

ARTICLE

ARE YOU READY TO COLLABORATE? IMPROVING THE QUALITY OF UNIVERSITY-INDUSTRY COLLABORATIONS

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Universities are under ever-increasing political and commercial pressure to engage with industry to convert their research into viable value-adding products and services. A longitudinal study by the Scandinavian researchers examining 25 university-industry collaborations suggests that aligning goals and creating a flexible setup between partners in the early stages of engagement is crucial for its success.

INTRODUCTION

This study examines the dynamics of university-industry collaboration (UIC) from a micro-level perspective. Emanating from policy considerations, UIC research has predominantly been conducted from a macro-perspective,¹ leaving a dearth of more detailed accounts of the dynamics behind the success and failure of UICs, especially during the initiation phase.² We thus explore the processes underpinning the criteria for UIC success. Adopting a dilemma approach,³ which is commonly used to address complex problems, we focus mainly on the early phases of UIC in a longitudinal study of UICs established between researchers and students at two Scandinavian universities, namely Aalborg University in Denmark and the Norwegian University for Life Sciences in Oslo, Norway, and the respective business communities situated in and around the two universities and the separate science parks.

1. Bjerregaard, 2009; Jones and Coates, in press

2. De Wit-de Vries, 2019; Mascarenhas et al., 2019

3. Suomi et al., 2019

There is a long history of scientific research as the basis for technology, economic growth, and national security, at least since the birth of the semiconductor industry in Silicon Valley in the mid-20th century.⁴ However, Bush⁵ had the somewhat romantic idea that free, basic research could be combined with the demands of capitalists and the welfare state. Machlup⁶ broadened the scope to other domains, marking the start of a discourse on a knowledge society, in which universities also played a central role. In its modern form, UIC typically takes place within the context of theory- and policy-driven expectations of a triple helix model of innovation⁷ or Mode 2 research,⁸ which both suggest collaboration between universities, industry, and public organisations that goes beyond the mere application of scientific knowledge to societal problems and instead implies different kinds of research efforts, with all parties involved in the process. A frequently cited source is Perkmann and Walsh⁹ who remarked that external resources for innovation are increasingly important to organisations and suggested a research agenda from an 'open innovation' perspective for exploring the characteristics of university-industry relations.

Orienting UIC in the broader field of open innovation (OI), Bogers et al.¹⁰ explored the OI field and the need for more permeable boundaries between different levels of analysis to address critical topics. One such example is to address

OI strategies and OI design in light of behaviour and cognition. This highlighted, on the one hand, intersections between intra-organisational issues of how individual-level behaviours and attributes are adopted concerning OI and, on the other hand, the inter-organisational topic of how new constellations combine value creation and value capture. Suomi et al.¹¹ questioned the oversimplified explanation of a 'shotgun wedding of industry and academia'¹² and instead suggested a dilemma approach to understand the dynamics of the interactions that occur with UIC.

The once savoured values of academic freedom and researcher autonomy that have traditionally been associated with the scholarly output of universities are changing drastically,¹³ generating notions such as research impact, value for money, and output measurement.¹⁴ In the past two decades, this has resulted in discussion about what constitutes universities' main activities.¹⁵ In the past, the two main activities were teaching and research, but a third core activity has been added, namely engagement with society,¹⁶ also called UIC. As such, research and the increasing focus on external research funding are currently transforming universities from ivory towers to knowledge brokers.¹⁷ According to Friesike et al.,¹⁸ the traditional gap between research-driven universities and application-driven private companies is diminishing rapidly.

4. Braun and Macdonald, 1978, 1982; Kenney, 2000

5. Bush, 1945; 1960

6. Machlup, 1962

7. Etzkowitz, 2005; Leydesdorff and Etzkowitz, 1996

8. Gibbons et al., 1994; Novotny et al., 2001

9. Perkmann and Walsh, 2007

10. Bogers et al., 2017

11. Suomi et al., 2019

12. Hampden-Turner, 1990, p. 201-221

13. Kok et al., 2010; Van Dierdonck et al., 1990

14. Nielsen, 2016

15. Bruneel et al., 2010; Hughes and Kitson, 2012

16. Barnes et al., 2006; D'Este and Patel, 2007; Rasmussen and Rice, 2012

17. Jones-Evans and Klofsten, 1998

18. Friesike et al., 2015

Presently, universities play a role in society not only as transmitters of knowledge through their graduates and academic research papers produced but also as co-producers of knowledge and even co-inventors of knowledge and new technologies.¹⁹ Governments worldwide are actively encouraging collaboration between universities and private companies²⁰ in their quest to ramp up innovation. Many national governments have aimed to increase the research productivity of universities.²¹ This has spurred a growing trend in projects and collaborations between industry and universities, which has brought with it challenges related to these new types of interaction between the academic and business worlds.

Many universities are working to strengthen their ties with industry, as the sharing and combination of information between academic science partners and industrial science partners are regarded as vital parts of the modern university's knowledge creation process.²² Some universities, for example, Stanford University and Massachusetts Institute of Technology in the United States, have longstanding traditions of intense collaboration with industry and have successfully done so for decades.²³ However, other universities are at the beginning of this journey and are facing the challenge of integrating the separate efforts of multiple individuals who may have varying motivations and capacities to interact.²⁴

The UIC literature has grown considerably during the last decade. The field of research has been described as multifaceted and ambiguous,²⁵ and fragmented and lacking a comprehensive view.²⁶ This scenario has led to the inclusion of a broad range of concepts. For example, in their review of the field, Sjöö and Hellström²⁷ mentioned 'academic entrepreneurship', 'mode 2', 'outreach', 'third mission', 'triple helix', 'university-industry interaction/collaboration/cooperation', 'public private partnership', 'co-production', and 'technology transfer' as expressions of UIC. At times 'the surrounding society' is used as a broader notion than 'industry'²⁸ and the 'third mission' is more broadly understood as 'all activities concerned with the generation, use, application and exploitation of knowledge and other university capabilities outside academic environments'.²⁹ In addition, widespread concepts such as the 'triple helix' have evolved,³⁰ thus altering definitions of concepts and their connotations as well as their relationships with each other. In response to this state of the field, many systematic literature reviews and bibliometric studies³¹ have recently emerged, suggesting clusters of topics within UIC research.

While these efforts will likely contribute to greater coherency and understanding in the overall field, helping to avoid the anecdotal motivation of further research, there are shortcomings and questions

19. Cowan and Zinovyeva, 2013; D'Este and Patel, 2007

20. Barnes et al., 2002

21. Lewis, 2014

22. Thursby and Thursby, 2002; Thursby et al., 2009

23. Wessner, 2013

24. Grant, 2002

25. Skute et al., 2019

26. Ankrah and Al-Tabbaa, 2015; Perkman et al., 2013

27. Sjöö and Hellström, 2019

28. cf. Hampden-Turner, 1990

29. Molas-Gallart and Castro-Martínez, 2007, p. 321

30. Galvao et al. 2019

31. cf. Ankrah and Al-Tabbaa, 2015; Galvao et al., 2019; Mascarenhas et al., 2018; Secundo et al., 2019; Sjöö and Hellström, 2019; Skute et al., 2019

left unanswered, notably on the micro-level. As Sjöo and Hellström³² remarked, meta-studies tend to gloss over details of the main variables at play, and factors are not always conceptualised causally, leaving unanswered questions about the direction and combinatorics of influence between factors. In a similar vein, Mascarenhas et al.³³ pointed out that it remains unclear whether universities' and companies' strategies are balanced and whether outcomes are effective for all stakeholders. Furthermore, there are many unanswered questions about how collaborative links initially develop, including partner selection, the way partnerships function, and the types of interaction that comprise different constellations.³⁴ Rajalo and Vadi³⁵ accentuated the persistent research gap regarding the understanding of the underlying mechanisms of UIC, including enablers and barriers. Earlier research often addressed the 'cultural divide' between UIC partners and highlighted that different institutional norms, trust, and prior knowledge of partners were critical, as well as the organisational and managerial skills required to handle these challenges. Both Ankrah and Al-Tabbaa³⁶ and Skute et al.³⁷ concluded from their literature reviews that there is a need for longitudinal studies on UICs to capture the nuance and depth of their complexity.

Research that can improve the probability of achieving success with the effort and resources currently invested in this sphere globally is thus both critical and timely, not only for the university sector but also society as a whole. The objective of this article is to contribute micro-level insights

for the improvement of UIC by studying enablers and barriers during the early phase. Activities in this phase typically include partner searches, the establishment of partnerships, and the initiation of projects. By studying the early phases, particularly partners' motivation for participating in UICs and how to initiate UICs, this research contributes by improving UIC practices.³⁸ The results can also help partners achieve the best possible outcomes³⁹ by providing timely and valuable insights⁴⁰ that will help improve innovation outputs. This objective motivated this qualitative and explorative micro-level study to address fundamental questions about the characteristics of these dynamics:

RQ: How should we understand the processes underpinning the criteria for success during the early stages of UIC?

