



**A micro-level exploration of University-Industry
collaboration to deliver clean and sustainable growth:
how can we make it work?**

By

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Abstract

Delivering against the objectives of clean and sustainable growth is a complex challenge requiring long-term collaboration between University and Industry. The process of developing effective collaborations in itself requires time to be effective. However, funding designed to stimulate these collaborations often comes laden with limitations which can create a shorter-term outlook and can hinder the development of long-term collaborations, creating tensions at the micro-level. If these tensions cannot be overcome then the success of these collaborations may only ever be partial. This research project seeks to assess and understand the ways in which individual academics and project delivery staff navigate this dichotomy between the long-term need and the short-term approach.

To date there has been an emphasis on macro level explorations of University and industry collaborations (Etzkowitz and Leydesdorff, 2000). There is much less insight into interactions, experiences and tensions at the micro-level. The literature that does exist focuses on topics such as; the causes of tensions (Cunningham et al., 2014; Miller et al., 2018b), barriers to collaboration (Rybnicek and Konigsgruber, 2019), measures of success (Veletanlic and Sa, 2018). and time restrictions (Lyall, 2019b).

This study is exploratory in nature taking an inductive research approach. Utilising semi-structured interview as the primary method of data collection and focusing on one individual case, the Centre for Global Eco-Innovation (CGE) at Lancaster University. This approach enables the study to contribute to the literature in the field by exploring the tensions and challenges that exist at the micro-level in greater detail and framing them in terms recognisable to academics. By doing so the actions individuals put in place to deal with these tensions can be identified and the potential unintended consequences of these tensions and actions can be highlighted. By doing this we are in a much better position to understand how the University level processes and support mechanisms can be adapted and improved. Without this insight the structures and mechanisms that are in place may continue to only partially support academics and the achievements these collaborations can generate are going to be limited.

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List of abbreviations and useful terms

CGE: The Centre for Global Eco-Innovation

Eco-Innovation: the development of new or modified processes, techniques, systems, and products which are designed to avoid or reduce environmental damage

ERDF: European Regional Development Fund

MHCLG: Ministry of Housing, Communities & Local Government

SIA: Science and Innovation Audit

UKRI: United Kingdom Research and Innovation

U-I Collaboration: University and Industry Collaboration

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1. Introduction

Delivering against the objectives of clean and sustainable growth is a complex challenge requiring long-term action and collaboration between University, Industry, Government and Community. These collaborations need to be multi & inter-disciplinary in nature (Muchmore et al., 2015; Carr et al., 2018; Lyall, 2019b) and underpinned by; a long-term approach (Perkmann and Walsh, 2007; Bjerregaard, 2009; Bruneel et al., 2010; Miller et al., 2016b; Vick and Robertson, 2017), consistent funding (Ankrah et al., 2013; McAdam et al., 2018; Ryan et al., 2018; Rybnicek and Königsgruber, 2019; Cunningham et al., 2018), institutional support (Fazey et al., 2014; Hein et al., 2018; Lyall et al., 2019a), and a continuity of approach far exceeding the current timescales on expected returns on investment (Muchmore et al., 2015; Alexander et al., 2020).

Developing exchanges between University and Industry in to effective collaborations takes time. Only through long-term interactions can shared values and understanding, open communication and trust be developed (Carr et al., 2017; Rybnicek and Königsgruber, 2018; Rajalo and Vadi, 2017). Yet the very structures and incentives of Governmental funding have created an environment at odds with the conditions identified above by imposing limitations in terms of project duration and partner eligibility, and specific objectives and targets that encourages a more short-term and reactionary approach (Arshed et al, 2016; Ryan et al., 2018).

The literature has highlighted a number of challenges, barriers and tensions between University and Industry that are created by that this contradiction between the long and short-term (Plewa et al., 2013b; Cunningham et al., 2014; Muchmore, 2018). The emphasis of explorations in to these relationships has, to date, primarily been at the macro and meso levels (Bjerregaard, 2009; McAdam et al., 2018; Muchmore, 2018). There is much less insight into the interactions, experiences and tensions experienced by individual academics and project delivery staff, who have been identified as the key actors in these collaborations (Carayannis et al., 2012; O'Reilly and Cunningham, 2017). As a result, there have been numerous calls for further research in to this at the micro-level (Bjerregaard, 2009; Philpott et al., 2011; Carayannis and Rakhmatullin, 2014; McAdam et al., 2018; Rajalo and Vadi,

2017; Miller et al., 2018b; Cunningham et al., 2018; Cunningham and Menter, 2020). It is these calls that this study is looking to address.

When considering clean and sustainable growth in the setting described above it is important to first understand the historical context. The 1987 Brundtland Report and the Rio Earth Summit in 1992 pushed the three fundamental components of sustainable development into international, national and local policy frameworks. These components being; the environment, economy, and society. This increased environmental awareness has subsequently been reinforced through greater understanding of climate change and global warming. At the same time the policy debate has shifted away from the generalities of sustainable development towards a more pragmatic emphasis on reducing carbon emissions through eco-innovation (Gibbs et al., 2017).

The concept of eco-innovation refers to the development of new or modified processes, techniques, systems, and products which are designed to avoid or reduce environmental damage (Durán-Romero et al., 2020). It is seen by many as a response to environmental and social issues and as a new source of economic development for regional economies and is oftentimes labelled as clean and sustainable growth (Rennings, 2000; Trencher et al., 2013a; Gibbs and O'Neill, 2014). This reframing of the debate around sustainability to one of economic opportunity rather than environmental and social benefit has allowed governments to set targets and present them as measures designed to increase economic competitiveness (O'Neill and Gibbs, 2016). These targets, such as; jobs created, revenue generated, and new products or services are economic measures that can be easily tracked and monitored in the short-term but ignore the benefits, both in terms of relationships and impact, associated with longer term collaborations (Rajalo and Vadi, 2017; de Wit-de Vries et al., 2019). Thus, the funding often used to stimulate this activity often comes with short-term stipulations that are at odds with the longer-term outlook required to develop good collaborations and deliver against the stated objectives of clean and sustainable growth.

In particular recent European regional policy has routinely failed to account for nuanced, regional variations and contextual influences when promoting these relationships and interactions (McMillan, 2016). However, with the UK's recent exit from the European Union,

Government interest in rebalancing the UK economy is likely to be enacted through 'place-based' investment and initiatives, such as UKRI's Strength in Places funding. Resultantly, it is likely that Universities role as anchor institutions and drivers of regional economic growth will only be heightened, and collaboration between University and Industry will play an increasingly crucial role (Pugh, 2017; Laidlaw, 2020). With Carayannis et al. (2012), Miller et al. (2016a), and O'Reilly and Cunningham (2017) all identifying that it is the individuals involved in these collaborations, rather than the institutions, that are key there is an imperative for a greater understanding of the opportunities, challenges and tensions that exist at the micro-level. Without this knowledge they cannot be addressed and the successes of these activities may only ever be partial. This thesis is based on fieldwork conducted over four months through 17 semi-structured interviews conducted with academics and project delivery staff linked to the Centre for Global Eco-Innovation (CGE). The CGE is a multi-disciplinary research Centre based at Lancaster University and focused on industry-led, eco-innovative research projects. Figure 1, overleaf, provides further detail.

The Centre for Global Eco-Innovation

The Centre for Global Eco-Innovation (CGE) was established at Lancaster University in 2012 with the specific remit of facilitating collaboration between academia and industry to deliver clean and sustainable growth. The Centre has run two projects; 2012-2015 and 2016-2019 with a third currently running from 2020-2023. All 3 projects have utilised European Regional Development Funding with the specific remit of supporting high quality business-led research to deliver new eco-innovative products and services across Cumbria, Lancashire, Cheshire, Merseyside and in the final project Greater Manchester. The Centre can draw on academic expertise from across the University to deliver a wide variety of projects ranging from tidal energy systems or new ways of growing crops to understanding how to predict and influence electric vehicle users charging behaviour. In total the Centre has funded 78 industry-led PhD's and 41 industry-led Masters by Research, with numerous other collaborations facilitated through student projects and short-term 'internships'. As a result, the Centre has worked with over 700 organisations in a wide variety of sectors across the North West delivering against a range of output targets set by its Government funders; the Ministry of Housing, Communities & Local Government (MHCLG). This includes the deployment of 257 new eco-innovative products, process and services, the creation of 311 new jobs and 176,520 tonnes of carbon saved.

The CGE has adopted a pan-regional approach. Fostering collaboration between institutions across the North West, including the University of Cumbria, Chester University, University of Central Lancashire, Liverpool John Moores University, the University of Liverpool and Manchester Metropolitan University. This approach has enabled Lancaster University and the CGE to lead on the North West regional Science and Innovation Audit as described in Figure 2.

Figure 1: The Centre for Global Eco-Innovation.

The success and profile of the CGE as described in Figure 1, aligned with Lancaster University's long-standing reputation for working with Small and Medium Enterprises across the North West has established the University as a leader within the sector. This is

demonstrated through its' lead role in the development of the North West Coastal Arc Science and Innovation Audit, as described in Figure 2.

North West Coastal Arc Science and Innovation Audit

In Autumn 2015, the UK Government announced a series of regional Science and Innovation Audits (SIA) designed to catalyse a new approach to regional economic development. These SIAs brought local consortia together to focus on analysing their regional strengths and identifying mechanisms through which to realise their potential. Led by Lancaster University and the CGE The North West Coastal Arc (NWCA) Partnership for Clean and Sustainable Growth was formed in 2017 to focus on the region's strength in science and innovation for Clean and Sustainable Growth (Home, 2019). This consortium incorporated all of the region's Local Enterprise Partnerships (Cumbria, Lancashire, Cheshire, Liverpool City, Stoke-on-Trent and Staffordshire), the North Wales Economic Ambition Board and the Mersey-Dee Alliance, numerous industrial partners and the complementary research strengths of ten universities (Liverpool, Bangor, Chester, Cumbria, Edge Hill, Keele, Liverpool John Moores, University of Central Lancashire (UCLAN) and Wrexham Glyndwr.

The SIA was designed to provide an evidence base to demonstrate that it is this region that has the unique set of characteristics, in terms of the people, technology and natural assets to lead nationally and globally in driving forward the economic and environmental benefits of Clean and Sustainable Growth. Ultimately creating a competitive advantage for the region by stimulating economic growth through the development of new high value jobs, the transformation of industry and the creation of new companies.

Figure 2: The North West Coast Arc Science and Innovation Audit

This study will explore the micro-level tensions and challenges associated with University-Industry collaboration within the context described above. By adopting a particular focus on how individuals deal with these challenges, this research builds upon discussions within the

literature and provides insights in to how University level processes may be adapted, refined and reorganised to better support academics with this endeavour.

Therefore, my main research aim is:

To assess and understand the ways in which individual academics and project delivery staff navigate the dichotomy between the need for long-term action and the short-term approach adopted to deliver clean and sustainable growth.

In order to do this, the thesis objectives are:

- **Explore the challenges and tensions that individual academics and project delivery staff face when collaborating with industry in order to deliver against the objectives of clean and sustainable growth**
- **Understand how individual academics and project delivery staff accommodate the irreconcilable difference between the need for a long-term outlook and the short-term funding mechanisms available**
- **Identify the unintended consequences that may occur, at the micro-level, as a result of the additional time and effort academics put in to navigating these tensions and challenges**
- **Suggest additional processes and procedures the University could implement in order to support academics in dealing with the above**

In order to answer the above this thesis is divided into five sections. This section (Section 1) has provided a brief overview of the Centre for Global Eco-Innovation and the North West Coastal Arc Science and Innovation Audit in order to provide the context in which the study is situated. Section 2 reviews the existing literature exploring University – Industry collaborations. Initially focusing on studies conducted at the macro-level, before exploring some of the tensions that exist, underneath the aforementioned overarching tension between the long-term and the short-term, at the micro-level. Section 3 explains the methodology, namely; why semi-structured interviews were chosen for data collection purposes and how this data was interrogated. Section 4 puts forward the research findings

in 4 main sections; the tensions and challenges individuals face, how they attempt to deal with these tensions, the unintended consequences of these tensions and the actions they take to mitigate against them and the contribution this research makes to the literature. Section 5 brings these findings together to form some concluding remarks and process recommendations for the University. Finally, this section then reflects on the research project and what future research could explore.

2. Literature Review

This literature review considers how we can engender better collaborative relationships between University and industry. In doing so I identify a number of key areas of literature that have considered how the role of Universities is changing and how scholars have developed theoretical frameworks in order to try and better understand these interactions. What became evident is that the majority of literature focuses on exploring the macro and meso-levels for explanations rather than attempting to develop insights at the micro-level. The following section reviews this literature before exploring the limited literature that does exist at the micro-level. These micro-level explorations have a particular focus on topics such as the tensions, challenges and barriers associated with collaboration between University and industry. Having a clearer idea of these factors will provide insight in to how more productive collaborations could be enabled. These areas are explored before I go on to identify the gap in the literature that this study addresses.

2.1 The changing role of Universities

In order to better understand collaborations between University and Industry it is important to first consider how the roles of Universities are changing. Their role now stretches beyond the traditional pillars of Research and Teaching, and they are increasingly considered to be a core element of a region's economic development. This comes with an associated requirement to develop collaborative relationships with a wide range of external partners (D'este and Perkmann, 2011; Etzkowitz, 2003; Miller et al., 2014; Urbano and Guerrero, 2013; De Wit-de Vries et al., 2019). This extended role has been labelled as the Third Mission of Universities with institutions that have embraced and prioritised this role labelled as Entrepreneurial Universities taking on a new role as 'catalysts for innovation' within regional policy frameworks (Etzkowitz and Leydesdorff, 2000; Rennings, 2000; Pugh et al., 2018; Miller et al., 2018b). Eco-innovation, defined as both a driver of productivity and employment through the decoupling of resource consumption from economic output, is closely aligned with the ideals of this third mission (Crespi et al., 2016).

Nowotny, Scott and Gibbons (2001) (cited in Muchmore et al., 2015) identify that these relatively recent developments have exerted novel pressures on those undertaking and

generating research, with society demanding greater accountability from the state and academia with funders and policy makers adjusting their priorities accordingly (Chesbrough, 2003; Perkmann et al., 2013). These additional pressures at the macro-level have created a complex environment of competing demands. Even with this new role Universities remain primarily focused on teaching and research, the Government on driving economic growth by stimulating research that is relevant to, and accessible by, industry, and industry seeking unique and individual collaborations which deliver a competitive and commercial advantage (Ankrah et al., 2013; Miller et al., 2016; Albats et al., 2018). As a result, university-industry collaborations are steeped in nuance, are highly unique and have almost limitless, and constantly changing, context dependent factors that influence these interactions between organisations with different cultures, values and perspectives (Bjerregaard, 2010; Perkmann et al., 2013; McMillan, 2016; Veletanlic and Sa, 2018).

Against this complex backdrop and changing role for Universities academic interest in the interaction between Government-University-Industry has led to the development of various concepts, frameworks and strategies. Such as; the aforementioned entrepreneurial university (Etzkowitz, 2003), Modes 1, 2 and 3 Knowledge Production (Carayannis and Campbell, 2006) and the Triple Helix of Innovation (Etzkowitz and Leydesdorff, 2000). What all of these models have in common is that they stress the importance of collaboration between Universities, Industry and Government and attempt to understand where Universities boundaries of responsibility lie and the increasingly complex relationships involved (Carayannis and Campbell, 2010; Etzkowitz and Leydesdorff, 2000; Miller et al., 2016b; McAdam et al., 2018).

When considering these collaborative relationships in the context of eco-innovation Sáez-Martínez et al. (2014) identified that strategic partnerships between policy makers, businesses, researchers and citizens are essential to make progress. This mirrors the environment in which the Centre for Global Eco-Innovation operates in; using public money, in the form of European Regional Development Funding, to facilitate collaborations between University and Industry for the betterment of society, by developing innovations that deliver environmental and economic improvements. This closely reflects the Triple

Helix of Innovation, and its development in to the Quadruple Helix of Innovation, therefore, the following section will explore these concepts.

2.2 The Triple Helix of Innovation

The concept of the Triple Helix was first introduced in 1995 by Henry Etzkowitz and Loet Leydesdorff with subsequent papers in 1998 and 2000 garnering academic attention (Etzkowitz and Leydesdorff, 2000). The model introduced a triadic relationship between government, academia and industry underpinned by the premise that knowledge produced in Universities is made accessible to industry through a series of complex and cyclical, rather than linear, interactions (D'Este and Patel, 2007; Ryan et al., 2018). Within this model (Ryan et al., 2018 p. 15) designated Government as the *“third agent in the process”* as they commit the resource, support and direction through dedicated funding programmes aimed at facilitating interaction between the other two agents; University and Industry.

The ultimate aim and condition of which is to deliver local, regional and national economic growth and societal benefit (de Man, 2008; Etzkowitz and Leydesdorff, 2000; Muchmore et al., 2015). Consequently, a growing incentive to measure the impact these collaborative interactions deliver has emerged (Muchmore et al., 2015). Figure 3 provides a visual representation of this model which aimed to provide a macro-level framework through which the interaction and knowledge co-creation between University, Industry and Government could be better understood and therefore enhanced (Ryan et al., 2018).

The importance of these macro-level interactions between University, Industry and Governments means that Etzkowitz and Leydesdorff's seminal work in 2000 has become critical in both policy and academic circles with much of the subsequent literature and theoretical framework developments, highlighted in Section 2.1, lying on its *“theoretical foundations”* (Orazbayeva et al., 2019 p.68). Furthermore, other areas of literature such as; eco-innovation and sustainable transitions, also refer to the Triple Helix of Innovation, demonstrating its wider influence.

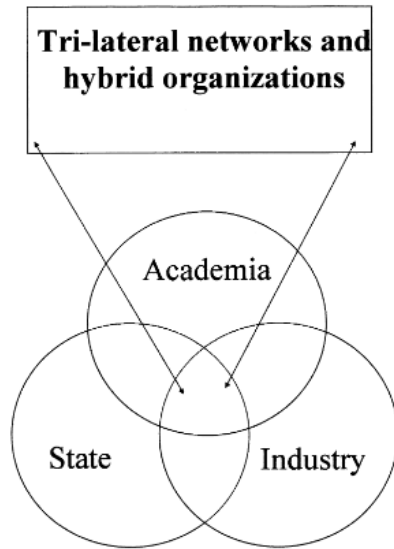


Figure 3: The Triple Helix Model of University-Industry-Government Relations. Etzkowitz and Leydesdorff (2000 p. 111)

However, it is not without its critiques. Mahdad (2017) cited Weingart (1997) when arguing that the triple helix model assumes to cut across all sectors and industries despite originating in a fairly small subset of sectors; these being, biotechnology and information technology. Likewise, Shinn (2002) questioned the way in which the model has been generalised despite stemming from a relatively narrow range of economic, technical and governmental configurations. Suggesting it was “*embodied by incubators*” rather than being a second academic revolution around which the claims lack evidence (Shinn, 2002 p.609). Thus, it is argued that it provides limited capacity to explain and compare practical issues across the variety of contexts in which University’s, business and government function (Cai and Etzkowitz, 2020). With due consideration of these individual circumstances being crucial, applying a generic framework does not account for the nuanced differences in each technical, sectoral or regional setting (Shinn, 2002; Pugh, 2017; Muchmore, 2018). This approach also ignores the findings of studies conducted by Kitagawa et al. (2016), Vick and Robertson (2017) and McAdam et al. (2018) which revealed that the individual culture of each University has a significant impact upon Triple Helix stakeholder approaches and engagement levels. Consequently, a one size fits all approach feels insufficient in seeking to understand and improve these interactions given that it ignores the significant institutional variances that exist across a diverse Higher Education sector (McMillan, 2016).

“despite their heterogeneous backgrounds and institutional differences, universities seem to be under a financial policy pressure to adopt similar practices”

(Kitagawa et al., 2016, p.736).

