Management Activities in Short-term Interorganisational Innovation Projects

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Abstract: Management Activities in Short-term Interorganisational Innovation Projects

Regardless of the prevailing economic conditions, firms need continuous innovation in order to provide them with a sustainable competitive advantage and also to create differentiation from competitors (Drucker, 2008). Innovation strategy can be achieved via projects (Kerzner, 2017) and project management has become a preferred method for delivering innovation (Kerzner, 2017). In practice, projects are prevalent and important for firm competitiveness and growth. However, little is known about how this works in the context of short-term interorganisational innovation projects, as much of the existing research is focused on innovation development which takes place in long-term interorganisational settings. Ahuja (2000); Schilling and Phelps, (2007); von Raesfeld, Geurts and Jansen, (2012) and de Zubielqui, Jones and Statsenko, (2016), for example, have all focused their studies on networks which organisations use to foster innovation.

This study focuses on the management activities (and their drivers and barriers), necessary for innovation development. The innovation process is explored via a conceptual framework, underpinned by an extensive review of literature on networks, projects, and innovation. It is based upon combining the principles of phased innovation development (Cooper and Kleinschmidt, 1995); and management activities proposed and discovered by Aarikka-Stenroos et al., (2017). A multiple case study research design is used to fully understand the innovation process and the specific management activities employed to create the innovations; thirty-four in-depth interviews, in six short-term interorganisational innovation projects were carried out. Additional document research and observation gave supplementary evidence to support the interview data collection process. Data analysis is thematic. The setting chosen for this research is the city of Manchester, in the North-West of England. Manchester is Europe's second largest creative, digital and media hub and the industry is growing faster in the city than anywhere else in the UK (Midas, 2015).

This research makes five contributions to extant literature on management activities, short-term interorganisational innovation projects and the innovation process: (1) The identification of the second order management activity: learning, knowledge creation & transfer and the importance of the differences observed in the management activities, particularly leveraging. (2) How the timely completion of the various innovation phases (through effective implementation of the management activities) impacts on the speed of innovation development and consequently faster market entry. (3) The lack of insurmountable barriers to the innovation process and adds nuance to our understanding through the indentifcation of interaction specific drivers and barriers. (4) How the atmosphere conditions the short-term interorganisational innovation projects; and finally (5) the updated empirical research framework.

This research informs managers about potential strategic choices that affect the speed at which innovation(s) in short-term interorganisational innovation projects are delivered. For example, to ensure innovations have momentum from the start, managers must coordinate relevant activities to facilitate early innovation development via institutional mechanisms, including idea generating events; thereby attracting early involvement from the most appropriate people to create effective short-term interorganisational innovation project teams.

Declaration

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Dedication

To my loving husband and children,

Paul, Hannah and Thomas

for your infinite understanding and support.

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1 Chapter One: Introduction

1.1 Introduction

In order to remain competitive, firms need to continually innovate (Crawford, Hobbs and Turner, 2006). Furthermore, greater competition, rapidly changing technology and customer expectations tend to make innovation more complex with less predictable outcomes (Keizer, Vos and Halman, 2005). Consequently, more than twenty years ago, Rycroft and Kash (1999) noted that projects were being used in traditional industries as well as emerging industries, such as biotechnology, to cope with the increasing complexity and challenge of innovation in production, technology and communication.

Innovation often takes place in long-term interorganisational settings such as networks. Ahuja (2000a); Schilling and Phelps, (2007); von Raesfeld, Geurts and Jansen, (2012) and de Zubielqui, Jones and Statsenko, (2016), for example, have all focused their studies on networks which organisations use to manage innovation. In contrast, there is little research on innovation in short-term interorganisational innovation projects, yet in practice these are prevalent and important for firm competitiveness and growth. Companies have realised that innovation strategy is achieved via projects (Kerzner, 2019). A project is defined as: "a unique, once-in-a-lifetime task; with a predetermined date of delivery; being subject to one or several performance goals (such as resource usage and quality); consisting of a number of complex and/or interdependent activities," (Packendorff, 1995, p. 320). Regardless of prevailing economic conditions, firms need continuous innovation in order to provide them with a sustainable competitive advantage and also to create differentiation from competitors (Drucker, 2008). Hence, project management has become the method for delivering innovation (Kerzner, 2019). Project Management is defined as: "…the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Project management is accomplished through the use of the processes such as: initiating, planning, executing, controlling and closing. The project team manages the work of the projects, and the work typically involves:

- Competing demands for: scope, time, cost, risk, quality.
- Stakeholders with differing needs and expectations.

- Identified requirements.” (Project Management Institute, 2000, p.6).

Fernez-Walch (2017, p. 23) defines an innovation project as, “…a deliberate and non-recurrent process which aims to propose and allow new offers of services to be adopted by an individual, a group of individuals or an organization (economic entity (a firm, for instance) community, network, etc.)”. Therefore, the focus of this study is on interorganisational innovation projects that comprise different companies involved in an innovation. Indeed, this research is focused on interorganisational innovation projects which are temporary in nature (therefore short-term) and formed purely for innovation creation. Hence, the unit of analysis in this research is the short-term interorganisational innovation project.

A new field of interest is emerging with respect to management activities; the activities required for the management of innovation, needed in the full innovation process from visioning to commercialisation (see Aarikka-Stenroos et al, 2017). Management activities involve an extensive range of network management theories, as covered by Möller and Halinen (2017). This includes concepts such as managerial work (Mason, Friesl and Ford, 2017); mechanisms (Perks et al., 2017), capabilities (Möller and Svahn, 2003), competences (Ritter and Gemünden, 2003), and management functions (Järvensivu and Möller, 2009). The different levels which have been suggested for management (Järvensivu and Möller, 2009; Möller and Halinen, 1999) are relevant; as there are similarities with task-level management (see Järvensivu and Möller, 2009).

Unquestionably, there is inadequate literature dedicated to the manifestations of management activities in short-term interorganisational innovation projects. The research by Aarikka-Stenroos et al., (2017) is focused on long-term interorganisational settings, as opposed to the short-term, timebound setting of a project. Furthermore, traditional project management approaches seem ill suited to short-term interorganisational innovation projects and calls have emerged for a closer integration of project management and innovation literature (Kerzner, 2019). While traditional project management focuses on structure, scope, and the goals of time, cost and quality (Haniff and Salama, 2016), innovation is a non-linear process which involves the pursuit of new ideas (through exploration and exploitation) recombining them via existing knowledge in the quest for sustained competitive advantage (Mooi and Filippov, 2010). Innovation tends to be unstructured, requiring people to think creatively, using free thinking and brainstorming (Kerzner, 2019). Hence, the innovation process used in short-term interorganisational innovation projects may require a set of management activities which differs from those used in traditional project management.

This study follows the definition of innovation provided by Baregheh, Rowley and Sambrook, (2009, p. 1334): "…the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace." Innovation can be considered to be multi-dimensional, centring on the firm, customer and the marketplace (Story, O'Malley and Hart, 2011). Garcia and Calantone (2002) highlight the substantial ambiguity regarding innovation types. The degree of innovation can be measured as a continuum from incremental to radical (Tidd, Bessant and Pavitt, 2005; Veryzer, 1998). Incremental innovations concentrate on small changes, advancing current standards within present-day market conditions, whereas radical innovations are focused on doing novel things (Story, O'Malley and Hart, 2011).

As noted, project management is the delivery mechanism for innovation (Kerzner, 2019); therefore, both projects and project management are required to convert a creative idea into reality. Traditional project management includes standardised processes to assist with planning, scheduling, controlling and, at times, risk management. As project managers implement the processes, they create the conditions under which an idea becomes reality. The traditional project management philosophy may not be appropriate for all types of innovation projects as innovations differ between sectors and firms within sectors may not all follow the same processes. The disparity appears to come from the fact that innovations have specific characteristics (Grol and Wensing, 2013), possibly necessitating different management tools. Lenfle and Loch (2010) suggested that managers must recognise the type of project that they are engaged in and oppose pressure to employ traditional project management approaches to all projects. This is emphasised by the recent call for management guidance in the area. However, currently, there is no recognised career pathway within project management for an innovation project management specialist

(Kerzner, 2019). Discussion about the future of project management was highlighted by Geraldi et al., (2008). They stressed that projects have been undertaken for more than 6,000 years and have been used to help society to develop and progress. However, they noted: "…it is clear that the (traditional) discipline of project management as we know it today is unable to cope with all issues involved in the undertaking of projects." (Geraldi et al., 2008, p. 586). Indeed, the innovation and project management research streams have developed in comparative isolation from each other (Anbari, 2005).

Consequently, as there is no overarching guidance for innovation project management, there is no specific direction regarding how to best manage short-term interorganisational innovation projects which have a radical or incremental innovation goal. The literature suggests that innovation development is far more complicated for radical than incremental innovations; necessitating the creation of new markets and the difficulties associated with new relationships and an evolving network structure. In contrast, incremental innovation implies modifications (Möller and Svahn, 2009; Sandberg and Aarikka-Stenroos, 2014). Aarikka-Stenroos et al. (2017) suggested, for example, that radical innovation requires more motivating and visioning (to overcome difficult episodes) whereas incremental innovation requires different, simpler activities as the process is, generally, less onerous. A longitudinal study has the potential to reveal the management activities throughout the process and changes that may appear between radical and incremental innovation goals.

Hence, the positioning statement of this research is the nature of short-term interorganisational innovation projects and the management activities which take place within them. It will aim to identify the management activities within short-term interorganisational innovation projects to reveal whether or not they hinder or drive successful delivery of the projects to the dissemination phase of innovation. This would support Waluszewski, Snehota and La Rocca's, (2019) call for a more developed depiction of the business world due to its ever-changing nature and nuanced characteristics.

The research aims and questions are presented next (1.2). A description of the research context, Manchester's Creative, Digital & Media Sector (MCD&MS), is then outlined (1.3).

The research motivations are then discussed (1.4). Finally, an overview of the thesis structure is presented (1.5).

Therefore, the focus is on the management activities used by the actor creating both radical and incremental innovation(s) in short-term interorganisational innovation projects. The actors include different types of organisations (companies, universities, freelancers, etc.) and also individual people within the organisations.

1.2 Research aims and questions

By observing, researching and analysing short-term interorganisational innovation projects within MCD&MS, the aim of this research is to contribute to a richer understanding of how radical and incremental innovation(s) are created by determining the pertinent management activities required in successful innovation project delivery; including the specific driver and barrier activities which appear within the management activities. Each phase of the innovation process will be investigated.

The research questions are:

- RQ1: Which management activities manifest in short-term interorganisational innovation projects?
- RQ2: What are the drivers and barriers of management activities involved in successful innovation project delivery?
- RQ3: How does the goal of innovation (radical vs. incremental) impact attempts at managing short-term interorganisational innovation projects?

The research gaps upon which these questions are based are explained in the literature review (chapter 2). To address the research aim and answer the research questions, a research framework was created, which guides the study. The concepts which underpin the framework are developed from the Aarikka-Stenroos et al. (2017) study in combination with the innovation phases (Cooper and Kleinschmidt, 1995).

In addition to theoretical motivations for carrying out this study, there are also practical motivations to elaborate on as the research can provide knowledge and information to potentially benefit and support practitioners and potentially grow the industry further. The valuable insight gained may be applied to other sectors, which, in turn, could spark further understanding of how short-term interorganisational innovation projects can be used to successfully develop innovations.

1.3 Wider Research context: Manchester's Creative, Digital & Media Sector

1.3.1 Overview of the Creative, Digital & Media sector in the UK

MCD&MS employs approximately 84,000 people in 8,000 firms, contributing £6.7bn Gross Value Added to the UK economy (MIDAS, 2015). Manchester is Europe's second largest creative, digital and media hub and the industry is growing faster in the city than anywhere else in the UK (MIDAS, 2015). Furthermore, it features in the top 10 "Large European cities of the future for economic potential" (FDi, 2018, p. 56). The North West (NW) is the most prolific area of network television programming outside London and a significant contributor to the economy. This was achieved by nurturing innovation; effective, popular, incremental and radical innovations provoke change, new ways of working and, in turn, regional economic growth. The chosen empirical setting, therefore, provides an opportunity to study short-term interorganisational innovation projects in a pertinent environment – a significant, thriving, economically, successful sector.

Jon Corner, Chief Digital Officer for Salford, discussed digital innovation and the digital economy in February 2019, highlighting the importance digital technologies bring to the local economy and its significance to the wider Greater Manchester vision. He suggested that larger companies in the NW are focused on innovation and in that aim are collaborating with smaller firms and freelancers (Telegraph, 2019). Additionally, Salford has the UK's first commercially operational 5G network across MediaCityUK and Salford Quays. MediaCityUK is a long-term development for MCD&MS, situated on a waterfront site at Salford Quays, a few minutes' drive from central Manchester. The first phase comprises 36 acres. It is anticipated that a further 200 acres will be developed in the next decade. In 2011, the BBC moved 2,500 staff to MediaCityUK and The University of Salford committed to a new higher education centre, accommodating over 1,700 students and staff. In 2012, ITV, the largest commercial television programme provider in the UK, moved its Manchester-based operation to MediaCityUK. Subsequently, over 250 companies have moved to the development, contributing to the region's 7,500+ creative, digital and media focused firms.

There is little new research which highlights the importance of MCD&MS in extant, innovation, business networks and project management literature. While books have been written about the effect television has had on contemporary life in fields including marketing, economics, public policy, political science, media, communication studies, art and art history, there is little current literature focused on the mechanisms which underpin broadcasting (Crawford, 2015) and consequently MCD&MS. Studies from over twenty years ago reviewed the UK television industry and focused on the emergence of flexible networks in the UK television industry (Barnatt and Starkey, 1994); flexible specialisation and the reconfiguration of television production (Starkey and Barnatt, 1997) and networks and hierarchies (Starkey, Barnatt and Tempest, 2000) but are not commonplace.

Broadcast technologies have adapted and evolved to address the dramatic change in viewing habits which have stemmed from the growth of internet and on-demand services in the UK. Trends include: internet protocol, networking and content delivery, a move to automated workflows, remote production, tapeless workflows, virtual reality (VR), video on demand, centralised operations and outsourced operations. Companies creating such innovations are included in this research.

The television sector is being transformed as superfast broadband and connected televisions change the way that the UK population watches television programmes. Over half of all UK households have a television connected to the internet. A third of people watch programmes on BBC iPlayer. Subscription streaming and on-demand services including Netflix and Amazon Prime Video are consumed in approximately 40% of UK households. There has been a fall in linear television viewing since 2010, with a sharp decline in 2017 with daily viewing down by 9% on average (Ofcom Media Nations report, 2018). Ofcom (2018) predicts that this may impact on public sector broadcast funding in the future. Figure 1 shows a decade of change in the UK communications sector, highlighting a remarkable shift in the ways in which people use communications networks and use media services.

Figure 1: UK communications services milestones: 2007-2018

Year	Products & Services Launched	Short-term Interorganisational Innovation Projects
2007	First Apple iPhone released; BBC iPlayer; amazon Prime	
2008	First commercially available Android smartphone; Up to 50Mb/s broadband services launched; itv Player; airbnb; Spotify; freesat; amazon kindle	
2009	First person to amass one million followers on Twitter (Ashton Kutcher); First YouTube channel to reach one million subscribers ('Fred'); YouTube; WhatsApp	
2010	National launch of fibre-to-the-cabinet broadband; iPad goes on sale in the UK; 3D; youview	
2011		
2012	4G mobile service launched in the UK by EE; Completion of digital switchover; NETFLIX; Candy Crush SAGA	
2013	Raspberry Pi is launched; chromecast	Metbot - developed and launched
2014	Netflix begins streaming content in 4k (House of Cards & Breaking Bad); 4K UHD; amazon prime video; amazon fireTV	Mediaworks - launched
2015	BBC MicroBit is launched in UK schools. Samsung virtual headsets go on sale; micro:bit; SAMSUNG VR; f LIVE	Audiolizer & CodingGame developed and launched
2016	Friends Reunited, pioneer of social networking, closes; amazon echo	Metbot - retired
2017	Sonos One (with Amazon Alexa built in) is released; Google Home	Demonland - developed and launched
2018	Share of digital radio listening exceeds 50%. 78% of adults have a smartphone; DAB+; HomePod; YouTube Premium	ARVR-Staging - developed

(based on Ofcom Media Nations Report, 2018)

The introduction of the Apple iPhone signalled the *age of the smartphone*. At the start of 2018, 78% of adults used one (Ofcom Technology Tracker, 2018). The growth of smartphone use and the introduction of 3G and 4G networks led to an uptake of UK mobile users consuming higher amounts of data, up to an average of 1.9GB per month in June 2017 (up from 1.3GB in 2016 and 0.11GB in March 2011). The launch of the BBC's iPlayer in July 2007 jumpstarted the take-up of broadcast television streaming and catch-up services. As this service and others such as Channel 4's All4 developed and matured, the connected television became mainstream. This has all been enabled by complementary technology: improved connectivity, new devices and services (Ofcom Technology Tracker, 2018).

All of these changes are reinforced by findings in a recent report on broadcast industry global trends (Devoncroft, 2018). It highlights that, for the ninth consecutive year, multi-platform content delivery was the most commercially important trend in the broadcast and media industry. Considering that global media companies seek to reach consumers across multiple devices this is unsurprising. Supporting this, further context regarding MCD&MS is now presented. To highlight the significance of the short-term interorganisational innovation projects studied, they are added to the figure, and are highlighted in purple text.

1.4 Research motivations

The researcher's first employed role after postgraduate study was with a large UK broadcaster, where she pursued a career in different divisions, for over eleven years, as a marketing practitioner. Consequently, she has observed many changes in the UK's Creative Digital & Media sector. Some of the changes were brought about by innovation and others have been directed by legislation.