The remainder of the article is structured as follows: 'Theoretical underpinnings' provides an account of earlier research and the theoretical assumptions of UIC based on two subdomains of early collaboration phases: 1) enablers and barriers to finding the right partner and the formation of collaborations and 2) enablers and barriers to the initiation and implementation of UICs. We also present the dilemma approach and Second Track processes to challenge conventional thinking about the norms and challenges associated with UICs. 'Methodology' explains the methodology applied, including data collection and analysis. 'Empirical findings' presents the empirical data, followed by discussion and concluding remarks that address potential avenues for future research.

32. Sjöo and Hellström, 2019

33. Mascarenhas et al., 2018

34. Ibid.

35. Rajalo and Vadi, 2017

36. Ankrah and Al-Tabbaa, 2015

37. Skute et al., 2019

38. Pertuzé et al., 2010

39. Lazzarotti et al., 2016a; 2016b

40. Nielsen, 2016

THEORETICAL UNDERPINNINGS

Our research is underpinned by several recent systematic literature reviews and bibliometric studies of the UIC literature⁴¹ as well studies on specific sub-topics of interest.

Literature review

Many of the topics addressed during the maturation process of the still-emerging field of UIC have informed the current study. While there have been interesting findings in the field, they are often somewhat anecdotal. The field also suffers from a lack of theoretical consistency in many new and some well-known, older studies as well as recently identified research gaps. At the most basic level, Rajalo and Vadi⁴² remarked on the dominance of macro- and meso-level studies and welcomed more micro-level studies. However, while qualitative micro-level studies may have poor statistical validity given the few or even single cases they often consider, they can contribute deeper insights on the dynamics of the interplay between already acknowledged factors in UICs (i.e., contributing insights about conceptual validity). The validity of that considerably limited number of cases can also be enhanced through better theory and the consistent design of single-topic studies, embedding these in the theoretical context of earlier findings.

UIC research can be improved by studying successes and failures or, as we prefer to say, by studying friction, complexities, and contradictions (i.e., by focusing on dilemmas and paradoxes). This can deepen the understanding of important known factors. Rajalo and Vadi⁴³ suggested that a crucial research gap lies in 'the limited understanding of

implicit key factors that affect the collaboration process' (p. 43) and operationalised the challenge by focusing on two key preconditions on both sides of UIC, namely 'motivation' and 'absorptive capacity'. Based on their bibliometric review of the UIC literature, Skute et al.⁴⁴ argued that new success factors should be studied by evaluating failure at different stages of UIC, as the governance mechanisms may vary by stage. Furthermore, the heterogeneity of UIC partners is a topic that is rarely addressed. All these issues point at considerable complexities that have been only rarely addressed by UIC research.

Among the factors motivating UIC and contributing to the success or failure of individual collaborations is complementarity. This factor is prominent, as the complementarity of competences, rather than their redundancy, is the main argument for UIC. Although it is the main motivation for UIC, it remains unclear as to how complementarity is identified by UIC partners and how the actual matchmaking process occurs. Skute et al.⁴⁵ noted longstanding calls for research on the selection processes employed in UIC. Further, Perkman and Walsh⁴⁶ addressed the need to understand firms' strategies for identifying and selecting academic partners. While this article is well cited, the call for further research has not yet been answered. Link⁴⁷ echoed this call for research, arguing that the industry's criteria for the choice of specific academic partners in UICs is an underexplored topic. In addition, Skute et al.⁴⁸ suggested that future research should focus on the strategic and cultural fit between partners to understand how the organisation and management of UICs can become more successful.

41. cf. Ankrah and Al-Tabbaa, 2015; Galvao et al., 2019; Mascarenhas et al., 2018; Secundo et al., 2019; Sjöö and Hellström, 2019; Skute et al., 2019

42. Rajalo and Vadi, 2017

43. Rajalo and Vadi, 2017

44. Skute et al., 2019

45. Ibid.

46. Perkman and Walsh, 2007

47. Link, 2015

48. Skute et al., 2019

In their systematic review of the UIC literature, Sjöo and Hellström⁴⁹ concluded that one of the strongest predictors of UIC was prior experience and commented that boundary-spanning is likely to create a basis for collaborative experience. This could take the form of industry-funded PhD students, temporarily hired researchers in the industry, or the transfer of research results. Hence, personal relationships that cross boundaries between university and industry can build familiarity, trust and a shared history and can facilitate understanding of other parties' perspectives, which, in turn, is associated with the institutionalisation of collaboration.⁵⁰ Just like the notion of 'culture', 'prior experience' is a container for many interesting aspects of UIC that have not yet been explored. After examining aspects of universities' OI capacity, Huggins et al. concluded: 'The focus of future developments should be on furthering our understanding of the nature of "openness" in a more holistic sense, and which more broadly encompasses the plethora of interactions and relationships that members of universities engage in'.⁵¹

In theoretical speculation about which factors help partners identify complementarity and determine the right fit between partners, previous experience with collaboration, network centrality,⁵² and proximity have been suggested as related physical and cognitive concepts.⁵³ As part of their recommendation for further research, Skute et al.⁵⁴ pointed at how the central partner in UICs affects the generation of innovative outcomes.

They also suggested further research into other factors complementing or mediating the impact of the proximity of partners, such as the availability of research resources, complementarity, and absorptive capacity.⁵⁵

The issue of the formalisation of routines and the management of UIC is a topic of recent controversy and perhaps reflects normative views as much as empirical observations. For instance, Rajalo and Vadi⁵⁶ insisted that 'the relevance of joint structures cannot be overstated', and Leichnig and Geigenmüller⁵⁷ suggested universities' alliance management capabilities (alliance proactiveness, alliance transformation, interorganisational coordination, and interorganisational learning) are decisive for UIC success. Sjöo and Hellström⁵⁸ remarked that university conditions such as their specific organisational structures and funding-characteristics are likely to affect boundary-spanning processes, at least to some extent, and that crossing organisational boundaries is, in turn, likely to affect formal structures. However, their review did not identify these effects. Further, Ankrah and Al-Tabbaa⁵⁹ argued in a literature review that UICs are managed rationally while de Wit-de Vries et al.⁶⁰ concluded that UICs are managed informally or even irrationally. In contrast, Skute et al.⁶¹ proposed that UICs may need goal-oriented management and that, from the firm perspective, control mechanisms may be beneficial while researchers' demand for autonomy may generate a balance between a control-based and a more hierarchical governance style.

49. Sjöo and Hellström, 2019

50. Ibid.

51. Huggins et al., 2020, p. 747

52. cf. Huggins et al., 2020

53. cf. Skute et al., 2019

54. Skute et al., 2019

55. Ibid.

56. Rajalo and Vadi, 2017, p. 50

57. Leichnig and Geigenmüller, 2020

58. Sjöo and Hellström, 2019

59. Ankrah and Al-Tabbaa, 2015

60. De Wit-de Vries et al., 2019

61. Skute et al., 2019

An additional complexity regarding the degree of formalisation of UIC management is the consideration of the different phases of collaborative efforts. Skute et al.⁶² suggested a possible need for formal governance mechanisms to reduce uncertainty at the initiation of a project, while later phases may allow partners to emphasise informal mechanisms such as trust as the UIC gradually develops. This may explain the success or failure of UICs, as neither the goals nor the respective contributions of partners can be fully defined in advance. The researchers thus suggested more cross-stage studies to shed light on these needs.⁶³ In a similar vein, de Wit-de Vries et al.⁶⁴ suggested that the differences between their own and Ankrah and Al-Tabbaa's⁶⁵ findings may lie in their focus on different stages in the UIC process. Nevertheless, de Wit-de Vries et al.⁶⁶ argued that this difference taps into a broader debate in which UICs were found to have a more informal irrational management style than often assumed. They thus concluded that there is a need for increased understanding of the use of informal or formal management in different conditions.⁶⁷

There is room to contribute to fundamental insights about collaborative processes to flesh out the logics and relationships behind the superficially determined success factors and expectations of 'one-size-fits-all' recipes for best practices. There are strong indications in the literature that UICs rely on emergent processes that are still poorly understood. Such insights and speculations about the underlying logic are reflected in Sjöo and Hellström's⁶⁸ summary of the reasoning behind UIC and Skute et al.'s⁶⁹ reflection on the state-of-the-art in UIC research and the promises of a process view:

'Over time, a number of individuals may accumulate experience in university-industry collaboration to such an extent that it affects university or corporate culture. As researchers and industry representatives build collaboration experience, an understanding of each other's routines and time horizons will increasingly be based on actual experience rather than preconception. Working together may also settle concerns about losing control over academic freedom or trade secrets. When such obstacles are overcome, a collaborative culture may develop. A collaborative culture implies long-term, stable intentions to collaborate. However, it may also lead to a form of social stratification based on status centrality, where the most reputable, successful and well-connected researchers at the highest-ranked universities attract the most R&D-intense firms as collaborating partners' (Sjöo and Hellström, 2019, p. 281f).