The model has subsequently been adapted and extended in an attempt to add in these nuanced contexts and account for the uniquely complex, and the constantly evolving combination of macro, meso and micro-level factors involved. At the same time acknowledging the influence of wider society and regional characteristics and constraints (Carayannis and Campbell, 2010; McAdam and Debackere, 2018; Muchmore, 2018). These developments include various Quadruple Helix of Innovation models which have added civil society, in the context of media and culture (Carayannis and Campbell, 2009), place-based contexts (McAdam et al., 2016; Miller et al., 2016b; McAdam and Debackere, 2018), green sustainable resources (Gouvea et al., 2013), and eco-innovation (Yang et al., 2012). There are other iterations of the triple helix model such as; the triple helix twins (Yang and Egelund Holgaard, 2012), Quintuple Helix (Carayannis et al., 2012) and N-tuple helices (Leydesdorff, 2012) which underlines how the original framework has been reconstructed numerous times in an attempt to understand the increasingly complex University-Industry interactions. Table 1 provides a summary of these different models:

Outset, characteristic and analytical focus for different helix models of innovation

	Outset	Characteristic	Analytical focus
Triple helix	Enhancing the role of universities in innovation	Places a particular emphasis on tri-lateral networks and hybrid organizations: university-industry-government	Knowledge infrastructure unstable tri-lateral networks
Triple helix twins	Introduce a missing element (public) into the model, while retaining the dynamic properties of a <i>tertius gaudens</i>	Emphasizes a need for public participation to ensure innovation is not harming environment and health: innovation triple helix of university-industry-government Sustainability triple helix of university-government-public	Tensions between industry (presumed economic interest) and public (presumed social and environmental interest)
Quadruple helix	Public reality is crucial for a society to assign top-priorities to innovation and knowledge	Emphasizes that culture and media-based public is as important as university, industry and government to be the fourth actor in innovation	Co-evolution and cross-integration of different knowledge modes
N-tuple helices	Complexity of innovation and diversity of actors	Break state, market and civil society into as many subsystems as possible	A plurality of agents, actors and organizations are involved

Table 1: Outset, characteristic and analytical focus for different helix models of innovation Yang et al. (2012) p. 377.

These developments are equally not without their critics. Cai and Etzkowitz (2020) in particular questioned the need of transforming the Triple Helix Model in to Quadruple and Quintuple Helix Models proposing that, for example, society or place should not be considered at the same level as the other spheres. However, they did cede that it could be considered equal in some rare cases. As is the case of the Centre for Global Eco-Innovation where the regional need plays a crucial role in the nature and development of collaborations.

Regardless of this, and the fact that there are different views as to what this fourth group actually consists of and represents, it is the concept of the Quadruple Helix that has become

increasingly accepted within the literature. Particularly those models which provide a place-based context as it is becoming increasingly imperative to think about these models in regional terms (Cai et al., 2015; Kriz et al., 2018; Galvao et al., 2019). Something which Gibbs and O'Neill (2017) highlighted as being particularly important when considering the 'green economy'. McAdam and Debackere (2018) also took this view when identifying the quadruple helix as being underpinned by the concept of place-based approaches to innovation by accounting for, and tailoring to, the local context. With the Quintuple Helix seeking to address the issue of climate change by adding a 5th Helix of the natural environment this would seem, initially at least, to be the most relevant framework for this study. However, if we consider the 4th helix to represent the region as per the model proposed by McAdam and Debackere (2018) rather than the media-based and culture-based public proposed by Carayannis et al. (2012) then all of the physical, infrastructural and environmental elements of the region are already accounted for. Thus, the addition of a 5th helix seems somewhat superfluous for the purposes of this study.

This study is placed within the context of the North West Coastal Arc Science and Innovation Audit, and focuses on the ERDF funded Centre for Global Eco-Innovation, which has the specific remit of encouraging and facilitating collaboration between University and Industry in the North West of England. As a result, the interrelatedness and interdependence of all four stakeholders within the quadruple helix are acknowledged. It is for these reasons, particularly the acknowledgement of the regional nuances and variations, that the Quadruple Helix is judged to be the most appropriate framework, see Figure 4, through which to explore the challenges and constraints felt at the micro-level.

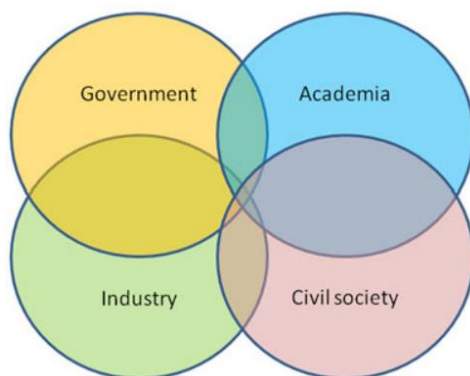


Figure 4: The Quadruple Helix of Innovation. (Lindberg et al., 2014 p. 102)

As highlighted previously Government is encouraging Universities to fully participate in the Quadruple Helix of Innovation, stimulate economic development and contribute to the knowledge economy (Philpott et al., 2011). This governmental push means University management are placing a greater emphasis on its academic communities' engagement in collaborative activities. Muchmore (2015) highlights that interactions between University and industry are highly complex social processes that require careful consideration of the individuals involved. Equally, the difficulties of collaborative research are rarely process based but created by the motives and behaviours of the individuals involved (Vick and Robertson, 2017; Al-Tabbaa and Ankrah, 2019). It is, therefore, fair to surmise that our ability to engender better collaborations between University and industry is reliant upon developing greater clarity of these interactions at the micro-level (Al-Tabbaa and Ankrah, 2019). The following section will look at the literature that has begun explorations at this level.

2.3 Moving to the micro-level

As discussed above there is a large and well-established body of literature seeking to understand and improve collaborations between University and Industry at the macro level. Studies at the micro-level are far more embryonic, as evidenced by the lack of consistency in the terminology used to describe these interactions (de Wit-de Vries et al., 2019). It is also characteristic of a view aggrandised in earlier studies that the influence of the Helix stakeholders is a strategic one (Leydesdorff, 2012; Ranga and Etzkowitz, 2015). Leydesdorff (2012) and Urbano and Guerrero (2013) believed that stakeholder influence was diminished at the micro-level where operational practices often take precedence. However, McAdam et al. (2018) strongly countered this view by identifying that processes and actions at the micro level are influenced by macro and meso-level interventions. Particularly through the provision of funding and the setting of performance measurement goals and targets designed to increase accountability and alignment between macro-level strategy and micro-level practice.

Whilst these macro- and meso-level factors are important if studies remain at this level there is a risk of being overly simplistic when considering the interactions between stakeholders within the Quadruple Helix. If the micro-level processes continue to be

insufficiently represented (Markard et al., 2015; cited by Muchmore, 2018) and organisational idiosyncrasies, cultures and policies that influence each individual's level of engagement are ignored (McAdam et al., 2018) then the true nuance and uniqueness of these interactions will continue to be overlooked (Muchmore, 2018; Cunningham and Menter, 2020). Deeper inquiries into the micro-level of University and industry collaborations will deliver insights that will help to engender improved collaborative relationships (Bjerregaard, 2009).

O'Reilly and Cunningham (2017 p.276) further highlighted the importance of the micro-level by defining the individuals involved as the 'linchpins' in bridging the gap between academia and industry as:

"it is not the institutions, but rather individual scientists and academics, who generate innovative ideas and novel research trajectories that can form the basis of value creation for other helix actors such as firms, government regulators, etc..."

Cunningham et al. (2017 p.137)

In an earlier paper Mangematin et al. (2014) also proffered this view with a simple quotation from an industrial participant from Boehm and Hogan (2013)'s study exploring the role of PI's within large, multi-stakeholder research projects. The quote neatly highlights the importance of the relationship between the researcher and the industry partner in that;

"it's not about Universities, it is about Professors".

Mangematin et al. (2014 p.6)

Ignoring these complex person-to-person interactions risks missing key insights in to how these activities and processes work at the micro-level (Pugh et al., 2018). As a result, understanding of the approaches needed to ensure the success of these interactions will be limited (Jones and Coates, 2020). By ignoring the nuanced differences within these micro-level relationships, both policy-makers and university administrators run the risk of delivering unified and co-ordinated policies, funding mechanisms and strategies to encourage these interactions but experiencing returns that remain fragmented and inconsistent at best (Pugh, 2017; Cunningham et al., 2017; Freel et al., 2019). Resultantly, the implementation of policy at a local level is complex, fragmented, unpredictable and

weak making it increasingly difficult for Universities to align the needs of all stakeholders creating further tensions both at the organisational and individual level (Arshed et al., 2016; McAdam et al., 2016).

Initial research that has been conducted at the micro-level focused on a few key themes; such as, attempting to define what academic engagement means (Perkmann and Walsh, 2007) and, perhaps, driven by Government preference for measurable or tangible outcomes for university-industry relationships, on specific activities such as patenting, licensing, joint ventures and spin-offs (Bubela and Caulfield, 2010; Philpott et al., 2011). D'Este and Patel (2007) explored how individual characteristics impacted upon a propensity to engage with industry, and the mechanisms they utilised to carry out this activity, defining these individuals as 'academic entrepreneurs' (Bercovitz and Feldman, 2008). Miller et al. (2018b)'s study further developed this notion and separately defined 'entrepreneurial academics' as those who participate in less formal modes of engagement such as; consultancy, contract research and collaborative student projects. This is a distinction worth noting when considering that it is the latter type of activities that the Centre for Global Eco-Innovation utilises. By focussing on the individual these studies provided an initial understanding about who interacts with industry, and why and how they do it. They also highlighted a potential disconnect between the macro-level drivers and micro-level actions. Finding that policies failed to duly consider the individuals involved and oftentimes prioritised short-term financial gains over long-term benefits (Perkmann et al., 2013). In the process creating a series of tensions and challenges for individuals to navigate when developing relationships with partners who have fundamental differences in values, norms and mindsets (Muscio and Vallanti, 2014).

These findings began discussions at the micro-level by establishing the wide varieties of ways in which collaborations and interactions between Universities and industrial partners can take place. It is, therefore, surprising that relatively little attention has been given to further understand collaborations between University and industry at the micro-level (Cunningham et al., 2017; Caetano, 2017). If the process through which these micro-level actors work together remains poorly understood (Bjerregaard, 2009; Bjerregaard, 2010; Muchmore et al., 2015) and as the difficulties inherent in collaborative research tend to

centre around the individuals involved rather than anything systemic (McAdam et al., 2016; Cunningham et al., 2016) this leaves a significant and critical gap in knowledge and understanding (Vick and Robertson, 2017). Only by developing our understanding of the challenges and tensions individuals face, and the ways in which they manage them, can we begin to develop the policies and processes that support and engender productive collaborations that are mutually beneficial and exist in to the long-term (Carayannis et al., 2012; Miller et al., 2016a; Cunningham et al., 2017; McAdam et al., 2018). This is a gap that has been acknowledged in the literature through numerous calls, discussed further in Section 2.6, for further research in to the interactions and relationships at the micro-level of the Quadruple Helix (Rajalo and Vadi, 2017; Miller et al., 2018b; Cunningham and Menter, 2020). Thus, the next section explores the literature that has focused on these tensions, challenges, enablers and barriers.

2.4 Tensions, Challenges, Enablers and Barriers

Initial studies that focused on the micro-level tensions and challenges tended to focus on the cultural differences that exist between academics and their industrial partners. This oft-cited '*inherent distance*' (Muscio and Vallenti, 2014 p.425) is seen as a barrier to U-I collaboration and underpinned by the principle that academics are deemed as having a long-term, knowledge sharing orientation with industry focused on short-term, commercial interests (Bruneel et al., 2010). These early studies focused on measuring how engagement with industry affected academic performance by examining the correlation between an individual researcher's patenting and publication activity and their engagement with industry (Agrawal and Henderson, 2002 cited by D'Este and Patel, 2007; Bruneel et al., 2010). Concerns around the universal appropriateness of focusing on these 'harder' activities were quickly raised by Philpott et al. (2011) and Perkmann et al. (2013) who demonstrated that these activities didn't encourage academic engagement. Plewa et al. (2013b)'s study strengthened this assertion by exploring how perceived success factors changed during the course of a University-Industry interaction. Finding that they went beyond descriptive, objective outcomes such as the number of publications generated or prototypes developed and focused on the development of trust, enthusiasm for collaboration and mutual understanding.

Moving beyond the more transactional interactions first examined and beginning to consider the more nuanced factors and long-term benefits involved (Perkmann and Walsh, 2007; Perkmann et al., 2013; Miller et al., 2018b). These 'softer' interactions require a far greater stability of policy, and approach and a longer-term perspective in order to encourage commitment and ongoing participation (Muchmore, 2018).

Latterly the literature has expanded to encompass a wider range of knowledge transfer activities and whilst there are significant overlaps and variations the key issues and factors can be, loosely, grouped in to the following key areas; funding pressures, the development of trust, achieving mutual benefit, and the impact upon career progression. It is these areas that are addressed in the coming sections with a view to better understanding those factors that stymie rather than facilitate good, productive collaborations in order to point towards opportunities for improvement.

2.4.1 Funding pressures

Funding is driven and directed at the macro-level but places an associated pressure upon academics to obtain funding and respond, adapt and flex to the requirements of both funders and industrial collaborators. Davey (2020) identified funding as a primary driving force for collaboration and Al-Tabaa and Ankrah (2019) and O'Kane (2018) quite rightly suggest that funding bodies act as a significant enabler in engendering engagement at the micro-level. Funding clearly has an important role to play in the facilitation of relationships between quadruple helix actors at the micro-level. Increasing the likelihood of successful collaborative relationships by reinforcing helix structures, creating shared values and reducing friction. However, as Perkmann et al. (2013) identified, more is not always better. The presence, and utilisation, of funding should not in its own right be a measure of its efficacy neither should the very existence of funded programmes be used as evidence of stronger ties (Veletanlić and Sá, 2018).

When exploring the potential and limitations of University involvement in regional sustainable development initiatives Radinger-Peer and Pflitsch (2017) identified that funding programmes strongly affected research activities and often laden them with unrealistic expectations of economic outputs and tangible contributions (Trencher et al., 2014). These

macro-level factors create a pressure for individuals at the micro-level to establish partnerships with a large and varied portfolio of external partners and an emphasis on fulfilling contractual duties in the short-term rather than delivering collaborations of real value in the long-term (Arshed et al., 2016; Steinmo, 2015). This creates a challenge for individuals looking to manage and maintain relationships over a sustained period.

This is something Cunningham et al. (2014) identified when studying 30 publicly funded principal investigators (PIs) finding a number of tensions that were generated through the use of funding streams designed to encourage interactions between University and industry. These tensions centred around the unreliable, competitive nature of funding, the short notice periods and inappropriate timing of funding calls and the expected short-term returns on investment. All of which hinders an academics ability to maintain momentum across research partnerships, teams and agendas. This view of the contrasting role public funding plays was reinforced by Rybnicek and Königsgruber (2019) who completed a systematic review of the literature and suggested that governmental funding, whilst a vital facilitator, does not provide the opportunity for trust building between partners at the micro-level. As it tends to exist only in the short-term with the notion of success oftentimes being dependant on what was being measured (Veletanlić and Sá, 2018). These findings are mirrored by Ryan et al. (2018) who, whilst looking at the interaction from the firm's perspective, identified similar barriers and tensions created by the short-term, stop-start nature of funding. All of which made it increasingly difficult to develop trusting, effective and mutually beneficial collaborative relationships. This notion of trust and mutual benefit is key and is explored in more detail in section 2.5.2.

Bringing these various drivers together; whereby the good intentions of the Universities 'third mission' is coupled with the availability of funding and the prospect of a scientific touch which 'seduces' companies there is a risk that a collaboration for collaborations sake emerges (Rybnicek and Königsgruber, 2018 p.235). This scenario where a collaboration has been engineered but the objectives of individual partners simply do not align is one that should be avoided at all costs (O'Reilly and Cunningham, 2017; Banal-Estanol et al., 2013 cited by Rybnicek and Königsgruber, 2019). Cunningham et al. (2014) and Alexander et al. (2020) provided some empirical evidence of this dynamic in action resulting in one or both

partners losing interest in the collaboration. Undermining the time and effort individuals had put in to developing these relationships and reducing appetite and interest in continuing the collaboration (Plewa et al., 2013b).

In an attempt to understand many of these funding related tensions Barnes et al. (2002) conducted a qualitative study to identify the key factors perceived, by both the academic and industrial partners, as being critical to the success of a collaboration. Uncovering a diverse range of factors such as; equality between partners, flexibility and goal setting, trust and the identification of mutual benefit. Thus, it can be surmised that using funding to engender better collaborations at the micro-level is reliant upon the time it allows people to spend on developing good and productive collaborations.

2.4.2 Trust and mutual benefit

The presence of trust was one of the key factors that emerged, during early explorations at the micro-level, as being critical in engendering productive collaborations. For example; Perkmann and Walsh (2007) identified that it is long-term partnerships, underpinned by engagement and trust, between individuals rather than organisations, that are the key to success. Both Gulbrandsen and Smeby (2005) and Bjerregaard (2009a) explored the drivers and barriers to collaboration that exist from an academic perspective, finding that a key driver for individual academics was a desire to establish long-term collaborations founded on trust.

In Cunningham et al. (2018)'s study of PI's role as value creators in the Quadruple Helix the tensions placed upon these individuals by virtue of them spanning multiple boundaries were explored. Identifying that it is the presence of a trusting relationships that enables this function to operate effectively. In something of a progressive paradox, the presence of trust is the foundation on which absorptive capacity can be increased, ambiguity and differences between individual actors reduced, ties cemented and a more productive collaborative relationship developed (Rajalo and Vadi, 2017). Thus, increasing activity levels and encouraging more continuous relationships (de Wit-de Vries et al., 2019). What is evident is that what underpins the development of trust in these relationships is a long-term investment in, and commitment to, an ongoing interaction based on mutual understanding

and benefit rather than a focus on any short-term gains. This can only be achieved if the funding and governance structures are aligned and established to support this as, summarised by Ryan et al. (2018) when quoting Forfás (2014):

“the time needed for the building of trust necessary to establish sustainable collaborations is considerable and still requires a structured form of governance”

Ryan et al. (2018. p22)

Ryan et al. (2018)'s study also suggested that applying looser metrics and avoiding short-term commercial outcomes provided the time needed for the building of trust and mutual understanding. As well as a deeper appreciation of other's motives and an increased likelihood of productive, long-term collaborations (Bjerregaard, 2010; Youtie and Shapira, 2008; Jain et al., 2009). Individuals who collaborate recurrently are more likely to establish the necessary meso-level processes and routines and reconcile conflicting views on research targets, the dissemination of results and the timing of deliverables. Providing the platform to overcome the disconnect that often exists between individual academics and industry professionals, developing more productive and mutually beneficial relationships in the process (Bruneel et al., 2010; Rajalo and Vadi, 2017; Scarpellini et al., 2012; Radingger-Peer and Pflitsch, 2017). Somewhat contradictorily Al-Tabbaa and Ankrah (2019) found that externally set, shorter-term objectives can act as a platform for creating the aforementioned shared values, establishing mutual understanding and reducing the cultural inconsistencies that exist between individuals in academia and industry. The right balance needs to be found between short-term targets which can be used to stimulate immediate action and longer-term projects which allow individuals the time and space required to develop trusting collaborations.

All of this literature acknowledges that the process of developing and maintaining trust and shared mutual values is not an easy one. Rybnicek and Königgruber (2019) conducted a systematic literature review exploring what makes University-industry collaborations succeed and identified three key factors which all need to coalesce to support the development of a trusting relationship at the micro-level:

1. Flexibility – on behalf of the institutions and in terms of priorities, cultural differences and compromise.

2. Honesty – between both partners, underpinned by treating partners fairly and an open communication stream.
3. Clarity – by providing clear aims with defined outputs and a realistic assessment of what is achievable.

This suggests that in order for collaborative relationships between University-Industry to succeed it is critical that individuals have sufficient time and space. Allowing this requires a stability of approach and an ambidextrousness and flexibility, on behalf of the University, to facilitate this activity (McAdam et al., 2016; Muchmore, 2018).