Historically, the UK's Creative Digital & Media sector was heavily focused in London and the South-East of England. After the millennium, government legislation encouraged regional development in this sector. The researcher has witnessed the rapid progress of the once embryonic MCD&MS which has grown and flourished. The researcher aspired to learn more about the key factors that have underwritten this transformation; to develop an appreciation of the characteristics of the short-term interorganisational innovation projects in the sector and to identify the management activities utilised, which have helped and/or hindered-innovation development.

1.5 Thesis structure

This introductory chapter includes an outline of the background, research aims, wider research context and thesis structure. Chapter 2 presents a review of extant innovation literature, business networks, project management and management activities found in the innovation process. This includes insights from extant literature on innovation and an overview of the management activities necessary for innovation to occur. The research gaps are highlighted along with the conceptual framework that guides the research. Chapter 3 includes the rationale behind the methodological and epistemological choices made in this study, including the explanation for the qualitative methodology and multiple case research design.

The analysis and findings are presented in three chapters (4, 5 & 6) and Appendix 1: Thematic Analysis Tables (see, 10.1). Chapter 4 presents an exemplar case study of the Metbot short-term interorganisational innovation project. Chapter 5 includes the first phase of analysis for the five remaining short-term interorganisational innovation projects. This includes a detailed description of each case and the organisations and individual actors featured in the innovations. The second analysis phase for the other five cases is included in Appendix 1: Thematic Analysis Tables, providing an analytical investigation of interviews. The third phase of analysis is presented in chapter 6 which provides a systematic cross-case analysis. The characteristics of the short-term interorganisational innovation projects are presented as well as how the innovations evolved through the innovation phases. The findings are linked back to the conceptual framework. Chapter 7 discusses these findings, with respect to extant literature and answers the research questions. Chapter 8 presents the research conclusions, summarising the theoretical and managerial contributions of the research. The chapter concludes with the research limitations and recommendations for future research.

2 Chapter Two: A Review of the Literature

2.1 Introduction

This chapter therefore includes a review of extant literature focused on short-term interorganisational innovation projects, starting with an introduction to innovation (2.2). As innovation projects can occur in networks (Fernez-Walch, 2017), a review of collaborative innovation literature is included (2.3). This is followed by the drivers and barriers to innovation (2.4), then project management (2.5) and innovation project literature (2.6). The review also includes a discussion of the management activities that are present in the innovation process (2.7). Thus, the chapter provides an overview of the key factors which are core to the research and the important components comprised within them. A framework is put forward to guide the empirical discussion. Gaps in the existing literature are identified, formulating the basis upon which the research questions are conceived. Lastly, the research questions are presented (2.8).

2.2 Innovation

The seminal writings of Joseph Schumpeter in the 1920s-1930s provide the basis of innovation studies (e.g. Schumpeter, 1934). Schumpeter's ideas gained popularity in the 1960s with widespread interest among policymakers and scholars in research and development (R&D), technological change and innovation. The field formed into a distinct academic discipline in the 1980s (Mooi and Filippov, 2010) and is much debated by entrepreneurs, practitioners, and academics alike. Four core themes are noted to be at the heart of innovation: (1) generating and searching for new ideas, (2) selecting good ones, (3) implementing them and (4) capturing value from innovation (Tidd and Bessant, 2018, p. 19). Baregheh, Rowley and Sambrook (2009) underlined the lack of a clear, common, and reliable definition of innovation. For example, O'Sullivan and Dooley (2008, p. 5) see innovation as "…the process of making changes, large and small, radical and incremental, to products, processes, and services that results in the introduction of something new for the organization that adds value to customers and contributes to the knowledge store of the organization." Alternatively, it is argued that innovation generates new industries

(Branscomb and Auerswald, 2002), creates new wealth (Drucker, 2002), captures value (Tidd and Bessant, 2018) or results in commercial success (OECD, 1991). Tidd and Bessant (2018) also note that innovation is connected with firm growth. They suggest that the competitve advantage of the firm is linked with mobilising knowledge, technological skills and experience, to create engaging innovations.

Expanding on the definition of innovation (Baregheh, Rowley and Sambrook, 2009) provided in Section 1.1, there are three main parts which give resonance to the study. Firstly “multi-stage process” acknowledges that innovation development is a process. Secondly, Baregheh, Rowley and Sambrook, (2009) include organisations as the focus of innovation development as innovation can occur in settings and contexts distinct from the firm. Thirdly, transforming ideas into “new/improved products, service or processes” highlights the importance of the ways that ideas are developed into innovations. The final part notes the strategic aim of innovation, to “advance, compete and differentiate” (Baregheh, Rowley and Sambrook, 2009, p. 1334). Thus, signalling the importance of innovation to create change in different social and environmental settings.

As included in the first part of Baregheh, Rowley and Sambrook’s (2009) innovation definition, the innovation process is represented as a series of stages or phases (Cooper and Kleinschmidt, 1995). The first phase is the idea. This is followed by product development and finally commercialisation. These three phases have been described by Gassmann (2006) as overlapping, implying a more dynamic, iterative process with interwoven innovation activities (Aarikka-Stenroos, Sandberg and Lehtimäki, 2014; Coviello and Joseph, 2012; Lynn, Morone and Paulson, 1996).

The first phase of innovation comprises ideation, envisioning and decision making. This phase is focused on which concepts to follow up and the likely users (O'Connor and Rice, 2013; Reid and de Brentani, 2010). R&D phases follow-on. The intention here is to develop the product into a feasible offering. This phase includes new product development (NPD), process development and prototyping (Lynn, Morone and Paulson, 1996). The commercialisation and dissemination phase rests on the novelty of the innovation meeting the needs of a segment in the relevant market/sector; confirming the commercialisation strategy and launching the innovation (Aarikka-Stenroos, Sandberg and Lehtimäki, 2014). Ojasalo (2008, p. 53) supports the notion that NPD can be broken down into three stages: "…generating ideas, technical development and commercializing." The process of innovation, therefore, captures the events that happen between departments within the firm that enable innovation to occur.

The process of innovation management covers these phases; from the initial concept and idea generation phase through to product, process, position, or paradigm change (Bessant and Tidd, 2007) and market launch. Research into the management of innovation reveals that attitudes of both employees and senior managers has been the subject of much interest (e.g. Ahn, Minshall and Mortara, 2017, Kraiczy, Hack and Kellermanns, 2015b, Kraiczy, Hack and Kellermanns, 2015a, Antons and Piller, 2015). This is due to their impact and influence on the conduct and behaviours of the people involved in innovation development (Bohner and Dickel, 2011) in addition to firm strategies and actions (Chapman and Hewitt-Dundas, 2018). Indeed, studies have shown that senior managers who actively engage in innovation and endure risk were found to be critical when creating a climate which encourages innovation in firms where innovation is well resourced and personnel are actively encouraged to participate in innovation (Kraiczy, Hack and Kellermanns, 2015b, Ling et al., 2008, Kraiczy, Hack and Kellermanns, 2015a).

Senior managers' approaches to innovation are important determinants of successful innovation (Chapman and Hewitt-Dundas, 2018). Firstly, these include their support for innovation including; active encouragement; idea generation and; providing appropriate resources for innovation development (Felekoglu and Moultrie, 2014; Gomes et al., 2001; Green, 1995). These factors actively demonstrate to staff how critical innovation is to the firm (Cooper and Kleinschmidt, 1996; Damanpour and Schneider, 2006; Rhee, Park and Lee, 2010; Scott and Bruce, 1994) and channel staff motivation to innovate (Mumford, 2000; Yuan and Woodman, 2010). Secondly, as innovation is a risky process, senior managers' tolerance of risk is an important factor. Senior managers' desire to embrace risk reveals whether they are content to accept and encourage activities with unknown results (Gilley, Walters and Olsen, 2002; Kraiczy, Hack and Kellermanns, 2015b; Ling et al., 2008). Ultimately, senior managers' high-risk tolerance indicates to employees' that innovative behaviours are actively sought (Scott and Bruce, 1994). Thirdly, senior managers who are open to external knowledge and actively seek it can help to propel innovation forward (Nieto and Santamaría, 2007; Rodriguez, Doloreux and Shearmur, 2017).

Many innovations are technologically led and research in this area attracts a great deal of attention. Technological innovations comprise new products and processes and significant technological changes of products and processes. An innovation has been implemented if it has been introduced in the market (product innovation) (OECD, 2001). With respect to technological innovation, two central points of differentiation are highlighted. Firstly, that the innovation process encompasses the technological development jointly with the market introduction of the invention to end-users/customers via adoption and diffusion; and, secondly, that the innovation process is iterative, involving both the initial innovation and subsequent improved versions. The iterative nature of the process of innovation suggests that there are varying degrees of innovativeness, requiring a typology to describe different types of innovations. Garcia and Calantone, (2002, p. 113) believe that product innovativeness, "…is a measure of the potential discontinuity a product (process or service) can generate in the marketing and/or technological process". Innovativeness involves the firm, customer, and marketplace (Story et al, 2011).

2.2.1 Radical and incremental innovation

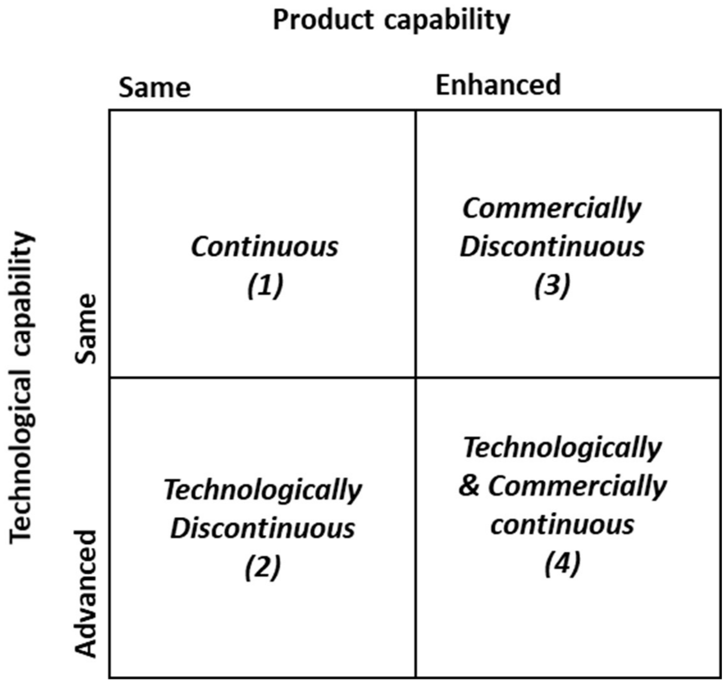
The degree of innovation can be measured along a continuum from incremental to radical (Tidd, Bessant and Pavitt, 2005; Veryzer, 1998) and is further explored below. Garcia and Calantone (2002) described incremental innovation as, "…products that provide new features, benefits, or improvements to the existing technology in the existing market." (Garcia and Calantone, 2002, p. 123) and radical innovation as: "…innovations that embody a new technology that results in a new market infrastructure." Garcia and Calantone (2002, p. 120).

However, some researchers suggest a broader set of distinctions between the different types. For example, Abetti (2000) applies the term highly radical innovation to those innovations which will make all others in their fields obsolete. Innovations in this arena tend to be based on proprietary technology, requiring significant R&D (Ojasalo, 2008). Intermediate innovation would involve a mix of NPD with proprietary technology, a combination of standard and unique or special features (Abetti, 2000). Significant incremental innovation would include a major adaptation of a product or service with the original adaptation of new technology and finally, minor incremental innovation refers to incremental enhancements to existing products, where there would be no patent protection and R&D requirement (Abetti, 2000).

Discontinuous product innovations, i.e. products which significantly depart from existing ways of doing things, are seen by Veryzer (1998, p. 306) as “radical, breakthrough, revolutionary, really new, game-changing and boundary expanding.” On occasion, these terms have been utilised interchangeably thus causing confusion (Craig and Hart, 1992; Garcia and Calantone, 2002; Veryzer, 1998). Indeed, researchers have a propensity to interchange terms when debating their findings (e.g. Rice et al., 2001; Leifer et al., 2000). The profusion of innovation typologies means that the same innovation can be categorised under different innovation typologies and also that different categorisations have been used for the same innovation (Garcia and Calantone, 2002).

Veryzer (1998) used two variables to define the degree of innovation (Figure 2): product capability and technological capability. The latter refers to the degree to which the product incorporates technological capabilities beyond existing boundaries. Discontinuous products, for example, encompass progressive capabilities which are not represented in current products and cannot be realised via extension of existing technology.

Figure 2: Types of Product Innovation



(Veryzer, 1998, p. 307)

In Figure 2, product capability refers to how the product benefits are recognised and experienced by the consumer. Four types of innovation are included. The first type (box 1) 'continuous' includes products which use existing technology and offer the same benefits as current products. While they are new, they are not especially innovative; they do not change customer experience or the way the technology is utilised.

Technologically discontinuous innovations can be considered discontinuous with regard to new technology (box 2) and/or the benefits perceived by the customer. Those products which are believed by consumers to be new, with or without the use of new technology are considered to be commercially discontinuous (box 3). Technologically and commercially discontinuous products contain important new technologies in addition to delivering significantly improved benefits (box 4) and would be seen as 'radical'. This illustrates the importance of the customer's perception in determining discontinuous (radical) innovation. Innovations can be regarded as radical or discontinuous if they denote a significant jump with regard to customer awareness and use (e.g. Bessant, 2003; Meyers and Tucker, 1989; Veryzer, 1998).

For example, an innovation can be considered radical if it (a) considerably changes how customers co-create value and (b) noticeably impacts market size, revenues, market share or prices (measure of value in exchange) (Michel, Brown and Gallan, 2008). Definitions of innovations tend to focus on different value propositions. It may be that when measured up against products and services in mainstream markets they underachieve, however, eventually they become more appealing to mainstream customer groups due to improved performance features (Abernathy and Clark, 1985; Christensen, 1997; Christensen and Raynor, 2013).

An exact definition of radical innovation remains elusive. Dahlin and Behrens (2005) suggest that the absence of a cohesive framework for defining radical innovation has diluted understanding of the role that radical innovations play in firms, industry sectors and the wider world. However, it can be argued that, largely, it relates to the technology comprised within it and customer satisfaction. Therefore, this study follows the description given by Veryzer (1998) for radical innovations which are technologically discontinuous (box 2); using highly advanced technologies but which may or may not be perceived by customers, to have dramatic change in technology. Incremental innovation attracts less debate and its manifestation is not contested; hence, Garcia and Calantone's definition (2002) regarding products that provide improvement or modification within an existing market is used.

2.3 Collaborative Innovation

It is widely accepted that firms seeking to develop both radical and incremental innovation(s) should consider interorganisational collaborations (Wang et al., 2015). Indeed, firms which collaborate externally gain advantages such as access to knowledge, lower costs of creating new knowledge and developing innovations and lower risks linked with R&D activities and innovation projects (Schilling, 2013). Evidence suggests that interorganisational collaboration can increase firms' innovation success (e.g. Faems, Van Looy and Debackere, 2005; Un, Cuervo-Cazurra and Asakawa, 2010; Powell, Koput and Smith-Doerr, 1996). Interorganisational collaboration focused on innovation and the co-creation of innovation(s), has long been a focus of business network studies (Håkansson, 1987; 1990). Araujo and Easton (1996, p. 83) emphasise the importance of innovation across organisational boundaries. Adner and Kapoor (2010) identify the drivers of increased interorganisational interdependence and network innovation, including: the continual fragmentation of traditional industries; high R&D costs; increased knowledge intensity and the globalisation of production. Tidd and Bessant (2018) proposed four principle reasons for increased levels of networking in innovation. These include: collective efficiency, collective learning, collective risk-taking and the intersection of different knowledge sets. Collective efficiency allows for access to different resources via a shared exchange process. It can be especially useful to small firms by permitting sharing of scarce or costly resources.

La Rocca and Snehota (2014) debated the benefits that networks create for innovation, especially new technology-based companies who access external resources via networks. They noted that actor relationships are the locus of knowledge, whereupon the innovation process develops and is 'enacted and produced' (La Rocca and Snehota, 2014). They also suggested that networks are critical for small technology-based firms to gain access to new knowledge and learn about novel developments. In turn this gives the firm an opportunity to co-evolve in pertinent network(s); shaping and directing the process of innovation. According to Tidd and Bessant (2018), a network is more than an aggregation of bilateral relationships or dyads. The achievements of networks are, "greater than the sum of its parts", therefore, when connected they have more worth than isolated firms (Tidd and Bessant, 2018, p. 261). The formation, goals and substance of a network may create both additional constraints and opportunities for innovation (Tidd and Bessant, 2018). Networks can also facilitate a shared learning process where partners swap experiences, allowing new insights and ideas to evolve and encourage shared experimentation (Bessant and Tsekouras, 2001). Additionally, higher levels of risk can be considered in the setting of collective activity networking. Furthermore, different relationships can develop and grow across knowledge frontiers, introducing firms to new stimuli and experiences (Bessant and Tsekouras, 2001). Other advantages of developing innovations in networks include combining knowledge, skills and physical assets as well as gaining access to knowledge spill-overs (Ahuja, 2000a), reduced uncertainty (Powell, 1998), shorter innovation development periods, gaining access to relevant markets and influencing market structure(s) (Hagedoorn, 1993).