'The process perspective (interaction process and knowledge transfer cluster) of U-I collaborations is not a core research stream; however, there is a strong need for future examinations, especially if we want to understand the complex processes of interaction between academia and industry ... What is the U-I collaboration journey, when has this journey started, when has this journey concluded, does it require particular interactions to progress; and what remains constant and what changes throughout the process of interaction between U-I partners?' (Skute et al., 2019, p. 938).

62. Ibid.

63. Ibid.

64. De Wit-de Vries et al., 2019

65. Ankrah and Al-Tabbaa, 2015

66. De Wit-de Vries et al., 2019

67. Ibid.

68. Sjöo and Hellström, 2019

69. Skute et al., 2019

A fundamental aspect of viewing UIC as a process is to acknowledge the reciprocity of interaction. In their literature review, de Wit-de Vries et al.⁷⁰ found a significant focus on academic partners but very limited attention on the role of industry in UIC, which risks underestimating the crucial role of companies' efforts to absorb knowledge and communicate needs to their partners. Hence, there is a need for further exploration of the role of companies and how they manage their partnerships. Furthermore, as the exchange is bidirectional, there is a need to understand better what academics gain from their interactions with firms that provide valuable results and meet the needs of industry partners. In addition, current research has often overlooked the management of problems during the initial phases of UIC and has instead favoured the implementation phase.

In a similar vein, there may be bias towards looking for solutions rather than using problems and areas of friction as a basis for examining the conditions necessary to meet the ambitions of UIC in real-life settings. In their systematic literature review of the triple helix, Galvao et al.⁷¹ remarked that few studies have shed light on the barriers to UIC from researchers' perspective, which contrasts with de Wit-de Vries et al.'s⁷² findings. However, these reviews agree on the need to study problems with UIC as well. Absorptive capacity, ambiguity, and cognitive distance are delicate challenges to overcome, as well as uncertainty about the role

of experience and management capabilities as facilitators of UIC.⁷³ A more conceptual challenge lies in exploring the underlying aspects of 'cultural differences', which are often referred to, but seldom explained, for example, in terms of differences in goals, organisational and managerial differences, and epistemic norms. Without further specification, the broad concept of culture runs the risk of overshadowing the causal relationships among different aspects and factors. For instance, the disadvantages of partners' differing logics may be outweighed by the benefits of collaboration, just as trust may outweigh threats, hence leaving room for further exploration.⁷⁴

As the lion's share of UIC studies has been focused on success factors, research has explicitly or implicitly assumed what UIC means for one or several stakeholders. Echoing Link,⁷⁵ Skute et al.⁷⁶ concluded that while studies have indicated firms' and universities' motivations for engaging in UIC, research on the nuts and bolts of the determinants of respective gains is in a nascent stage. However, many recent studies have looked into some of the more intricate aspects of UIC, such as obstacles, dialectic tensions,⁷⁸ dilemmas,⁷⁹ barriers to knowledge transfer,⁸⁰ company motivation,⁸¹ trust and learning,⁸² and, last but not least, autonomy.⁸³ Additionally, de Wit-de Vries et al.⁸⁴ pointed out the need for more knowledge about the motivation for UIC, especially for companies.

70. De Wit-de Vries et al., 2019

71. Galvao et al., 2019

72. De Wit-de Vries et al., 2019

73. Ibid.

74. Ibid.

75. Link, 2015

76. Skute et al., 2019

77. Mascarenhas et al., 2020

78. Dooley and Gubbins, 2019

79. Suomi et al., 2019

80. Alexander et al., 2020

81. Giones, 2019

82. Kunttu and Neuvo, 2019; Oliver et al. 2020

83. Zalewska-Kurek and Harms, 2020

84. De Wit-de Vries et al., 2019

When considered as a whole, this situation indicates a general need for a research-based discussion about how to define, operationalise, and measure success in UICs. A common, but in our view underdefined, description of UIC success is Leishing and Geigemüller's⁸⁵ notion of success as the perceived performance of bilateral interorganisational relationships between partners. This definition runs the risk of reducing the meaning of success to a frictionless collaboration between partners rather than focusing on potentially problematic interactions with non-redundant partners that could generate valuable outputs in many dimensions and time horizons.

Ankrah and Al-Tabbaa⁸⁶ discussed the problem of defining success, remarking that parties may define the concept differently and that it would be desirable to put in place more objective measures of the effectiveness of UIC in addition to the subjective measures currently employed. They added that there is little evidence that any single dimension of evaluation, such as financial gain or rate of survival, is superior. They also noted the impact of academic engagement in the process, such as the consequences of teaching and learning from experience being overlooked, thus addressing the potential intangible value of UIC. On the other hand, there is a need to move from the resource complementarity approach to the actual leveraging of companies' competitive advantage, including the value of intellectual exchange and the contribution of academic collaborators' fresh perspectives to firms' research capabilities, which can, in turn, affect companies' motivation for UIC. Hence, there is a need to develop an understanding of

the circumstances of such valuations. These valuations are based on insights into causal dynamics, which helps assess the value of the full range of long- and short-term outcomes.⁸⁷ In a similar vein, Mascarenhas et al.⁸⁸ addressed the issue of whether UIC constitutes an innovation strategy or a research strategy, pointing out the possibility that it is a mutual strategy, a topic that has not yet been fully explored, particularly regarding its efficiency for stakeholders.

In summary, in their literature review, Skute et al.⁸⁹ noted that while UIC literature has expanded in the last two decades and identified tremendous potential for economic and social development, the complexities of UIC are still not well understood. In a similar vein, Mascarenhas et al.'s⁹⁰ review of the UIC field highlights the need for greater conceptualisation and development of research. With an integrative ambition, de Wit-de Vries et al.⁹¹ suggested that closing the gap between qualitative and quantitative streams of research would bring the field forward. While both studies identified important factors, their results have not been integrated. Wit-de Vries et al.⁹² lamented this state of affairs, arguing that such an integration could increase the understanding of the underlying mechanisms and add qualitative research to the theoretical underpinnings of UIC, which is often based on descriptive research. Commenting on the methodological limits of literature reviews, Sjöo and Hellström⁹³ expressed humility regarding their theoretical speculations, as the proper identification of direction and the combinatorics of the influence between factors would require a deeper scrutinisation of the literature and the

85. Leishing and Geigemüller, 2020

86. Ankrah and Al-Tabbaa, 2015

87. Ibid.

88. Mascarenhas et al., 2018

89. Skute et al., 2019

90. Mascarenhas et al., 2018

91. De Wit-de Vries et al., 2019

92. Ibid.

93. Sjöo and Hellström, 2019

incorporation of additional layers of complexity in the analysis. However, they argued that their (humble) speculations may stimulate further research on UIC.⁹⁴

Despite the attention to the third mission of universities, Hughes and Kitson⁹⁵ argued that there remain gaps in understanding as to the why, how, and impacts of UICs. Collaboration between universities and industry is full of challenges and potential conflicts⁹⁶ related to the creation of value and the transfer of intellectual capital between partners,⁹⁷ often resulting in the poor realisation of potential benefits.⁹⁸ This is because these types of collaboration and interaction are highly complex problems and must thus be interpreted as Second Track processes.⁹⁹ Prior UIC studies have identified several critical success factors, including aspects such as time planning, mutually agreed-upon objectives between partners,¹⁰⁰ and choosing the appropriate partner by matching the levels of the preconditions that must be met.¹⁰¹ Further, several studies have found that many problems in UICs can be overcome if they are managed properly from the beginning.¹⁰²

The early phases of university-industry collaboration

This section discusses the theoretical foundation on which the existing understanding of UIC, especially during the early phases, is based. In the subsections,

frames of reference concerning the identification of partners and related aspects of the initiation of UICs are constructed for later application and structuring of the empirical contributions. Recent contributions by Rajalo and Vadi¹⁰³ and Bogers et al.¹⁰⁴ outline the importance of expanding current knowledge and contemporary understanding to improve UIC outcomes. UIC and partnerships between universities, companies, and public institutions are expanding from industrial economies to developing countries,¹⁰⁵ with the intention of fostering growth and innovation, meaning that the agenda raised here is essential for universities, funding agencies, and governments worldwide. The research objective of this study is thus to contribute micro-level insights that can improve UIC by explicitly studying the enablers and barriers encountered during the early phases of UIC as well as how to improve the chances that such collaboration will lead to innovation and growth.