2.4.3. Career Progression

At a strategic level university funding is becoming increasingly dependent on academics engaging with industry and society and many Universities are looking to position this activity as a priority (Perkmann et al., 2013; Miller et al., 2018a). This is increasing pressure on academics to be more entrepreneurial, engage actively with industry in diverse ways and demonstrate how their research has had a wider impact in society (Alexander et al., 2020; Bercovitz and Feldman, 2008). However, it is widely noted throughout the literature that this does not always fit within the norms of traditional University activities, often occurring informally through personal interactions (Collier and Gray, 2011). As a result, reward and promotional mechanisms often favour core activities, such as publishing and teaching, over collaboration (D'este and Perkmann, 2011; Philpott et al., 2011).

The prioritisation of these metrics, and an associated lack of institutional support for more informal collaborative activities, are seen as significant barriers to greater levels of engagement and to the development productive collaborations (Koryakina et al., 2015; Miller et al., 2018b). With collaboration with industry being a complex activity that runs counter to the traditional influences of being an academic it continues to be viewed as a discretionary activity. It is, therefore, easy to see how this new role is perceived as a risky one laden with tensions and challenges (Muchmore, 2015; Miller et al., 2016a). As Muchmore (2015) identified ineffective reward and recognition systems have a limiting effect on alignment with other Quadruple Helix stakeholders. Even in those instances where both research and impact feature heavily in career development metrics there remains a

tension between the priorities of publishing and impact and a feeling that there is not enough time to dedicate to both; one has to be sacrificed for the other (McAdam et al., 2018). This “*time squeeze*” (Gulbrandson and Smeby, 2005 p.937) creates an inherent challenge for academics in finding a balance between research exploration and research exploitation activities and the additional duties and time pressures at the institutional and individual level (Pugh et al., 2018; Alexander et al., 2020). Something, O’Kane et al. (2015a) suggests, perhaps only the most experienced researchers will be able to achieve without becoming frustrated. Especially when considering the lack of clarity, and numerous conflicting objectives that exist around what weighting to allocate to each activity (Miller et al., 2014).

These challenges are not unexpected, as Mangematin et al. (2014 p. 4) observed; “*the emergence of new roles comes hand in hand with tensions*”. This tension is exacerbated as academics are rarely provided with training, formal or otherwise, to help them engage with industry (Cunningham et al., 2014; Mangematin et al., 2014). Equally, collaboration with industry does not appear to be a natural pre-cursor to academic success (Skute et al., 2019). Without the requisite incentives and reward systems designed to encourage this activity and without mechanisms in place to support them, academics, particularly those at earlier stages of their career, will continue to focus on those activities that are measured, rewarded and supported. As a result, collaboration and engagement with industry will continue to have a high opportunity cost (Klofsten et al., 2019; Miller et al., 2016b; Muchmore et al., 2015). Becoming, more often than not, dependent on internally motivated members of staff driving initiatives from the bottom-up in something of an ad-hoc manner. With individuals placing little to no expectations on the opportunity it will provide for career progression (Muscio and Vallenti, 2014; Koryakina et al., 2015). It is the Universities ambidextrousness, flexibility, supportive frameworks and its willingness to give kudos to academics for engaging in this type of activity that is key to unlocking this dilemma and supporting the development of good collaborative relationships (McAdam et al., 2016; Bercovitz and Feldman, 2006; Philpott et al., 2011; Miller et al., 2018b).

It is, increasingly, the case that successful research grant applications require the involvement of external partners. As a result the correlation between engagement and

career progression may begin to become clearer than as stated above. Muchmore et al. (2015) suggests that as impact becomes an increasingly important component of an individual's academic career development, an indicator of research quality, and a mechanism through which funds are distributed the propensity for academics to engage will increase. Although there is a risk that this may lead academics to become disproportionately concerned with writing proposals in their attempts to secure funding (O'Kane et al., 2015). Interestingly this change may be more established than some of the prior literature suggests with Freel et al. (2019) citing findings from the *Survey of Knowledge Exchange Activity by UK Academics (2012–2015)* which somewhat surprisingly ranked the standard of teaching only slightly higher than working with business in terms of importance for career progression. Suggesting that discussions in the literature around career progression may not be as one dimensional as first implied.

Miller et al. (2016a)'s exploratory study on entrepreneurial academics found that early career academics were increasingly seeking out sources of research income, joint supervision opportunities, and shared publications in an effort to reinforce the metrics required for career progression. This wasn't just limited to those early in their career with more established academics perceiving these activities as being increasingly embedded within their job and providing a significant benefit for their research. However, this study again highlighted that there was a lack of recognition and reward associated with these activities. Thus emphasising the bottom-up nature identified by Koryakina et al. (2015) and supported by McAdam et al. (2016a), Hein et al. (2018) and Lyall (2019a). All of whom acknowledged that this type of work is not considered a core initiative thus creating a conflict between the need for inter and multidisciplinary research to deliver clean and sustainable growth and the potential detriment this approach has on career advancement, finding that:

"I was left with a strong sense of interdisciplinarians struggling to succeed in their careers with Universities often relying on the good will of their staff in order to 'muddle through'."

Lyall (2019 p.43)

2.5 Time

There appears to be a common theme which runs across all of the literature examined; time. Time afforded to collaborations through funding, or the lack thereof, time needed and required to develop trusting and mutually beneficial relationships with external partners and the institutional limitations for time to be allocated to this endeavour and the short and long-term implications that this has on career progression.

Fundamentally, good collaborations take time to develop in to trusting and mutually beneficial relationships (Pugh et al., 2018). This is due to the fact that as Plewa et al. (2013 p.39) identified; *'it is critical to allow time for personal connections and trust to develop'*. Despite the fact that solving the 'grand challenge' of clean and sustainable growth (Business, Energy and Industrial Strategy, 2017) requires an increased time allocation for projects, long-term targets and a stable policy environment the current funding landscape typically provides opportunities which are time limited, inconsistent in nature and with a focus on delivering contractual duties (Muchmore, 2015; Arshad et al., 2016). If these funding drivers continue to be dominated by a short-term focus a tension between the long-term impact and the availability of primarily short-term support mechanisms will remain (O'Kane et al., 2015). They simply do not provide the *'time needed for the building of trust necessary to establish sustainable collaborations'* (Forfás, 2014 cited by Ryan et al., 2018 p. 22).

Many scholars have commented on the issue of time creating a trade-off between collaborative working and day-to-day activities such as teaching, publishing and administrative tasks. Some have even suggested one cannot be symbiotic with the other (Miller et al., 2014; Alexander et al., 2015; Cunningham et al., 2016b). With funding increasingly focused on encouraging collaborations this time-based conflict is being heightened at the micro-level. This is due to Government requiring shorter-term results and returns on investment whilst at the same time encouraging academics to work in ways that are significantly more complex and time consuming (Fazey, 2014; Lyall, 2019a). Thus, presenting new challenges for academics seeking the best route for promotion and also for making an impact to society (Cunningham et al., 2015; Miller et al., 2018b). As Bjerregaard (2009)'s study identified these strategies that are restricted to the immediate, tangible

outcomes miss the opportunity to develop lasting and, ultimately more impactful, relationships. By not providing the time and space to develop meaningful relationships there is a risk that they generate transient ones, reducing the opportunity for individuals to build, shape and adjust the relationship. Consequently, limiting the opportunity to create a stable relationship that will exist in to the long-term and reducing the relationships capacity to become mutually beneficial (Ankrah et al., 2013; McAdams et al., 2016).

With academics facing pressures to extend their remit but being given limited time to allocate to this type of work, and receiving limited personal benefit in return, there is an opportunity cost created and a gap emerging between aspirational and espoused behaviour (Alexander et al., 2020; Cunningham et al., 2018). This gap magnifies the decision they need to make between the potential costs and benefits of collaborating creating a tension over how to manage these competing, and sometimes conflicting, demands (Davey, 2020). Even where both appear in career development metrics there is simply not enough time to dedicate to both; one has to be sacrificed for the other (Muchmore, 2018). This creates a point of contention for individuals around the amount of time to allocate to each activity when considering how to progress their career, particularly for activities where value and impact may be harder to measure (Cunningham et al., 2014; Miller et al., 2016a; Alexander et al., 2020). This is a situation which is exacerbated given how an academics time is at a premium and resource is scarce.

Gibson and Birkenshaw (2004) and Radinger-Peer and Pflitsch (2017) both highlighted that if research activities are strongly affected by funding programmes then the mechanisms Universities put in place to encourage and support academics to engage with external organisations are key (D'Este and Patel, 2007; Perkmann et al., 2012; Fazey et al., 2014). These mechanisms need to create a supportive environment which enables individuals to make their own informed judgements as to how they align with these drivers. Whilst, at the same time, avoiding any negative impact on their career advancement and overcoming the conflict that exists between the need for *“interdisciplinary climate change research and its potential detriment to career advancement”* (Hein et al., 2018 p. 1). With funding drivers

unlikely to change the onus is on the University to give the academics the time and space to develop and engender productive collaborative relationships. However, as McAdam et al. (2016) identified this alignment of needs is difficult for Universities to balance internally at the micro-level. This is primarily due to the fact that Government appear to have the stakeholder power and can withhold or withdraw funding, creating a perceived penalty on collaborative working due to their predominant focus on targeted, short-term outcomes (Hein et al., 2018; Lyall, 2019b).

2.6 Gap in the literature

It is acknowledged within the literature that the macro-level policies aimed at encouraging engagement often have a negative impact by focusing on short-term funding and short-term returns on investment (Ryan et al., 2018). These policies, designed to encourage multidisciplinary and interdisciplinary working, fail to consider the implications that conducting this type of work has on academic careers. Thus, creating an inherent conflict and tension between the short-term demands for cost-effectiveness and commercial results and the *“long-term, value-laden”* approach required to deliver clean and sustainable growth (Trencher, 2013b; Muchmore, 2018; Lyall, 2019b).

It is within this conflicted wider macro-level policy context that academics, and project delivery teams, must operate. This study will contribute to the literature described above by further exploring the tensions and challenges that exist at the micro-level in greater detail by focusing on one specific case; the Centre for Global Eco-Innovation at Lancaster University. It will then build on this by exploring the mechanisms, processes and actions that individuals put in place to deal with these challenges and the unintended consequences that these actions may have at the individual level. Responding to a specific call by Miller et al. (2018b) who identified a lack of empirical evidence around individual level challenges and a need to identify what coping strategies academics utilise in this context.

This specific call complements numerous other calls for research to address the scant attention given to University-Industry collaborations at the micro-level playing out under the Triple and Quadruple Helix frameworks through case-based research (Bjerregaard, 2009;

Philpott et al., 2011; Miller et al., 2016b; Rajalo and Vadi, 2017; O'Reilly and Cunningham, 2017; Cunningham et al., 2018; Cunningham and Menter, 2020; Cai and Etzkowitz, 2020). As Rybnicek and Königgruber (2019) acknowledged until there is more substantive qualitative and quantitative investigation of sector-specific collaborations, policy efforts and funding in order to promote collaboration are only ever going to be partially successful.

Achieving clean and sustainable growth cannot be achieved in isolation and whilst no one group can build the helix model alone it is widely identified within the literature that Universities are seen as the driving force within this process at the macro level (Etzkowitz and Leydesdorff, 2000; Perkmann et al., 2013; Philpott et al., 2011; Rajalo and Vadi, 2017).. If, as Mangematin et al. (2014), O'Kane (2018), and Cunningham et al. (2016) identify the role of individual academics is key then understanding the tensions, and challenges imposed upon individuals at the micro-level, the coping strategies they put in place and the resultant unintended consequences is a critical detail currently omitted from the literature. Only by developing our understanding of this can we begin to explore ways in which we can engender better, more productive collaborations.

Therefore, my contribution to the literature will be to explore, and develop understanding of, the micro-level challenges and tensions within the context of a particular case study. Beyond that the contribution will focus on how academics and project delivery teams make sense of, and deal with, these tensions, the coping strategies they put in place and the associated unintended consequences. This insight will be developed in to University process recommendations targeted at reducing the tensions, challenges and barriers to successful long-term collaborations. Creating an environment and culture more conducive to interdisciplinarity and external collaborations and increasing the likelihood of real and sustained impact and change through University-Industry collaborations. With this in mind, the following section explains the methodology I used in order to collect and analyse the data.

3. Methodology

Utilising semi-structured interview as the primary method of data collection this study focused on one individual case, the Centre for Global Eco-Innovation (CGE). The use of semi-structured interviews as the source of data which underpinned this study allowed a more nuanced understanding of the unique tensions associated with working collaboratively, across disciplines and with industry, to deliver clean and sustainable growth. This approach allowed the space for a greater consideration of the contextual factors which contribute towards the findings (Starman, 2013). As the case in question was, for the majority of the duration of the study, where I was employed and as the topic of the study is in itself an area that was highly pertinent to my role this method of data collection was complemented by observations, meetings and informal conversations which occurred during the 'everyday' undertakings of my professional role. This approach was defined by Musante (2014 p.249) as "*Complete Participation*" whereby the researcher is completely integrated to the population of the study prior to the studies commencement by virtue of already being a member of this group. This approach was critical in the framing of the initial research question and helped to add further context, depth and nuance to the data collection and analysis conducted during the course of the research project.

I focussed on the CGE, a multiple award-winning research centre delivering clean and sustainable growth across the North West, for a number of reasons. Firstly, the context in which CGE exists is highly relevant to the practical problem being investigated, and secondly it provided good access to participants thus ensuring data richness (Aberdeen, 2013; Denscombe, 2014). This was an important decision within the overall study with Eisenhardt (1989) identifying that when conducting exploratory research, the selection of the case is a key stage of the research project as it defines where the research sample or data is drawn from. There were also a number of practical considerations which influenced my decision; by choosing a single research site the attitudes of academics from different disciplines and from different career stages could be studied, additionally with limited time available studying CGE reduced travel time and costs and meant that the relationships critical to the success of the project were already in existence. This helped to reduce the amount of time spent getting access to data, something Denscombe (2014) highlighted as a particularly

important consideration when conducting face to face interviews. Finally, it provided reassurance that the research was of interest to key stakeholders across the University. Many of whom expressed interest and encouragement prior to, and throughout, the study. By purposively focusing on a single case I had the opportunity to undertake a more in-depth analysis, uncover greater detail and richness, whilst allowing for the views of academics from different disciplines to be represented. Insights to emerged that would not have come to light had I looked at numerous cases (Philpott, 2011; Denscombe, 2014; Saunders et al., 2015; Gustafsson, 2017). In other words, it was possible to provide a higher level of depth than if I had attempted to access multiple cases, particularly when considering the time and resources available for this research project, as Yin (2014, p.57) stated; *“the conduct of a multiple-case study can require extensive resources and time beyond the means of a single student or independent research investigator”*.

Ultimately my familiarity with, and proximity, to the case and my subsequent ability to identify and access participants are the main reasons that CGE was chosen. The decision to base the research where I worked for the majority of the duration of the study undoubtedly influenced my positionality, discussed further in Section 3.2. However, it ensured that the study was of personal interest and as Langley and Abdallah (2015 p.102) stated when citing Gioia (2004):

“No organization is more salient or more important to me than my own organization, so that helps to explain why I sometimes study my own university”

As Eisenhardt (1989) and Saunders (2015) identify semi-structured interviews are best used as the source of data in exploratory studies taking an inductive approach as they are *“best rewarded”* when, as is the case with this project, exploring complex phenomena such as opinions, feelings and emotions (Denscombe 2014 p. 186). Equally, as King and Horrocks (2010 p.7) identified when citing Kvale (1996); *“if you want to know how people understand their world and their life, why not talk to them”*. It is for these reasons that this method was selected. Even though semi-structured interviews can be used as a stand-alone method (Longhurst 2003) and are defined as genuine research as engagement (Gioia et al., 2013) by focusing the project on such a familiar case the opportunity was provided to supplement the data gathered during the interviews through informal discussions with colleagues,

participation in formal team and University wide meetings, meetings with academics and facilitating discussions between academics and industrial partners. By solely using semi-structured interviews as the source of data this project follows precedence set in similar studies by Bjerregaard (2009), O'Reilly and Cunningham (2017), and Oliver et al. (2019). All of whom utilised semi-structured interviews for data collection when exploring the strategies individuals deployed when undertaking University and Industry collaborations, academic Principal Investigators perceptions of the enablers and barriers to working with business, and the development of trust in collaborations between academia and industry respectively.

There are also a number of studies which utilised semi-structured interviews as their primary method of data collection, these include; Cunningham et al. (2014)'s study in to factors inhibiting PI's in leading publicly funded research, Nguyen and Marques (2018)'s study exploring the challenges of implementing quadruple helix structures within living labs, Al-Tabaa and Ankrah (2019)'s micro-level exploration of engineered collaborations, Dolan et al. (2019)'s micro-level study of academics interactions with the Irish Centre for Research in Medical Devices and Philpott et al (2011)'s study examining the underlying academic tensions within an entrepreneurial University. A key advantage of semi-structured interviews is that they are sensitive and people-oriented. Allowing interviewees to describe and explain in their own words and providing the opportunity for respondents to raise issues that may otherwise not have emerged (Valentine, 2005; Hussein 2009). It was, therefore, possible to unearth a deeper picture than through other potential methods and consequently helped to enhance my understanding of the topics and themes as they emerged. It is for this reason, and those described above, that this data collection approach has been chosen as, ultimately, it is the one that I feel is the best fit for the specific research question (Cunningham et al., 2016).

Cunningham et al. (2016) identified that with qualitative case methods still being in an emergent state within this field of study it is essential to provide a detailed account of all data collection and analysis. The following chapter will provide this clarity and detail by clearly identifying the way in which this research was approached and how it was conducted. This includes; covering the overarching methodology, participant selection, data

collection, data analysis, ethical considerations, positionality, and finally an acknowledgement of the limitations inherent within the selected approach.

3.1 Research Methodology

The study commenced with a broad initial exploration of the literature in the field of the drivers of eco-innovation before focusing on more specific literature areas pertinent to this study. There was a particular focus on University-Industry collaborations and the Triple and Quadruple Helices of Innovation at the macro, meso and micro-levels. Developing an understanding of this literature highlighted a predominant focus at the macro-level and identified a gap in the literature around the challenges and tensions felt by individuals at the micro-level and the ways in which these individuals manage and respond to them. This was a critical step in the research project as without narrowing and defining a research focus, even if only tentatively, it would have been easy to be overwhelmed by the volume of data collected through the semi-structured interviews (Eisenhardt, 1989). It also helped to facilitate the formulation of the research questions and thus informed the subsequent research approach as being an inductive one. The project focuses on a relatively understudied area aiming not to provide generalisations but to gain an in-depth understanding within this specific context (Eisenhardt, 1989). It also allowed an exploratory approach to be taken in looking at the micro-level tensions and challenges associated with collaboration for clean and sustainable growth and the actions and consequences these tensions can create. The approach enabled the findings to emerge directly from the perspective of the participants thus providing the opportunity for new insights and explanations to be uncovered (Bernard, 2013). Subsequently by moving between data collection, data analysis and the literature in an iterative, cyclical approach clear links between the research objectives, the extant literature and the research findings were established (Eisenhardt, 1989; Cresswell, 2007).

The main criticisms levelled at this approach focus on a lack of reliability, due to the lack of standardisation in semi-structured interviews, and the production of generalised theories and conclusions based on a relatively small number of observations. These criticisms, which are primarily centred around reliability and rigour, are discussed in detail Section 3.3. This section also provides further detail on the steps taken within this study to ensure a high

level of detail and transparency whilst not undermining the strength of this approach. However, the approach taken and the methods used have been designed to overcome these issues as best as possible and deliver findings that could potentially provide useful generalisations to theory in other settings where similar characteristics and conditions prevail (Yin, 2014). This could include, for example; other large-scale publicly funded research projects and collaborative projects between University-Industry which have a primary focus on delivering clean and sustainable growth both within Lancaster University and in other Academic Institutions. Ultimately the reasons for taking an inductive approach are two-fold, firstly; the topic and context of this project is not one that has been widely studied to date. Secondly; as mentioned previously the time and resources available to this research project necessitated a small sample, and in these instances an inductive approach is most appropriate (Yin 2014). As highlighted in Section 2 previous research conducted in the context of the Quadruple Helix has primarily focused on the macro-level rather than the micro-level, therefore it was necessary, as highlighted earlier, to take an exploratory approach, starting with data collection and analysis before any subsequent theories were proposed.

