-CSO collaborations occur when joint UI labs undertake self-funded social projects. [↑](#footnote-ref-1)
2. The board of governors is “the governing body which is ultimately responsible for all the affairs of the institution[university]” (Bennett, 2002, p.290) [↑](#footnote-ref-2)
3. Research (Borah et al., 2019, 2021) show that engage in teaching activities can help companies to identify and recruit talent for their R&D functions. [↑](#footnote-ref-3)
4. The teaching, supervision and subsequently talent selection activities could improve Samuel’s competencies in human resource management (HRM), and studies report (e.g., Ángel and Sánchez, 2009) that such HRM competencies can help company scientists fast-track their transitions to senior managerial roles. [↑](#footnote-ref-4)