Initiating university-industry collaboration

Several studies have emphasised the importance of choosing the right partners for the success of UIC.¹⁰⁶ Among the advantages of being the initiating stakeholder in a given collaboration is the ability to choose the initial partners. The ability to choose the 'right' partners has attracted attention in previous research.¹⁰⁷ According to Rajalo and Vadi,¹⁰⁸ this can be understood as an expression of absorptive capacity. The realisation

94. Ibid.

95. Hughes and Kitson, 2012; 2013

96. Bruneel et al., 2010

97. Nielsen and Cappelen, 2014; Nielsen and Sort, 2013

98. Barnes et al., 2002

99. Massingham, 2019

100. Nielsen et al., 2013

101. Rajalo and Vadi, 2017

102. E.g., Barnes et al., 2002, 2006; Ruuska and Teigland, 2009

103. Rajalo and Vadi, 2017

104. Bogers et al., 2017

105. Guimon, 2013; Marotta, 2007

106. Barnes et al., 2006; Goduscheit and Knudsen, 2015; Mora-Valentin et al., 2004

107. Barnes et al., 2002, Giuliani and Arza, 2009

108. Rajalo and Vadi, 2017

of the scarcity of a competence as a strategic resource is a prerequisite for collaboration, which, per definition, requires absorptive capacity.¹⁰⁹ Here, absorptive capacity is the dynamic capability to evaluate and utilise outside knowledge based on prior related knowledge.¹¹⁰

Santos and Eisenhart¹¹¹ suggested that organisational boundaries, in terms of competence and identity, may trigger the initiation of collaboration. Among prior studies of how organisations identify partners and form collaborations, Gulati and Gargiulo¹¹² found that organisations, in general, tend to seek partners that have 'complementary resources and capabilities' and can be regarded as reliable counterparts, while Freitas et al.¹¹³ argued that complementary modes of governance are influential in partner selection. Further, Carayol¹¹⁴ found that researchers are focused on identifying exploitable synergies between their interests and corporate interests and tend to accept or refuse to collaborate based on whether the proposed project fits their current research agenda. Complementarity, therefore, is a variable in the initiation phase.

Carayol¹¹⁵ further examined the reasons companies provided for selecting a given academic partner and the factors that would lead the chosen academic partner to accept or refuse a proposition to collaborate. In line with Gulati and Gargiulo,¹¹⁶ Carayol¹¹⁷ found that companies were focused on

avoiding uncertainty, and this led them to choose academics with good reputations. Reputation, therefore, is also a variable in the initiation phase.

Mora-Valentin et al.¹¹⁸ found that choosing former collaboration partners or partners with vast collaborative experience improves the chance of success for projects. This is in line with Thune,¹¹⁹ who found that companies tend to collaborate with research partners with whom they had established prior relationships. On this matter, Gulati and Gargiulo¹²⁰ argued that the tendency to enter 'secure' partnerships (e.g., by choosing former collaboration partners) may be problematic as this could cause partners to fail to realise the potential of alternative alliances. Thune¹²¹ argued that the tendency to choose former collaboration partners is often related to the goal of building mutual experience before undertaking larger projects. This indicates that trust is a key dimension in UIC, in an identical fashion as in the general literature on inter-organisational relationships.¹²² The tendency to connect with prior collaborators or, at best, partners with prior experience with UIC is an important variable in the initiation phase.

Thune¹²³ and Barnes et al.¹²⁴ both emphasised the importance of identifying committed partners and underlined that commitment and trust are essential dimensions in a university-industry (UI) context. However, it is important to note that stakeholders

109. Ibid.

110. Cohen and Levinthal, 1990

111. Santos and Eisenhart, 2005

112. Gulati and Gargiulo, 1999

113. Freitas et al., 2013

114. Carayol, 2003

115. Ibid.

116. Gulati and Gargiulo, 1999

117. Carayol, 2003

118. Mora-Valentin et al., 2004

119. Thune, 2011

120. Gulati and Gargiulo, 1999

121. Thune, 2011

122. See, e.g., Tomkins, 2001

123. Thune, 2011

124. Barnes et al., 2002

in different sectors of the economy and different fields of science interact differently.¹²⁵ Commitment among partners is thus an important variable for achieving UIC success.

Finally, prior work has emphasised the importance of the thorough assessment of potential partners from both the university and industry stakeholder perspectives with the aim of identifying committed partners with more or less complementary objectives.¹²⁶ Mora-Valentin et al.¹²⁷ provided evidence that the assessment of aims and competences is important for ensuring the success of UIC projects, while Perkmann and Salter¹²⁸ accentuated that sufficient preparation is a crucial factor for ensuring active participation in a UIC. Perkmann et al.¹²⁹ furthermore stress that if policy is to successfully increase the impact of academic research through fostering engagement, then both academics and firms need to be skilled in initiating and maintaining such collaborations, but also need to recognise that collaborating with academia presents challenges that are distinctly different to those of customers or suppliers. Therefore, the assessment of partners is an important variable in establishing sound UIC. The identified variables relate to the initiation phase of UIC. Our empirical probing helps to identify enablers and barriers to achieving these aspects. Next, we turn to the specifics of UIC implementation.

Launching university-industry collaboration

UIC faces several essential factors during implementation, including the need for good management. Good management is perceived to be of vital importance to improving the probability of success in collaborative projects involving private, public, and academic partners.¹³⁰ Barnes et al.¹³¹ argued that clearly defined and mutually agreed-upon objectives and realistic aims are essential for ensuring the proper management of UI projects because, without defined objectives, projects tend to become unfocused. Further, Ruuska and Teigland¹³² argued that the co-development of a clear project plan is essential for establishing a common understanding among partners. Furthermore, they stressed the importance of the project leader and effective communication for the continuous balance of ambitions and expectations.¹³³

Likewise, Anderson et al.,¹³⁴ in an examination of how projects involving private, public, and academic partners are managed, stressed the importance of clearly identifying and explaining the motives and goals of each partner. They also found that it is vital for all partners to be allowed to influence decisions affecting the partnership. However, in most cases, the literature provides little guidance on how to establish such UIC objectives and how to implement good planning and management in practice, leaving a significant gap to be filled. Hence, planning, management structures and explicit objectives are essential variables for improving the implementation of UIC projects.

125. Schartinger et al., 2002

126. Barnes et al., 2002

127. Mora-Valentin et al., 2004

128. Perkmann and Salter, 2012

129. Perkmann et al., 2013

130. Philbin, 2008; Ruuska and Teigland, 2009

131. Barnes et al., 2002

132. Ruuska and Teigland, 2009

133. See also Barnes et al., 2002

134. Anderson et al., 2012

Rajalo and Vadi¹³⁵ emphasised the development of projects over time during the implementation phase, leading to the classification of 'excellent', 'promising', and 'modest' collaborators. The claim made in this classification is that the reasons behind the variety of UIC projects can be explained through motivation and absorptive capacity. The researchers concluded that collaborators are engaged in a constant bilateral learning process and that the preconditions of both sides should be of equal value. Likewise, Thomas et al.¹³⁶ suggested a series of action points to improve the functioning of the project team, stressing the importance of developing relationships among partners, including teambuilding, formalising the collaboration, and communicating. Merely 'planning' may be insufficient for ensuring the success of a UIC project. The literature suggests that the quality of the project team responsible for the implementation and execution of a project is also important. This may create tension in the form of social group inefficiency because, from the perspective of the researcher, the scale economies of being an expert must be traded off against the time it takes to engage with others. Participants' continual review of this trade-off decision influences their contribution to the group. Second Track processes provide integration mechanisms based on dissemination effects that can resolve this trade-off decision.¹³⁷ Therefore, mature and formalised collaborations, high-performance teams, and excellent internal communication are expected to improve UIC.

Challenging conventional thinking

A dilemma is a difficult choice, or a situation in which a choice must be made between two or more alternatives. The prisoner's dilemma is a classic example of the choice between collaborative or non-collaborative action.¹³⁸ A false dilemma is instead an either-or situation in which a choice is required without considering all relevant possibilities (i.e., a fallacy). A paradox is a self-contradictory situation or statement that seems impossible or difficult to understand as it contains two opposite facts; it can be true only if it is also false. In both cases, theoretical as well as everyday assumptions play a role in how situations and alternatives are perceived and enacted. Mintzberg¹³⁹ remarked that both strategy and theory are simplifications, necessarily distorting reality – they are to organisations what blinders are to horses. Research into paradoxes debates whether paradoxes should be seen as inherent, socially constructed, or both; as entities or processes; and through a normative or a descriptive lens.¹⁴⁰ In the context of UIC, it is possible and likely that theory, strategies and normative expectations can create both (true or false) dilemmas and (apparent) paradoxes that can be transcended or redefined through broadened perspectives and interactions within the UIC.