3.1.1 Participant selection

A purposive sampling method was used to build the initial sample of participants for this research project (Seawright and Gerring 2008, Pratt 2009). This method was chosen as selecting specific data sources ensured that the participants had a direct experience, and knowledge of the case in question and an ability to discuss different perspectives. Allowing me to collect data pertinent to the research question (Cresswell, 2007; Gioia et al., 2013, Gentles et al., 2015). Participants were selected from an existing network of contacts from across the University and their selection was based on their knowledge, relationships and expertise regarding the research subject. An approach advocated by Patton (2014) who asserted that:

“The logic and power of purposeful sampling lie in selecting information-rich cases for in-depth study [...] from which one can learn a great deal about issues of central importance to the purpose of the inquiry.”

(Patton, 2014, p. 264)

Consequently, all of the participants in the study had close links to CGE and, more importantly, an understanding of what the Centre does, how it does it and what it is trying to achieve. Table 2 identifies the exact make-up of the participants interviewed in the first wave of interviews:

Participant Grouping	Role & Department	Justification
Academics x 8	Senior Lecturer, Chemical Engineering	All academics had supervised at least one CGE funded project which had commenced between 2012 and 2018.
	Professor, Chemistry	
	Senior Lecturer, Engineering	
	Professor, Engineering	
	Lecturer, Geography	
	Lecturer, Environmental Science	
	Professor, Management Science	
	Lecturer, Psychology	
Project Delivery Staff x 3	Project Manager	All staff had either directly, or indirectly, worked for the Centre between 2012 and 2018.
	Operations Manager	
	Innovation Fellow	

Table 2: Wave 1 Interview Participants

The validity of this approach was ensured by selecting a sample which was as representative as possible of the overall make-up of CGE. Crouch and McKenzie (2006) proposed that cohorts of less than 20 participants were ideal when aiming to mitigate some of the bias and validity threats inherent in qualitative research as a relatively small sample size helps the researcher to build and maintain close relationships with the participants thus enabling a more open and frank exchange of information. As the sample size was relatively small it was critical to determine at which point saturation had been achieved, i.e. the point at which no new information appeared to be emerging and to identify the areas that required further exploration through follow-up interviews (Denzin and Lincoln, 2011; Saldana, 2015). This process, and the point at which saturation was achieved within this study, is discussed in more detail in Section 3.1.2.

Within the academic ‘cohort’ there is a reflective mix of both early career and experienced academics and representation of the wide range of disciplines involved, with the number of

interviews in each area weighted in an attempt to reflect representation within CGE. At this point it is worth noting that the participant mix is heavily weighted towards the STEM subjects and, particularly within the academic staff, males. But that is reflective of the balance of projects and participants within CGE and weighting it any other way may have run the risk of misrepresenting the case in question.

Following on from the initial wave of interviews a second series of interviews were conducted in the form of theoretical sampling through an adapted and evolved interview structure (Appendix 1). All of the second wave interview participants were selected from those who had taken part in the first wave of interviews and were identified as key informants, Table 3 details those participants in full. This was done to expand upon emerging themes and recurring patterns identified through the initial interviews. These key informants were asked to provide additional detail and clarity on categories that appeared to be central to the emerging data.

Participant Grouping	Role & Department
Academics x 4	Professor, Chemistry
	Senior Lecturer, Engineering
	Lecturer, Environmental Science
	Lecturer, Psychology
Project Delivery Staff x 2	Project Manager
	Operations Manager

Table 3: Wave 2 Interview Participants

Across the duration of the data collection process 17 semi-structured interviews were conducted, over a 4-month timeframe. Wave 1 was conducted within 6 weeks with Wave 2 conducted across within a similar timeframe commencing 2 months after the conclusion of Wave 1. It was after interview 14 that I felt that data saturation had been reached, the remaining 3 interviews had been pre-arranged and were conducted as planned. Repetition within these final few interviews confirmed that this was the case.

3.1.2 Data collection

Beginning with a broad theoretical direction I initially looked at the literature surrounding the drivers of eco-innovation generally before focusing more specifically on interactions and collaborations between University-Industry in this area. Finally, focusing on the Triple and Quadruple Helixes of Innovation and the tensions and challenges that exist between the stakeholders (Government, Academia, Industry & Region) within these frameworks at the macro, meso and micro levels. This approach provided a good grounding in the literature and helped to identify the gap that this study would look to address. Allowing for relevant questions to be designed for the semi-structured interviews that focused on key topics relevant to the research aims and objectives. The interview schedules did vary slightly between academic and project delivery staff, to reflect the variations in their roles, some examples of questions can be found in Figure 5 with the full schedules available in Appendix 1. One section that was identical in all interviews was a pre-prepared statement that provided a clear summary of CGE, its aims and objectives as well as a definition of the research question and an assertion that this study was an independent one and was not sponsored by CGE (Appendix 2). I felt it was important to do this for a number of reasons; first, all participants will have had different levels of awareness and understanding about CGE; second, I felt that it was important to reiterate at the beginning what the research was focusing on. Providing a way of separating the interaction from being a work related one and to provide reassurance that this was an independent study uninfluenced by CGE.

1. What were/are your short-term priorities and long-term goals within this CGE project?
 - a. How do you reconcile the two?
 - b. Does this create any challenges? How do you address these?
2. Do the short-term project delivery targets impact upon your approach to building collaborations?
3. Could you provide an example of a challenge you faced when developing a long-term relationship (beyond CGE project) and/or collaboration to deliver clean and sustainable growth?
 - a. How did you overcome this/what would have helped you to overcome this?
 - b. What do you think are other significant challenges?
4. Should University/policy drive and encourage interdisciplinary working?

Figure 5: Sample interview questions

Once the interview schedule, and the participants, had been identified in full all of the participants were contacted by email, asking for their agreement to participate, an example of the email sent and the participant consent form can be found in Appendix 3 and 4 respectively. The Participant Information Sheet that accompanied this email can be found in Appendix 5. Given the purposeful nature of the participant selection a high agreement rate was achieved with only 3 potential participants either declining or failing to respond to the request.

One-to-one semi structured interviews were then conducted over a period of four months across 2 'waves' of interviews, as highlighted earlier. One interview was conducted on Skype with all other interviews conducted in person, with the majority held in the participants offices or, on a couple of occasions, in a public café. They ranged in duration from 45 minutes to 1 hour 30 minutes, with most lasting just under 1 hour. All interviews were recorded and transcribed, before being coded manually rather than using any Computer-Assisted Qualitative Data Analysis Software (CAQDAS), this process is described in more detail in Section 3.1.3. All of the interviews followed a very similar structure and pattern except, as highlighted earlier, for the minor differences depending on the core nature of the participants professional role. Whilst this was done in order to ensure reliability and to allow comparisons to be made it was important that participants were given the space and opportunity to reflect their own views within the interviews.

To facilitate this the interviews always started with more general, open questions, such as; *"Can you tell me a little bit about your background and your involvement with the Centre for Global Eco-Innovation?"* and *"What attracted you to engage with CGE?"*. This relaxed opening was followed by more detailed and specific questions, focusing on the key topics that this project is addressing providing them with the opportunity and confidence to give open and in-depth answers. The majority of the data pertinent to this research project was collected in this later section and followed an approach described by Longhurst (2003) p.107:

"Researchers often start with a question that participants are likely to feel comfortable answering. More difficult, sensitive or thought-provoking questions are

best left to the second half of the interview ... when participants are feeling more comfortable.”

Given the nature of my professional role within the Centre initially and latterly within the wider University there were times when it was not possible to extricate my research from my professional role. In Section 3.2 I explore my positionality and its impact upon the project. This ‘dual-role’ did allow me the opportunity to participate in team meetings, professional meetings with academics and facilitate meetings between academics and industrial partners. All of which helped to furnish, support and further contextualise the data emerging through the semi-structured interviews, and the subsequent analysis of this data. Whilst this was of some concern at first, the potential pitfalls are discussed in Section 3.2, I soon found that rather than limiting the study it helped in understanding and interpreting the ways in which the tensions and challenges emerged and impacted upon individuals.

3.1.3 Data analysis

All interviews were recorded and transcribed before being manually coded. A method of inductive coding (Miles et al., 1994) was adopted following a thematic analysis approach provided by King and Horrocks (2010). This approach begins with a process of descriptive coding before clustering these descriptive codes and finally identifying the overarching themes. Prior to commencing this process, the interview transcriptions were formatted so that they were all displayed in a consistent manner with spacing allowed for codes, notes and comments. The text was then separated in to short paragraphs with line-breaks in between topic changes, an approach advocated by (Saldaña, 2015) to account for the fact that social interaction does not occur in neat or isolated units. This formatting process was treated as the initial part of the analysis and provided the opportunity to pre-code by highlighting particularly rich or significant participant quotes and passages, for example;

A: “multi-disciplinary working in terms of working engaging with industry partners is, I think, the more important one than interdisciplinarity between scientific disciplines. Because without the question you don’t really know how to proceed ... if we don’t understand the problem we can’t talk about it”

“I’ve done work in the past like which has been collaborative. I guess a lot of it’s been collaborative with industry or with private companies and to be fair, it does make the work a lot more challenging sometimes ... it’s not just between different academic disciplines but also industry and government as well. If you want to change anything, if you want to have a real-world impact then it makes complete sense to have those people on board in the first place because scientists on their own aren’t going to, it’s very difficult to do that. Whereas if you’ve got those people in the loop then we’re all going to do that journey together if you like.

I: So it’s more challenging but more-?

A: It’s 100 times more rewarding but it will take longer, it will probably cost more money. I think there’s no doubt about it but the end product is probably better

Or shorter extracts of text, such as;

A: “We get paid to walk off the edge, go and have a look around and come back and then report what we see. Probably the most of it’s useless but the whole point of walking off the edge is that there are also hints about how to move forward”

The results of this pre-coding exercise were then explored in more detail through line-by-line coding. Whilst this was a time-consuming process it allowed the data to be efficiently coded therefore reducing the likelihood of applying my own motives and preconceptions on to the respondents, and their responses. At the same time it provided me with a more manageable list of codes (Gioia et al, 2013; Saldaña, 2015). This approach allowed the data to be better represented and understood and enabled key topics and themes such as; *‘project delivery pressures’, ‘siloes approaches to career progression’, and ‘the lack of mutual benefit’* to emerge and be more easily identified.

These initial codes were then grouped in to categorised codes, in the form of tensions and conflicts thus maintaining the link to the original research questions and literature. These categorised codes included; *‘Access to funding v Career progression’, ‘Collaborative Working v Long-term Impact’, and ‘Bigger picture v Piecemeal projects’*. It was these categorised

codes which were then grouped in to the key tensions utilised in the findings section, these being:

1. A push for collaboration v A requirement for short-term returns
2. Academic value of long-term collaborations v Short-term project timescales
3. Long-term career progression v Short-term reactionary approach to funding and industry collaboration

During this process a number of additional codes and themes were identified which focused less on the tensions felt in individuals' everyday lives and more on the way in which they dealt with these challenges. This included topics such as; *'Spread betting'*, and *'Translating'*. By starting the process with open and descriptive codes, some of which were drawn *in-vivo* from the transcripts themselves, then grouping those with common meanings in to categorised codes before identifying the key, overarching themes/tensions, it was possible to understand the data and the meanings within the data more deeply (King and Horrocks, 2010). Table 4 provides examples of some of the different codes, categories and themes that emerged throughout the process described above. Samples of coding logs and more detailed coding tables are available in Appendix 6 and 7 respectively.

Sample data	Initial codes	Categorised codes	Key tensions
<i>"our mindsets are in boxes of; project one like literally archived in a box, project two put all your energy in to that"</i>	Delivery pressures/timescales	Policy influence v long-term impact	Importance of long-term relationships v Short-term project timescales
<i>"It's more people like you and I that know that benefit from it on the ground doing those things, trying to push it, then the University is 'great, that's fantastic'."</i>	Universities role		
<i>"what we should do is aim to get academics regularly working with industries ... if we're going to work with partners it should be on a long-term basis"</i>	Continuity of relationships	Funding v collaborative working	
<i>"with the funding pressures at the moment ... everyone's looking for money and so it's a</i>	Funding pressure		

<i>natural inclination to say yes to anyone that contacts you about a project"</i>			
<i>"the assumption of academics is that government wants academics to bend over and do whatever industry wants"</i>	Business-led collaboration	Career progression v building relationships	A reactionary approach v career progression
<i>"Everything goes back to funding because it pays for people's time"</i>	Access to funding		
<i>"To develop interdisciplinary relationships takes longer than more siloed interactions"</i>	Siloed approach	Policy/funding v career progression	
<i>"we're always working in three and a half year windows the three-year projects have to start at the start, that's a real problem for us"</i>	Short-term approach		

Table 4: Coding summary

The data was then closely aligned to the research questions through an iterative process of data analysis, reflection, and further consideration of the literature before returning to the data again. This process was conducted to develop a deep understanding of which of the emerging themes were most important, relevant and insightful (Gioia et al., 2013; Saldaña 2015).

3.2 Ethical Considerations

As with any research involving participants, there were several ethical considerations in this study. In order to ensure full consideration was given to these factors approval was sought from, and granted by, Lancaster University's Faculty of Science and Technology Research Ethics Committee (FSTREC) before approaching participants and scheduling the interviews. On invitation to take part interview participants were sent an information sheet explaining the purpose of the study and the use of their data, and signed a consent form based on this (Appendix 5).

Participants were made aware that they could retract their contributions up to two weeks after the interview took place. Providing anonymity was essential so that participants didn't feel their role within the University or their involvement with CGE would be compromised, particularly if they wished to give a critical or sensitive opinion. Neither would they have their privacy infringed upon, be exposed to embarrassment or any disadvantageous consequences (Saunders et al., 2015). All data has been anonymised and pseudonyms used, however where there was still any potential for the individual to be identified they were made aware of these limitations. All transcriptions were backed up onto a hard-drive and removed from the recording device as soon as possible.

3.3 Limitations

Reliability is achievable if a research design is replicated and the same results are achieved (Saunders et al., 2015). A general criticism of qualitative research is that it is too subjective, difficult to replicate and the significance and importance of the data collected is determined by the researcher and how they focus on and interpret it (Bell et al., 2018). Equally the reliability and replicability of the study is hampered by the fact that as (Denscombe 2014 p.297) identified; *"it is impossible to replicate a social setting"*. This is particularly prescient in the case of semi-structured interviews which are by their very nature unstandardised. It is critical in these instances, where a lack of rigour is the primary criticism, that the process followed is identified in a clear and transparent way through a detailed and comprehensive audit trail without undermining the strengths of this type of research (Yin, 2014; Saunders, 2015).

When looking more specifically at taking an inductive approach, as this study has, the criticism is that it produces generalized theories and conclusions based on a small number of observations limiting the potential transferability (Yin and Davis, 2007; Denzin & Lincoln, 2005). As this project focussed on a small number of participants the reliability of the research results may subsequently be questioned. However, as Eisenhardt and Graebner (2007) identified when undertaking inductive research, it is often the case that you're laying the ground for further, more extensive research in this area. The aim of this study is to closely align the findings with the extant literature and thus provide a grounding that is

accurate, interesting, testable and could be used to develop theory through future research and further studies rather than providing a statistical generalisation (Saunders, 2015). The selective sampling method described in Section 3.1.3, focussed on identifying and involving participants with an in-depth knowledge of the subject matter and a firm understanding of CGE and the context the Centre is working in. Thus providing access to a rich data source even from a relatively small pool of participants. By collecting data from a representative sample of a wide cross-section of participants questions around the generalizability or transferability of the findings are addressed. Additionally, when aiming to mitigate against some of the bias, validity and credibility threats inherent in qualitative research Crouch and McKenzie (2006) believe that focussing on a small cohort can be advantageous by allowing greater scope to gain access to a participant's knowledge and experience, and infer meanings from the language they use (Saunders, 2015).

Finally, it is important to stress that this study does not assume that its findings can be exactly replicated in all situations more it is hoped that it may reveal new considerations that may be relevant in other situations (Yin, 2009). By framing the research around a specific project, the study is able to develop conclusions and findings that could be tested in a variety of other scenarios and settings. I have given as much detail as possible on the methods and processes used and the thinking behind the decision-making that have led to the conclusions drawn to counter claims of unreliability (Denscombe 2014).

3.3.1 Positionality

Positionality in research is determined by where an individual stands in relation to the people being studied (Merriam et al., 2001). At this point it feels appropriate to acknowledge my own positionality and how my relationship with the interviewees may have affected their responses. On commencing the research, I was a member of staff within CGE changing roles to one in the wider University mid-way through the project. As a result, all of the participants were well-known to myself, and I to them, prior to the research commencing.

Early discussions in the social sciences tended to frame the researcher as either an 'Insider' or 'Outsider'. Even though I approached participants as a researcher it was impossible to extricate myself from my role as a colleague to the participants. As a result, even though the 'Insider'/'Outsider' division is now more widely regarded as a fluid concept (Mercer 2007), I identified primarily as an 'Insider'. This familiarity meant that I was highly aware of the need to treat participants as people, rather than as objects to be exploited or mined for information. Equally ensuring that the interview provided an opportunity to explore the subjective values, beliefs and thoughts of the individual respondent rather than impose my own world view upon them (Flowerdew and Martin 2013). This required an attentiveness and flexibility in the interview (King et al., 2018) and an ability to identify and acknowledge that:

"The interview is a social encounter, and how the respondent answers the questions will depend to some degree upon what the respondent and interviewer think and feel about each other"

(Valentine 2005 p.119)

The most significant 'Insider' quality I was conscious of before, during and after the interviews was my perceived expertise of the subject, the case being researched and the strong relationships with other people connected to the project:

A: "Certainly, one of those companies can be fraught and feisty sometimes and can be a bit difficult to work with and they've tried through various programmes and things here at Lancaster but somehow, I still manage to get on with them. I don't know what that says about me actually. You probably know who I'm talking about.

I: Yeah.

A: The recorders still ticking away... no names. But it seems to work."

And in another instance:

A: "...and with the MSc by research, they were again, I don't know, you probably know more about Company Z because they approached-, they probably saw the advert and approached us, is that right?"

In many instances this familiarity helped to encourage the participants to open up at an earlier stage of the interview than they may have ordinarily and move beyond the rapport building stage of the interview earlier than would otherwise have been possible. On the other hand, this could have led to a degree of social desirability bias, where respondents speak more positively about a topic because they feel there is a 'right' way to answer (King and Bruner 2000). This may have created instances where participants tailored or held back their full views on some potentially sensitive topics due to their awareness of our relationship as colleagues as well as researcher and participant. This is a sort of participant-induced reflexivity, the participants themselves acknowledging my role and status as a colleague was a factor in shaping our discussion (Riach 2009). For example;

A: "I don't know whether I can say this... .. I don't know whether that's okay to say."

And:

A: "I'm asking for several reasons but partly because the project will be over and we will still be colleagues so I don't want to be awkward in that way."

One anticipated 'Outsider' quality characterised a 'lack of fit' or an inability to empathise with their experiences (Riach 2009 p.362) by virtue of not being an academic never emerged. Dwyer and Buckle (2009) note that there is no advantage in the researcher being considered 'Insider', 'Outsider' or anywhere in between. They have previously been listed with distinct benefits and disadvantages, but in this example the pre-existing familiarity and perceived level expertise demonstrates ambiguity; a single quality acting as both a barrier and a way-in to conversation at different stages of the interview process.