Easton et al. (1992) and Medlin (2006, p. 858) highlighted that managing in networks assumes acknowledgement of both the individual and collective interests of the involved actors; who comprehend, appreciate, and make sense of their surroundings via their "self and collective interest in business relationships". Medlin and Törnroos (2014) noted the presence of adaptive processes which help to respond to these interests with the intention to either change or preserve the status quo. The creation and adoption of innovation requires the acceptance of extensive change in networks. A single actor is unlikely to realise the necessary change alone; therefore, the network actors must be willing to collaborate to muster both individual and joint aspirations (Paquin and Howard-Grenville, 2013).

Various forms of innovation networks have been identified, e.g., science driven networks, technology coalitions, dominant design networks, new production nets and commercialisation networks (Möller and Halinen, 2017). Within the stream of literature focused on innovation networks, studies include formal networks intentionally set up to initiate innovation. Tidd and Bessant (2018) referred to these networks as engineered innovation networks. Engineered innovation research focuses on internal project teams positioned inside firms, research groups and business associations. However, approaches to network organisation and orchestration capabilities vary between different forms of innovation networks (Möller and Svahn, 2009; Pisano and Verganti, 2008; Powell, Grodal and Fagerberg, 2006).

Birkinshaw, Bessant and Delbridge, (2007) noted that in order for firms to benefit from the opportunities that innovation networks provide, as well as mitigating risks and constraints connected with networks, they should picture relationships as a tool to increase their aptitude for radical innovation. Additionally, they recognised important barriers which prevent firms from accessing and building networks for managing radical innovation, including: locating the best partners; establishing relationships with them; and creating high performing networks. They advocated direct contact with prospective partners where the challenges associated with new partnerships are low. Where there are potential issues, they suggested bridging the gap by employing specialist support. They accentuated the importance of keeping the network engaged and committed in order to transform new relationships into high-performing networks (Birkinshaw, Bessant and Delbridge, 2007). One avenue to achieve this is through innovation projects.

2.4 Drivers and barriers to innovation

Studies which explore why firms innovate and why others do not give insight into innovation drivers and barriers. The barrier approach (Hadjimanolis, 2003; Piatier, 1984) explores factors that obstruct or hinder innovative activities (D'Este et al., 2012; Madrid-Guijarro, Garcia and Van Auken, 2009). Whereas the drivers approach investigates the foundations and sources of innovations (Cloutier, 2012; Damanpour, 1991).

2.4.1 Drivers to innovation

As innovativeness is often viewed as essential for a firm's success and survival, many scholars have explored drivers to it. Gratton (2000) asserted that the key drivers of innovation are knowledge, skills and competencies. Gubbins and Dooley (2014) proposed that to achieve successful innovation, knowledge is a key resource; requiring deep insight into the roles of network actors, a high level of understanding of the interaction effects and appreciation of network features. Additionally, progress in science and technology were identified as strong drivers (Pantano and Viassone, 2014; Parrilli and Elola, 2012), with the provision of sophisticated systems to enhance firm processes.

Extant literature has also suggested market orientation and entrepreneurial innovativeness (Boso, Cadogan and Story, 2013; Hameed, Counsell and Swift, 2012) as important drivers to innovation, whereas others have elucidated the importance of organisational characteristics (Ashurst et al., 2012; Ellonen, Wikström and Jantunen, 2009; Gunday et al., 2008; Hameed, Counsell and Swift, 2012).

Cooper (2019) focused on three groups of success drivers in NPD, outlined as follows:

- Tactical drivers which embrace the features of NPD projects and elucidate "executional best practices" such as incorporating consumer requirements, capturing all possible NPD needs, embracing a global emphasis (if relevant) and the product itself (for example, a convincing value proposition) (Cooper, 2019, p. 36).

- Business level drivers including strategic and organisational features which comprise: climate, culture, leadership and decisions regarding how the firm prepares for NPD and its innovation strategy.
- The firms' systems and methods for managing NPD including ideation processes, gating systems and Agile development.

Rose, Jones and Furneaux (2016) focussed on small and medium-sized enterprises (SMEs); their qualitative, Silicon Fen focused, study revealed that the most important innovation drivers for SME software firms were: external knowledge, leadership and team process.

Becheikh, Landry and Amara (2006) created a systematic review of empirical articles on technological innovations in the manufacturing sector (1993-2003). They sought to discover the driving forces of technological innovations and presented the results of the examined literature in two segments: (1) results concerning the internal determinants of innovation, and (2) those specific to the contextual determinants. This was developed by Dziallas and Blind (2019) with a study of the literature (between 1980-2015). Dziallas and Blind (2019) identified company-specific (innovation culture (10%), strategy (4%), organizational structure (10%), R&D input and activities (11%), competence and knowledge (9%), financial performance (7%)) and contextual dimensions (environment (5%), market (13%) and network (4%)).

Saunila (2017) studied the challenges and characteristics of innovation performance measurement in SMEs. The focus was comparable to the research by Dziallas and Blind (2019) and identified leadership practices; (Smith et al., 2008); employees' skills (Martínez-Román, Gamero and Tamayo, 2011); processes and tools for managing ideas (Martínez-Román, Gamero and Tamayo, 2011); a supportive culture (Saunila, 2014); external sources for information (Saunila, 2014; Smith et al., 2008); development of individual knowledge (Romijn and Albaladejo, 2002); employees' welfare (Saunila, 2014; Smith et al., 2008) and finally, links to strategic goals and an ability to learn from the past (Martínez-Román, Gamero and Tamayo, 2011; Saunila, 2014; Smith et al., 2008).

2.4.2 Barriers to innovation

Firms are obliged to handle challenges, impediments, complications and hurdles during the innovation process. Extant literature often refers to these as innovation barriers (D'Este et al., 2012; Madrid-Guijarro, Garcia and Van Auken, 2009). Innovation barriers may constrain or prevent innovation and therefore researchers have placed significance on identifying, categorising and understanding them (D'Este et al., 2012; Hadjimanolis, 2003).

Piatier (1984) suggested *internal* (endogenous) versus *external* (exogenous) barriers. D'Este et al., (2012) proposed *revealed* and *deterring* barriers. The EOGI barrier model (External environment, Organisation, Group and Individual) was put forward by Hueske and Guenther (2015). Hartono and Kusumawardhani (2019) contended that internal and external barriers are most commonly used in extant research. Internal barriers may be split into firms' resources and capabilities (Hewitt-Dundas, 2006); including poor finance, lack of technical know-how or management time/expertise; systems and culture (Rush and Bessant, 1992) and staff resistance to innovation (Zwick, 2002). External barriers may be split into supply, demand and environmental issues (Hadjimanolis, 1999).

D'Este et al.'s (2012, p. 482) categorisation of *revealed* barriers refers to the firms, "awareness of the difficulties involved…[with] engagement in innovation activities…", emphasising "disclosing" or "learning" from direct experience. *Deterring barriers* signified barriers, viewed by firms as "being insurmountable" (D'Este et al., 2012, p. 482), where obstacles appreciably reduce innovation activity (Mohnen and Röller, 2005).

Extant research has often concentrated on one or two barriers relevant to specific companies or within a particular industry setting (Ford, Garnsey and Probert, 2010; Lempiala, 2010). Innovation barriers are regarded by Hadjimanolis (2003) as *dynamic*. He also proposed that their significance and presence may vary and is dependent on particular firm activities. Furthermore, Hadjimanolis (2003) suggested that firms encounter nascent barriers, successively, throughout innovation development. Hölzl and Janger (2012) and Mohnen and Rosa (2002) argued that the importance of innovation barriers differs in accordance with firm size and industry connections. Viability risks, commercial failure, ambiguity connected with costs and internal issues tend to be linked with more established firms, while embryonic companies are confronted with impediments related to resource scarcity (lack of funding, expertise and knowledge) and market structure (company legitimacy) (D'Este et al., 2012; Hewitt-Dundas, 2006; Mohnen and Rosa, 2002). Sandberg and Aarikka-Stenroos (2014) suggested that certain industries appeared to be sensitive to specific barriers; linking legal complications with the telecommunications sector and banking with internal intransigence. Furthermore, companies in industries with elevated competitive and R&D pressures, perceived barriers to be strong and penetrating (Mohnen and Rosa, 2002; Savignac, 2006; Tiwari et al., 2008). Significantly, Hartono and Kusumawardhani (2019) proposed that the bearing of different industry sectors on innovation is critical; highlighting that different sectors may perceive barriers to innovation development differently.

2.5 Project management

Haniff and Salama (2016) note that projects are not routine or repetitive and are aimed at actioning specific organisational goals. Barker and Cole (2007) suggest that projects are an essential way to structure work in many firms and Winter et al., (2006) argue that they constitute one of the most significant organisational developments. Project work and its management has been extensively adopted by different firms, industry sectors and countries (Turner, Ledwith and Kelly, 2010; Winter et al., 2006).

Project management has been a recognised field for over sixty years with universally accepted methodologies, practices and guidelines, including PMBOK[1]® and PRINCE2®[2]. Pollack and Adler (2015) highlight that the discipline of project management is scattered

[1] PMBOK stands for Project Management Body of Knowledge. It comprises the entire collection of processes, best practices, terminologies, and guidelines that are accepted as standards within the project management industry. As the body of knowledge is constantly growing as practitioners discover new methods or best practices, it is regularly updated and disseminated. This work is overseen by the Project Management Institute (PMI), the global not-for-profit member association of PM professionals which captures and publishes the PMBOK within the book, *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*. The first edition of the PMBOK Guide was published in 1996.

[2] PRINCE2 is a process-based method for effective project management. It provides people with the fundamental skills needed to become a successful project manager. It stands for **PR**ojects **IN C**ontrolled **E**nvironments and is used and recognised all over the world.

and multidisciplinary with a sizable corpus of literature in both peer-reviewed and practitioner journals, as presented in numerous reviews (Pinto and Slevin, 1988; Kloppenborg and Opfer, 2002; Herroelen and Leus, 2004, 2005; Crawford, Hobbs and Turner, 2006; Kwak and Anbari, 2009). However, despite the volume and variety of project management research, due to its multidisciplinary nature, there is no cohesive theoretical basis and unified theory of project management (Smyth and Morris, 2007). Moreover, project management has an applied approach when compared to other management fields.

Managing a project typically involves outlining the project objectives of time, cost, and quality in addition to the specification of the project scope and requirements (Haniff and Salama, 2016). The role of the project manager is to manage delivery of the objectives in combination with stakeholder expectations via effective communication. Even though there has been a notable increase in organisations carrying out project work, Koskela and Howell (2002) highlight that there has been little development from the initial theoretical methodologies and models of project management, which have been dominated by a technocratic and rationalistic viewpoint (Morris, Pinto and Söderlund, 2011; Packendorff, 1995). This is referred to as traditional project management. Koskela and Howell (2002) and Sahlin-Andersson and Söderholm (2002) have all criticised traditional project management for its limitations in practice.

Traditional project management is normally seen as a series of standardised processes which entail planning, scheduling, controlling and, on some occasions, risk management. These standardised processes are grounded in strict policies and procedures which must be adhered to despite the unique characteristics of every project (Coombs and Hull, 1998). Geraldi et al. (2008) suggest that traditional project management implies conformity to authority, guidelines, procedure, and conventions. Consequently, the traditional project management discipline does not necessarily conform well to the development of innovation(s). Kerzner (2019) suggests that a certain amount of flexibility is required in the development of an innovation project because project managers need to be able to tailor the process to fit their innovation project development needs. Furthermore, he notes that this is applicable even for projects that do not necessitate innovation. Flexible project management tools including Agile and Scrum provide some innovation projects, in particular industries, with the approach they need (Cooper and Sommer, 2016).

Lenfle and Loch (2010) comment that in some industries, while traditional project management methods remain relevant, change is occurring and it is important that an appropriate approach, pertinent to the project type, is employed. Traditional project management does not differentiate between project types, tending to categorise all projects as similar (Shenhar, 2001). Coombs and Hull (1998) suggested that bespoke project management designs can be applied, depending on the needs of the innovation. However, while the traditional model of project management could be considered to be too simplistic, the various dimensions highlighted could potentially result in a vast array of custom project management styles. Coombs and Hull (1998) therefore, proposed the need to compromise between the traditional model and a tailored approach to project management.

Kwak and Anbari (2009) reported that only 11% of project management articles related to innovation. While interest in this area is persistent and growing, mainstream project management research in other areas such as strategy has dominated. Due to the importance of innovation to business success, this highlights an area that needs further research.

2.6 Innovation projects

Two research streams combine to form our understanding of innovation projects and how they relate to each other: the disciplines of innovation studies and project management. The interrelationship emerged during the 1940s and 1950s (Davies, Manning and Söderlund, 2018) as a result of the development of sizable government sponsored projects designed to create defence and aerospace systems including the Apollo moon landing projects (Morris, 1994; Hughes, 1998; Sapolsky, 1971). Factoring in time, quality, cost, and operational outcomes (Klein et al., 1962), these projects were extremely ambiguous and uncertain. Intrigued by this, Klein and Meckling (1958) outlined two models for managing these: the optimising and adaptive models (Davies, 2014; Brady, Davies and Nightingale, 2012).

The optimising model concentrates on formal processes, planning and diagnostic techniques, employed at the beginning of a project to forecast future outcomes and decide on the optimal product from a set of alternatives (Söderlund, 2011). Lenfle and Loch (2017) note that this necessitates careful and considered planning to choose relevant technologies, comprehensive project activity planning and assimilation of components in the final, chosen system. The optimising model, however, does not tackle the emerging project and the problems that may occur with the development of new technologies. When such forecasts prove incorrect, the cost of making changes can be considerable (Morris and Hough, 1987).

In contrast, the adaptive model, acknowledges that the goal of innovation is profoundly uncertain (Davies, Manning and Söderlund, 2018). As opposed to planning and adhering to strict processes, decision making in adaptive project management is guided by informal processes, intuition, instinct, and learning derived from trial and error (Hirschman, 1967). Indeed, the adaptive model highlights experimentation, testing, and evaluation of alternatives prior to selecting the most attractive solution. Rather than setting optimum performance goals, the initial project goal is adapted and changed when new information is presented (Hirschman, 1967). Lenfle and Loch (2010) suggest that in the creation of an innovation project, firm project specifications must be eschewed, allowing the opportunity to change direction or incorporate new technologies as the project develops. Hirschman (1967) suggests that it is potentially more beneficial and cost effective, in the long run, to engage with numerous ideas in parallel. Sometimes, one focused design idea can lead to major difficulties, which are not initially anticipated, ending in project failure. The adaptive model, therefore, assumes that project management is an adaptive process which allows firms to manage uncertainty (Hirschman and Lindblom, 1962).

Davies, Manning and Söderlund, (2018), suggest that these early studies identified in project management and innovation research were not constrained by the practical and theoretical differences between the fields. Neither were they restricted by professional bodies. When the fields became independent disciplines in the 1960s and 1970s, the disciplines grew apart. The creation of the Project Management Institute (PMI) enabled project management to become established as a profession and nurture project management research (Morris, 1994). The development of specific project management tools and techniques inspired both practitioners and academics to espouse a normative approach and set the foundations for the profession (see Engwall, 1995).

In contrast, innovation research was tightly allied with academic studies in organisational theory and management research (Lenfle and Loch, 2010). Additionally, there was no affiliation with a key professional body and innovation scholars did not select methods and techniques to certify 'innovation managers'. Despite this, at some level, innovation research has informed practice. A notable example, by Miles and Snow (1986, p. 62) observes that new, flexible, organisational forms developed in the 1980s, comprising a combination "of strategy, structure and management processes" to address the firm's ability to keep pace with competitors. While project management scholars embraced the optimising model as an exemplar approach, innovation researchers backed the adaptive model. Project management pursued applied frameworks and methods which could be employed across industry sectors. The optimising model was supported as the exploration for a set of tools which worked for a high volume of projects in numerous settings (PMBOK, 1996). On the other hand, the adaptive model was selected by innovation academics as they wanted to understand how organisations embrace change and adapt to changing environments (Davies, Manning and Söderlund, 2018).

Posner and Randolph (1988, p. 65) report that in practice, innovation projects were handled in a similar pattern to any other project and project managers were anticipated to, "plan, then manage the plan", innovation projects were expected to be, "…done on time, within budget, and according to the desired quality standards". However, Davies, Manning and Söderlund, (2018) suggest that project management researchers thought of innovation as a risk and a challenge necessitating management control, time and scope management, alongside dedicated scheduling and executing. Whereas innovation researchers believed projects were a suitable way to investigate, research, adapt and innovate. Project management scholars overlooked the possibilities of creativity, crisis management processes and muddling through, which innovation researchers underlined as important (Betts and Lansley, 1995; Themistocleous and Wearner, 2000; Zobel and Wearne, 2000).

Therefore, while project management and innovation studies diverged and ignored each other's respective contributions for many years, increased cross referencing and mutual appreciation has been acknowledged in more recent research (Davies, Manning and Söderlund, 2018). Pollack and Adler (2015), for example, observed that innovation is the third most popular topic in project management conferences, journals, and significantly, project management scholars depend on innovation studies literature. Additionally, Kwak and Anbari (2009) and Söderlund (2011) highlight that project management and innovation are being discussed theoretically in mainstream organisational studies and management journals. Vice versa, innovation academics are citing project management literature (Davies, Manning and Söderlund, 2018) including literature produced jointly between innovation and project management scholars (for example, Cattani et al., 2011; Lundin et al., 2015; Midler, Jullien and Lung, 2017). While there is some convergence in the literature and project management is acknowledged as the delivery mechanism for innovation (Kerzner, 2019), there is no single defined career path for innovation project managers to follow. Kerzner (2019) highlights the lack of literature which identifies the innovation competencies that project managers must possess. Consequently, there is no definitive blueprint detailing how to best manage short-term interorganisational innovation projects.