With their unique dilemma approach to UIC research, Suomi et al.¹⁴¹ pointed at two classic dilemmas of UICs, namely 'highlighting intrinsic value of research vs. highlighting instrumental value of research' and 'focusing on international

135. Rajalo and Vadi, 2017

136. Thomas et al., 2008

137. Massingham, 2019

138. cf. Kuhn, 2019

139. Mintzberg, 2009

140. Smith et al., 2017

141. Suomi et al., 2019, p. 81

publications vs. focusing on the popularisation of science'. Departing from Hampden-Turner's¹⁴² definition, they saw dilemmas as mutually exclusive (un)desirable options that are often as the result of conflicting values, generating tension and dispute. Viewing dilemma reconciliation as a strategic process, the researchers emphasised dilemmatic situations as opportunities for avoiding collision, either-or solutions, and mere compromise.

In a similar vein, and quite contradictory to, for example, Rajalo and Vadi's¹⁴³ focus on the formalisation of UIC, Massingham¹⁴⁴ proposed Second Track processes as a better way of understanding the mechanisms behind successful UIC projects. Rather than taking general assumptions behind administrative theory as a starting point, the concept is inspired by principles of international diplomacy and conflict resolution, emphasising a focus on the common problem rather than the similarity of the involved stakeholders. Hence, this approach amounts to an entirely different paradigm in the notion of what constitutes UIC collaboration. It is participants' relationship with the problem, rather than with each other, that makes collaboration effective. In this perspective, shaping the environment of collaboration is crucial, not in terms of matchmaking between partners but rather in terms of all participants being connected to the same third parties and the problem at hand. This creates mechanisms that, over time, transform both individual and group cognition, establishing a common understanding of the problem. Thus, the mental models that facilitate collaboration are not dependent upon a perfect exchange and instead

encourage sharing without the expectation of payback. Second Track processes hence embrace higher levels of complexity and are thereby capable of transcending apparent paradoxes in UICs.

METHODOLOGY

A case study approach¹⁴⁵ is applied to the study of UIC. The case study approach is used in studies concerned with gaining insights on the dynamics of new fields and theory building.¹⁴⁶

Data collection

The empirical foundation of this paper is built on 38 semi-structured research interviews conducted with participants in 25 UIC projects from 2011 to 2012. Cases were selected using convenience sampling to study different types of UICs and a mix of projects with collaborations between companies and researchers and between companies and students. Company/researcher constellations were identified using the official database of Aalborg University's contracting unit for the Danish collaborations, while the identification of the Norwegian collaborations was achieved by directly contacting university departments. The respondents were selected to provide balanced insights into the different academic fields, stages of collaboration, and project sizes involved in UIC. When looking for enablers and barriers to the success of UIC, it is important to note that there are limitations as to the validity of the results because of the impossibility of studying UICs that never made it to the table, so to speak. Table I shows the distribution of the 38 interviews across the 25 UI collaboration projects.

142. Hampden-Turner, 1990

143. Rajalo and Vadi, 2017

144. Massingham, 2019

145. Yin, 2013

146. Eisenhardt, 1989; 1991; Yin, 2013

TABLE I: UNIVERSITY-INDUSTRY COLLABORATIONS STUDIED

INTERVIEWS	PROJECT FIELD	PROJECT TYPE	COMPANY RESPONDENT	UNIVERSITY RESPONDENT	STUDENT RESPONDENT	PROJECT PHASE
Collaboration A	Engineering and technology management project	Student project	R&D manager		Undergraduate	Terminated
Collaboration B	Compliance with customer needs for commercialization	Research project	HR manager			Terminated
Collaboration C	Gamification of queue waiting time	Student project	Market coordinator		Undergraduate	Terminated
Collaboration D	Construction development project	Trainee position	Department manager			In process
Collaboration E	Research in new communication technology	Research project	1) Founder 2) CEO	Associate Professor		In initialization
Collaboration F	Developing new engineering technology	PhD project	Department manager	External lecturer		Terminated
Collaboration G	Utilization of mobile technologies in media	PhD project	Head of digital markets	PhD student		Terminated
Collaboration H	Commercialization of newly developed technology	Research project	Technical manager			Terminated
Collaboration I	Customer experience research	Research project	Department manager	Associate Professor		In process
Collaboration J	Developing a strategy for growth	Research project	1) CEO 2) Manager	Associate Professor		In initialization
Collaboration K	Company overview project	Student project	CFO		Undergraduate	Terminated
Collaboration L	Medico-technology development	PhD project	Statistician	PhD student	Undergraduate	In process

CONTINUED OVERLEAF >

INTERVIEWS	PROJECT FIELD	PROJECT TYPE	COMPANY RESPONDENT	UNIVERSITY RESPONDENT	STUDENT RESPONDENT	PROJECT PHASE
Collaboration M	Costing and profitability project	Research project	Head of technologies			Terminated
Collaboration N	Concept development for ICT services	Research project	Project leader			Terminated
Collaboration O	Service quality calculations	PhD project	R&D manager			Terminated
Collaboration P	Company overview project	Research project	CEO			Terminated
Collaboration Q	Computer programming	Research project	Technical manager			In process
Collaboration R	Improving administrative procedures	Trainee position	Department manager			Terminated
Collaboration S	Development of logistics systems	Research project	CEO	Professor		In process
Collaboration T	Business and market development research	Research project	Head of quality assurance			Terminated
Collaboration U	Development of plant seeds	Research project		Communications assistant		Terminated
Collaboration V	Developing equipment for horse stables	Research project		Professor		Terminated
Collaboration W	Developing technical analyses for biogas	Research project		Assistant Professor		Terminated
Collaboration X	Developing production systems for the dairy industry	Research project		Coordinator		Terminated
Collaboration Y	Developing equipment for forestry mapping	Research project		Professor		Terminated

Data were collected through semi-structured, face-to-face interviews with participants.¹⁴⁷ The researchers prepared an interview guide but allowed the conversation to flow to interesting topics, following the recommendations of Kvale¹⁴⁸ and Kreiner and Mouritsen.¹⁴⁹ All interviews were recorded and transcribed. The interviewers were aware of the need to probe continuously for examples to illustrate the stories told by the respondents and to avoid getting representative answers, instead seeking to acquire practical answers.¹⁵⁰ Two interviewers were present during each interview to strengthen the data collection and ensure a coherent understanding of the impressions. Likewise, the interviewers had clear roles, with one researcher talking and providing productive interaction with the respondent and the other taking notes and ensuring that all main topics were covered, in line with Yin's¹⁵¹ recommendations.

The interviews probed several themes reflecting the purpose of the study. These included expectations and ambitions for the formation of the collaboration, the search for partners, making contact with potential partners, initiating the project, satisfaction with the overall cooperation, and perceived success at the current stage of the project. Identical interview guides were used for both university and industry participants in the same manner as Rajala and Vadi.¹⁵² An advantage of this approach is that the respondents provided insights based on their perspectives regarding what is crucial for improving UIC.

Analysing the data

The data were validated through the implementation of what Yin¹⁵³ called a case study protocol. Following each interview, both interviewers created a summary of the interview, noting critical points raised and indicating whether anything happened that the voice recorder could not document, in line with Eisenhardt.¹⁵⁴ The entire interviews were transcribed, and a structural coding approach was applied to analyse the content, along the lines of Krippendorff's¹⁵⁵ recommendations. Manual analysis was used, since automation for this type of analysis is still somewhat questionable. Furthermore, considerations were taken in the decision to use structural coding as this method has been criticised in several papers.¹⁵⁶ The main critique revolves around the use of codes based on context that is not present in the data and, as such, forces patterns to emerge from data that were never meant for the determination of such patterns.¹⁵⁷ This challenge is addressed here as data collection was aligned with the purpose of the paper, and the coding, while a time-consuming process, yielded reliable results.

The coding tree was based on the full interview guide and the scope of the theoretical setting. The codification of the interviews created a list of the barriers and enablers related to the factors identified concerning 1) finding the right partner and forming a UIC and 2) initiating and implementing a UIC. Subsequently, the data analysis began with searching for similarities in the list containing the

147. Qu and Dumay, 2011

148. Kvale, 1996

149. Kreiner and Mouritsen, 2005

150. cf. Czarniawska, 2001

151. Yin, 2013

152. Rajala and Vadi, 2017

153. Yin, 2013

154. Eisenhardt, 1989

155. Krippendorff, 1980

156. cf. Dumay and Cai, 2014

157. Ibid.

codes and patterns found in and between the different cases.¹⁵⁸ From this analysis, a set of working propositions was generated. These propositions were compared to the existing theory and data, creating an iterative process to develop an explanation/theory that fits both the data and the findings of the existing literature.¹⁵⁹

EMPIRICAL FINDINGS

Concerning the initiation of UIC projects, several factors were identified in the data. First, an analysis of complementary competencies illustrated that the companies looked for researchers with unique theoretical competences. Interestingly, researchers successful in UIC had strong skills related to project management. However, on both side of collaboration, reputation did not play a significant role in the search process between universities and industry, although experience in collaboration was assessed as necessary. The assessment of partners on both sides was typically not done before a project, especially in cases where there was prior knowledge or former engagement.