Every effort was made to mitigate against any potential impact; by providing anonymity, carefully selecting the participants, choosing a comfortable place to hold the interviews and reading a pre-determined statement prior to each interview to clarify the context under which the interviews were taking place. The full statement is available to read in Appendix 2 along with the rest of the interview schedule. All research has to contend with and mitigate

positive and negative elements of positionality. Considering all of the above, for this project my role at Lancaster University and within the Centre for Global Eco-Innovation was beneficial in opening up greater methodological potential and giving the findings a sense of practical purpose, situated firmly in the context that CGE operates within.

4. Findings and Discussion

In order to address the research questions, this section explores how the contradiction between the short-term policies and funding targets set by Government, as a way of stimulating and promoting clean and sustainable growth, are at odds with the long-term collaborations that are required to achieve this goal. Ultimately this disconnect, between the short-term approach and the long-term need, does not allow the time or continuity required to develop productive and long-standing collaborative relationships. Thus, creating tensions and challenges felt by individuals at the micro-level.

This section initially focuses on these tensions and challenges and the impact they have on the everyday lives of the academics and project delivery staff involved, some of which have been identified in previous studies (Philpott et al., 2011; Perkmann et al., 2013; Cunningham et al., 2014). I then go on to identify the ways in which academics and project delivery staff deal with, and overcome, these tensions and challenges. I have labelled these actions as 'workarounds', a term commonly used in computing as a method for overcoming a problem or limitation in a program or system (Workaround | Definition of Workaround by Oxford Dictionary on Lexico.com also meaning of Workaround, 2020). These workarounds include; for example, how individuals adjust their priorities and expectations depending on the type and nature of the collaboration. These actions are discussed in more detail in Section 4.2.

Those academics who are unable to successfully adopt these workarounds and make the additional time and effort invested in collaborative work productive for themselves, particularly in terms career progression, may subsequently lose enthusiasm and appetite for future collaborations. Thus, unbalancing the Quadruple Helix of Innovation and fundamentally undermining the UK's ability to deliver real change and to meet the 2016 Paris Agreement. This development is visually described in Figure 6 which demonstrates how the dichotomy between the need for a long-term approach and the short-term requirements pushes academics in to adopting a series of workarounds. Whilst they ensure the delivery of short-term results if there is limited benefit felt by the academic, particularly in terms of career progressions then individual's enthusiasm for collaboration may decrease

in the future. Reducing the capacity for delivering impact in the longer-term. This is discussed in greater detail in Section 4.3.

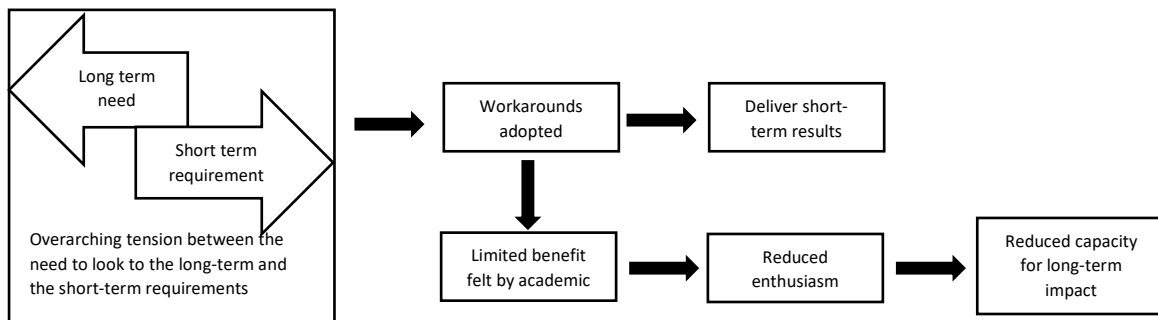


Figure 6: Impact of the tension between the long-term and short-term

4.1 Tensions

The conditions needed to deliver clean and sustainable growth are characterised by a continuity of approach, collaboration and a long-term perspective. These conditions are in direct conflict with the current conditions and the restriction imposed upon individuals. These restrictions are characterised by inconsistent and time-limited funding opportunities, a misalignment between policies and incentives, and a focus on short-term gains. Whilst this is a disconnect that is created at the macro-level the conflict emerges at the micro-level where good, productive collaboration takes time but funding requires immediate action and short-term results. This conflict emerges through the three key tensions listed below:

1. A push for collaboration v A requirement for short-term returns
2. Academic value of long-term collaborations v Short-term project timescales
3. Long-term career progression v Short-term reactionary approach to funding and industry collaboration

Whilst these tensions are discussed independently they do not exist in isolation. They are highly interwoven and interlinked with similar themes emerging throughout. These include, career progression, a lack benefit felt by academics and a feeling of being unequal stakeholders within the Quadruple Helix. Whilst highlighting the differences the following sections also identify the similarities and overlaps between these three key tensions.

4.1.1 A push for collaboration v A requirement for short-term returns

Academics are increasingly being encouraged to work collaboratively across academic disciplines and with external partners. This is an approach that is more complex, takes longer and costs more money than working in a disciplinary silo. At the same time, there is a pressure to deliver returns to industry and society in shorter timescales. This sub-section explores individuals' perceptions of the benefits and challenges of collaborative working, how the requirement for short-term returns arises and the tensions these conflicting expectations creates.

4.1.1.1 A push for collaboration

Collaborations which are multi-disciplinary in nature are critical to the delivery of clean and sustainable growth, as one participant stated; *"if you want to break the boundaries it has to be multi-disciplinary"* (Academic 9). Whilst spanning boundaries across different academic disciplines is important many participants stressed that it is the interactions and collaborations with external, non-academic partners that are crucial. These interactions provide greater opportunity to develop impactful results than simply collaborating across academic disciplines:

"if you want to change anything, if you want to have real world impact then it makes complete sense to have those people (industrial partners) on board in the first place"
- Academic 4

"multi-disciplinary working in terms of working, engaging with industry partners is, I think, the more important one than interdisciplinarity between scientific disciplines. Because without the question you don't really know how to proceed ... if we don't understand the problem we can't talk about it" – Academic 7

This boundary spanning activity is also deemed as critical by Government particularly for solving the 'grand challenges' facing society and is being actively driven through funding opportunities (Dowling, 2015). The funding utilised by CGE exists within this context and provides a nature and structure that does inherently work to provide the 'question' and context in a clear and concise manner by being; *"industry facing out of the gate"* (Academic

7). This clarity of direction ensures that; *“right from the start everyone knows what CGE is about”* (Academic 4) and, as a result, these collaborative relationships do tend to start in a clear and focused manner. Something identified within the literature as being a key factor in the process (Perkmann et al., 2011). Nevertheless, however clearly the question or problem is laid out working collaboratively is not an easy process for academics to undertake. Particularly where the focus of the funding *“is for the business, to benefit the business ... very much led by the business”* (Project Delivery 1). This focus often means that it is the industrial partner driving the timeframes of any project, the implications of which are explored in more detail in Section 4.1.1.2. Whilst there was undoubtedly a strong recognition of the benefits of collaboration there remained a cognisance of the challenges and a caution towards this way of working. A caution which extended to several calls for the individualism and independence provided by disciplinary working to be maintained, albeit alongside collaborative working:

“a lot of it’s been collaborative with industry or with private companies and to be fair, it does make the work a lot more challenging” - Academic 4

“there’s a lot of hype ... interdisciplinarity also hurts quite a lot. It’s quite painful ... I think disciplinaries should be encouraged as well, let’s put it that way” - Academic 5

“I’m afraid it’s problematic all round and closer collaboration and co-creation with industry is increasingly important but, yeah it’s a challenge” – Academic 6

Some of the reasons behind this caution have already been identified within the literature. This includes; the volatility of business need, a long-standing culture gap between industry and academia and the additional expectations and pressures of delivering against industry-based challenges (Bjerregaard, 2010; Perkmann et al., 2013; Miller et al., 2016; Al-Tabbaa and Ankrah, 2019). However, the main challenges that emerged through this study was the need to deliver results within shorter timeframes, driven by both funding and industry requirements and an insufficient amount of time to deliver.

4.1.1.2 Shorter-term returns

The reticence and caution towards collaborative working primarily centred around the time available, or more specifically the lack thereof, for academics to attribute to this activity.

This tension or *'pain'* felt by academics is the micro-level embodiment of a macro-level dichotomy between the longer-term outlook needed to deliver clean and sustainable growth and the requirements for shorter-term results and returns on investment:

"BEIS are obviously talking to the education bits of government and going; we, for our investments we pump into these things, we want to see shorter to shorter return, shorter term returns to industry and society ... I think they've gone too far" –

Academic 1

The tension between the requirement for shorter returns to industry and society and the traditional long-term research trajectories academics typically work around is a long-standing one. However, it is one that has been further heightened by the way in which academics are increasingly being encouraged to work in ways that are more complex, develop more slowly, cost more money, and are characterised by a longer time lags between research activities and results. The quotes below neatly highlight how academics feel that collaborative research activities take longer than working independently:

"it is 100 times more rewarding but it will take longer, it will probably cost more money, I think there's no doubt about it. But the end product is probably better" –

Academic 9

"I think time's the main issue. To develop interdisciplinary relationships takes longer than more siloed interactions" – Academic 2

Despite collaborative work having this inherent need for additional time, the current environment is intently focused on the business-related outcomes and where *"it's usually the business driving the timeframes on these projects"* (Project Delivery 1). With Government directing funding primarily towards these industry-focused timeframes there may be an imbalance created between the stakeholders within the Quadruple Helix. This imbalance may lead to academics being encouraged in to activities which are resource-intensive, with a high degree of pressure to deliver outcomes for others but which provide limited short to medium term personal rewards. Thus, there is a risk that academics may begin to feel like second-class citizens in comparison to other stakeholders and that in order

to work with industry they need to bend to its will, and its timeframes. Or as one participant stated:

“the assumption of academics is that government wants academics to bend over and do whatever industry wants” – Academic 7

4.1.1.3 Tension felt

This feeling of being perceived or treated as an unequal stakeholder runs counter to the premise of a properly functioning Quadruple Helix at the micro-level. If the Government appears to be prioritising the needs of industry and society, and the creation of “added value” (Carr et al., 2018 p. 40) over the needs of the academic community a feeling is thus created that due consideration of what would be beneficial to them is missing:

“it’s important for me as an academic researcher to be able to have things that give me an advantage in terms of my research ... I don’t want to waste my time working on something that a company’s then going to say, ‘oh we’re not interested in that’” – Academic 3

“particularly for an early career person, we’ve got to make sure they’re not wasting their time. They have to get something productive from this.” – Academic 7

As the quotes above demonstrate the time sensitivities and the pressure to be productive are at the heart of this tension. These pressures are driven by the fact that the mechanisms in place are often designed and targeted around the needs, challenges and timeframes of industry rather than those of academics. Thus, the view that academics are second-class citizens within the Quadruple Helix is reinforced:

“the Governmental strategy; where it seems almost any engagement with industry is beneficial for an academic ... we have to remember that ... academics primary job is to teach and to do research” – Academic 9

This last quote highlights how despite being encouraged, through macro-level drivers, towards collaborative working there is a perception that it remains an additional or

secondary activity (D'Este and Perkmann, 2011; Philpott et al., 2011). This discernment is increased by the impression that collaborative activity remains at the behest of individual staff rather than through any deliberate or focused institutional policy:

“I don't know that they put in place, strategically, the infrastructure to allow us to do that. We have to do that ourselves” – Academic 2.

“in saying that there's a bit of an underestimation by University management ... of how difficult, and the effort that's involved on behalf of staff who do interdisciplinary work” – Academic 4

This perceived lack of understanding of the additional time and effort associated with this way of working creates an impression that collaborative working can hamper career progression. This is an issue that is explored in greater detail in Section 4.1.3. If funding designed to encourage academics to collaborate continues to prioritise the needs of other stakeholders and collaborative working continues to be perceived as being outside of an academics' primary role, and not worthy of promotion, there will continue to be a tension between the time invested in the activity and the reward received. Ultimately, if academics continue to work in more complex and time-consuming ways where the needs of others are driving the activity, and the benefit felt in return is limited, this tension will remain.

Nevertheless, there remained a desire to engage and work more closely with industry and a recognition of the benefits this way of working can bring. Equally there was an understanding that engaging with external partners is an important element of obtaining funding for research and achieving impact. However, enthusiasm is tempered by this tension and the way in which academics approach collaborative relationships with a high degree of caution and pragmatism. The ways in which academics attempt to overcome this, and look to maximise the benefits of collaborations with external partners are explored in Section 4.2.

4.1.2 Academic value of long-term collaborations v Short-term project timescales

Enacting change on the scale required in order to deliver against the objectives of clean and sustainable growth requires long-term objectives and a stability of approach, a commitment to collaborations and a move away from short-term, unstable policies (Muchmore et al., 2015). It also requires a certain degree of academic freedom to explore, take risks, push the boundaries or as one participant put it:

“Walk off the edge, go and have a look around and come back and then report what we see. Probably the most of it’s useless but the whole point of walking off the edge is that there are also hints about how to move forward” – Academic 1

This opportunity or desire to “look around” is hindered by a mismatch between the inherently long-term nature of academic research cycles and the challenges of working within shorter-term project timescales. As one participant stated; *“I’m afraid a lot of what we’re now doing is becoming very short-termist; one project to the next.”* (Academic 6). Within the context of CGE this mismatch is manifested through individual project targets that have to be realised within the short-term and the stop-start delivery approach it has to enact. Thus, creating an environment at the micro-level potentially at odds with the required conditions to deliver clean and sustainable growth. The following sub-section explores the value and benefits of long-term collaborations, the implications of short-term project lifecycles and the tension this creates at the micro-level.

4.1.2.1 Academic value of long-term collaborations

Throughout this study the value that academics and project delivery staff placed on long-term relationships was strongly expressed. Benefits varied from providing the opportunity to adopt a longer-term outlook, in terms of the impact of the work undertaken, through to an acknowledgment of how long-term partnerships delivered increased benefit to all involved. All participants were keen to work with industry on a regular and consistent basis with the overwhelming feeling that, as one participant stressed:

“what we should do is aim to get academics regularly working with industries ... if we’re going to work with partners it should be on a long-term basis” – Academic 7

Working with partners over a prolonged period allows the development of familiarity, confidence and trust between partners. Something that Cunningham et al. (2014), Veletanlić and Sá (2018) and Ryan et al., (2018) all highlighted as being critical to successful collaborations. Initially my impression, as suggested by Bjerregaard (2009) and Muscio and Vallanti, (2014), had been that the nature of collaborative relationships was shortened due to the inherent short-termism of industry. However, this was countered by participants who highlighted that not all industry is focused on the immediate future. As one individual identified whilst there is; *“some constraint on the long-term relationship thing imposed by the SME thing ... to cast industry as this short termism thing is completely wrong”* (Academic 1). What emerged in the findings was that it is the three-year cycles that CGE operates in that imposes these time restrictions and creates a feeling of transience to these relationships. There was a strong consensus that in order for the relationships to be productive, both for the individuals involved and in terms of the ideals of clean and sustainable growth, they needed to exist far beyond these three-year timescale limitations:

“if we could have a longer relationship with these companies, you know three years Even our longest projects, three years isn’t that long” - Project Delivery 2

“It would be great if there were elements of CGE that weren’t about three years as the turnaround time, but it was about fostering some long-term thing. Why would it be great? Well ... (it’s) the only way that we find things that are just not obvious” – Academic 1

Working in longer time frames would provide the opportunity to, as the quote above highlights, reveal insights that are not immediately obvious. It would also allow an increased level of consistency and a more secure, less transient, approach to these collaborative relationships, and one that becomes *“easier for you just at a personal level because you can go and talk to them”* (Academic 4). This familiarity provides the platform through which

individuals can maintain and build relationships with external partners enabling them to extend their research in to new, industry focussed and contextual settings:

“you have those ideas under the surface but if someone comes in and says, well actually here’s a way of constraining it... it helps to solidify some of those wacky ideas” - Academic 4

4.1.2.2 The challenge of short-term project timescales

Realising the benefits discussed above needs partnerships to be built on a high degree of mutual engagement and a continuity of approach far exceeding what is currently available, as highlighted below:

“our mindsets are in boxes of project one, like literally archived in a box. Project two, put all your energy into that ... if we didn’t have these timeframes in our head which is sort of day to day what we’re driven by I think, we’d look up a bit more and think ... it’s difficult to think too long term.” - Project Delivery Team 1

These enforced timeframes create a sense of immediacy and a feeling of brevity not only to the availability of funding opportunities but also to the collaborative relationships built upon this funding. As a result, projects or interactions between academics and industry can become characterised as *“rather piecemeal ... a collection of individual projects not working together”* (Academic 6). This ‘piecemeal’ approach is a direct result of the significant peaks and troughs in activity and opportunity. Thus, the timing of the interaction between the academic and the business has a higher degree of influence on the establishment of a collaborative relationship than the potential strength or otherwise of each collaboration. This is primarily due to the fact that as some participants put it:

“we’re always working in three and a half year windows the three-year projects have to start at the start, that’s a real problem for us” – Project Delivery 2.

“you don’t meet the right businesses straightaway ... longer funding means we can make sure we speak to the right businesses that will benefit the most from funding

instead of perhaps the businesses we happen to speak to because you've only got two months to find 20 PhDs" – Project Delivery 1

With funding playing a key role as a '*simmelian tie*' between partners (Cunningham et al., 2017 p.139); facilitating and encouraging collaborations between academia and industry its time sensitive and unpredictable nature has several potential ramifications:

1. It instigates collaboration for collaboration's sake with businesses who are there because "*there's less risk ... the money's there, you've got it to spend*" – Academic 2
2. It creates a pressure to demonstrate success in the short-term rather than giving due consideration to the longer-term impact and implications of the work undertaken. Thus, creating a focus on short-term project delivery metrics within fixed reporting windows rather than the 'real' value that can be gleaned from the project.

4.1.2.3 Tension felt

As highlighted above the availability of funding and the associated targets and outputs are a key enabler and catalyst for stimulating collaborative activity. However, they also create a need for immediate action and a pressure act to the timescales dictated by the availability of funding rather than when is most appropriate for those involved. Resultantly, there is a risk that the unstable and time limited nature of the current funding environment creates collaboration for collaborations sake with companies that are '*seduced*' by funding opportunities (Rybnicek and Königsgruber, 2018 p.235). Whilst these companies may approach the collaboration with the best of intentions they may, as one participant highlighted, be; "*just not in the right place to be collaborating with academia in a basis that is mutually beneficial*" (Academic 7). This is particularly pertinent where, as is the case with CGE, the funding available only exists in the short term and does not necessarily provide the opportunity to build trust between partners. This short-term availability of opportunity can create a pressure to collaborate now due to the fact that:

“the money’s here, you’ve got it to spend. If CGE wasn’t there and you’re trying to do the same thing you’d be more wary, CGE lessens that risk and you just get on with it”
- Academic 2.

Thus, there is a risk of establishing a cyclical process where collaborative partnerships come and go with significant amounts of time spent on trying to develop relationships and interactions characterised by; *“conversations that go back and forth and ultimately lead nowhere, which as you know is actually probably the majority of the engagements”* (Academic 7). This quote links back to the tension discussed in Section 4.1.1.3 in which academics feel a pressure to be productive. This need for productivity contrasts against the feeling that time spent with industry comes with limited guarantees of success. Many academics do appear to manage this tension by having a highly pragmatic approach to this challenge. Taking a view that some relationships will progress and some will disappear and some collaborations will succeed and some will fail. Appearing to accept that there is an inevitability to this natural drop off and that this is a price worth paying for the benefits that those relationships that do succeed can deliver:

“you kind of have to be happy (with relationships ending), that is the nature of wherever research has been funded from ... there’s always a company coming along that’ll keep me interested ... it’s not like I’m pinning all of my hopes on one relationship or anything like that” – Academic 3

On the other hand, there were some academics who appeared to struggle to find this degree of pragmatism highlighting their concern around the amount of time spent on these activities and the potential limited return on this investment of time; *“funding bids take time, collaborative research takes time, if they’re unsuccessful you have no safety net”* (Academic 10). In these instances, it is easy to see how an academics willingness to invest significant time and effort in to developing these relationships may be undermined by a lack of productivity or individual benefit (Plewa et al., 2013b). This potential outcome and the ways in which academics attempt to mitigate against this is explored in greater detail throughout Sections 4.2 and 4.3.