2.7 Management activities in collaborative innovation

2.7.1 Introduction to management activities

Management activities have been discussed from a number of different perspectives, including capabilities theory. Capability indicates an ability to do something and is established both by strategies and operational activities (Teece, 2014). Organisational capabilities have been defined as high-level procedures with input flows that present management with a range of possible choices for constructing important outputs (Winter, 2003). Thus, capabilities rather than management activities are given prominence. As the aim is to understand the specific management activities that are employed to develop innovations, this study, uses an activity or task perspective of managing (Järvensivu and Möller, 2009).

For example:

- Network management capability (e.g.; coordination, management capability, control capability and alliance evaluation) (Schreiner, Kale and Corsten, 2009; Smirnova et al., 2011; Walter, Auer and Ritter, 2006).
- Network integration capability (e.g.; relational skills, bonding, customer linking) (Schreiner, Kale and Corsten, 2009; Smirnova et al., 2011; Walter, Auer and Ritter, 2006).
- Network learning capability (e.g.; internal communication, partner knowledge and mechanisms) (Kale and Singh, 2007; Walter, Auer and Ritter, 2006).

Järvensivu and Möller (2009) assessed management functions by introducing a metatheoretical, contingency-based framework of interorganisational network management. They suggested that management tasks, which are founded from general management functions and linked to network characteristics, vary according to network type. An example of this is the work of Manser et al., (2016) who explored network management activities employed by firms; noting that in eleven innovation projects, different combinations of activities were undertaken to manage a network. Three modes of network management were identified: basically coordinated, control-oriented and reward-oriented (Manser et al., 2016).

Planko et al., (2017) debated how networks are managed for collective system building, with evidence from the Dutch smart grid sector regarding; the composition of the network, management structure, modes of governance, project management, trust-building structures and decision-making processes resulting in a clear understanding of effective management of systems building networks, with the aim to increase success when establishing new business fields. Aarikka-Stenroos and Ritala (2017) also examined ecosystem management in a network setting and determined that the ecosystem could be considered as a level to be managed comprising an embedded set of networks with continually evolving boundaries.

The General Theory of Network Management NetFrame put forward by Möller and Halinen (2017, p. 19) explained network management via a set of six management activities including: visioning & sensemaking; mobilising & creating constellations; goal construction & organisation; effectiveness seeking; efficiency seeking; and network maintenance. This was supported by four management principles including: basic-level contingency of management, functional-level, task-level and role-level contingencies (Järvensivu and Möller, 2009, p. 657). The basic-level focuses on the industrial and institutional socio-economic context of organising; each setting bestows different permutations for managers. The functional-level concentrates on the management functions within certain modes of governance (markets, hierarchies, or networks). Task-level explores network management tasks and role-level contingencies focuses on the different type of network management roles actors may take on (Järvensivu and Möller, 2009).

Furthermore, the management activities involved in the innovation process are highlighted by Aarikka-Stenroos et al. (2017) in their study which explores how to manage innovation processes in extensive networks. It reveals how: actor diversity may assist or obfuscate management; how the goal of innovation impacts on management activities; and during the innovation process, how agency of management changes. Using literature from the three schools of thought: IMP group, strategic networks, and innovation research, Aarikka-Stenroos et al. (2017, p. 91) identified six management activities with a priori definitions including: motivating & rewarding, resourcing, goal setting & refining, consolidating, coordinating and controlling. Aarikka-Stenroos et al. (2017) build upon the Järvensivu and Möller (2009) perspective. This involves complex activity patterns that may be intentional or emergent and strategic or operational (Håkansson and Snehota, 1995). Aarikka-Stenroos et al., (2017) built upon this viewpoint, took an activity perspective and define management activities "as a means for 'mobilization', 'orchestration', and 'involvement'," (Aarikka-Stenroos et al., 2017, p. 89). This definition is used in this study. Their research framework combined three main components: innovation process; extensive network and management activities (Aarikka-Stenroos et al., 2017). It was used as an analytical tool to explore the management activities observed in the end-to-end process of "innovating in extensive networks characterised by actor diversity for both radical and incremental innovation," (Aarikka-Stenroos et al., 2017, p. 92). Their study specifically focused on management activities relevant to the innovation process and thus, has relevance to this study.

Management activities have also been discussed in the project management literature. A key feature of project management in the innovation context is the utilisation of information communications and technology (ICT) systems (Gemünden, Lehner and Kock, 2018). Such methods support planning, controlling, coordinating and decision-making functions. Furthermore, Gemünden, Lehner and Kock, (2018) refer to resource requirements within a project; specifically, to their quality and availability. They also debated the 'iron triangle' adhered to in project performance, the agreement and adherence to budget, time, and scope deadlines (Haniff and Salama, 2016). The contemporary viewpoint is that projects can run a temporary business process and meet business goals (Turner and Zolin, 2012; Serrador and Turner, 2015). Thus, coordinating, controlling and goal setting management activities are critical to both the established and contemporary project management visions.

While it is noted that management activities are significant to innovation development and there is evidence developed in studies set in long-term interorganisational settings (Aarikka-Stenroos et al., 2017) there is a lack of research for short-term interorganisational innovation projects. Whereas traditional project management focuses on structure, scope, and the goals of time, cost and quality (Haniff and Salama, 2016), innovation is a non-linear process which involves the pursuit of new ideas (through exploration and exploitation) recombining them via existing knowledge in the quest for sustained competitive advantage (Mooi and Filippov, 2010). Innovation tends to be unstructured, requiring people to think creatively, using free thinking and brainstorming (Kerzner, 2019). Hence, the innovation process used in short-term interorganisational innovation projects may require a set of management activities which differs from those used in traditional project management and which may also differ from management activities observed in longer-term interorganisational settings.

Another factor to consider is the literature which suggests that the management activities carried out in the phases of innovation (Cooper and Kleinschmidt, 1995) are potentially different for radical and incremental innovations, as the processes involved are not the same (Aarikka-Stenroos et al., 2017). For example, radical innovation necessitates the creation of new markets; complicating new relationships and changing the structure of the network when compared to incremental innovation which requires modifications to existing networks (Möller and Svahn, 2009; Sandberg and Aarikka-Stenroos, 2014). While research exists about this in longer-term settings (Aarikka-Stenroos et al., 2017), there is insufficient research to address how the goal of innovation (radical or incremental) may influence management activities, in short-term interorganisational innovation projects. A longitudinal study could, potentially, show the management activities involved in these settings and changes that may appear between radical/incremental innovation goals.

In the sections below, a detailed discussion of management activities in the context of short-term interorganisational innovation projects is provided. Each key management activity identified in previous literature is presented separately as follows: resourcing (2.7.2), goal setting & refining (2.7.3), motivating & rewarding (2.7.4), consolidating (2.7.5), coordinating (2.7.6), controlling (2.7.7) and leveraging (2.7.8). This comprises a list of management activities developed from Aarikka-Stenroos et al. (2017), synthesised with additional works.

2.7.2 Resourcing

Resourcing includes identifying resources required for the innovation (for example, Baraldi and Strömsten, 2009; Heikkinen et al., 2007; Perks and Moxey, 2011). This may include actors who own relevant resources or actors that can develop specific resources throughout the innovation process. Resourcing must ensure the availability of resources for the involved actors, empowering them to co-innovate. As change occurs throughout the process, resourcing must be constantly reviewed to ensure that relevant resources are available (Aarikka-Stenroos et al., 2017).

Resourcing also covers combining resources (for example Baraldi and Strömsten, 2009); the management of resources as observed in the planner role described by Heikkinen et al.

(2007); resource sharing (Aarikka-Stenroos and Sandberg, 2012) and; knowledge resources observed by Perks and Moxey (2011) when gathering stakeholder knowledge resources.

Resourcing is important because the ability to combine resources and work in networks including many different actors is a source of competitive advantage (Ritter, Wilkinson and Johnston, 2004). Due to the heightened pace of innovation development and technology fragmentation, there is an increased desire for knowledge and resources in R&D activities. Indeed, Bjorvatn and Wald, (2018) note the importance of knowledge processes in innovation projects. This ties in with the observation from Hanisch et al., (2009) that in order to keep a project on time and within budget, in the latter phases of project implementation, active communication and knowledge exchange between members of the project team is imperative.

Baraldi and Strömsten (2009) discussed the importance, and complex nature, of combining resources in innovation networks. They claimed that different network actors aspired to control the utilisation of specific resources, seeking to steer the innovation process in a certain direction. They also revealed how resources are, "combined and controlled", in the network throughout the innovation process and examined how actors use control mechanisms including, "action, results and personnel controls," (Baraldi and Strömsten, 2009, p. 541). They underlined the importance that networked actors place on different resource controls when aiming to meet their objectives.

Moreover, it is important to understand how firms obtain and organise resources as SME resource shortages have been linked to innovation failure (Hewitt-Dundas, 2006). SMEs have tackled resource limitations encountered in innovation by sharing and acquiring resources with other companies (Clark, Fujimoto and Cook, 1991). Firms involved in collaborative innovation have been observed to share non-critical resources. Core resources, including technically skilled employees may be retained with the intention to steer and appraise partnering firms' development activities. However, recognising necessary resources and their precise application in product innovation is problematic (Perks and Moxey, 2011). Resources can be difficult to select if they are bundled with others and used in combination (Ray, Barney and Muhanna, 2004). Resources may be tangible,

"(…equipment, technology or software) and also intangible and tacit (such as reputation, customer insight or employee experience.)" (Perks and Moxey, 2011, p. 126).

In the commercialisation phase of innovation development, businesses may aspire to optimise relationships and combine relevant resources with the intention to safeguard the success of their innovations (Aarikka-Stenroos and Sandberg, 2012). When progressing from R&D to commercialisation activities, Aarikka-Stenroos and Sandberg (2012) suggest that the innovating firm seeks resources in order to facilitate the completion of essential stages including distribution, marketing, communication and credibility building for example. To attain such resources, the firm must exercise adjustments in network relations. Therefore, the innovating firm needs specialist competence in, "…accessing, mobilising, and organising relational resources" (Aarikka-Stenroos and Sandberg, 2012, p. 198). Thus, the literature highlights that successful resourcing in the innovation process is difficult, featuring in all phases of the innovation process. As successful resourcing in networks is linked with competitive advantage (Ritter, Wilkinson and Johnston, 2004) it is a critical management activity.

2.7.3 Goal setting & refining

Goal setting & refining includes establishing and refining stretching goals and realistic milestones for the innovation process and the involved actors (Aarikka-Stenroos et al., (2017, p. 100). Aarikka-Stenroos et al., (2017) highlight that goal refinement ensues throughout innovation development, potentially impacting on resource requirements and actor motivation. Features of goal setting include sensemaking, clear communication and refining innovation goals (for example Möller, 2010; Öberg and Shih, 2014; Aarikka-Stenroos et al., 2017). As the innovation process is complicated and unforeseen, problems occur in both incremental and radical innovation development. Goal refinement is, therefore, necessary; with more extreme modifications for radical innovations in comparison to incremental innovation development (Aarikka-Stenroos et al., 2017).

Establishing goals within the parameters of cost, time (or schedule) and quality (Boddy and Buchanan, 1992) is a fundamental part of the definition of a project. This is also known as the triple constraint or iron triangle (Haniff and Salama, 2016). While its origins are uncertain, it has been used since the 1950s. The iron triangle argues that; the quality of work is constrained by the project features of budget, deadlines and scope; the project manager can negotiate within the constraints and; changes within one constraint may demand changes within others to compensate, otherwise quality will deteriorate (Atkinson, 1999).

Van der Hoorn and Whitty (2015) evaluated the iron triangle against how practitioners actually manage projects, noting that it is one of many project management factors which strengthen academic thought but, importantly, revealed that it is not completely allied with the lived project experience. Van Wyngaard, Pretorius and Pretorius (2012, p. 1992) also intimated that "[…] project managers often create an illusion of tangible progress by relying heavily upon traditional on-time, on-budget and on-target measures", with the inference that the iron triangle is an oversimplification of practice. Research, therefore, suggests that while the iron triangle is an important principle, it does not expose the whole narrative of goal setting and consequent project success or failure. Pollack, Helm and Adler, (2018) highlighted that client and contractor satisfaction are also important measures of project success. Thus, as a didactic tool; scope, performance, requirements, and quality are potentially all switchable factors as the third point on the iron triangle, depending on the overarching goals of the project (Pollack, Helm and Adler, 2018).

Numerous reasons can drive actors to cooperate on innovation(s), including shared goals and the intention to collaborate with an aspiration to advance 'negotiation power' (Aarikka-Stenroos and Sandberg, 2012). However, commercialisation creates extensive challenges when managing networks. In fact, due to differing goals, Heikkinen et al., (2007) observed how a network focused on NPD disintegrated during the commercialisation phase. Aarikka-Stenroos and Sandberg (2012) illuminated, with case studies, how collaboration for commercialisation can differ for actors; from following long-term goals with a strategic focus, to executing tactical short-term marketing activities. Other challenges involved in the commercialisation phase of innovation stemmed from divergent individual goals, strategic relevance, and mistrust (Aarikka-Stenroos and Sandberg, 2012). Commercialisation therefore creates extensive challenges when managing innovation networks.

Greenwood et al., (2010) and Mishina, Pollock and Porac, (2002) contended that, if a proposed innovation is to be effective and pave the way to commercialisation, firms' priorities must be aligned in addition to interaction goals and aspirations for the future. Contrastingly, research from Corsaro and Snehota (2011); Lind (2012) and Wilkinson, Young and Freytag, (2005) illustrated that interaction goals may not align between firms in a network setting. As interaction decisions evolve from the complementary nature and close similarities of firm behaviours, this can be problematic. Not all firms are motivated by the same goals, network interaction can therefore result in difficulties (Wilkinson, Young and Freytag, 2005). Corsaro and Snehota (2011) argued that firms collaborating in networks may follow their company objectives and goals as opposed to those of the network, generating potential problems with network coordination.

An appreciation of divergent and convergent logic can assist network actors when aiming to realise the potential of the network(s) they are involved in; discover likely future impediments and explore possible ways to respond (Öberg and Shih, 2014). In their study, Öberg and Shih (2014, p. 420) brought together firm, "interests, priorities and interaction goals" referring to them jointly as logic (Prahalad and Bettis, 1986; Thornton, 2002; Thornton and Ocasio, 1999). Öberg and Shih (2014) highlight that an innovation is more likely to be successful if the involved firms have convergent logic, implying that their main concerns, priorities and attention are aligned.

However, alignment is not always beneficial to innovation development (Baraldi and Strömsten, 2009). Baraldi and Strömsten (2009) advocated that the innovation process is non-linear, resulting in false starts (Van de Ven et al., 1999). It can be understood, partly, by the relationship between the employed control strategies and mechanisms introduced by the network actors. In one of Baraldi and Strömsten's (2009) case studies, there was no single actor that could unilaterally control the innovation process nor realise its goals via the employed control mechanisms. As opposed to a closed system (Otley and Berry, 1980; Thrane, 2007), a few actors attempted to control network colleagues, who, at the same time, attempted to control them. The suggestion is that these episodes arise because of the contrasting goals and opinions of the involved actors and their aspirations to control resources. On occasion, these differences led to major disputes; when they are eventually resolved the innovation propels forward.

Overall, contributions to the literature on goal setting & refining are highlighted in all phases of the innovation process. There was wide consensus regarding shared goals for successful innovation (for example Greenwood et al., 2010 and Öberg and Shih, 2014). Corsaro and Snehota (2011) stated that when firms do not pursue network goals and instead focus on those of the firm; future problems are potentially generated. Issues between network actors, may potentially propel innovation forwards, once resolved (Baraldi and Strömsten, 2009).

2.7.4 Motivating & rewarding

Motivating has been defined as "identifying and providing short and long term financial or social incentives for actors involved in the innovation process to facilitate their co-innovation efforts." (Aarikka-Stenroos et al., 2017, p. 100). Furthermore, Aarikka-Stenroos et al., (2017) suggested that motivating is required right through innovation development and enables resourcing.

Öberg and Shih (2014) emphasised the existence of different motivational drivers in relation to innovations and Manser et al. (2016) highlighted the importance of rewarding and communication in innovation management. Rewarding, therefore, builds upon motivating; emphasising how the involved actors are motivated to be involved in innovation development through the attainment of rewards.

The reward-oriented networks identified by Manser et al., (2016) relate closely to motivation. Their study revealed both informal and formal rewarding, whereby informal rewarding could be a spur-of-the-moment activity including a party or bonus where there is no formal commitment, whereas formal rewarding referred to, "giving pre-defined incentives for meeting objectives," (Manser et al., 2016, p. 191). They also noted that actors involved in 'reward' oriented networks were more likely to commit to the network voluntarily and formalisation might be agreed afterwards in a contract. This was distinct from control-oriented networks where contracts would be established as a priority. Other characteristics included elevated levels of communication. This was not solely for daily activity updates, but also to articulate to actors their importance in the overall innovation goals of the network; actors were rewarded for 'doing a good job'. Hence, shared aims, team spirit and cohesion were key factors in reward-oriented networks.

Other traits in the reward-oriented networks illustrated that network partners were described as, "people that have intrinsic motivation, exercise self-control, are creative and ingenious in solving problems, and have joint goals." (Manser et al., 2016, p. 195). These characteristics were described as *mental models* providing the basis of the network mode. The reward-oriented mode revealed that the actors' dominant mental model was intrinsic to who they are, implying that it was embedded in the actors' beliefs. Commitment was also a dominant theme, via informal relationships in the network and social events that developed to 'friend-like' relationships (Şahin, 2012; Van Dyne and LePine, 1998).