Our empirical data indicate that contact is primarily initiated from the university side through, for example, students asking a company for access when writing a paper or researchers informing a company of a potential collaborative research project. A large proportion of the respondents mentioned several networking initiatives¹⁶⁰ in which the universities were engaged, for example, employing intermediaries for creating fruitful matches between companies and researchers.¹⁶¹ 'We almost always receive queries about collaboration through this (matchmaking) network and quite seldom directly from the researchers or students', stated a company respondent from Collaboration I. As several respondents expressed difficulty in finding points of contact

at the universities (both physically and virtually), and concurrently finding the right partners in the universities nearly impossible, this can be considered an important element going forward. Local marketing through, for example, the media, executive seminars, and conferences aimed at practitioners and entrepreneurs are good examples of communication channels that can potentially lead to such contacts and that were being tested at both universities and their affiliated science parks. In terms of activities aimed at corporate managers, it was suggested that researchers could be more open or, expressed alternatively, 'more aggressive' about communicating the types of companies they would like to contact and which problems they would like to study in these companies.

The search process is often characterised by the use of informal connections. This accentuates the often limited assessment of potential partners because collaborators tend to be trusted, longstanding partners. The company respondent from Collaboration O noted: 'We've really had many collaborations with the university and so the assessment was not vital. Even though the selection process may spread through the companies' or researchers' networks, this lack of formalisation and assessment continues to be the case'. Respondent I in Collaboration J noted, 'Having those established relationships just makes contact much smoother'. In time, this could be problematic because new and potentially even more fruitful constellations are not tested.

Establishing trust between the parties was seen as important for creating and maintaining commitment. Likewise, the notion of shared initiative was found problematic in several instances. Among the remarks made by respondents was that the universities were not prepared to appraise their commitments to business partners. On the other

158. Yin, 2013

159. Eisenhardt, 1989

160. cf. Huggins, 2010

161. See also Howells, 2006

hand, respondents from the companies admitted finding it difficult to commit to UIC projects during busy periods, as paying attention to customers always comes first.

A major hurdle to be overcome is that much of the knowledge about who works with which problems and technologies in which departments is tacit. The company respondent in Collaboration G agreed, stating that 'because the contacts are not organised and formalised, we tend to identify the researchers we know in advance'. Hence, this tacit knowledge is built up around the partners participating in concrete research projects known by the companies and the universities' administration offices supporting UIC. This is accentuated by the finding that partners with extensive collaboration experience tend to conduct more successful projects, which, in part, is due to the fact that there is a steep learning curve for identifying complementary competence. This was confirmed to be a major criterion of value from the perspective of the companies.

Concerning UIC implementation efforts, planning projects, defining projects' objectives, and formalising collaborations were emphasised. Companies' tendency to establish formal deadlines presents an interesting challenge; students live with such deadlines throughout their programs, but researchers do not necessarily feel comfortable with them. This insinuates that researchers need to pay more attention to the return on investment (ROI) for companies in collaborations. Company respondents were quite clear in stating that milestones must be agreed upon from the beginning. However, some projects tended to discard the initial milestones and change scope, which could result in both good and bad outcomes. Objectives were sometimes communicated and aligned from the beginning, but projects were not always carried out in accordance with

these agreements as a result of limited or poor communication, as stated by respondents from Collaborations H and J. For some companies, it is problematic that objectives and milestones are established that may not be entirely in accordance with the company's goals, meaning that alignment of expectations and terms is insufficient and there has been a lack of follow-up meetings. It is evident that problems arise when the theoretical ambitions of the researchers and the practical aspirations of the company are not aligned, for example, when the company's ideas and objectives are merely fitted to researchers' ambitions and objectives retrospectively.

The respondents noted some barriers to the formalisation of collaborations. Our empirical probing found no explicitly stated positive effects of formalising collaborations through actions such as drawing up legal contracts and contracting rights to the potential outputs of the UIC. In the words of some respondents, 'the registration process works very slowly', so potential problems concerning intellectual property rights are prone to arise. A company respondent from Collaboration N stated, 'We might sometimes actually start the collaboration before the administrative forms, including NDAs, are finalised, and that might, of course, be problematic. Our lawyers generally don't like that'. Accordingly, an informal and agile collaboration style seems to be an advantage.

In this regard, one respondent from Collaboration N argued that 'aligning goals and expectations is a, well, innovative and interactive process where the overall objectives might be in place, but sub-goals are added during the process'. On the other hand, much of the respondents' expressed dissatisfaction was related to a lack of commitment to the plan from the side of the researchers. 'The problems arose because they had no clear plan regarding how this collaboration should function', stated a

respondent in Collaboration H. It was explicitly noted that, at the beginning of a collaboration, researchers tend to propose a research design but tend to drift away from it as early as the initial negotiations, thus leaving open to debate whether the objectives of the company has been sufficiently incorporated. The company respondent of Collaboration J noted, 'Let's just be frank, the university has its own objectives and way of working, and we need to make sure there is room for our needs'.

The final perspective raised in the empirical enquiry concerned communication. There were indications that well-functioning UICs typically form a project management group with the presence and activity of all relevant partners. Likewise, communication is adjusted during this period, with intensive communication in the early stages and less communication in the later stages of the project. In several instances, the common project management group helped introduce the researchers to the company, promoting mutual understanding of the objectives of each stakeholder group, including anticipated time horizons for measuring success, and any related culture gaps.

Our findings indicate several anomalies that cannot be readily explained by established theory and conventional wisdom about how UIC should work. There is no doubt that the initiation phase could be developed further and that the selection of partners matters, but it is uncertain whether formalisation is the problem. Further, reputation does not seem to matter; instead, the establishment of the interaction itself, building trust, and commitment, which is, to a large extent, based on tacit knowledge, are important. Remarkably, UIC seems to work, although researchers should perhaps pay more attention to the ROI for companies and the lack of follow-up after a collaborative project. Indeed, there also seems to be no demand for formalising

collaborations as the process appears to be interactive and emergent. While such deficiencies can be addressed with an expectation of formalisation and more precise goals and follow-ups, there seems to be an acceptance of these conditions. We thus conclude that there are differences in how different UIC projects work, as well as different normative expectations about how they should work. What stands out in our findings is rather strong deviations from norms of formalisation and tight alignment and the acceptance of emergent processes that represent a less-than-perfect exchange between parties. This indicates that to understand how UIC works, we need not only to look at actual cases at the micro-level but also to consider equally meso/macro-levels of specific contexts and institutional norms influencing expectations and performance.

DISCUSSION

This longitudinal, explorative, micro-level study of the early phases of UIC was rewarding as we were able to contribute to several aspects of present knowledge about UIC, respond to earlier calls for further research, and add more insights into many central topics in the field. On a general level, our findings support Bogers et al.'s¹⁶² conclusion regarding the need to break the impermeable boundaries between levels of analysis to examine the interplay between intra- and inter-organisational factors influencing UIC on the individual as well as the organisational level. We also concur with Rajalo and Vadi's¹⁶³ view that micro-level studies have clear potential to add nuance for a better explanation of the variety of UIC characteristics and outcomes. The nuance behind this variation was apparent during both the initiation and implementation phases. Another takeaway message from this study is that during the initiation phase of UIC, stakeholders need to trust the emergent process.

162. Bogers et al., 2017

163. Rajalo and Vadi, 2017

Accordingly, formalisation and structure may not be decisive for matchmaking.

One of the biggest and, to a great extent, implicit issues in this study is the aspect of complementarity, which not only plays a central role behind the curtain for superficial dramas such as everyday expressions of cultural differences but also represents the main motivator for the acceptance of deficiencies in the UIC process. Our main finding is the remarkable fact that UIC seems to work despite researchers' lack of attention to companies' ROI and other administrative shortcomings such as follow-ups, thus suggesting that the benefits from complementarity, rather than redundancy, may outweigh the drawbacks of cultural differences, which are often discussed but rarely specified, to shed light on the actual value and costs of collaboration.

Reputation does not seem to play a significant role in the search processes employed by universities and industry. This is contradictory to existing theory.¹⁶⁴ This finding can potentially be explained by the unique setting of the two universities in this particular study. Both are rather large institutions in their respective business ecosystems,¹⁶⁵ and, further, most of the collaborations studied are with small and medium-sized companies¹⁶⁶ that do not have aspirations of working with universities in other continents, countries, or even regions. Despite this knowledge, it was expected that there would be some evidence that the choice of researcher/company contact could be explained by reputation at the individual level. As this was not supported, this indicates that the respondents were unbiased at the beginning

of the collaboration and instead assessed potential partners during the contact phase.