4.1.3 Long-term career progression v Short-term reactionary approach to funding and industry collaboration

As highlighted above the current mechanisms through which University- Industry collaboration is facilitated potentially creates a cyclical and reactionary environment for academics to work in. CGE sits within this wider, contextual environment by operating in stop-start, three-year cycles often with funding gaps in between. This lack of continuity and consistency of funding can create a challenge for academics looking to adopt a planned and strategic approach to their career progression. The following sub-section will explore how an academics' desire to progress their career, which favours a more traditional, siloed approach, contrasts with the need for collaborative working to increase their chances of success in a competitive and reactionary funding environment.

4.1.3.1 Career progression

For many academics the primary driver is to be *“promoted up through the academic ranks, to eventually reach Professor”* (Academic 2). There is evidence that a collaborative approach to research has been given greater eminence at Lancaster University through the addition of an 'Engagement Pathway' to the promotion's framework. This has created a sense, amongst non-academic staff that: *“the view that multi-disciplinarity harms career progression is an outdated one”* (Project Delivery 4). However, a perception remains amongst the academic community that promotion is far more likely to be achieved by taking a more traditional, disciplinary approach, namely; obtaining funding and publishing.

“research is about funding and publications ... the things that will get people promoted are funding and publications” – Academic 7

The quote above highlights how academics continue to feel that in order to progress in their careers they have to be bringing in money and producing research papers that are of a level and quality that would justify a promotion. This objective could be in direct conflict to working with an industrial partner particularly where as one participant identified *“they don't want anything to be in the public domain so how do I get something that's of value for a promotion application when I'm not allowed to talk about it?”* (Academic 2). If the

perception remains that collaborative working can act in direct conflict with meeting promotional objectives then academics will inevitably be inclined to continue working in silos. This way they can prove their autonomy within their field of expertise, enhance their capacity to bring in funding to support their research activity, publish, and ultimately progress towards Professorship:

“they (academics) all want to get their own promotions and they’ve got departmental profiles or discipline profiles that they’ve got to meet in terms of their funding and their publications” – Academic 2

Throughout the findings it emerged that it is funding, rather than opportunities for career progression per se, that is the key enabler and motivator for working with external partners. As one participant highlighted; *“when I’m engaged with the company now, I’m not really interested in publications. I’m interested in funding because that’s how you get people to do things”* (Academic 7). With funding ultimately driving collaborative work there is an associated need for academics to adopt a much more reactive and opportunistic approach. Primarily due to the fact that, as some participants identified, funding is becoming increasingly volatile, time sensitive and; *“so incredibly competitive ... when you look at the sheer numbers of people bidding”* (Academic 6).

4.1.3.2 A reactionary approach

Collaborations develop and emerge in a *“piecemeal”* and reactionary fashion, driven by the inconsistent and competitive nature of funding and the short-term focus on business needs and economic growth targets. As a result, academics oftentimes have to work in a reactionary way, responding to opportunity as and when it arises:

“you can’t plan for getting certain things. You’re always having to respond to opportunity and sometimes the opportunities you get aren’t necessarily-, you think well I really would have liked that other project but we didn’t get that one, because that would have actually been strategically the thing that would have, you think, advanced what we were thinking” – Academic 3

Consequently, those academics who do work collaboratively with industry find it more difficult to take a long-term or strategic approach to their career progression. As one participant stated; *“I’m not convinced that my long-term vision will be the same next week ... a lot of work is quite reactionary”* (Academic 4). This reactionary approach also has implications on the way academics approach their work. Whereby, in spite of the intentions and desires of those involved the priority oftentimes comes, first and foremost, to ensuring that the funding objectives are met. This reduces their opportunity, and inclination, to look to the long-term as *“to do the long-term stuff there has to be quite speculative things.”* (Academic 1). This long-term approach is something which funded collaboration with industry doesn’t necessarily encourage. If academics become more focused on the immediacy of obtaining funding and delivering against the associated short-term metrics then the very people who should be looking to the longer-term, exploring speculative ideas and opportunities, risk becoming inherently more focused on the short-term:

I think it’s harder often to get the time to think about the longer-term bigger picture ... when you actually start thinking on a longer-term version, that’s actually sometimes quite difficult to-, that requires a lot of time” – Academic 4

“I don’t know if I think beyond (the first project) ... I always want to establish relationships with companies who would then, there would be something in the future as well.” – Academic 3

4.1.3.3 Tension felt

Those academics who regularly collaborate with industry appear to be torn between two differing objectives. On the one hand remaining in a siloed research environment, reliably meeting departmental profiles and following a more straightforward and assured approach to gaining promotion. On the other working collaboratively and in a way which they are more comfortable with and believe will deliver better results. The latter comes with an associated risk of being more reactionary in approach and ultimately missing out on opportunities for promotion:

“there’s a bit sort of a conflict in myself in that I’m, my previous background is an industrial background ... I like them (projects) to be industry linked anything we do as much as possible, so which I do enjoy. I feel more at home almost sometimes with that” – Academic 3

“I probably think more that way, like a company does, you know; I need something by then not in 12 months or 3 years down the line. A literature review is not going to be of any value to me as a company” – Academic 2

A tension emerges as academics invest increasing amounts of time on activities that more aligned to industry need but that jar against the traditional routes to promotion. Whilst these individuals feel that; *‘the end product is probably better’* (Academic 9) there is no guarantee of success and therefore a greater degree of risk is associated with this approach. A feeling of vulnerability is created and a concern on the implications should their efforts prove to be unproductive; *“funding bids take time, collaborative research takes time, if they’re unsuccessful you have no safety net”* (Academic 10).

The way in which academics manage this tension and the actions they put in place in order to stay true to their industry facing ideals whilst attempting to progress their careers is explored in detail in Section 4.2.

4.2 Workarounds

So far, I have focused on the specific tensions that are inherent in working collaboratively with external partners and across academic disciplines to deliver clean and sustainable growth. The following section will begin to explore the ways in which individuals attempt to overcome these tensions, something I have labelled as ‘workarounds’, as defined earlier in Section 4. Essentially, these individuals are attempting to manage the tensions discussed above and ensure that the benefit felt, in return for the time spent on these relationships, is maximised. In simple terms they do this by:

1. finding ways to create new collaborative relationships and maximise future funding opportunities by building a large network of external partners; and
2. managing these relationships so that, as much as is possible, they are established for the long-term and that benefit is reciprocated for the academic.

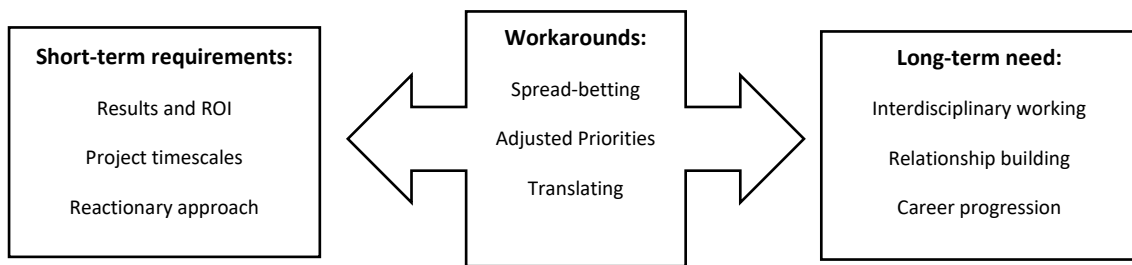


Figure 7: Conflict between the short-term and the long-term

Figure 7 demonstrates how the contrast between the short-term requirements and longer-term needs creates a fine line along which individuals have to navigate. Putting in specific workarounds in order to find the middle ground and make it work for them.

4.2.1 Spread betting

As highlighted throughout Section 4 academics are under increasing pressure to work with an ever-widening range of external and internal partners, across multiple agendas and in spheres potentially outside of their normal ways of working. In order to minimise a potential over-reliance on a small number of external relationships, and improve their ability to respond to funding opportunities, academics look to develop a large network of external partners to turn to when responding to opportunities and funding calls:

“it allows that kind of more strategic partnering for when things arise ... it makes life easier for you just at a personal level because you can go and talk to them” –

Academic 9.

This requires an ability to combine both the development of exploratory, early-stage relationships and the maintenance of a ready-made list of contacts to turn to as and when opportunities present themselves (Bjerregaard, 2010). This is not an easy process given the time pressures and sensitivities discussed previously. Equally some participants acknowledged that it is relatively common for relationships with external partners to fall away. Thus, creating a feeling of transience to many of these relationships whereby:

“I think you kind of have to be (happy with relationships dropping off), that is the nature of wherever research has been funded from” – Academic 5

Resultantly, it appears that many academics take a pragmatic approach to working with external partners recognising that there is a natural and inevitable drop off of relationships. This pragmatic approach exists in initial meetings, which they approach with a heavy dose of realism; *“I tend not to get my hopes up too much ... I’ve been in lots of meetings ... where it doesn’t work”* (Academic 4). Through to occasions where more established relationships come to a natural conclusion for any number of reasons *“there are many, tens of company projects more over the last 17 years where they’ve just dropped off”* (Academic 2). The potential transience of these relationships means that academics are keen to develop multiple collaborative relationships in order to avoid becoming overly reliant on a small number of partners. Developing and managing these relationships is potentially a significant challenge for many academics, particularly those who are at earlier stages of their careers:

“I imagine it could be quite tough for junior academics and those that haven’t got many external links when they need them... ...If they haven’t got that, when they do develop a relationship with a company that’s their world just falling in, isn’t it, instantly. But we can just turn to something else.” – Academic 2

The acknowledgement and understanding that many of these relationships will not last in to the long-term does somewhat undermine the development of a trusting relationship in the first place. Something Perkmann and Walsh (2007) and Vick and Robertson (2017) identified as the key ingredient to a successful collaboration. My findings demonstrate that academics

spend a lot of time and give due consideration to how they test, establish and develop relationships, in order to try and maximise the number of relationships that do progress on to become these sought-after long-term interactions:

“People wouldn’t necessarily do that when they get married. Look, I’ve just met you on a Saturday night and marry you on Monday morning so you’re trying to get to know each other through whatever mechanisms you can. Dating in that context and doing small projects in the other context.” – Academic 2

“it’s also just testing the water for the relationship as well ... and a lot of that’s about trust” – Academic 4

“understanding on what they will do for us in the way they engage with us ... share information, that sort of thing. So that’s what I’m always looking for in a first meeting.” – Academic 9

The subtext of the above being a sense of academics looking for indications as to how the relationship may develop. Adopting ways to, explicitly or implicitly, test the relationship prior to committing to any significant or longer-term collaboration. This is an approach laden with a high degree of pragmatism and a general attitude that; *“there will be projects that do lead to great things, there will be projects where okay we tried, didn’t work”* (Academic 5). Ultimately by acknowledging the need to work with a wide network of external partners to account for those relationships that don’t work one academic found, to me, the perfect simile by comparing it to spread betting:

“it’s sort of like stocks and shares. It’s all like spread betting in a way ... the point is, I guess, you’ve spread your risk portfolio ... you have the chance that almost certainly some of these are ... going to get very good returns” – Academic 4

By engaging, testing the water, and working with a wide range of partners they are attempting to guarantee that at least some of these relationships will develop in to something that is long-term, fruitful and mutually beneficial. This approach is an effective way of removing an overreliance on a small number of external partners, especially when

considering the potential transience of these relationships. However, by allocating significant time and enthusiasm to managing relationships with a wide range of partners there are implications on other areas of academic responsibility. As well as on an individual's opportunity to progress their career, as highlighted in Section 4.1.3.1. The impact, implications and consequences of 'spread-betting' are discussed in Section 4.3.

4.2.2 – Adjusting priorities

With a wide range of activities to undertake and pressures to deal with it is unsurprising that academics look to vary their priorities depending on the type of activity that they're undertaking and the partners they're working with. As Bjerregaard (2009) highlighted this requires an ability to adopt different strategies according to each situation. It would appear that when engaging in collaborative activities academics tend to prioritise the needs of their partner rather than their own self-interests:

“when I get involved in these conversations it's because I want to do something that has an impact with the company” – Academic 7

“With industry, just making sure that they deliver on what we promised ... that is the best really, and if you come up with positive answers that they can take forward” – Academic 8

This approach is perhaps driven by the industry centric nature of funding and the helical imbalance this has created, as discussed in Section 4.1.1. This predisposition to prioritise the needs of partners over their own seemed to be more prevalent amongst those participants who were in earlier stages of their careers. Senior academics appeared far more likely to adjust their priorities in different ways. Focusing more on how to extract benefit from these interactions, primarily by using them to access funding, and generally having a more relaxed approach to other factors such as impact:

“I think it would depend how junior you are as an academic ... as a kind of senior academic I'm just aware that if you worry about impact you'll be worrying all the time because you never know when it's going to arrive” – Academic 7

This adds to discussions, led by Perkmann et al. (2011), around how collaboration with external partners appears to follow the Matthews Effect. Whereby success is reinforced through a virtuous cycle of achievement, or as one academic put it; *“if things are going well, they (industry) can reward you with more and more and more”* (Academic 8). Perhaps it comes down to a perceived need amongst early-career academics to prove themselves by focusing on building their networks and ‘social capital’ with a wide range of external partners (Steinmo, 2015 p. 597). Given that industry typically work to shorter timescales than academia this requires an adjusted approach. This different approach comes with a risk of hindering their immediate career prospects for two reasons. First, as one participant highlighted *“with industry you have to play the longer game”* (Academic 3). This patience comes with no guarantee of success with participants identifying that when working with industry there is no point setting specific aims or objectives. Primarily due to the unpredictable nature of the interactions as there’s; *“no point in trying to set targets ... you don’t know what the impact’s going to be”* (Academic 7). Second, promotion mechanisms continue to primarily reward academics for their ability to publish, obtain grant funding for research, and teach. This creates an opportunity cost for academics who want to be more entrepreneurial (Miller et al., 2016a). It would appear that this opportunity cost is created by a time limitation, whereby any decision is a balance between the benefit it will deliver and the time they can commit to it. The lack of time that academics can afford to attribute to collaborative working was highlighted numerous times:

“relationships are hard in that respect because ... workloads are always over 100% ... institutionally it’s a bit of an issue” – Academic 2.

“But to get involved ... you need to have plenty of free time to do that and in universities you don’t get that” – Academic 8

This need to adjust their priorities is a way of trying to balance the actions that will directly enhance their opportunities for career progression and their interest in collaborating with external partners. One participant who had collaborated with industry throughout their academic career, considered this as:

“the compromise you’ve got to make. That’s why I’m not Professor yet.” - Academic 2

Perhaps it is simply that career progression isn’t something that academics are thinking of when they enter in to these relationships or perhaps they are prioritising their collaborative ideals over any short-term personal gains. Whatever the reason it appears that this is a compromise academics currently have to make.

The impact, implications and consequences of prioritising the needs of others over their own self-interest are discussed in Section 4.3.

4.2.3 Translating

In order to make collaborations work academics’ look to adjust what they say and how they say it depending on the particular stakeholder they’re communicating with. In the case of industrial partners it is widely noted within the literature that academics need to, first and foremost, overcome the cultural differences that exist (Bjerregard, 2010; Rybnicek and Königgruber, 2018; Veletanlic and Sa, 2019). In order to do this academics’ need to become adept at adjusting and adapting how they speak to different stakeholders whilst at the same time regulating their expectations of what they will get out of these interactions. Ultimately becoming, as one participant stated; *“skilled at translating”* (Academic 5). This is particularly the case in early stage discussions as they seek to establish and manage expectations:

“what you need to do is have conversations earlier about the next phase. Which is difficult because you’re talking about progressing something that you haven’t yet done” – Academic 7

This process of translation between the academic world and the industry world is a notoriously fine line to tread. To ensure that collaborative relationships are established for the long-term academics need to talk in a language and timescale that industry can understand. At the same time translating the industry focused problem in to terms that

academia can grasp by; *“being able to talk ... in currencies that it (the University) understands”* (Project Delivery 2) and in timescales that the world of academia can accommodate:

“It’s difficult because the sort of timescales as an academic. You’ve got these kind of like, well it’s a one year MSc research, it’s a three year PhD, it’s a three year post-doc, so there’s a sort of a lifecycle” – Academic 3

This is a difficult task and one compounded by the fact that oftentimes whilst companies are very keen to collaborate; *“when they turn up there’s actually no, either no collaboration or they don’t know what they want”* (Academic 2). This makes it very difficult for academics to understand what the nature of the problem actually is, something which is a key part of the process, as initially identified in Section 4.1.1. Consequently, a feeling exists that what is missing is an effort of reciprocal translation on behalf of the industrial partner and an overreliance on the academics’ ability to translate and therefore manage the relationship:

“keeping those relationships alive it can’t just be on the academic partner” – Academic 2

“If Company X were more proactive and were able to grow more dynamically, then yes I think I would spot that opportunity and say, let’s have a deeper relationship and maybe we can help them ... if maybe it was a different company it might have gone differently” – Academic 6.

This seeming reliance on the academic to manage the relationship further highlights the helical imbalance that has been discussed throughout. As a consequence, this lack of reciprocation seemed to create some reticence towards collaborating with industry amongst several of the participants:

“academics are continually asked to do something that’s fit for purpose for industry. But then industry never tells us what they want ... so a lot of academics find it very difficult to collaborate with industry on that basis” – Academic 7

The long-term implications of this imbalance in the relational responsibility and the reticence towards collaboration it engenders is explored further in section 4.3.

4.2.4 A sense of responsibility

The responses from all participants, across both the academic and delivery staff demonstrated a sense of responsibility to deliver for the benefit of all parties. I was left with the impression that the workarounds individuals put in place are underpinned by an attempt to ensure that all partners involved get what they need out of the collaboration. Whether that's a PhD or MSc-R for the researcher, a business improvement or new product and service for the industry partner and piece of high quality and impactful research for the individual academic and the University. The pressure that balancing all of these conflicting demands creates was neatly surmised by one participant:

“they’re the questions that sometimes keep you awake at night. What the hell, I’ve got to get everybody happy” – Academic 2.

To ensure that collaboration with external partners becomes an attractive career option for academics, despite its inherent challenges, there needs to be steps made to increase the individual benefit they feel from these activities. There also needs to be a move away from academics having to balance the multiple, conflicting demands on their time, as well as the constant re-prioritising and adjusting in order to protect their own self-interest and progress their careers. By creating a supportive environment Gibson and Birkenshaw (2004) believe Universities can empower academics to make their own informed judgements as to how they allocate their time and meet these various conflicting demands. This would facilitate a move away from a reliance on the actions of individuals, primarily motivated by a sense of responsibility, to deliver collaborative activity.

4.3 Unintended consequence

As has been noted throughout this Section collaborative working is critical to delivering against the objectives of clean and sustainable growth. It is more complex, costly, and time-consuming than working in a single discipline, and comes with an expectation to deliver a return on investment in shorter time periods. This dichotomy between the need for a long-term approach and the short-term requirements creates a number of tensions felt in academics everyday lives, as discussed in Section 4.1. To manage these tensions academics' adopt several workarounds, as highlighted in Section 4.2. These workarounds are put in place to develop a large network of external partners and to maintain and manage these relationships in a way that will deliver something that is valuable and beneficial to themselves and the other actors within the Quadruple Helix. Those academics who don't successfully adopt these workarounds may develop a perception that the time and effort invested does not deliver sufficient individual benefit in return. A risk then emerges that their enthusiasm and appetite for collaborative work will reduce as they progress through their careers. The following sections explores this scenario in more detail.