Actors are also motivated by task delivery. For example, Gemünden, Lehner and Kock, (2018) suggested that project-oriented firms offer their project managers improved careers with more motivating tasks. Moreover, they utilise and exploit the knowledge of their project managers well, fitting appropriately with their abilities. Ekrot, Rank and Gemünden, (2016) explored project managers' voice behaviour. Voice behaviour signifies behaviour that contests the status quo and creates constructive changes. Their findings suggest that it is important for organisational learning to heed the voice and therefore, the advice of capable and motivated project managers. Ekrot, Kock and Gemünden, (2016) revealed that voice behaviour influences the learning of senior managers and consequently, project success.

While Aarikka-Stenroos et al's., (2017) study highlighted that motivating is vital for both radical and incremental innovation, they noted that the anticipated benefits were simpler to predict for incremental than radical innovation. Additionally, the goal of radical innovation acts as a basis of 'intrinsic motivation' (Aarikka-Stenroos et al., 2017). Furthermore, extant literature regarding motivating and rewarding has revealed differences between the development of radical and incremental innovations when compared to other management activities. Incremental innovations were thought to be managed, reasonably well, with the use of specific procedures in a top-down manner. In radical innovation however, these methods were perceived as unhelpful (McCarthy et al., 2006; Adams, Alexander and Öberg, 2014). Many studies have proven that rigid process management methods are not useful in radical innovation (Benner and Tushman, 2003; O'Connor, 2008) and therefore, employees should be given the opportunity to experiment and uncover breakthroughs without the constraints of management control (Hill and Rothaermel, 2003; McGrath, 2001; Poskela and Martinsuo, 2009). Individual actors working with radical innovation are commonly branded as independent and highly motivated and therefore well-matched to self-directed work (Assink, 2006; Kelley et al., 2011; O'Connor and DeMartino, 2006). Poskela and Martinsuo (2009) stated that often, the extraordinary levels of individual motivation are readily accepted by firms and there is little understood about how managers might influence them. Thus, highlighting an important knowledge gap.

O'Connor and McDermott (2004) identifiy the impact of diminished motivation where significant team members involved in radical innovation have left their jobs due to lack of recognition, jealousy, or frustrations from the perceived bureaucratic mindset of the firm. Other factors have hindered motivation, such as inappropriate reward systems (Burgelman, 1985; Leifer et al., 2000) and lack of acceptance of failure (Alexander and Van Knippenberg, 2014; Bessant et al., 2005). Hence, it is important to understand how managers can improve and preserve employee motivation (Kelley et al., 2011). Pihlajamaa's (2017) study showed that the management of motivation is a significant factor of the management of radical innovation as it is strongly contingent upon the efforts of individuals. The study suggested that via goal assignment and providing organisational support, managers can affect the levels of individual motivation towards radical innovation and therefore the success of specific development tasks (Pihlajamaa, 2017).

Overall, while motivating and rewarding have been discussed in the literature for many years in the setting of networks of innovation development, only recently in the studies by Aarikka-Stenroos et al., (2017) and Manser et al., (2016) has the significance of motivating in the innovation process been highlighted. Thus, emphasising an area of emerging importance and further research.

2.7.5 Consolidating

Consolidating has been referred to as: "1) building common ground, mutuality, trust, and commitment between actors involved in the innovation process, and 2) exercising democratic principles and methods that enable dialogue and cooperation." (Aarikka-Stenroos et al., 2017, p. 100). Aarikka-Stenroos et al., (2017) also suggested that consolidating is imperative during the innovation process and critical at the very start of innovation development as it is essential to encourage the involved actors to co-innovate.

As actor perceptions, within a network, about a situation can sometimes be unclear, Aarikka-Stenroos and Sandberg (2012) noted the importance of trust creation. Morgan and Hunt (1994, p. 23) defined trust as, "confidence in an exchange partner's reliability and integrity". Seppänen, Blomqvist and Sundqvist, (2007) asserted that trust has been acknowledged for its significance in successful relationships for many years. Rampersad, Quester and Troshani, (2010) advocated that trust is a significant precursor to network processes. Furthermore, trust is an important component of network success, therefore actors must take part in "trustworthy practices", including honouring promises, demonstrating forthright and open behaviours as well as integrity (Rampersad, Quester and Troshani, 2010, p. 801). Prior to this, research about trust in networks was primarily focused on organisational and individual levels of analysis (Andersen and Kumar, 2006; Doney and Cannon, 1997; Ganesan, 1994; Nooteboom, Berger and Noorderhaven, 1997; Smith and Barclay, 1997) and dyads, including firms and universities (Plewa, Quester and Baaken, 2005).

Although there are few studies focused on trust at the network level, theorists such as Cravens, Shipp and Cravens, (1994) have reasoned that trust is aligned with the success of networks. Additionally, authors contend that trust affects the coordination of networks as it is understood as a governance tool where networks experiencing higher levels of trust need less coordination and experience (Powell, 1990; Rowley, Behrens and Krackhardt, 2000; Seppänen, Blomqvist and Sundqvist, 2007). Furthermore, others have proposed that trust has a bearing on harmony as it simplifies conflict management; actors in a trusting network may waive short-sighted goals, share opinions openly and emphasise shared initiatives

(Achrol and Kotler, 1999; Powell, 1990; Rowley, Behrens and Krackhardt, 2000; Seppänen, Blomqvist and Sundqvist, 2007; Uzzi, 1996). Story, Hart and O'Malley, (2009) proposed that if firms lack shared history, they may consequently lack trust resulting in problematic innovation development. Trust may transpire when firms select associates with similar values and, when collaborating, shun opportunism and competition.

Aarikka-Stenroos and Sandberg's study (2012) highlighted that if precursors to trust are prevalent between network actors it is more likely that access to resources will be easier within the network. Past social contact which originated in R&D and other business relationships or reputational knowledge are examples of antecedents of trust (Jarillo, 1988; Larson, 1992; Partanen et al., 2008) in addition to company triumphs including accolades, awards, and references (Zott and Huy, 2007).

Dhanaraj and Parkhe (2006) suggested that as innovation networks experience uncertainty during the process of innovation, network orchestration can help to build trust and convey sanctions for the infringement of trust. Macaulay (1963) and Podolny and Stuart (1995) also noted that the innovation process involves challenges and uncertain outcomes. They highlighted that these episodes are often intensified by the worries of partner behaviour. Therefore, reputation may offer evidence and signs of trustworthiness.

As consolidating involves numerous aspects including mutuality, trust, and commitment, in addition to actor engagement in dialogue and cooperation, it is multi-layered and complex. Aarikka-Stenroos et al., (2017) noted that in radical innovation, the dynamics of collaboration and competition can be difficult. Consolidating is therefore vital to safeguard the actor's desire to co-innovate.

2.7.6 Coordinating

Coordination is described as the degree to which different actors in the network collaborate when aiming to undertake and realise an agreed set of tasks (Mohr, Fisher and Nevin, 1996; Van de Ven, 1976). It has been defined as: "…developing and communicating a task division that connects actors with innovation activities throughout the innovation process and monitoring the progress." (Aarikka-Stenroos et al., 2017, p. 100). Researchers focused on the study of networks propose that while strict controls must not govern networks, appropriate mechanisms must be in place to safeguard positive outcomes (Ojasalo, 2004; Powell, 1990; Williamson, 1991). Therefore, right through innovation development, coordinating activities are required due to goal refinement and fluctuating resource requirements (Aarikka-Stenroos et al., 2017). Aarikka-Stenroos et al., (2017) also observed that coordinating is more complicated and challenging for radical innovation than incremental innovation as it tends to comprise more goals and tasks. They went on to suggest that actors who possess or have access to relevant resources for the network must be linked via coordinating activities. Thus, establishing roles and responsibilities, communication, project governance and task division are pertinent to coordinating (Aarikka-Stenroos et al., 2017). Role theorists including Snow, Miles and Coleman, (1992) pinpointed critical network coordinator roles and Heikkinen et al., (2007) and Medlin (2006) called for further studies to ascertain how coordination impacts on other network factors and outcomes.

Roles relate to the opportunity to coordinate and mobilise networks (Möller and Halinen, 1999; Möller, Rajala and Svahn, 2005) and were acknowledged by Story, O'Malley and Hart, (2011), specifically in radical innovation development. Story, O'Malley and Hart, (2011) identified eight role functions, resulting from interactions and collaborations between network actors when developing radical innovation competencies. Similarly, to Heikkinen et al., (2007), they categorised task and network focused roles. The three network-oriented roles included: connecting, integrating and endorsing. They noted that different actors with access to specific resources needed to be connected and assimilated through coordinating. The role of connecting is critical for radical innovations as firms do not always know how to locate partners with the capabilities needed or have access to them. Additionally, the function of connecting is critical when introducing potential new partners and when nurturing existing relationships between connected actors.

Roles were also discussed by Gemünden, Lehner and Kock, (2018). They contended that the empowerment of project managers is important, noting that project managers are often given more responsibility than decision making power. The notion that project managers must work to the constraints of time, budget, and scope places restrictions on project managers' autonomy, thus limiting their power. Turner and Müller, (2004) asserted that project managers may become caretakers and coordinators, as opposed to managers, if they have restricted authority to give instructions to carry out tasks or if some team members are not working full-time on the project. Research has shown that the empowerment of project managers leads to improved project performance, especially for very innovative projects (Larson and Gobeli, 1989; Clark and Wheelwright, 1992; Patanakul et al., 2012).

Within cross-functional project teams, teamwork quality positively influences learning and innovation (Högl and Gemünden, 2001). Högl, Parboteeah and Gemünden, (2003) explored this further, noting that for highly innovative projects the connection is pronounced. This positive effect was corroborated and new characteristics including, vision and external communication were added (Hülsheger, Anderson and Salgado, 2009). Furthermore, teamwork within and between project teams was noted to have maximum influence when it occurs in the early phases of a project; as uncertainty is elevated and learning is desirable (Högl, Parboteeah and Gemünden, 2003; Högl, Weinkauf and Gemünden, 2004).

Uncertainty can be moderated with coordinating, planning, controlling, and decision-making activities and ICT systems (known to be pervasive in project management and project work) can help to facilitate them (Gemünden, Lehner and Kock, 2018). Project management software provides a central knowledge base for project documentation and information and can be used for all facets of managing, monitoring, and controlling a project. Team members can optimise processes and collaborate efficiently. One central, virtual, location is created for planning, management, and project supervision. Tasks can be coordinated and the workflow can be automated, to allow team members to receive task deadline notifications, with the aim to reduce delays. Furthermore, the software can include time tracking functionality, to identify hold-ups and problems. Communication can also be improved between project team members who may not be located within one central office, regardless of their location or time zone.

Agile development methods appropriated from the software industry are now employed in different industry sectors, supporting project coordination (Cooper and Sommer, 2016) and should be considered as part of the coordinating management activity. Agile is a process involving the management of a project by breaking it up into stages or short cycles of work (known as sprints) with regular stakeholder collaboration in addition to continuous improvement, which is, discussed at every stage (iteration). The intention is that the short cycles of work allow for rapid production and constant revision, if required. Agile methodology starts when clients outline how the final product will be used and the problems it may solve, thus clarifying customer expectations to the project team. When the work begins, the project team works through a series of coordinated planning cycles, with the intention to resolve any underlying issues to ensure that the customer needs are fully met. Informed decisions are made with full collaboration between team members and project stakeholders. Agile methods are often incorporated into an existing Stage-Gate system (Cooper and Sommer, 2016). The advantages of Agile development methods experienced in the software industry include, flexibility, efficiency, and speed (Begel and Nagappan, 2007). Cooper and Sommer (2016) noted that software development firms were the first to combine Agile with Stage-Gate, from the early 2000s (Boehm and Turner 2004; Karlström and Runeson 2005). Product manufacturers pursuing routes to accelerate their product development processes started to explore the success experienced in the software industry (Cooper and Sommer, 2016). Coordinating, therefore, is well documented and understood as a significant management activity, in extant literature, in the setting of networks of innovation development. However, it is important to identify if there are different processes identified in the coordination of the activities involved in short-term interorganisational innovation project delivery.

2.7.7 Controlling

While firms may aspire to control and manipulate others within networks, the IMP tradition notes that orchestration by one actor is not possible; control is not achievable by one actor (Håkansson and Ford, 2002; Håkansson and Johanson, 1988; Håkansson and Snehota, 1995; Ritter, Wilkinson and Johnston, 2004). The literature also highlights the importance of power distribution as a pertinent management issue (Rampersad, Quester and Troshani, 2010) and Manser et al.'s (2016) study which focused on sanctions and the utilisation of social control. A definition of controlling includes: “1) instructing, giving orders, and imposing rules, and 2) legitimizing the rules via agreements, and 3) sanctioning when needed.” (Aarikka-Stenroos et al., 2017, p. 100). In Aarikka-Stenroos et al.’s (2017) study, controlling activities were primarily observed in the R&D and dissemination phases.

Control is a network issue in addition to an interorganisational and intraorganisational concern (Håkansson, 1987; Ritter and Gemünden, 2003). The actor’s primary focus is on increasing network control and improving their position, utilising their knowledge, experience, and network relationships. Furthermore, control concerns how actors design and utilise control mechanisms with the intention to move, tactically, in the network, over time (Baraldi and Strömsten, 2009). In a network context control can, therefore, be understood as the tools and methods utilised by actors which affect their own and others’ resource use and execution of activities. Networks contain both informal and formal control systems. Actors use these to manipulate others to align with their goals and objectives.

The use of social control refers to compelling network actors to follow network, ‘norms, values or goals’ (Jones, Hesterly and Borgatti, 1997; Ouchi, 1979). Thus, outlining and underpinning the parameters of appropriate behaviour by illustrating what can occur if standards are breached. Manser et al., (2016) suggested that control-oriented networks were typified with a strong reliance on social control. In contrast with sanctioning, social control does not involve retribution, instead it uses social pressure on network actors to conform, thereby correcting behaviours of network actors after an infringement, to ensure that the undesired behaviour will not transpire again. Social control can be used to guide the behaviour of network actors in advance; to avert unwelcome behaviour and make specific network actors feel compelled to behave in the desired direction.

Manser et al., (2016) claimed that the most significant characteristics of control-oriented networks, include focus on control and the deterrence of unprincipled behaviour(s). They suggested that sanctioning performed a significant function, both informally and formally; permitting network actors to retain control over the network and lessen opportunism. Informal sanctioning was important, for example, when network actors were aware that genuine sanctions would be employed if informal agreements were not honoured. In contrast to ‘reward-oriented’ networks, the actors involved in ‘control-oriented’ networks, preferred control centred activities (Manser et al., 2016). Actors were aware that although the network actors shared the common, agreed, goals of the innovation, they also had personal interests which were likely to outweigh shared ones. They suggested that control activities created a clear-cut position, giving little room for misgivings and dishonesty (Manser et al., 2016).

Controlling is suggested to be simpler in incremental innovation as resources and tasks are easier to settle through contracting than radical innovation where resources and tasks are often evolving and emerging (Aarikka-Stenroos et al., 2017). Overall, controlling appears to play an important role in the process of innovation. Including, for example; open or closed controls (Baraldi and Strömsten, 2009); control-oriented networks where actors prefer control-centred activities (Manser et al., 2016) and the belief that control is a network issue (Håkansson, 1987; Ritter and Gemünden, 2003).

2.7.8 Leveraging

Leveraging has been described as an emergent activity: “…intentionally preparing actors in every layer of the network for the forthcoming innovation via a) coercive means such as legislation and standards and b) softer means such as changing actors' mind-set via education and creating critical mass around the novel issue.” (Aarikka-Stenroos et al., 2017, p. 100). Aarikka-Stenroos et al., (2017) suggested that leveraging is important to the development of the entire innovation and especially significant in the commercialisation and dissemination phases. Moreover, they proposed that as innovation necessitates change in the wider environment there is a requirement to stimulate change in the extensive network setting. In their research this was exhibited differently; in one case, legislation was a primary feature and in the other, lighter approaches included; changing actors’ viewpoints through training and creating new guidelines to sponsor change. Furthermore, they proposed that radical innovations required more leveraging activities to support the diverse actor network (observed in their study) and transcend impediments embedded in the existing institutions.

When leveraging knowledge-based resources, the role of contracts is relevant (Mouzas and Ford, 2012). This builds on the interactive picture of resource leveraging and specifically on knowledge-based resources (Håkansson et al., 2009). For example, firms may seek to leverage valuable resources including intellectual assets, knowhow, and expertise. This was realised via interaction with similarly minded firms; joint consent between the involved actors was frequently observed (Mouzas and Ford., 2012). Additionally, when investigating the role of leveraging resources for retail brand paints (where innovation is critical to attain differentiation and generate value), Ostendorf, Mouzas and Chakrabarti, (2014) observed that retailers and manufacturers collaborated to leverage resources, jointly developing and launching brands.

Leveraging internal resources and external business networks from a dynamic capabilities' standpoint has also been explored (Zhang and Wu, 2017). In business networks a firm's power manipulates the impact of its internal resources on its capacity to sense and seize opportunities, considered to be an important dynamic capability (Zhang and Wu, 2017). This, was observed to play an essential role when converting the benefits of leveraging resources into successful innovations.

Various studies have focused on NPD achievements and the drivers of success in NPD (Cooper, 2019). Although, these success factors were not specifically management activities and leveraging was included at a higher level (as an organisational and strategic factor for the company driving innovation); Cooper (2019) highlighted the importance of leveraging core competencies and specifically, when there is lack of synergy between NPD and the backbone of a business, NPD are more likely to fail (Cooper, 2013; Cooper, 2017a; Montoya-Weiss and Calantone, 1994; Song and Parry, 1996). This is because there is a requirement for a robust connection between the requirements to develop the NPD and the existing, "resources, competencies and experience of the firm" (Cooper, 2019, p. 41).