This goes against current theoretical expectations. Our findings are in stark contrast with Rajalo and Vadi's¹⁶⁷ insistence that 'the relevance of joint structures cannot be overstated'. They also concluded that 'the ability to make the 'right' choice of partner before the initiation phase is dependent upon the prior levels of preconditions'.¹⁶⁸ This statement demonstrates the 'come as you are' attitude found during our empirical observations, suggesting that partners rely on actual interactions rather than prior expectations. Consequently, the problem should perhaps not be stated in terms of a blind date arranged through common acquaintances but rather as a real-life meeting where becoming the right partner is as relevant as picking the right 'other'. The contradictions in these findings illustrate Skute et al.'s¹⁶⁹ remarks on the lacking responses to longstanding calls for research on the selection process for UIC.¹⁷⁰

It was also expected that structural arrangements or formalised processes and procedures to enable the smooth search and selection of partners and thus increase the chances of a productive collaboration would be found, possibly even asserting the influence of research and technology officers, as found by Goduscheit and Knudsen.¹⁷¹ While potential partners' reputation was not found to matter, it was obvious that partners with extensive experience tended to be involved in more successful projects. On the one hand, this finding confirms the findings of Sjöo and Hellström's¹⁷² literature review, allowing the conclusion that prior experience is one of the

164. See, e.g., Gulati and Gargiulo, 1999

165. cf. Clarysse et al., 2014

166. Marinetti et al., 2007; Collinson and Quinn, 2002

167. Rajalo and Vadi, 2017, p. 50

168. Ibid.

169. Skute et al., 2019

170. cf. Link, 2015; Perkaman and Walsh, 2007

171. Goduscheit and Knudsen, 2015

172. Sjöo and Hellström, 2019

strongest predictors of UIC. On the other hand, it suggests a nuanced understanding of the character of the relationship, namely that it may have more to do with actual interaction rather than more distant 'word of mouth'.

In our empirical findings, it can be noted that tacit knowledge is built around partners. This suggests that network centrality plays a role at the micro-level in terms of individual interaction rather than at the meso- or macro-level of organisations and institutional spheres.¹⁷³ Our data illustrate the importance of the contact phase of UIC but generated somewhat contradictive findings on the need for formalisation. On the one hand, the management of UIC is important; on the other hand, formalisation of UIC relations was not seen as desirable. This confirms Martinelli et al.,¹⁷⁴ who found that academics without external relationships perceived involvement with industry as risky to the values of the scientific community. Hence, they may need to be exposed to such collaboration gradually. The viewpoints expressed here indicate the potential usefulness of structuring the contact zone between researchers and industry, as well as educating researchers on the benefits, do's, and don'ts of UIC, but also suggest a limit to formalisation should be imposed.

An adaptive understanding of project collaboration poses potential problems and advantages. The latter are related to flexibility in outcomes and the ability to optimise a project's focus during its course. Concerning the former (i.e., potential problems), the predicted result is that when projects go wrong, they tend to go very wrong. The analysis suggests the need for a greater emphasis on the formalisation of content and contracts in such

a manner that partners do not feel overly bureaucratized. Concerning the early phases of UIC, planning was found to be an important instigator for perceived success during initiation¹⁷⁵ and thereby is also used for evaluation of the early phases of collaboration. The company respondents, in general, appreciated the use of milestones and deadlines and the alignment of expectations and objectives, but researchers did not. However, they did admit that technical, organisational, and legal boundaries were important. The arguments posed here relate to an important point from this study, namely that flexibility should be incorporated into project planning. However, this generally requires better communication between the partners involved, than was evident in the UIC projects studied here. Our findings suggest that UIC projects in the initial phase should be understood in terms of an emergent process of interaction between partners rather than as an object for administrative over-ambition.

Our findings tap into a broader debate in the field of UIC that goes beyond practical discussion on the appropriate level of formalisation in different phases to the more fundamental question of how we should understand the very character of the processes involved, especially during the early phases of UIC. For instance, Rajalo and Vadi¹⁷⁶ emphasised that the importance of joint structures cannot be overstated, while Lechnig and Geigenmüller¹⁷⁷ suggested that management capabilities should also embrace flexibility, particularly regarding alliance transformation. Our contradictory findings also reflect the discrepancy between Ankrah and Al-Tabbaa's¹⁷⁸ and de Wit-de Wries¹⁷⁹ respective literature reviews, with the

173. cf. Huggins et al., 2020

174. Martinelli et al., 2008

175. See also Nielsen, 2016

176. Rajalo and Vadi, 2017

177. Lechnig and Geigenmüller, 2020

178. Ankrah and Al-Tabbaa, 2015

179. De Wit-de Wries, 2019

former assuming rational management from an administrative perspective and the latter suggesting that UIC is mainly informal or even irrational. Skute et al.¹⁸⁰ took a more balanced view, which our findings support, namely that while goal-oriented UIC management is important, it should also be balanced with researchers' need for autonomy.

Our data present a somewhat paradoxical picture of simultaneous friction within and contentment with the UIC projects studied. The processes detected appear to be, if not irrational, then at least informal. Further, the knowledge needed to navigate the early phases appears to be tacit and built around the partners rather than explicit, formalised, and existing among the partners through formal communication and intermediaries. There is little assessment of potential partners before the interaction starts, and, consequently, 'word of mouth' and general reputation do not seem to be tools that are actively used in the process. However, as earlier literature has shown, prior experience is among the strongest predictors of UIC.¹⁸¹ We also found that prior experience seems to be a strong condition for successful interaction. Further, as tacit knowledge is built around project partners, the capability for actively managing or taking part in the interaction that is part of UIC projects increases over time, as does the range of the respective actors' spheres. This is in addition to well-known and documented frictions and frustrations normally discussed in terms of cultural differences.

A possible explanation of the lack of formality during the early phases of UIC is the focus of collaboration. Thereby, the contents and actions of a collaboration should continuously evolve and is not necessarily determined at the beginning of

a UIC project. This was captured by a respondent from Collaboration O who stated, 'It is rather an ongoing dialogue with the purpose of understanding each other's agendas and objectives'. Therefore, sharp distinctions between the initiation and implementation phases, as depicted by Rajalo and Vadi,¹⁸² should be questioned. This leads to the argument that in the relationship between micro-processes and the meso/macro environment, a discovery step will lead to formalisation, which, in turn, will push collaboration another step further. Hence, our findings suggest that the initial phase is part of a highly innovative, interactive process and that it is the interaction within the process, rather than prior analysis and formal, administrative structures, that is at play. This reflects what Skute et al.¹⁸³ addressed as the strategic and cultural fit between partners. This should be further examined in future research, specifically further specification of the proximity that Huggins et al.¹⁸⁴ suggested.

Consequently, a good implementation of UIC may turn out to be a hen-or-egg situation. It is safe to say that formalising collaborations is relevant and has positive effects. However, it is less certain what the effects may be in different phases. There is a gap concerning the positive impacts of formalising the collaborations, such as drawing up legal contracts and contracting rights to the potential outputs of UIC. This is interesting as it contradicts administrative common sense as well as some of the existing knowledge in the field, including Rajalo and Vadi's¹⁸⁵ findings, as noted above. However, it currently unclear which comes first – collaboration or formalisation. Formal agreements and non-disclosure agreements (NDAs) have been found to help build trust between partners.¹⁸⁶ However, the collaborations studied here tended to be

180. Skute et al., 2019

181. Sjöo and Hellström, 2019

182. Rajalo and Vadi, 2017

183. Skute et al., 2019

184. Huggins et al., 2020

185. Rajalo and Vadi, 2017

186. cf. Tomkins, 2001

implemented before formal agreements were made, as one participant's comment about the registration process at the contract unit of one of the universities illustrated. According to de Writ-de Vries¹⁸⁷ literature review of the field, the most delicate challenges to UIC seem to be absorptive capacity, ambiguity, and cognitive distance. These issues do not lend themselves to analysis, simply because of the complexity and their centrality to interaction and communication.

Hence, rather than analysis, the process itself may be the remedy for ambiguity regarding understanding partners' interests and ambitions, how to communicate across cognitive distance, and how to generate absorptive capacity without losing the focus on the common interest that, at the end of the day, makes all this possible, namely relevant complementarity in very specific areas of knowledge.

The above insights amount to a reconsideration of how we should understand and measure UIC success. In our empirical examples, there was no lack of friction and, at times, frustration, despite project management's attempts to promote mutual understanding to overcome cultural differences. Researchers were not comfortable with tighter and more formal management of processes and were described as not paying enough attention to companies' ROI. Further, they tended to drift away from plans and agreements over time, fostering debate on whether companies' objectives are sufficiently incorporated in UIC projects. These findings are reflected in many recent studies addressing challenges and friction in UIC projects.¹⁸⁸

However, what truly stands out in our study is the acceptance of such imperfections in UIC. As noted above, these findings are in contrast to the administrative imperative to meet such challenges

with stricter formalisation, strategy formulation, and control mechanisms to ensure alignment and compliance with agreements. While such initiatives may be accepted and even appreciated in some constellations under some conditions at some stages of the process, we feel confident to conclude from our results that administrative logic is not necessarily a solution. Hence, besides practical variation in different UIC projects, there is also normative variation.