4.3.1 A pressure to say 'Yes'

There is an incentive for academics, primarily driven by a competitive funding environment, to explore and develop partnerships with a large number of organisations. As a result, academics oftentimes find it difficult to say no to potential external partners when offered an opportunity to collaborate:

“with the funding pressures at the moment ... everyone's looking for money and so it's a natural inclination to say yes to anyone that contacts you about a project” –

Academic 6

This natural inclination can lead to a significant amount of time spent interacting with these organisations and exploring possible collaborations. These interactions are often characterised by discussions where; *“it's not really been clear what they've kind of wanted”* (Academic 7) and *“meetings ... where it doesn't work”* (Academic 4). With funding designed

to be attractive to industry in an effort to stimulate these collaborations there is a risk that industry is 'seduced' (Rybnicek and Königsgruber, 2018 p. 235) by the potential scientific touch of working with an academic. Something Banal- Estañol et al. (2013) labelled as collaboration for collaboration's sake. Oftentimes, these organisations come in to the partnership unprepared and unable to collaborate on a project in a way that resonates with academics and with an attitude that:

"the funding is there, let's tap in to it. Coming back to the Company X thing; spend someone else's money before you spend your own" – Academic 2.

As identified in Section 4.2 the workarounds individuals put in place mean that they spend a significant amount of time collaborating with a wide variety of partners and prioritising the needs of these partners over their own. Expending time and effort translating between academia and industry and back again. It is, perhaps, only natural that a reticence towards collaboration may develop if they feel that personal benefit, especially in the form of opportunities for career progression, isn't being realised. Particularly when there is a lack of clarity provided by industry and the motivation for working with the academic has been generated by the availability of funding rather than any intrinsic desire to engage with academia:

"it's really important for an academic's career and for their productivity that they do something that is mutually beneficial. And I think that sometimes is, it may seem obvious but I think sometimes that's lost in the strategy, the governmental strategy where it seems almost that any engagement with industry is beneficial for an academic" – Academic 7

4.3.2 Limited career progression opportunities

Prior to one interview a participant cited their frustrations around a recently rejected promotion application. Despite the aforementioned addition of an Engagement Pathway within the Universities promotion framework they felt that the high level of collaborative working they'd undertaken hadn't been given due consideration. They felt that this was primarily due to a lack of understanding of the additional time and effort required for this way of working. The participant thought that it had been a hindrance to their promotion

application and thus their immediate and longer-term career progression. They left with the distinct impression that if they'd worked solely within their own discipline they would have had a greater chance of promotion. As a direct result they went on to secure a role at another University. This perception was not a one-off with other participants identifying that, particularly for early career academics, it is critical that the additional time and effort spent proves to be productive. Otherwise there is a risk that the scenario highlighted above is exacerbated as academics struggle to benefit out of these relationships, ultimately failing to progress in their careers; *"the evidence I see at Lancaster is ... many colleagues that are trapped in the junior academic rank"* (Academic 2).

This isn't a scenario unique to Lancaster University. Lyall (2019 p.43) characterised those who worked collaboratively as; "struggling to succeed in their careers with universities often relying on the good will of their staff in order to 'muddle through'. Equally O'Kane et al. (2015a) found that if academics were unable to appropriately balance research exploration and research exploitation activities there may be reduced effort levels due to a frustration at stagnating career paths. Consequently, there is a significant challenge for those academics who can't navigate the tensions highlighted or successfully adopt the workarounds discussed to find a compromise that works for them. These individuals are at risk of spending a large amount of time on collaborative relationships that are transactional and transient in nature and don't develop in to the long-term collaborations that deliver real benefit to all involved. If this additional effort doesn't prove to be productive for them they could develop a reduced level of enthusiasm and appetite for collaboration with external partners. As demonstrated in the quotes and Figure 8 below:

"there are certain staff you can't persuade them to even talk to companies, and to be fair it's because their track record has been unproductive – Academic 7

"this is a horrible generalisation but I would suggest that the majority of academics that I've come across in Lancaster, and I exclude myself from that group in this respect, they tend to turn their noses up at industry. They're more interested in publications than impact." – Academic 6

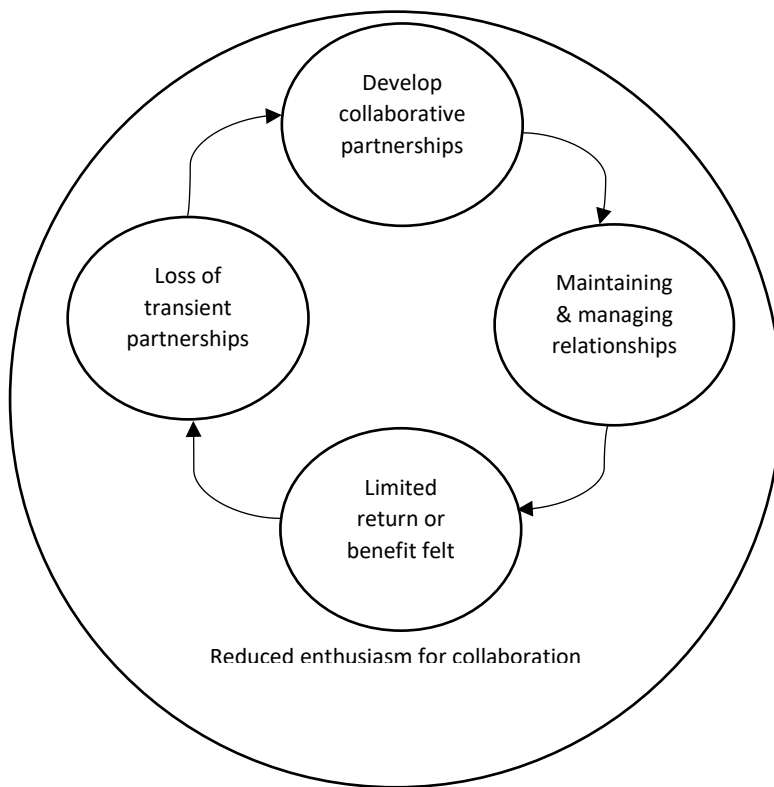


Figure 8: Enthusiasm for collaboration

With achieving clean and sustainable growth being reliant on multi and inter-disciplinary partnerships flourishing in the long-term, avoiding a scenario whereby collaborative relationships are both transient and transactional is critical. Otherwise the real benefit that can be found from long-term partnerships founded on trust and mutual respect may be missed. With a shorter-term approach at risk of making academics become inherently more short-termist in their outlook and approach. As has been established within the literature and through this study, the macro and meso level drivers are key in supporting academics to engage with external partners in a meaningful and productive way. Section 5 builds on the findings described above to provide process recommendations at the meso (University) level which would help academics navigate some of these tensions.

4.4 My contribution to the literature

The following section will concentrate on identifying and consolidating the contributions this study has made towards the literature. The literature that already exists exploring University and industry collaborations at the micro-level, has focused on topics such as; the causes of tensions (Cunningham et al., 2014; Alexander et al., 2020; Miller et al., 2018b), the barriers to collaboration (Plewa et al., 2013b; Rybnicek and Konigsgruber, 2019), and measures of success (Veletanlic and Sa, 2018). There is also some exploration of the implications of collaboration on career progression and the time pressures individuals face (Muchmore, 2015; Lyall, 2019b). Yet there is insufficient insight in to how tensions and challenges are felt in the everyday lives of academics and in to the actions they put in place to try and overcome them. This is evidenced through numerous calls to address the scant attention which has been given to individuals within University-Industry collaborations and the micro-level interactions playing out under the Quadruple Helix of Innovation framework (Bjerregaard, 2009; Philpott et al., 2011; Rajalo and Vadi, 2017; Cunningham et al., 2018; Miller 2018b; Cunningham and Menter, 2020). This study addresses these calls by identifying some of the tensions and challenges felt by individuals and linking them to the actions they put in place to try and overcome them. Additionally, the study identifies a potential unintended consequence that could emerge if this is not addressed.

By focusing my attention on one particular setting this study is grounded in the context of the Centre for Global Eco-Innovation. However, the findings from this study are generalisable to other contexts for two reasons. Firstly; the context itself is representative of other, similar initiatives nationwide, and secondly; it is impossible to extricate the participants from the wider environment in which they work.

4.5.1 The dark side of funding – a helical imbalance

Numerous discussions on the role of funding focus on its role as an enabler of collaboration or a '*simmelian tie*' (Al-Tabaa and Ankrah, 2019; O'Kane, 2018; Cunningham et al., 2017). With other discussions unpicking some of the tensions created at the micro-level through the use of public funding (Bjerregaard; 2009; Cunningham et al., 2014; Miller et al., 2016a;

Lyall, 2019a; Rybnicek and Königsgruber, 2019; Veletanlic and Sa, 2019). This study has enriched the literature around the Quadruple Helix of Innovation at the micro-level by highlighting how funding, designed to facilitate and encourage collaborative activity, may in fact be creating an imbalance between stakeholders within the Quadruple Helix. With findings demonstrating that academics feel that the needs of industry are prioritised over their own. This is due to a lack of consideration as to what may be of benefit to them as individuals. This creates a feeling amongst academics that their needs are less of a priority in comparison to other stakeholders within the helix. This imbalance is creating a pressure for academics to participate in activities which are resource-intensive, have a high degree of external pressure to deliver specific outcomes for others but may deliver limited personal rewards. If this is not addressed it can, ultimately, lead to a reduced appetite and enthusiasm for collaboration.

At the same time this study has extended the literature by highlighting how collaborative relationships between University and Industry may be undermined by a feeling of transience caused by the intermittent and reactionary nature of funding. The findings within this study have highlighted that it is a relatively common occurrence for relationships with external partners to fall away, with the lack of consistency of opportunity highlighted as a key factor. This creates a feeling of impermanence to many of these relationships and a need to adopt a cyclical process in which individuals have to continuously generate and manage new relationships which then regularly fall away. This high turnover of relationships has several implications when compared to the main conditions, identified within the literature, as being critical to the success of University-industry collaborations. First; it does not allow the time needed for the development of a trusting relationship (Perkmann and Walsh, 2007; Bjerregaard, 2009a; Rybnicek and Königsgruber 2019) and mutual respect (Youtie and Shapira, 2008; Jain et al., 2009; Carr et al., 2017). Second; it does not provide the stability (Muchmore et al., 2016) or continuity of approach (Ankrah et al., 2013; Alexander et al., 2020; de Wit-de Vries et al., 2019) that these relationships must be built upon.

4.5.2 Accommodating the irreconcilable

There appears to be an irreconcilable difference between the long-term outlook required for clean and sustainable growth and the mechanisms that support collaboration between University and Industry to achieve this. University level initiatives, such as the Centre for Global Eco-Innovation, and individuals working at the interface of these collaborations go a long way in overcoming these differences. However, the process is not without its challenges as is demonstrated within the literature. There are numerous discussions on the causes of tensions at the micro-level tensions; including, a lack of consistency of funding (Cunningham et al., 2014; Rybnicek and Königsgruber, 2019), the time needed to develop good collaborative relationships (Barnes et al., 2002; Bjerregaard, 2009a; Vick and Robertson, 2017; Cunningham et al., 2018), a requirement for short-term returns on investment (O’Kane et al., 2015; Ryan et al., 2018), and limited career progression opportunities (Philpott et al., 2011 Koryakina et al., 2015; Cunningham et al., 2015; Miller et al., 2018b, Lyall, 2019a). This study has developed and enriched this literature by coalescing these challenges in to 3 overlapping, interwoven and identifiable tensions felt at the micro-level, described and discussed throughout Section 4.1.

By identifying these tensions in terms put forward by, and pertinent to, academics this study was able to identify the specific actions or practices that academics put in place to mitigate these tensions, something I have labelled as workarounds. Equally, by exploring the ways in which individual academics respond to these challenges it was possible to identify a clear and explicit link between the tensions individual academics feel and the specific actions and activities that they take to ultimately overcome these tensions. In other words; why they adopted these workarounds, what they did and how they did it, as demonstrated in Figure 9 below:

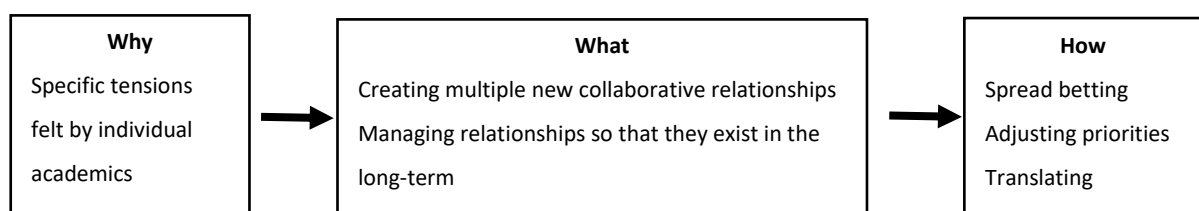


Figure 9: Demonstrates the direct link between the tensions felt by individuals undertaking collaborative activity and the actions, and specific activities they take to overcome these tensions.

This leads me on to the second key contribution of this study. Only by making these tensions, challenges and workarounds visible is it possible to identify and implement improvements. As well as literature that explores the causes of tensions, as highlighted above, there has been limited research in to the ways in which academics attempt to overcome them. This includes, for example; by developing a ready-made contacts list (Bjerregaard, 2010), considering the needs of others (Alexander et al., 2020), and attempting to overcome cultural differences that exist at the meso-level (Rybnicek and Königsgruber, 2018; Veletanlic and Sa, 2019). However, there remains a lack of empirical evidence around the tension's academics experience in their everyday lives and a need to identify what coping strategies they utilise to overcome them (Miller et al., 2018a). By developing our understanding of the implications on the everyday lives of those delivering against these objectives we are in a much better position to see how the processes and support mechanisms can be adapted and improved. If the structures and mechanisms that are in place continue to only partially support academics then the achievements are only ever going to be limited. With greater insight and understanding these adaptations and improvements can be designed to help academics better accommodate these tensions and ultimately assist them in their efforts at enacting real change and impact. Ultimately, we can identify how we can make it work more effectively.

The study has answered in part the numerous calls to expand knowledge of University-Industry collaborations at the micro-level. It has identified 3 specific tensions academics face in their everyday lives when collaborating with industry to deliver clean and sustainable growth. Furthermore, it has explored the ways academics mitigate these tensions and the potential unintended consequences of the additional effort these workarounds entail. By adding this detail and context and by enriching the existing literature it has been possible to develop University level process recommendations which may help academics to overcome

these tensions and challenges. The following section, covers these recommendations in detail.

5. Conclusion and Recommendations

The previous chapters have explored the ways in which individual academics and project delivery staff navigate the dichotomy between the need for long-term collaborations to achieve clean and sustainable growth, and the short-term approach encouraged by funding designed to facilitate collaboration with industry. The objectives of this thesis, as set out in Section 1, have been met by first, considering the challenges and tensions this dichotomy creates at the micro-level; such as, a need for immediate action and a pressure act to external timescales and the implications of collaborative working on career progression. Second, by exploring the action's individuals put in place to try and accommodate and overcome these tensions. For example; building a large network of external partners to spread the risk of relationships dropping off and ensuring that at least some exist in to the long-term delivering benefit to the academic. Third, by uncovering the unintended consequences that may occur should the additional time and effort academics expend upon these activities prove to be unproductive. Only by understanding the areas discussed above can the fourth and final objective be addressed and recommendations for improvements be made.

Accordingly, the study adopted the methodologies as presented in Chapter 3. Using semi-structured interviews allowed me to get closer to the participants and develop a more nuanced understanding of the everyday lives of academics. A subsequent process of inductive coding then allowed a series of themes to emerge from the data which answered the research question and fulfilled the studies objectives.

The study found that an irreconcilable disconnect exists between the conditions needed to deliver clean and sustainable growth; such as, multi-disciplinary working, a stability of approach and long-term collaborations, and the current milieu, characterised by inconsistent and time-limited funding opportunities, a misalignment between policies and incentives, and a focus on short-term gains. The findings of this study also demonstrated that a collaborative approach is more complex, takes longer and costs more money than working in a silo but comes laden with an expectation of short-term returns on investment.

These factors combined with the competitive nature of funding may create a natural inclination for academics, particularly those earlier in their careers, to agree to any collaborative opportunity as it emerges.

However, if academics are unable to navigate the tensions highlighted through the successful adoption of the workarounds identified then collaborative relationships may feel inequitable. Particularly for those academics who are unable to make this additional time and effort productive for themselves. A risk then emerges that they may, over time, lose interest and enthusiasm for collaborative working, struggle to progress in their careers or return to the safety of their own academic silos. As a result, true commitment and buy-in may only ever be conditional or coerced and relationships will feel transient and temporary. Given that the literature identifies that it is the individuals involved that are key to unlocking the potential of University and industry collaborations then finding ways to help them overcome this disconnect and mitigate these tensions, highlighted above and described throughout Section 4, is essential.

It is likely that Governmental funding will remain inconsistent and unpredictable, encouraging academics to work collaboratively with industry whilst prioritising industry need. Therefore, it is becoming incumbent upon the University to understand the constraints individual academics face and to provide the right supportive mechanisms, processes, incentives and the institutional culture to facilitate successful engagement with external partners and government led, funding driven initiatives. Only by highlighting the challenges and tensions felt by individual academics and identifying the workarounds they put in place to overcome them can we begin to explore opportunities for meso-level process improvements. The micro-level exploration this study has adopted enables the following section to propose a series of process and procedural amendments the University could implement in order to support academics to overcome these challenges and tensions. At the same time reducing the time and effort they have to invest in to the workarounds identified.

5.1 University level process implications – making it work at the micro-level

As stated previously it is unlikely that the macro-level conditions will change in the immediate future. Therefore, it is imperative to think about how to adapt the meso-level processes in order to mitigate against the tensions and challenges I've identified at the micro-level. Establishing a balance between the macro-level funding drivers and the meso-level processes, with a particular focus on giving academics the required time, opportunity and incentives to engage, will help to engender good collaborations which are productive for individual academics. Given that it is these individuals who can instigate and facilitate successful collaborations we need to ensure that they are mutually beneficial and, wherever possible, exist as long-term partnerships founded in trust and respect.

Throughout this study the invisible culture that exists within the University that encourages academics to remain in their disciplinary silos was highlighted. Adding an 'Engagement Pathway' in to the Promotions Framework is a significant step towards actively rewarding and fostering transdisciplinary and collaborative efforts, but this could still be further embedded in to the culture of the University. By addressing the first three objectives of this thesis in turn, as set out earlier in this section, it then becomes possible to address the final objective; identifying the supportive processes and mechanisms the University could develop to support academics in this endeavour. All of these recommendations are listed below:

1. Clearly embed collaborative activities in to the Workload model at a departmental level by allowing buy out for engagement related activities. This could be achieved by building flexibility around specific academic groupings within departments to provide the space needed to allow certain individuals to respond to opportunities as they arise in real-time.
2. Provide staff mobility opportunities by allowing individual academics to embed themselves within companies on a short-term basis. This would provide the time and space necessary for partners to develop a real understanding of each other's priorities, perspectives and constraints in the early stages of the relationship. Building the foundations of the relationship that will help to ensure it is productive

and exists in the long-term by allowing both partners to truly get to grips with the nature of the collaboration.

3. Distribute small grants, on an ongoing basis, at a departmental level to allow academics the opportunity to develop collaborative relationships. Offering individuals, the time and space to take risks in the short-term with success judged through an evidential continuation of the relationship or the progression on to further, externally funded, collaborations with the same partner(s). Doing this without risking opportunities for promotion would signal a commitment to engagement and a trust in academic intentions. Distributing these funds through a light touch faculty level arbitration would ensure that these activities aligned with strategic objectives.
4. Development of a comprehensive training and development programme designed to provide academics with the skills and expertise to become comfortable working with industry. Supporting academics in this way would help to reduce the additional time and effort they have to invest in to the workarounds highlighted throughout Section 4. This support could be further tailored to reflect departmental aims and objectives and the natural routes for collaboration relevant to different academic disciplines. However, this will only be effective if the other mechanisms, listed above, are in line with this multi-faceted approach.