Thus, extant literature is predominantly focused on the role that leveraging plays in specific contexts and settings. The new context that Aarikka-Stenroos et al., (2017) set out; highlighting the importance of leveraging throughout the innovation process and its increased significance in the commercialisation and dissemination phases is under researched and requires further investigation.

2.8 Research gaps, research questions and research framework

Interorganisational collaboration only accounts for a minor section of innovation network research carried out in the business and management discipline, revealing an interesting gap in the literature (Möller and Halinen, 2017). Innovation management is a matter of strategic concern to firms and of significance to researchers and practitioners in different industry sectors (Baregheh, Rowley and Sambrook, 2009). Furthermore, the resources, methods, and processes required to drive innovation need to be identified by researchers and used to support firms when strategy building and planning (Baregheh, Rowley and Sambrook, 2009). These could, potentially, provide knowledge of the different processes required to build innovations in diverse industry settings. Thus, underlining why this is an important area to study. This is further exemplified by the call from Waluszewski, Snehota and La Rocca, (2019) which also identified similar areas of future research, including:

> (a) The need for a focused, "more elaborated and nuanced" representation of the business world (Waluszewski, Snehota and La Rocca, 2019, p. 232); as it is constantly changing, and
>
> (b) A requirement for methodological and conceptual developments illustrating business activities from novel perspectives (Waluszewski, Snehota and La Rocca, 2019).

Therefore, more knowledge of management processes and frameworks is required to better understand how to create and build successful innovations. Specifically, these areas are pertinent to the study of innovation in business networks and the subsequent development of contemporary discourse.

As noted, there is little research on innovation in short-term interorganisational innovation projects (see 2.6), yet these are widespread and important for firm competitiveness. Additionally, management activities are essential to innovation development and have been discussed extensively in the literature. The innovation process used in short-term interorganisational innovation projects may require a set of management activities which differs from those used in traditional project management. Hence the first question, (RQ1): Which management activities manifest in short-term interorganisational innovation projects?

In addition, knowledge of management processes and frameworks in the setting of innovation networks is needed to better understand how to create and build successful innovations. Waluszewski, Snehota and La Rocca, (2019) sought a more developed depiction of the business world due to its ever-changing nature and nuanced characteristics. This includes improved understanding of the management activity characteristics, such as drivers and barriers. Drivers and barriers are external to management activities; drivers instigate and barriers hinder these activities. Drivers cause activities involved in the innovation development to occur or develop. For example, success drivers may include activities such as "iterative or spiral development – build, test, obtain feedback, and revise…" (Cooper, 2019, p. 37). Barriers challenge, hinder or halt management activities and, therefore, stall innovation development. For example, the presence of financial constraints has been shown to hamper the implementation of innovative projects (Savignac, 2006). It is important to understand these properties as they can either stimulate innovation development or hinder the develpment of innovation and potentially stop it. Hence, the second question, (RQ2): What are the drivers and barriers of management activities involved in successful innovation project delivery?

The literature suggests that the processes involved in creating radical and incremental innovations are quite different (Aarikka-Stenroos et al., 2017). However, there is a lack of research that addresses how the differences between radical and incremental innovations may influence management activities, particularly in short-term interorganisational innovation projects. This leads to the third research question (RQ3): What management activities are required in radical vs. incremental short-term interorganisational innovation projects? A historical study could, potentially, show the management activities involved in short-term interorganisational innovation projects and the differences that may appear in radical and incremental innovation development.

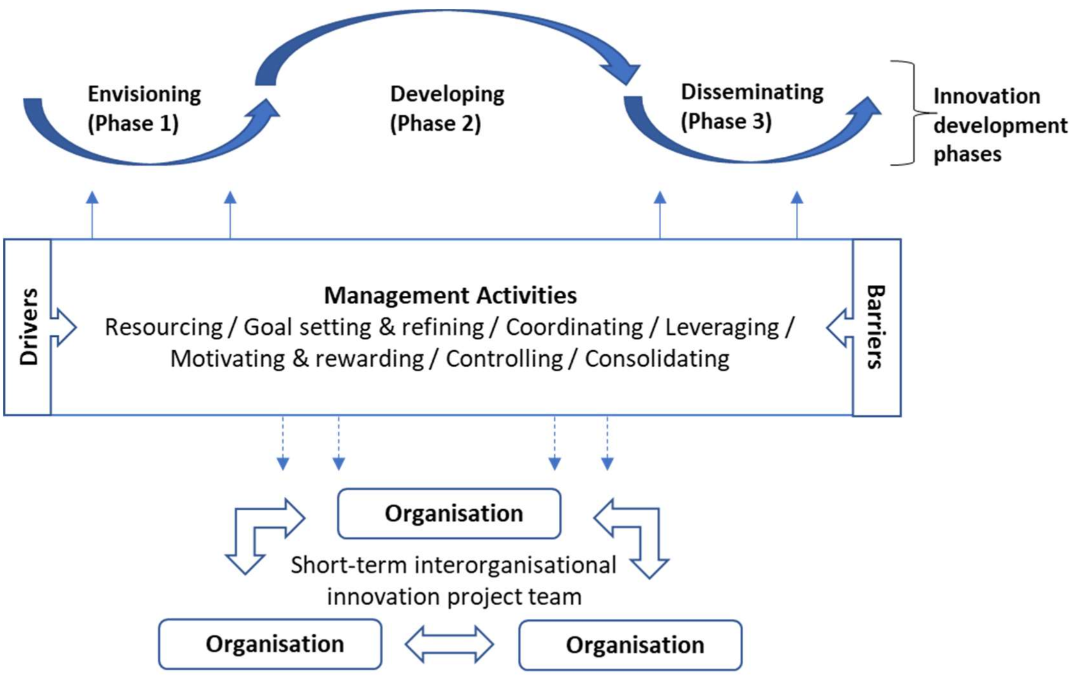
To facilitate answering the research questions, a conceptual research framework has been developed (

Figure 3). The framework incorporates:

(a) the innovation process and is based upon combining the principles of phased innovation development (Aarikka-Stenroos et al., 2017; Cooper and Kleinschmidt, 1995).

(b) management activities proposed and discovered in the Aarikka-Stenroos et al., (2017) study.

Figure 3: Conceptual Framework



Adapted from Aarikka-Stenroos et al., (2017, p. 92).

The innovation process comprises three phases (Cooper and Kleinschmidt, 1995): Phase 1 is envisioning, Phase 2 is developing and Phase 3 is disseminating. The project lifecycle (Haniff and Salama, 2016) includes similar phases or stages, however, there are overlaps with the innovation process dimensions. Project initiation could be thought of as similar in phase to envisioning (Phase 1) although work may start earlier than envisioning if the project scope needs to be broken down into specific parts first. Project planning and execution have similarities with the developing phase (Phase 2). However, disseminating (Phase 3) overlaps with the execution phase and project closure (the defined ending of a project). Note that project closure is not mentioned in Cooper and Kleinschmidt's (1995) innovation development phases. The thick, blue, curved arrows at the top of the conceptual framework represent the progression from one phase to the next phase, for example from Phase 1 to Phase 2. The short, narrow, blue arrows pointing upwards from the management activities illustrate that management activities may occur during one or more innovation phase(s). The rectangle representing the management activities is flanked by drivers and barriers, illustrating that they are external by nature and have potential influence. The short, narrow, dashed, blue arrows between the management activities and the short-term interorganisational innovation project team highlight that the aforementioned team carries out the management activities. The short-term interorganisational innovation project team is represented by three rectangles , each labelled 'organisation' and whose interrelationships are illustrated by double-headed, arrows which are outlined in blue. Members of the short-term interorganisational innovation project team carry out the management activities in various phases of innovation.

It is likely that different combinations of management activities occur in each distinct phase of innovation development. The framework, therefore, creates an opportunity to capture the different management activity groupings for each innovation phase. There is no allowance in the conceptual research framework for innovation failure and it is therefore not represented. The innovation activities comprised within phases 1-3 may be consecutively or iteratively interconnected towards an innovation goal (radical or incremental).

The innovation network is conceptualized as the short-term interorganisational innovation project team. The management activities are not necessarily directed by nor carried out by the same actors throughout innovation development. The short-term interorganisational innovation project team may perform, orchestrate, involve, mobilise or collaborate with each other to meet the demands of innovation development which will have implications for innovation management (e.g. Möller, 2010; Sandberg and Aarikka-Stenroos, 2014; Story, O'Malley and Hart, 2011).

This study takes a holistic approach to address the research questions. In addition to the key management activities outlined, additional features may be discovered, for example, in particular phases of innovation which may give new insights, therefore, developing the conceptual framework as illustrated in

Figure 3. This research will be open to any factors that emerge that are not currently included in the framework.

In summary, an overview of the different approaches towards short-term interorganisational innovation projects and management activities have been illustrated and gaps in the literature identified. The empirical research, the data collection and data analysis methods are all informed by the theoretical foundations reviewed and developed in this chapter.

3 Chapter Three: Methodology and Data Analysis

3.1 Introduction

Research methodology comprises "…guiding paradigms, aspects of research design, methods of data collection and analysis..." (Given, 2008, p. 517). With this foundation, this chapter provides the rationale behind the methodological and epistemological choices made in this study as outlined below.

3.2 Guiding paradigm

3.2.1 Critical realism: significance to management research

Researchers naturally make assumptions about how something existed in the world, its nature or being (ontology) and how we, as researchers, come to know and understand it (epistemology) (Bell, Bryman and Harley, 2018). Epistemological assumptions assist the researcher to ask pertinent questions and afford guidance about selecting appropriate research methods. The critical realist ontology and epistemology adopted in this research are now reviewed in light of their relevance to management research, noting their bearing on decisions regarding research methodology and methods.

The two main philosophical positions which have fundamentally influenced social research are positivism and constructivism (Guba and Lincoln, 1994; Mingers, 2000; Reed, 2009). Other research philosophies, including critical theory and pragmatism exist between these two dominant philosophical standpoints. Such philosophies rely on elements of positivism and constructivism, promoting some factors of one stance while reducing aspects of the opposing philosophy (Bryman, 2008). Positivism and constructivism, therefore, represent opposite ends of the philosophical spectrum with their opposing ontology and epistemology (Guba and Lincoln, 1994). Critical realism falls in between positivism and constructivism and provides an alternative perspective (Van de Ven, 2007).

3.2.2 The strength of critical realism in the social sciences

Short-term interorganisational innovation projects can be comprised of different firms involved in innovation; consequently, they can be described as a special type of network (Fernez-Walch, 2017). As there is little discussion of critical realism in the project management literature the business network literature helps to frame the epistemological discussion of this work. Tranfield and Starkey (1998) stated that academic consensus on an ontological viewpoint for the research of business networks was lacking. Furthermore, the field had become disorganised with opposing research perspectives resulting from different opinions with regard to the, “nature of business networks,” (Peters et al., 2013, p. 336). Peters et al., (2013) explored how constructivism and critical realism could be used to explain networks.

Constructivism and critical realism are anti-positivist (Kwan and Tsang, 2001). Both ontologies align with interpretivist methods, including case studies, when conducting organisational research (Easton, 2010; Fleetwood, 2005). However, critical realism recognises that there is a natural order of things, in contrast to constructivism. Regarding the natural world, critical realism suggests a “mind-independent reality” that is understandable by research (Peters et al., 2013, p. 339).

Critical realism was created as an alternative philosophy to the traditional positivistic models of social science, postmodern methods, and theories of constructivism. Bhaskar (1978, 1989, 1998) was the leading writer on critical realism. Through his writings, critical realism has achieved recognition as a relevant philosophy for the social sciences. Critical realism can be viewed as a particular type of realism. Specifically, its philosophy seeks to identify the reality of the natural order, events and discourses of the social world (Bhaskar, 1989).

The key principles of critical realism include ontological realism, epistemic relativism and judgmental rationality. Ontological realism infers that there is a reality that endures independently of one’s own knowledge of it; the ‘mind-independent’ reality Peters et al., (2013). Epistemic relativism suggests that knowledge is shaped by our past social and historical knowledge and experiences, as opposed to being absolute. It is accepting of the hermeneutic view that knowledge is constructed by communication and that knowledge created via realist analysis is open to question and likely to change both empirically and theoretically. Ontological realism and epistemic relativism are combined with judgemental rationality which infers that logic can be applied, by an individual, to ascertain if certain theories are more valuable and effective than others (Wikgren, 2005). It also comprises an emancipatory feature (Manicas, 1998). This suggests that social science must do more than explain the world as viewed by its participants. It must seek thoughts from its participants regarding their appreciation of their world. If they do not have a suitably solid understanding, this must be explained.

Ryan et al., (2012) suggested that methods based on critical realism have clear benefits when researching processes over time, in comparison to positivistic conceptualisations (which view industrial networks as directed by laws and rules). Their argument demonstrated that methods based on critical realism provided a broad-minded response to earlier concerns raised by Halinen and Törnroos (1995) that, until that point, a dearth of methodological tools existed in extant business and marketing literature. Sayer (2000) proposed: “In both everyday life and social science, we frequently explain things by reference to causal powers” (Sayer, 2000, p. 14). Indeed, this critical realist perspective of causality has been used in many management fields (Ackroyd and Fleetwood, 2000; Edwards, O'Mahoney and Vincent, 2014) including marketing (Easton, 2010). Easton (2010) gave further weight to this, advising that the most important aspect of critical realism is that causal terminology can be used to explain the world. While causal mechanisms are an important feature of critical realism this study does not go as far as to endorse this perspective, by employing Sayer’s causation framework in the design of the study (see Sayer, 2000, for example). It does however subscribe to the perspective that critical realism is ‘performative’; emphasising that one behaves as if the world is real (Easton, 2010, p. 119). Critical realists interpret rather than construct the world (Easton, 2010). Indeed, “Critical realism acknowledges that social phenomena are intrinsically meaningful, and hence that meaning is not only externally descriptive of them but constitutive of them…Meaning has to be understood, it cannot be measured or counted, and hence there is always an interpretative or hermeneutic element in social science" (Sayer, 2000, p. 17). This statement provides the epistemological stance behind this study.

Sayer (2000) endorsed two comprehensive types of research method: extensive and intensive. Extensive research includes: large scale surveys, questionnaires and statistical analyses; seeking patterns, trends and similarities, to ascertain how common or widespread a problem may be (Al-Hindi, 2009). It is useful for its generalisability to other situations. Intensive research may include the study of individual agents via interviews, ethnography, and qualitative studies. It explores causal relationships amid phenomena with the intention of ascertaining the mechanisms that cause a particular event to take place (Al-Hindi, 2009). Danermark and Jakobsen (2009) suggested that the intensive method comprises large amounts of data collection that are qualitative in nature, while the extensive method accentuates quantitative data collection and statistical analysis. However, Easton (2010) proposed that it is not so clear cut, as intensive approaches do not have to be restricted to a single case study and additional methods could be used alongside ethnographic ones, while extensive methods could be used within a single case study.

Critical realism is not perfect (Bhaskar, 2008) and the continued use of critical realism within the marketing and business fields may mean that its shortcomings are exposed in time (Smith, 2006). However, for the purpose of this study, it provides a suitable approach. To summarise, the adoption of a critical realist perspective provides guidance grounded in ontological and epistemological thought which circumvents the drawbacks of both positivism and constructivism (Sayer, 2004). This is supported by researchers in the marketing and business domain who argue that critical realism provides a logical and rational approach to the appraisal of knowledge assertions in the marketing field (Easton, 2002; Ehret, 2013; Harrison and Easton, 2004). Additionally, it provides researchers with the autonomy to use a wider variety of research tools. Thus, case studies can help to understand and develop deep contextual explanations of a phenomenon, such as in this research which studies short-term interorganisational innovation projects. Here, the utilisation of the case study method allows for a holistic perspective where social perspectives can be explored in rich detail (Lindgreen et al., 2020).

3.3 Research design and methods of data collection

3.3.1 Research design

A research design is a framework for both data collection and data analysis (Bell, Bryman and Harley, 2018). Selecting an appropriate research design relates to the importance of different dimensions involved in the research process, such as: causal connections between identified variables; the ability to generalise to larger groups; understanding behavioural insights and a temporal perspective (Bell, Bryman and Harley, 2018).

To support the research aims and objectives of this study, the research design will focus on exploration and theory building (Möller, 2013). Case studies provide an opportunity to study phenomena thoroughly and in great depth (Easton, 2010), often employing 'how' and 'why' questions which tend to be exploratory in nature. Such questions can handle operational links which can be tracked over time as opposed to frequency or occurance (Yin, 2003, p. 6). Furthermore, case research permits the researcher to untangle multifaceted relationships and complicated features which appear in the phenomenon under study (Easton, 2010). Case research is therefore, a research method which involves researching at least one or a handful of examples where data are collected using multiple data sources, while also building a holistic report via an iterative research approach (Easton, 2010). Case studies allow a holistic appreciation of complex phenomena that are not easily separable from their context (Easton, 1995; Halinen and Törnroos, 2005; Yin, 2009) and do not require control over behavioural events (Ritchie et al., 2013; Yin, 2018). As such, case studies are, therefore, distinct from surveys, experiments, or modelling studies and focus on real life. With an emphasis on contemporary events, case studies are also different from other types of research including a phenomenological approach with its emphasis on appreciating experiences, narrative research which centres on accounts and stories expressed by individuals and also ethnographic research which focuses on the portrayal and interpretation of group culture (Creswell and Poth, 2018).