This raises the following question: Should we assess the success of UIC in terms of outcomes or low friction? Some companies in our study seemed to have no problem with researchers not delivering results on time or in a professional manner. This stands in contrast to the conventional understanding of value transfer. A related aspect brought up by Rajalo and Vadi¹⁸⁹ is that of the minimal level of individual investment required for successful collaboration and their conclusion that the preconditions of both partners are of equal value. Our findings instead suggest that low expectations or acceptance of varying degrees of equality may be a factor for the success of UIC in practice, as it reflects acceptance of making room for tolerance in a collaboration before it is deemed unsuccessful.

Related to this question are more methodological considerations about the validity of notions of UIC success. From Rajalo and Vadi,¹⁹⁰ the idea of UIC success (i.e., the selection of a 'best practice' case) is judged in terms of a low level of friction in interactions or mutual dependence in daily work. Consequently, all excellent cases relied on joint structures and mutually understood language as well as anticipated and reframed interests. This is also what constitutes their higher degree of overlapping. However, this means that the learning

187. De Writ-de Vries, 2019

188. cf. Alexander et al., 2020; Dooley and Gubbins, 2019; Giones, 2019; Kunttua and Neuvo, 2019; Mascarenhas et al., 2020; Oliver et al., 2020; Zalewska-Kurek and Harms, 2020

189. Rajalo and Vadi, 2017

190. Ibid.

potential was lower than in less successful UIC projects, according to this definition of success, as these cases were less redundant. This leads to the possibly false paradox that the most successful collaborations also have the least learning potential, which seems intuitively self-contradictive, as the most successful cases would have too much absorptive capacity, reflecting redundancy.

This paradox calls for the further consideration of UIC success: Is it risky to measure low friction rather than high (potential) value creation? Philosophically as well as practically, having a common language is not as much a prerequisite for efficient communication and/or joint value-creation/action as shared interests (albeit varying in intensity over time). As McKernan¹⁹¹ put it, the ability to communicate across communities relies less on initially shared understandings than an imaginative awareness of human interests, attitudes, and concerns: 'We could not communicate with a creature that shared none of our interests and consequently did not respond to the world's features in ways that made patterns we could make sense of'. In a similar vein, Boland and Tenkasi¹⁹² suggested a balance between perspective making and perspective taking is necessary for cross-community interaction. This begs the question of whether we can conclude that the less friction in UIC, the better the practice of collaboration. An alternative would be to focus on the outcomes of UIC and its future (and thereby unrealised) potential for value creation through the complementarity rather than redundancy of knowledge, understanding, practices, and language. Consequently, what may seem a modest or promising collaborator in terms of friction may turn out to be high performing in terms of outcomes over time. It would be a rewarding task to explore further these dynamics and the conceptual validity of UIC success and best practices. Such

considerations may be of even greater importance when considering the rising pressure for exploitation in both industry and academia.

Thus, our findings have given us reason to extend Ankrah and Al-Tabbaa's¹⁹³ discussion based on their literature review, namely the definition of UIC success. This discussion is valuable not only for the specification of a valid or commonly agreed-upon definition of UIC success but also for more explicit discussion about norms and assumptions in the field and, ultimately, a better understanding and specification of UIC phenomena themselves as well as the complexities of their interaction.

The apparent paradoxes and anomalies observed in this study may also be resolved by shifting the paradigm to Second Track processes. Indeed, it seems that the challenges presented in our research cannot be solved by clearer administrative order in UIC. Instead, what works seems to work despite such shortcomings and what does not work is not likely to be resolved by increased administrative order. Rather, the dimensions of trust, tacitness, and emergence are of great importance. Remarkably, it seems that collaboration continues despite a lack of reciprocity between partners. While partner selection is important, becoming the right partner is even more urgent, and UIC seems to be more of a hen-or-egg situation rather than one that requires analysis per se. These findings point at a potential need to shift the paradigm in UIC research, in line with the Second Track approach.

One of the strengths of the Second Track approach is that it can integrate micro-level analysis with meso- and macro-approaches to explain how the local context becomes interlinked with the societal level. Furthermore, the Second Track framework is capable of explaining why reciprocity in exchange is not always necessary and how UIC

191. McKernan, 2007, p. 172

192. Boland and Tenkasi, 1995

193. Ankrah and Al-Tabbaa, 2015

can transform individual cognition. It can also explain group dynamics, as different partners focus on the common denominator (i.e., the problem at hand) rather than on differences between partners. Not least, Second Track processes are capable of explaining why further formalisations and plans may not lead to the creation of efficient UICs. This alternative perspective on UIC amounts to an ontological question of what UIC is, and what essential qualities characterise it. We conclude that there seems to be greater diversity in the functioning of UIC than previously assumed by established theory and that the norms for UIC success may differ as much as the actual empirical examples.

CONCLUDING REMARKS AND FUTURE RESEARCH

If anything, our study illustrates, in line with recent literature reviews of the UIC field, not only the richness of future research opportunities and their breadth and depth but also the fundamental aspects of what makes potential partners ready to collaborate across boundaries, what constitutes a successful collaboration, and what normative ideals and theories best reflect the character of the phenomenon at hand. There is still much room for further research on many of the topics touched in this study.

It is essential to understand the drivers of a successful UIC launch from a micro-perspective and to acknowledge that there is always reciprocal ROI in good collaborations. Advantages should go both ways. However, the present literature on UIC is unclear about the actual content of this exchange, and there is an urgent need for further exploration. Our results indicate that there is greater openness to what the process may bring as well as higher expectations for the outcomes of the collaborative process rather than the smoothness of the process

(i.e., eliminating friction due to differences in culture and interests). Our study results indicate that a stronger link between UIC and what is expected in terms of innovation outcomes is essential.¹⁹⁴ However, innovation systems are currently under pressure from the focus on commercialisation and thus so is the university sector. This raises the question of how this pressure for exploitation will be handled.

A surprising finding was that companies seemed to accept researchers not delivering ROI in a professional manner, which stands in contrast to the conventional understanding of the unproblematic transfer of value. While we appreciate existing macro/meso studies, they have been unable to capture the problems on the floor, and these can have more significant effects than first realised. Hence, we question and seek to understand in a more nuanced way the usefulness of structures for successful UIC. Indeed, there is room for fundamental contributions clarifying the role and importance of formalisation and administrative management on the one hand and the complex interactions of co-creation on the other, reflecting the disagreements and differing conclusions from literature reviews in the field.

This study provides empirical evidence of overcoming barriers during the early phases of UIC at the micro-level. For example, the commitment of both parties is important, as is the communication between them, which eases the pressure of non-conformance to the agreements made at the beginning of a collaboration. Apart from visualising specific culture gaps, communication of the expectations regarding administrative procedures within the university was also critical. Goduscheit and Knudsen¹⁹⁵ suggested that while universities perceive industry as a significant collaboration partner, the same sense of importance is not shared by industry regarding collaboration with universities.

194. cf. Nielsen, 2020

195. Goduscheit and Knudsen, 2015

The present study did not find this same imbalance, and the UIC literature is also inconclusive in its findings. However, there were indications that researchers had problems understanding the value of UIC as seen from the perspective of industry partners, in turn potentially prompting them to miscalculate the incentives of industry partners in UIC. This misunderstanding ranged from time horizons to application possibilities. A limitation of the present study is a lack of detailed data on these perspectives, which could be a topic for future research.

The objectives of each partner should be identified and communicated from the beginning of a collaboration or a specific project. In doing so, the involved partners would have a basis for negotiating the alignment of expectations and objectives. Hence, the use of formal, but non-contractual, agreements that explicitly state the roles and responsibilities of each partner and clarify the value that each partner derives from the collaboration are also suggested in this context.¹⁹⁶ While this is currently the general practice in industry, the study findings indicate that it may comprise new ground for many researchers. There is additional evidence of a distinct culture gap between universities and companies. This is not necessarily a problem, but it must be recognised and managed. This would entail agreeing on expectations and planning the UIC process from the beginning of a project. Finally, there is the problem of differences in the time horizon of outcomes between universities and industry, which must be considered at the outset of UIC. All these aspects deserve further attention in future research. Given the observed anomalies and the tentative contributions of the analysis of Second Track processes, further investigations into this potential paradigm shift in UIC studies is recommended, especially when the findings seem contradictory at first glance.

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196. cf. Freitas et al., 2013

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