These suggestions address the tensions identified and minimise the need for academics to adopt workarounds. Primarily by affording academics the time and space, something in short supply in academia, to participate but also giving them the necessary skills to make the time they do spend on these activities as productive as possible. By providing clear steps through which the University could better support academics in their collaborative endeavours the strategic co-ordination is brought in line with the on-the-ground activity. By fostering a supportive culture and acknowledging the additional time and effort required for collaborative working the associated risks, particularly in terms of time pressures and career progression, are reduced. Removing these barriers would allow a collaborative culture to develop, nurturing the individual bright spots and encouraging wider participation. If Lancaster University can take the actions highlighted above and bring the University level

policy and approach in to closer alignment with the macro-level funding drivers it could maximise the University's ability to deliver against the objectives of clean and sustainable growth. Subsequently underpinning its desire to lead the North West Coastal Arc regions collaborative activity, drive the regions clean and sustainable growth and become internationally leading in the space of eco-innovation.

5.2 Reflections and improvements

This study utilised semi-structured interviews, purposefully sampling participants from one case in order to investigate the subject of interest. The individuals chosen in the study were chosen for their levels of expertise on the subject matter but also with accessibility issues in mind. As a result, there exists a certain degree of self-selection bias in that all those interviewed actively engaged with industry through their work with the CGE. Consequently, there is no consideration of those not currently engaging with this particular research centre. The nature of the study meant that I was the single researcher collecting and analysing the data. This, combined with my wider role within the University, as detailed in Section 3.3.1, means that there is a subjective view of the data as I am intrinsically linked to the participants and the data. Thus, the potential for researcher bias undoubtedly exists. In line with the methodological literature, researcher bias has been minimised by the very awareness of this potential bias. But also, through the use of recognised coding methods, actively looking for alternative explanations for findings and discussing the study's findings with my supervisors. However, despite these efforts, bias may still exist. Whilst this is something that could not have been mitigated against any further it remains a limitation of the study.

The research that has been undertaken for this thesis has highlighted a number of topics on which further research would be beneficial but could not be covered in the timescales and resource available to this study:

1. Greater attention could be afforded to factors such as age, career stage, gender and academic discipline. With particular attention given to how this influences an individual's inclination to adopt the workarounds identified.

2. An exploration of how these findings impact upon other individuals, particularly those employed to facilitate and support these activities, across the wider University. Considering the implications at this wider level, whilst remaining at the micro-level, would help to develop a more thorough understanding of why certain tensions and challenges arise. By completing this picture, it may be possible to limit the risk of the same scenarios occurring repeatedly, thus helping to ensure they are anticipated and handled before they emerge.
3. Future studies could explore the challenges and tensions that are experienced by individuals within industry when engaging with academia. This would provide further clarity and understanding on how individuals in industry engage with academia and how these relationships are instigated and developed. This additional understanding would help to further inform the approaches and processes adopted by Universities to encourage long-term collaboration.

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Appendices

Appendix 1 – Interview Schedules

Academic staff

1. Opening
 - a. Can you tell me a little bit about your background and your involvement with the Centre for Global Eco-Innovation?
 - b. What attracted you to engage with CGE generally and what attracted you to the specific project(s)? Views on clean growth more generally?
2. Outcomes:
 - a. What do you think the University is hoping to achieve through projects of this nature?
 - b. Does that differ from your own objectives? If so, how?
 - c. What do you believe is the purpose of such collaborations/ what is driving the collaboration (business growth/ environmental benefit/ research capacity of uni?)
 - d. Typically, what happens at the end of CGE collaborative projects? Could you give me an example (both +ve and –ve) of projects you’ve been involved in?
 - e. Specifically looking at your CGE project(s) what would be/ would have been a successful outcome from this project? Did you achieve this? What enabled/prevented this?
 - f. What were/are your short-term priorities and long-term goals within this CGE project?
 - i. How do you reconcile the two? What challenges does this create? How do you meet both?
 - g. Do the short-term project delivery targets impact upon your approach to building collaborations?
3. Tensions and challenges:
 - a. Could you explain how you typically go about developing long-term collaborations or partnerships (beyond the first project)
 - i. Could you give an example of when a collaboration didn’t progress? What stopped that project from being progressing?
 - ii. What would have helped you to continue this relationship?
 - iii. Why do you think some collaborations progress and others do not?
 - iv. At the start/ scoping a collaboration what are the main priorities/ what are you interested in?
 - v. Does your need to meet/prove short-term results impact on long-term opportunities?
 - b. Could you provide an example of a challenge you faced when developing a long-term relationship (beyond CGE project) and/or collaboration to deliver clean and sustainable growth?
 - i. How did you overcome this/what would have helped you to overcome this?
 - ii. What do you think are other significant challenges?
 - iii. What do you consider to be a long-term collaboration?

- c. Could you provide an example of when a long-term collaboration did develop through CGE?
 - i. If so - What enabled you to do this? Why did that specific project progress?
 - ii. If not – why not? What prevented this?
 - iii. Could you give an example of when a collaboration didn't progress as you hoped? What stopped that project from being successful?
 - iv. What would have helped you to overcome these challenges?
4. Final questions
- a. If there were no constraints, what would the 'perfect programme' look like to you?
 - i. Whom would you work with, how, how often, to what depth?
 - ii. What prevents this from happening?
 - b. Interdisciplinary projects are key to addressing these challenges. How can the University/policy drive and encourage this? Rather than having academics return to their natural silos.
 - c. To what extent do you think that there is a long-term contribution to be made from this project (CGE)?

Project Delivery Staff

1. Opening

- a. Can you tell me a little bit about your background and your involvement with the Centre for Global Eco-Innovation?
- b. What attracted you to engage with/work for CGE?

2. Student:

- a. Did the project delivery targets influence your work?
 - i. How?
 - ii. Why not?
- b. In your experience what, typically, happens at the end of a CGE funded collaborative projects? Could you give me an example (both +ve and -ve)?
- c. Did the research/work continue from your study?
 - i. Why not/why not you?
 - ii. What would have made you continue?
- d. Did many projects progress?
 - i. Why so many/few?
 - ii. Of those that did – why?
 - iii. Of those that didn't – why not?
- e. What were the main challenges in managing the relationship between academic, CGE and business?

3. Outcomes:

- a. What do you think the University is hoping to achieve through projects of this nature?
- b. Does that differ from your own objectives?
- c. What do you think are the purpose of such collaborations/ what is driving the collaboration (business growth/ environmental benefit/ research capacity of uni?)

- d. What are the main drivers that influence your approach to developing collaborations? (outputs and targets)
- e. Do you think project output targets influence who CGE works with and how we work with?
- f. Are there any other outcomes you would consider to be a success? What role do these play on the way the project runs/is structured?
- g. Why do you think CGE stimulates so many new collaborations?
- h. What are your short-term priorities and long-term goals within the work CGE does?
 - i. How do you reconcile the two? What challenges/tensions does this create? How do you meet both?

4. Final questions

- a. If there were no constraints, what would the 'perfect programme' look like?
 - i. Who would you work with, how, how often, to what depth?
 - ii. What prevents this from happening?
- b. To what extent do you think that there is a viable long-term contribution from this project (CGE)?

Follow up interviews

1. Do you think that working in a multi-disciplinary way is critical to addressing the grand challenge of clean growth?
2. Should the University be encouraging academics and researchers to spend the time on multi-disciplinary research?
 - a. How can they do this?
 - b. Have you seen this in action? What helped this to work, what stopped it working well?
3. Equally do you think funders and policy makers should be encouraging multi-disciplinary working:
 - a. Have you any experience of this? How was it done? Was it successful?
4. Do you think this will be a future direction/requirement of funding?
 - a. What are your positive experiences of multi-disciplinary working?
 - i. What made it go well?
 - b. What are your negative experiences of multi-disciplinary working
 - i. What made it go wrong?

Appendix 2 – Pre-interview Statement

Title:

Examining the underlying tensions in delivering long-term collaborations for clean and sustainable growth

Introductory statement:

The Centre for Global Eco-Innovation, subsequently referred to as CGE, is a multi-disciplinary centre, which works with every faculty within the University. CGE works with businesses across the North West utilising European Regional Development Funding to drive clean growth within the region. This is done through collaborative projects ranging from one month internships to three-year PhD's, all of which have the specified aim of developing new products and services and reducing carbon emissions.

Delivering this type of clean growth requires effective collaborations between Universities, industry, Government and Community and a long-term approach. The very process of developing effective collaborations between all of these different stakeholders is, in itself, a time consuming one. Whilst funding is an important stimulator of these collaborations these mechanisms come with limitations, in terms of duration and partner eligibility, and short-term outcomes and targets that may hinder the formation of these long-term collaborations.

The primary aim of this research project is therefore; to examine and explore these underlying tensions, which may prevent long-term collaborations from developing to deliver clean and sustainable growth.

Please note that whilst I do work for CGE I am not conducting this research project as an employee of CGE, it is not part of my role and is being treated independently.

Appendix 3 – Interview Request Email

From: King, Stephen <s.king7@lancaster.ac.uk>

Sent: 16 May 2019 20:23

To: <Participant email>

Subject: Research project

Hi <Participant>

As you may know I'm currently studying, part-time, for a Masters by Research. This email is to enquire as to your interest and availability to participate in this research project. The attached Participant Information Sheet provides all of the information you'll need to make your decision however if you have any questions please do feel free to get in touch.

Once you've read through the details please could you let me know either way.

Best wishes,
Stephen

Stephen King

Business Partnerships Officer

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Part funded by:



Appendix 4 – Participant Consent Form



Lancaster Environment Centre

CONSENT FORM

Project Title: Examining the underlying tensions of delivering long-term collaborations for clean growth and sustainable development

Name of Researcher: Stephen King

Email: s.king7@lancaster.ac.uk

Please tick each box

1. I confirm that I have read and understand the participant information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason. If I withdraw within 2 weeks of interview taking place my data will be removed.
3. I understand that any information given by me may be used in future reports, academic articles, publications or presentations by the researcher/s, but my personal information will not be included and I will not be identifiable.
4. I understand that my name/my organisation's name will not appear in any reports, articles or presentation without my consent.
5. I understand that any interviews will be audio-recorded and transcribed and that data will be protected on encrypted devices and kept secure.
6. I understand that data will be kept according to University guidelines for a minimum of 10 years after the end of the study.
7. I agree to take part in the above study.

Name of Participant

Date

Signature

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent_____

Date _____ Day/month/year

One copy of this form will be given to the participant and the original kept in the files of the researcher at Lancaster University

Appendix 5 – Participant Information Sheet



Lancaster Environment Centre

Participant information sheet

For further information about how Lancaster University processes personal data for research purposes and your data rights please visit our webpage: www.lancaster.ac.uk/research/data-protection.

I am a Masters by Research student at Lancaster University and I would like to invite you to take part in a research study about the underlying tensions involved in collaborative projects looking to deliver long-term impact in the form of clean growth and regional sustainability.

Please take time to read the following information carefully before you decide whether you wish to take part or not.

What is the study about?

Clean growth is, increasingly seen as both a response to environmental issues and a new source of economic development. Different regions are looking to position themselves as leaders in this field, as illustrated locally by the recent North West Coastal Arc's Science and Innovation Audit.

Achieving clean growth is a complex and complicated challenge requiring long-term action and collaboration between University, Industry, Government and Community. Only through these long term interactions can shared values and understanding, open communication and, most importantly, trust develop. However, funding designed to stimulate these collaborations often comes with limitations, in terms of duration and partner eligibility, and specific outcomes and targets that can create tensions and challenges thus hindering long-term collaborations.

Further understanding and appreciation of these underlying tensions, at a micro-level, will help to inform policy and practice as Lancaster University drives the North West Coastal Arcs ambition to be the leaders in clean and sustainable growth.

Why have I been invited?

I have approached you because I am trying to understand the tensions involved in, and restrictions imposed upon, efforts to develop long-term collaborations delivering clean growth and sustainable development. Given your involvement in projects funded through the Centre for Global Eco-Innovation, you have 'on-the-ground' knowledge and experience of delivering these types of collaborations. This insight would be very valuable to the study and I would be very grateful if you would agree to take part.

What will I be asked to do if I take part?

If you would like to take part it would involve participation in a semi-structured interview lasting approximately one hour. The interview will be audio recorded and held in a mutually agreed place at a time of your convenience.

What are the possible benefits from taking part?

Although I hope that the experience of taking part will be interesting for you, there may be no immediate benefits from participation. In the longer term, the research that your participation makes possible will help to inform the academic research community about how collaborative projects can deliver real long-term impact; which I hope would be of interest to you. The study may also be used to inform future projects and to provide policy recommendations.

Do I have to take part?

No, participation in this study is voluntary. You should feel free to ask for clarification or information throughout the process and it is completely up to you to decide whether you take part or not.

What if I change my mind?

You may withdraw at any point prior to, during and up to two weeks after the interview by contacting me on the details provided at the bottom of this document. After this two-week period your data may already have been anonymised and incorporated in to the analysis therefore making it impossible to remove.

Should you decide to withdraw you will not be asked for, nor will you need to give, any reason for this decision. At this point any information collected from you will then be destroyed. Before the study commences you will be asked to sign a consent form to confirm that you have received and read this information sheet and that you are willing to take part in the research.

What are the possible disadvantages and risks of taking part?

It is unlikely that there will be any major disadvantages or risks associated with taking part in this study. The only investment you will make is your time, which I expect will be approximately one hour for a semi-structured interview.

Will my data be identifiable?

After the interview only myself, the researcher conducting this study, and my supervisory team, Dr. Alexandra Gormally and Dr. Joanne Larty, will have access to the data you share with me.

There is a small risk that those who know you personally very well may be able to guess your identity from anonymised accounts. If so, the impact on you is likely to be negligible. I will take particular care over any sensitive topics that may arise during the discussions. If you feel that any aspects of the interviews are too personal or if a question makes you uncomfortable, you need not provide an answer. You can also withdraw from the process at any point.

How will my data be stored?

I will keep all personal information about you (e.g. your name and other information about you that can identify you) confidential, and will not share it with others. I will anonymise audio recordings and hard copies of any data by removing all personal information.

Your data will be stored in encrypted files, on a password-protected computer or USB drive that only my supervisory team, listed above, and myself will be able to access. Any hard copies of the data will be securely stored in a locked cabinet in my office. In accordance with University guidelines, I will keep this data securely for a minimum of ten years.

How will I use the information you have shared with me and what will happen to the results of the research study?

I will use the data you have shared solely for academic purposes. This will include; my Masters by Research thesis, journal articles and presentations of the results of my study at academic and practitioner conferences. I will also look to inform policy-makers and senior managers within the University about the findings of my study.

When writing up the findings from this study, I would like to reproduce some of the views, opinions and ideas you shared with me. When doing so I will only use anonymised quotes, recorded during our interview and whilst I will use your exact words, it will not be possible to identify you in and publication or presentation.

Who has reviewed the project?

This study has been reviewed and approved by the Faculty of Science and Technology Research Ethics Committee.

What if I have a question or concern?

If you have any queries or if you are unhappy with anything that happens concerning your participation in the study, please contact either my supervisory team or myself. Contact details provided below:

Stephen King - 07722 609832 - s.king7@lancaster.ac.uk

Dr. Alexandra Gormally - 01524 594376 - a.gormally@lancaster.ac.uk

Dr. Joanne Larty - 01524 592192 - j.larty@lancaster.ac.uk

If you have any concerns or complaints that you wish to discuss with a person who is not directly involved in the research, you can also contact:

Prof. Phil Barker - 01524 510262 - p.barker@lancaster.ac.uk

Thank you for considering your participation in this project.

Appendix 6 – Example Coding Logs

Coding Log

<p>Date: 01/10/2019</p>
<p>Today I coded:</p> <p>Interviews 2, 3, 4– 1st order coding</p> <p>Potential 1st order codes identified</p> <ul style="list-style-type: none">• Clean growth scepticism• Tripartite relationships• Delivery pressures• Collaborative working for career progression• Applicability of research for funding availability• CGE misunderstanding• University support/policy• Policy influence on long-term impact• Business influence on long-term impact• Funding for long-term impact• Funding for collaborative working• Spread betting• Clean growth scepticism v long-term impact• Continuity of relationships• University support/policy for collaborative working• Business influence on collaborative working• Collaborative working and career progression• Business type• Siloed approach• Business impact v academic impact• Multi-disciplinary impact on career progression• Project outputs and short timescales• Bigger picture• Workload pressure
<p>Improving the procedure:</p> <p>What are the problems within the study? There are far too many 1st order codes. Once all transcriptions have gone through the process of 1st coding I will look to rationalise this in to a maximum of 10 key codes. Initial thoughts on this would be to focus on grouping multiple areas in to Academic tensions (impact, career progression, collaborative working, managing tripartite relationships, business influence etc...) and then matching that up with policy drivers, University drivers, funding drivers etc...</p> <p>What are the future directions for the study? Focus on the tensions created through external factors and how they are experienced in the everyday lives of academics.</p>

Other notes:

What are the emergent patterns, categories, themes and concepts?

- It would seem that long-term collaborations are not a priority of many academics and each project/potential collaboration is viewed through the prism of how will this impact on other research areas rather than can I work with this company for x number of years.
- Funding and policy influences are driving academics to think in shorter and shorter time frames not allowing as much opportunity to look to the long-term or 'step off the edge and have a look around'.
- The challenges in maintaining a tripartite relationship between researcher, business and academic puts a huge strain on the collaborative process.
- The presence of funding attracts a particular type of business who 'spends other people's money first'. May not be the most suitable to progress on to long-term collaborations but the funding does provide a low-risk way of testing the relationship and encourages projects and collaborations that wouldn't ordinarily happen.
- There is a conflict between multi-disciplinary working and the tendency of academics to work in silos due to departmental pressures/profiles and the need for career progression.

Appendix 7 – Coding table

Sample data	Initial codes	Categorised codes	Key tensions
<i>"our mindsets are in boxes of; project one like literally archived in a box, project two put all your energy in to that"</i>	Delivery pressures/timescales	Policy influence v long-term impact	Importance of long-term relationships v Short-term project timescales
<i>"It's more people like you and I that know that benefit from it on the ground doing those things, trying to push it, then the University is 'great, that's fantastic'."</i>	Universities role		
<i>"what we should do is aim to get academics regularly working with industries ... if we're going to work with partners it should be on a long-term basis"</i>	Continuity of relationships	Funding v collaborative working	
<i>"conversations that go back and forth and ultimately lead nowhere, which as you know is actually probably the majority of the engagements"</i>			
<i>"with the funding pressures at the moment ... everyone's looking for money and so it's a natural inclination to say yes to anyone that contacts you about a project"</i>			
<i>"just not in the right place to be collaborating with academia in a basis that is mutually beneficial"</i>	Funding pressure		
<i>"the assumption of academics is that government wants academics to bend over and do whatever industry wants"</i>	Business-led collaboration	Career progression v building relationships	A reactionary approach v career progression
<i>"multi-disciplinary working in terms of working, engaging with industry partners is, I think, the more important one than interdisciplinarity between scientific disciplines."</i>			
<i>"Everything goes back to funding because it pays for people's time"</i>	Access to funding		
<i>"so incredibly competitive ... when you look at the sheer numbers of people bidding"</i>			
<i>"To develop interdisciplinary relationships takes longer than more siloed interactions"</i>	Siloed approach	Policy/funding v career progression	
<i>"there's a lot of hype ... interdisciplinarity also hurts quite a lot. It's quite painful ... I think disciplinaries should be encouraged as well, let's put it that way"</i>			

<i>"we're always working in three and a half year windows the three-year projects have to start at the start, that's a real problem for us"</i>	Short-term approach		
<i>"you can't plan for getting certain things. You're always having to respond to opportunity"</i>			
<i>"I think you kind of have to be (happy with relationships dropping off), that is the nature of wherever research has been funded from"</i>	Testing the relationship	Spread betting	Workarounds
<i>"it's also just testing the water for the relationship as well ... and a lot of that's about trust"</i>			
<i>"it's sort of like stocks and shares. It's all like spread betting in a way ... the point is, I guess, you've spread your risk portfolio"</i>	Risk		