Yin (1984) and Eisenhardt (1989) suggested that case studies can entail both multiple and single cases. Eisenhardt (1991) highlighted that multiple cases are a formidable means to create theory as they allow for *replication and extension*. Replication refers to the use of independent cases to independently validate proposals or propositions, assisting pattern identification. Extensions can be used in multiple cases to progress more complex theory, as numerous cases can highlight similar or complementary aspects of a phenomenon.

Abercrombie, Hill and Turner, (1984) stated that use of case studies infers a detailed exploration of a single example of a class of phenomena. They allow the examination of real-life events including managerial and organisational practices (Yin, 1984). Gummesson (2000) emphasises the advantages that the holistic view, afforded by case studies, brings to individual phenomenon and events. In a similar vein, Ragin (2014, p. 49) highlighted that each case must be examined as a whole and that all cases, "…are compared with each other as wholes." Case data can be longitudinal or cross-sectional (Aaltio and Heilmann, 2010). In fact, a case study research design permits the use of several methods, making triangulation possible; hence the resulting data can be examined and compared increasing its validity. Furthermore, Dubois and Gadde (2002) and Dubois and Araujo (2004) argue that one of the main strengths of case study research is flexibility.

Critical realism is well matched to qualitative case research as it supports the investigation of any kind of study irrespective of the total number of research units comprised within it (Easton, 2010). Critical realist based epistemological approaches which favour quantitative methods over qualitative can aim, for example, to isolate cause and effects, calculate and assess phenomena and develop research designs that allow the generalisation of findings and devise new general laws (Flick, 2013). However, limitations exist with the quantitative approach. Some types of information cannot be sought from structured data collection tools including surveys (Bell, Bryman and Harley, 2018). Furthermore, there is often fragmented or poor information regarding contextual factors which might support the interpretation of results or differences between subjects or behaviours exhibited in the research. Indeed, qualitative case studies are advantageous for realists who seek to understand phenomena (Lindgreen et al., 2020) and the associated complexity (Bhaskar, 1979). Easton highlights that studies which endorse the critical realist perspective must comprise processes which produce extensive and detailed research with the clear purpose of understanding exactly what is happening in a situation (Easton, 2010).

Qualitative research employs methodologies that embrace complexity, nuance, depth, and richness (Mason, 2002). While some forms of measurement are used in qualitative research; statistical forms are not thought to be critical (Mason, 2002). Social science research can be undertaken in different ways, each strategy has advantages and disadvantages. Qualitative approaches offer the ability to create persuasive arguments regarding how things work in certain contexts or situations (Mason, 2002). In this study, the justification for engaging a qualitative approach is guided by the capacity of qualitative data to provide insights into complicated social processes that are not necessarily exposed in quantitative data (Eisenhardt and Graebner, 2007).

Qualitative research focuses on events which occur naturally, providing depth and detail by tapping into the approaches, behaviours, and perspectives of the involved actors (Miles, Huberman and Saldana, 2014). It also has the potential to provide richness and holism (Miles, Huberman and Saldana, 2014) and the prospect of learning more about complex phenomena via, "thick descriptions" (Geertz, 1973). If carried out well, the actors have an opportunity to develop their responses and discussions may evolve into new areas of research. A detailed understanding and picture can, therefore, be developed which explains why people behave the way they do, while also recording their feelings and perspective about their actions (Miles, Huberman and Saldana, 2014).

For this research a qualitative, multiple case research design which is longitudinal and historical is most suitable. It is longitudinal because the lifetime of each project including each innovation phase, in each case, will be reviewed and investigated (Aaboen, Dubois, and Lind, 2012). This will be carried out retrospectively. Hence, the study is historical as the cases will observe innovations which have been disseminated. Furthermore, the study is comparative. An opportunity to make comparisons was provided by including a total of six cases. Three short-term interorganisational innovation projects were selected which developed radical innovations and three additional short-term interorganisational innovation projects which developed incremental innovations (purposive sampling criteria is provided in section 3.4.3.1). Therefore, the study employs a qualitative multiple case research design; allowing themes and patterns to be observed across more than one case (Aaboen, Dubois, and Lind, 2012) in MCD&MS sector.

3.3.2 Case study evidence

The empirical evidence provided in a case study can be qualitative, quantitative or comprise elements of both (Eisenhardt, 1989). Yin (1984) emphasised the importance of collecting evidence for case studies in the form of: interviews, direct observation, participant observation, documentation, archival resources, and physical artefacts. One of the resulting benefits of qualitative research is that researchers can observe and understand the context within which actions and decisions take place (Myers, 2013).

In-depth interviews are an appropriate data collection method, as rich information can be obtained from the managers and people directly involved in the short-term interorganisational innovation projects. In-depth interviews allow the interviewer to question the interviewee to uncover a wide array of information regarding their own behaviour as well as others (Bryman and Bell, 2015). Additionally, weight can be given to "…specific situations and action sequences…" (Kvale, 1983, p. 176). Furthermore, when compared to focus groups or surveys, interviews allow greater flexibility to secure and schedule interview dates and the opportunity to gain deep insight (Malhotra and Malhotra, 2012). Easterby-Smith, Thorpe and Lowe, (2002) supported this by maintaining that interviews allow the researcher to uncover detail about complex processes and gain innate appreciation of the world the interviewee inhabits. However, interviews present disadvantages as the data is vulnerable to the researcher's bias and influence. Likewise, the interpretation of interview data profoundly relies on the researcher's skills. These potential obstacles are addressed later (3.4.4.4).

Document analysis and observation are also important areas to consider, as they can provide information about activities of different actors in the respective short-term interorganisational innovation projects, thus giving a rich source of insight. Forster (1994) suggests that document analysis can provide important information to a researcher that is new to an organisation. However, for the purposes of this research it is unlikely to play a significant role; management activities in the innovation process may not show up in company documentation such as meeting notes, minutes, legal documents or annual reports. However, documentation analysis can potentially assist data triangulation. In this research, several sources of evidence were used to support this process.

The technique of cross-checking data from numerous sources allows the researcher to search for consistency (Flick, 2013). A significant advantage of using various sources of evidence is the ability to note converging lines of inquiry (Yin, 2009). In this study, data sources comprise: semi-structured, in-depth interviews with individuals in each short-term interorganisational innovation project as the primary research method selected. These are corroborated with document analysis and observation where the data is available, comprising: press releases, company websites, annual reports, innovation briefs, meeting notes, proposals, videos, news and other reports as a source of secondary data.

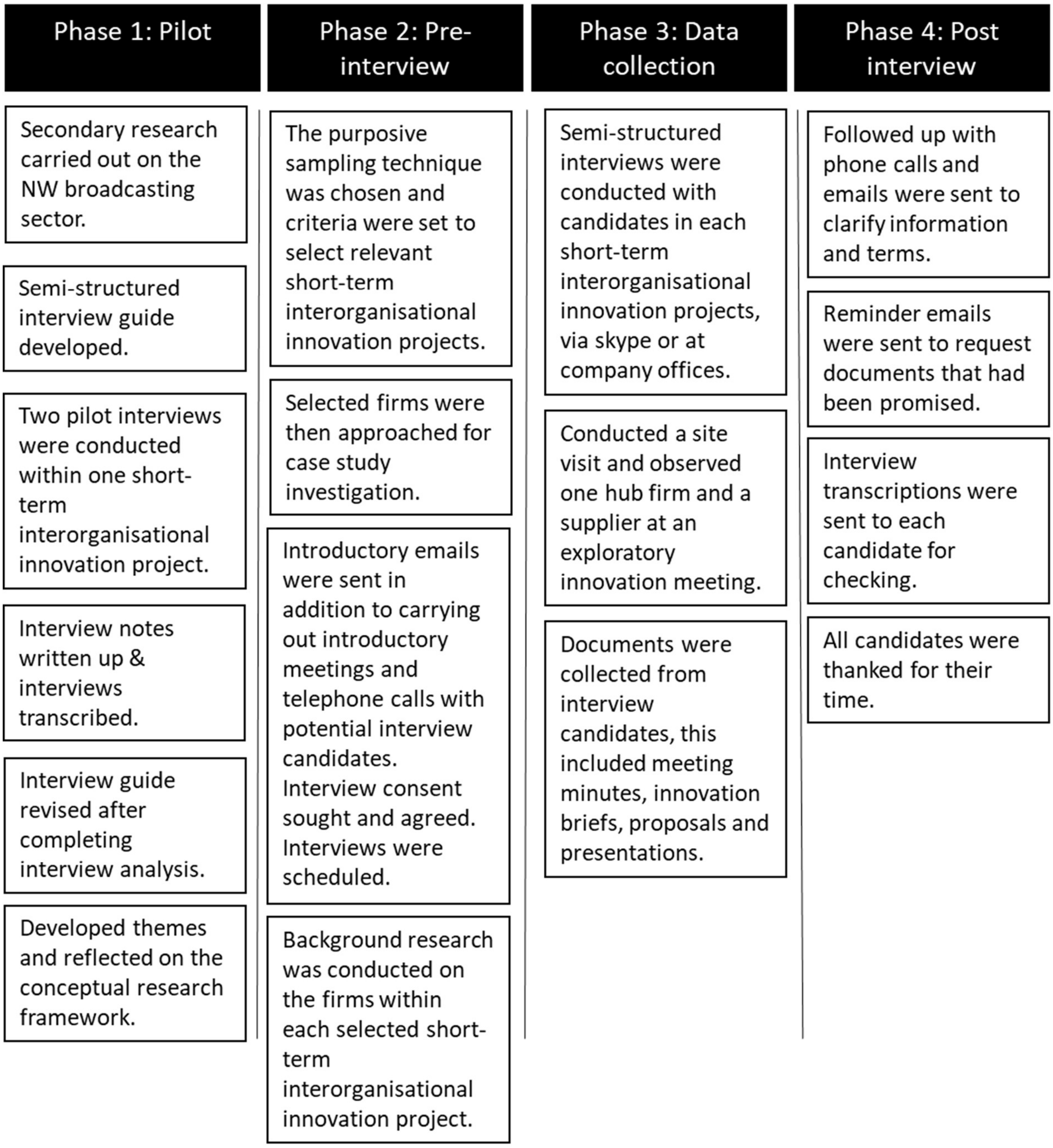
3.4 Data Collection

3.4.1 Data collection – phased approach

The ethical guidelines provided by the University of Manchester (2016) were adhered to throughout data collection. The interviewees were informed about the rationale and principles of the interviews, additionally consent for the audio recordings was discussed and agreed. The interviewees were also notified of their right to withdraw without notice, at any time, and reminded that their personal data were confidential.

Figure 4 outlines the four-phase process that was carried out during data collection. The phases are described, starting with phase 1: pilot (3.4.2) through to phase 4: post interview (3.4.5).

Figure 4: Qualitative Case Research Design (phased approach)



3.4.2 Phase 1: Pilot

The pilot phase involved carrying out primary research on the UK broadcasting industry, as illustrated in the first phase of Figure 4. The researcher has direct personal experience of the sector, due to her past career. The foundation of this knowledge was built upon with the clarification of the key firms and organisations in the industry and the specific services offered. The secondary research activities comprised searching and analysing current news stories on the sector and visiting the websites of the leading organisations. This provided information about the types of innovations being created and the firms that were behind them. Thus, supporting the background to the research context given in chapter 1 (see 1.3) and providing information on the current industry trends and innovation activities.

Conducting two pilot interviews helped to refine the interview guide and give a general appreciation of the interview process. The intention was to ensure the experience would be smooth before proceeding with the main sample.

3.4.2.1 *Interview guide development and pilot interviews*

Based on the research questions outlined in the literature review, a preliminary semi-structured interview guide was created. The pilot interview protocol included exploratory questions forming a semi-structured interview format. A large number of questions were initially included. Once the pilot was completed the questions were revised to include only those pertinent to the study.

The recording procedure recommended by Cresswell (1998) was followed; where the formal procedure of the interview introduces: the structure of the interview, confidentiality, the capture of company demographics, open ended questions (space is left for answers) and closing comments. It is suggested that the interviewer memorises the questions; so as not to forget the thread of the interview, eye contact must be maintained.

Using these guidelines, two interviews were carried out with people involved in a short-term interorganisational innovation project instigated by Blue. Blue are a prominent digital media services provider based at MediaCityUK (see Table 33). As the interviewees were overseas (based in Los Angeles, USA, and the Netherlands), it was not possible to organise face to face meetings. Skype or a telephone call was therefore offered as an alternative.

The pilot study resulted in adaptation of the questions and the phrasing of the updated interview guide (Bryman and Bell, 2015). For example, after the pilot study, the researcher did not refer to the terms used in the conceptual framework including specific innovation phases nor management activities, instead more general terms were used. It was important to use terms which could be easily understood by the interviewee who did not use academic language in their daily working lives.

Additionally, the experience gained from the pilot interviews enabled the researcher to develop interviewing techniques, including, for example, when to explore and probe interviewees for more detail, as well as learning which types of probe might inspire interviewees to disclose more information. Recognising when it is appropriate to probe or when it is beneficial to continue with the interview guide is a significant skill, given the time constraints in an interview (Berry, 2002). The interview guide can be found in section 10.2.

3.4.3 Phase 2: Pre-interview

3.4.3.1 *Data collection methods (case selection and access)*

The cases were selected using the purposive sampling technique (Patton, 1990), where the deliberate choice of a participant is selected due to the qualities the participant possesses. This involves the selection of firms that are well-informed about the phenomenon of interest, in addition to knowledge, experience, availability, willingness to participate, and the ability to communicate their experience(s). The following criteria were exercised:

- Short-term interorganisational innovation projects, with evidence of orchestration by one actor (not in-house innovation) in the innovation network.
    - Each innovation must involve a minimum of three actors (Halinen and Törnroos, 2005).
- Cases must involve the whole innovation process (as far as possible) to ensure that management activities could be examined across the innovation development process.
- Innovations should represent processes aiming at either radical or incremental innovation to potentially reveal contrasting themes and patterns (Eisenhardt and Graebner, 2007).

In order to find appropriate cases, prior to conducting interviews with candidates in each short-term interorganisational innovation project, the researcher organised meetings with the intention of determining if the criteria could be met. If the criteria could not be met, the researcher did not pursue further discussions. Note that the radical vs. incremental multiple case design was important in order to answer RQ3; to understand which management activities are required in radical and incremental innovation development. The six cases (see Table 1) were disguised throughout the thesis, for reasons of confidentiality. Further detail can be found in Table 2 and Table 3.

Table 1: Case names and innovation types

Innovation type	Cases / Short-term Interorganisational Innovation Projects
Incremental	CodingGame, Demonland, ARVR-Staging.
Radical	Metbot, Mediaworks, Audiolizer.

Access can be a practical barrier when conducting case study research. Indeed, suitable cases cannot always be easily accessed (Yin, 2009). In this instance, initiating new contacts was balanced with building on pre-existing relationships. Cases were identified by re-establishing relationships with existing contacts, via email and telephone calls. This led to six potential cases. For example, the researcher emailed the Head of Red R&D explaining her background and aspirations to contact individuals that might help with data gathering. Red is a leading British broadcaster with a history of innovating at the cutting edge of technology (see Figure 5 for further background to Red). He put her in touch with two people who had both been directly involved with a range of innovations. The researcher had separate face-to-face meetings with them. The first person directly supported the data collection process. This was because they had personal involvement with innovations that fitted the criteria. Meetings with the second person came to a natural conclusion; as the innovations that they had been involved in did not meet the sampling criteria, there was nothing to pursue. The face-to-face meetings with the first individual helped to generate rapport and trust which smoothed the path for interviews. Consequently, this path led to interviews with participants in the Audiolizer (see 5.6) and CodingGame (see 5.2) short-term interorganisational innovation projects. Snowballing from contacts involved in Audiolizer, led to establishing connections with individuals in the Metbot (see chapter 4) short-term interorganisational innovation project.

To identify further suitable short-term interorganisational innovation projects, contact was made with The Landing; an enterprise sponsored by Salford City Council which gives digital SMEs and micro businesses a place to work alongside large media and technology organisations at MediaCityUK. Using the purposive sampling criteria identified above, four businesses were identified from approximately fifty firms. This led to contact with one case, as it was discovered that the other firms did not fit the criteria. Personal contact was made with participants in the Demonland (see 5.3) short-term interorganisational innovation project. Initial face-to-face meetings were conducted prior to formal interviews and agreement that contact could be made with the other individuals in the short-term interorganisational innovation projects.

Finally, ARVR-Staging (see 5.4) and Mediaworks (see 5.5) were sourced through the Chief Technology Officer and Head of Studios at Blue. Overall, the researcher found that the majority of people she asked to interview were content to be involved. However, due to access and practicality, it was not possible to interview all the people involved in each short-term interorganisational innovation project and on two occasions she was rebuffed. Emails and phone calls were never returned. This included respondents from the short-term interorganisational innovation projects ARVR-Staging and CodingGame. The researcher was aware that both people were very busy delivering commitments to other major projects. While their insight would have given greater clarity, it is unlikely that the lack of these two interviews detracted from the process.

Each short-term interorganisational innovation project met the purposive sampling criteria as set out earlier in this section. In the first instance, short-term interorganisational innovation projects were selected, as defined by Fernez-Walch, (2017) (see 1.1). They all had a minimum of three actor organisations (network pictures of each short-term interorganisational innovation project can be found in chapter 4 and chapter 5). Finally, except for ARVR-Staging, which at the time of interview had not been completed to dissemination, the cases covered the whole innovation process. However, since September 2019, ARVR-Staging has been in full production. Furthermore, sector endorsement also justifies its inclusion in the study; as evidenced by winning a notable industry award.

3.4.4 Phase 3: Data collection

3.4.4.1 *Briefing interviewees and preparing for interview*

Desk research was carried out prior to each interview to maximise the understanding of the interviewee's work, enabling the researcher to prepare relevant questions. The semi-structured interviews concentrated on clarifying the management activities comprised within the short-term interorganisational innovation projects.

Once relationships were established, follow-up telephone calls were made to urge managers to participate and finalise a date and time for interview(s). In advance, an interview consent form was sent to participants, this included the confidentiality and anonymity agreements and an outline of the interview questions if requested, (see 10.2). These efforts resulted in thirty-four interviews within six short-term interorganisational innovation projects.

3.4.4.2 *Unit of analysis in the case studies, 'short-term interorganisational innovation projects'*

The case studies in this research are focused on short-term interorganisational innovation projects within innovation networks as opposed to in-house innovation where an organisation might be explored in detail. Therefore, in accordance with Yin's (2009) argument, the focus is on a specific topic or, in this situation, each innovation created in the individual projects. Therefore, the unit of analysis is short-term interorganisational innovation projects. For each network, the development of innovation is at the heart of the activity and full concentration is given to achieving successful innovation by all of the project members.

3.4.4.3 *Semi-structured in-depth interviews*

Semi-structured interviews are advantageous, allowing engagement with the interviewee within a set of interview themes which may vary. In addition, new questions applicable to the context of the research situation may be asked (Thornhill, Saunders and Lewis, 2009). This allows for flexibility, sensitivity, and provides an opportunity to explore an area in depth (Yin, 2009). Disadvantages include the time-consuming nature of developing the interview guide, conducting interviews and analysing the transcripts (King, Cassell and Symon, 2004). Additionally, potential interviewees may be put off, finding difficulty to dedicate time within their own schedules (King, Cassell and Symon, 2004).

The semi-structured interview format was chosen as it gave the researcher a defined list of topics to discuss, while also allowing the interviewee scope with their response (Bryman and Bell, 2015) (see 10.2). Moreover, semi-structured interviews are recommended by Yin (2018) in multiple-case study research. It is important, for cross-case comparison, to have a robust structure.

Semi-structured interviews gave the researcher flexibility to respond and develop the discussion, by reacting to the topics generated by the interviewee. Interviews were carried out with people in many different types of role including Chief Technology Officer and Chief Executive Officer, to Managing Director, Executive Producer, Producer, Senior Technologist, Lead Developer, Developer, Project Manager and Account Manager, amongst others. These individuals worked within the short-term interorganisational innovation projects either for one of the firms, organisations or suppliers.

3.4.4.4 *The interview process*

The timings of the interviews were determined by the prior commitments and availability of each interviewee. The interviews were conducted either at the interviewee's office, via Skype or telephone. The intention was to make the process as straightforward as possible for the interviewees.

The researcher endeavoured to build rapport with each interviewee, ensuring they felt at ease. For example, the types of question were outlined in advance via email and in telephone conversations, to ensure that the interviewee was aware of what was going to be asked. The suggestions made by Leech (2002) regarding interviewing techniques were followed. As the researcher had previous experience of working in the broadcasting industry, she was able to put herself in the shoes of the interviewee. Rapport was built using appropriate language and terms of reference. Therefore, in line with Leech's (2002) recommendations, the researcher suggested “talking with” as opposed to “interviewing” (Leech, 2002, p. 666) each interviewee. The focus was on developing the discussion.

Leech (2002, p. 666) stresses the importance of the “grand tour” question, as proposed by Spradley (1979). These types of question ask the interviewee to provide a *verbal tour* of something they know well. In this research the focus was the innovation and associated short-term interorganisational innovation project. Following this, interviewees were asked to discuss their relationships with the people participating in the project. They were then asked to elaborate what activities and resources were involved in the interactions and who provided them. As the focus was on management activities, the innovation and the relationships in each short-term interorganisational innovation project the discussion was guided around these areas. Often the discussion evolved naturally without reverting to the interview guide. The researcher did not specifically ask about negative aspects of the relationships, this was not assumed, and questions were only pursued if the interviewee mentioned that problems occurred, then the researcher asked non-leading questions such as, “what problems do you encounter?” Interview questions then concentrated on learning more about how the problems were managed and resolved.

During the interview process different types of probing questions were employed. These included: planned, informal and floating prompts (McCracken, 1988). Planned prompts were included in the interview guide as an italicised list. These were used if the interviewee did not naturally discuss them (Leech, 2002). This included probing resources that were used during innovation development. Informal prompts included encouraging noises that the researcher gave to express interest, including, “yes” and “mmmm”. These types of interjection appear in day-to-day conversation (Leech, 2002). The use of floating prompts included the following phrases: “How?”, “What happened then?”, “Can you tell me more?”, “Why do you think that occurred?” The intention was to provoke the interviewee to elaborate, to seek more detail or clarification. When situations arose where the interviewee was hesitant to discuss factors that they considered to be detrimental or negative, the researcher reminded the interviewee about the confidential nature of the discussion and that candid discussion was sought. Although the researcher had many years of work experience these sections of discussion were not always easy. It was important for the researcher to be sincere and empathetic, reflecting this in appropriate body language and tone of voice.

By the time the researcher had completed interviews for the fifth case study and commenced the preliminary interview analysis, the final, sixth, case study did not reveal any, significantly, new information; limited new concepts were presented by interviewees. Strauss and Corbin (1998) recommend that when no new themes and insights appear in the case studies, data saturation level is reached. Therefore, once the sixth case study was completed the interview process ended. The duration of each interview was approximately forty minutes with some interviews taking up to one and a half hours. The initial briefing discussions were in addition to this. Table 2 and Table 3 present the interview data, split by innovation type. A total of thirty-four interviews were carried out, thirty-one with people that were not previously known to the researcher. The remaining three interviews were conducted with past industry colleagues.

Table 2: Participant data – Incremental innovations / short-term interorganisational innovation projects

<table>
<tr><th>Innovation</th><th>Company Name</th><th>Type</th><th>Total number of interviews undertaken</th><th>Job titles and pseudonyms of the interviewees
(by firm for each interorganisational innovation project)</th></tr>
<tr><td>CodingGame</td><td>Codeclub
Pine
Red</td><td>UK volunteer led community of computer gaming clubs
UK game development studio
UK broadcasting company</td><td>6</td><td>Codeclub
· Lead Developer, Charlie.
· Developer, David.
Pine
· Managing Director, Phillip.
Red
· Red Producer, Sarah.
· Red Innovation_Hub Project Manager, Patrick.
· Red_Go_Digital, Executive Producer, Charlotte.</td></tr>
<tr><td>Demonland</td><td>Gold
Platinum
Sapphire</td><td>UK music composition company
UK game development company
UK broadcasting company</td><td>3</td><td>Gold
· Managing Director, Gavin.
Platinum
· Managing Director, Nathan.
Sapphire
· Executive Producer, Tyler.</td></tr>
<tr><td>ARVR-Staging</td><td>Red
Flame
Moss
Blue</td><td>UK broadcasting company
UK VR and Augmented Reality (AR) broadcast solutions
UK camera technology for film and broadcast
UK digital media company</td><td>7</td><td>Red
· Red Sport Creative Director, Julian.
Flame
· Director of Technology, Adam.
Moss
· Managing Director, Magnus.
· Account Manager, Lloyd.
Blue
· VFX Supervisor, Aiden.
· Head of 360 Production, Robyn.
· Head of Studios, Austin.</td></tr>
</table>

Table 3: Participant data – Radical innovations / short-term interorganisational innovation projects

Innovation	Company Name	Type	Total number of interviews undertaken	Job titles and pseudonyms of the interviewees (by firm for each interorganisational innovation project)
Audiolizer	Morph Red Air	UK animation and digital web agency UK broadcasting company UK digital web agency	6	Morph · *Producer, Greg.* Red · *Red Femteam Designer, Jane.* · *Red Femteam Technologist, Rebecca.* · *Red Go Digital, Executive Producer, Jack.* · *Red Go Digital, Project Manager, Andy.* Air · *CEO, Peter.*
Metbot	Scarlett Red President	UK university UK broadcasting company UK marketing led web agency	7	Scarlett · *Developer, Sebastian.* Red · *Red News and Weather Editor, Stephanie.* · *Red Innovation Hub Project Manager, Patrick.* · *Red R&D Developer & Project Manager, Beth.* · *Red R&D Developer, Alistair.* President · *Head of Applied Technology, Stanley.* · *Developer, Todd.*
Mediaworks	Amber Liquorice Blue Freelance	USA multimedia and technology company Dutch software & media company UK digital media company UK Freelance cameraman	5	Amber · *Account Manager, Daniel.* Liquorice · *CEO, Matthew.* Blue · *Chief Technology Officer, Peter.* · *Senior Technologist, James.* · *Freelance cameraman, Michael.*

3.4.4.5 *Documentation collection*

Documents including meeting notes, minutes, innovation briefs and proposals were offered by twenty-three of the interviewees (see Appendix 3: Summary of Interviews Conducted, 10.3). Specifically, the researcher sought documentation that would explicitly illustrate the interactions between the people in each short-term interorganisational innovation project. Examples of the innovation briefs were helpful to appreciate what the members of each project were seeking to develop in the first instance. Interviewees also gave meeting notes to the researcher which crystallised the content of their discussions.

3.4.4.6 *Observation*

Where it was possible to conduct a face-to-face interview, the researcher undertook non-participant and unstructured observation (thirteen occasions). The observation did not entail a precise document behaviour-observation schedule (Bryman and Bell, 2015) and is particularly useful for exploratory research where the phenomenon is unknown (Ríos and Campo, 2013). The intention was to gain as much information about the activities interviewees undertook and their specific interactions in the short-term interorganisational innovation projects. Though, Ríos and Campo (2013) highlight that research bias can be elevated, the researcher found that these observations gave insight to support the data gained from the interviews. It also gave the researcher an immediate appreciation of the relationships between individual actors.

The researcher was fortunate to be shown around offices and often the office floor. This provided an understanding of the office layout, the work environment and, importantly, experience of the company culture or climate. Notes were taken directly after each interview and observation. This included comments about the conversations that were observed as well as accounts of conversations that were overheard, in addition to the researcher’s immediate feelings about the encounter. The strong rapport that existed between the teams of people working in the short-term interorganisational innovation projects and their perceptible open body language was observed.

3.4.5 Phase 4: Post-interview

After the interviews were conducted, the researcher thanked the participants for their time, support and contributions to the research via email. All of the interviews were recorded, transcribed and returned to the interviewees for checking. They were all returned, three interviewees made redactions to the transcripts. The redacted data was removed and not analysed. Preliminary data analysis occurred alongside data collection. Notes were made by the researcher directly after the interviews (and often during the interviews). Initial analysis sometimes led to follow-up conversations with interviewees to confirm their comments. In some instances, interviewees followed up by passing on documents to the researcher that were related to the development of the innovations. The researcher used this information to help generate codes at a later point in the research, including, for example, the management activities that occurred in each phase of the innovation development process. Copies of the documents were saved and added to the database of information related to the case studies. This ensured that they were contained in one secure place.

3.5 Analysis

3.5.1 Coding

This section describes how the findings were extracted from the coding of individual interviews and aggregated. The interview transcripts were analysed in cycles, case study by case study. The final list of codes evolved after reviewing each case and its associated interviews. To unearth explicit and implicit significance from the data (Flick, 2013), several levels of analysis are required. In this study, the analysis was separated into two parts: firstly, by writing a detailed description of each case, pulling together the interviews and secondary data sources and, secondly, by an analytical investigation of interviews with the utilisation of the conceptual research framework. Here, thematic analysis was used. This approach was used for each case followed by cross-case exploration. Thematic analysis helps to distinguish the core themes in qualitative data and involves creating a hierarchical template of data codes which represent themes present in the data and the relationships found between them (Thornhill, Saunders and Lewis, 2009).

The conceptual framework (Figure 3) provided the starting point for the analysis. This was followed by using a systematic combining approach grounded in abductive logic (Dubois and Gadde, 2002) to analyse the data. This involves moving between the empirical evidence and theory (Dubois and Gadde, 2002). NVivo 11, a qualitative data analysis computer programme, was used to code and explore connections between the themes. The data for these themes originally came from primary sources such as interviews and innovation briefs and secondary sources, for example, included company websites, meeting notes, videos, and blogs.

The data were categorised to facilitate analysis; this was an analytical, data condensation process (Miles, Huberman and Saldana, 2014). The most significant information was selected and attributed with other similar groups of data. This was further condensed into analysable units (Miles, Huberman and Saldana, 2014). Codes are allocated to groups of data, they may have a simple descriptive categorisation or a more complex one (Miles, Huberman and Saldana, 2014).

NVivo11 enabled effective and organised coding, recoding, and data retrieval (Bazeley and Jackson, 2013). It was therefore, straight forward for the researcher to review the node structure (in list view) and reflect on the connections between the themes, to facilitate second cycle coding. In NVivo11 a node is a group of references which are specific to a theme, case, or relationship. References were gathered by coding sources to a node. All the references were therefore located in one place. This made it easier to explore all the relevant references as an aggregation. For example, similar codes were related to leveraging (a broader theme/higher order node). The researcher was able to retrieve quotations easily, by selecting a specific code. It was also easy to note how many interviewees had mentioned a theme. As the new themes were not known from the outset, the researcher worked ‘up’ from the sources, creating nodes as they became apparent and the connections appeared. The researcher also used a text search query function to find references that might be relevant and included them, if appropriate once the overall theme description was finalised. Miles, Huberman and Saldana, (2014, p. 77) suggest that *provisional coding* is useful as a “start list of researcher generated codes”. This is based on what might emerge in the data before collection and analysis. Hence, the provisional list of codes was generated from the literature review, the pilot interviews, and the interview guide. As an example, the list of provisional codes for Goal setting & refining is listed in Table 4.

Table 4: Provisional level one codes

Goal setting & refining: provisional level one codes
• Giving direction & framing the agenda • Successful collaboration • The kick-off meeting, agenda setting

This may be compared to the final level one and level two codes (final tables are presented in the analysis chapters).

Table 5: Final level one and level two codes for management activity drivers

Goal setting & refining: final level one codes	**Goal setting & refining: final level two codes**
• Early goal setting • Giving direction and framing the agenda • Good target audience fit • Company goals & alignment	***Goal_alignment***
• Early innovation ideas • Meeting goals • High actor expectations • Keeping goals insight • Goals linked to revenues • Brand building • Clear brief and clear goals • Formal agreements	***Goal_setting***
• Successful collaboration • Early testing of innovation ideas	***Collaboration***
• Agenda setting and project management tools • The kick-off meeting	***Project_management_tasks***

Broad 'goal setting' themes included activities such as:

- the 'kick-off' meeting;
- instances that the researcher identified as 'successful collaboration' between individual actors in the short-term interorganisational innovation projects; and

- where orchestrators ‘gave direction’.

Descriptive *first cycle coding* (Miles and Huberman, 1984; Miles, Huberman and Saldana, 2014) was used to support the initial coding of the transcripts, where sections of data were coded.

Second cycle coding subsequently followed. This entailed generating new codes that acknowledged important emergent themes, actor relationships, descriptions, or explanations (Miles and Huberman, 1984; Miles, Huberman and Saldana, 2014). Subsequently, the list of codes grew, reflecting the large data gathering exercise.

The development of a definitive list of codes was an iterative process. Note that codes were frequently the result of an abductive process (Dubois and Gadde, 2002). For example, in ***Goal_setting & refining*** the code ***Collaboration*** emerged as follows. The data showed that when there are high levels of similarities between different individual actors in the projects, the greater is the connection between network activities and interorganisational success. This is supported by Saxton (1997). Thus, goal alignment appears to be important for successful innovation development. Furthermore, Corsaro and Snehota (2011) noted that even when there is misalignment between the network actors, effort to create alignment engenders positive results. Hence, this research supports the view that if innovation is to be fruitful and collaboration is to occur easily, then firms’ priorities must be aligned. In this research the short-term interorganisational innovation projects had goals which were largely congruent with the hub firm. The final level two code ***Collaboration***, therefore, was evidenced in the literature and in the research.

3.5.2 Comparison between cases

The cases were analysed and compared by creating matrices to assess and visualise the data. Firstly, descriptive tables were created for each case. The data structure was adapted from Corley and Gioia (2004, p. 184). Descriptive tables included:

(i) second order themes (level two codes) with accompanying descriptions,

(ii) first order concepts (level one codes) with illustrative quotations from the interviews.

Separate tables were developed for intrinsic drivers and barriers from within the major theme/aggregate dimension for each case study. An example for Goal setting & refining is illustrated in Table 6.

Table 6: Descriptive Table: Goal setting & refining (intrinsic barriers)

Second order themes (level two codes)		**First order concepts (level one codes)**
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Expectations	Actor expectations were numerous including: risk taking, setting innovation goals and a new process.	*Risk_taking:* Nathan had a desire to spread the risk of his business; specialising in the 'bubble bursting' genre where Platinum were market leaders was perceived to be precarious. "*…if that genre… (is) no longer the flavour of the day, you've got no business model*." Nathan, Managing Director, Platinum-Demonland.

After this process was carried out for each case, coding structure tables were created. These included:

(i) first order concepts (level one codes),

(ii) second order themes (level two codes),

(iii) major theme/aggregate dimension (included in the table heading),

(iv) the innovation phase that each first order concept appeared in, for each short-term interorganisational innovation project, as denoted by either 1 (phase 1), 2 (phase 2), 3 (phase 3) or left blank if the first order concept did not appear in the data.

An example for the management activity, Goal setting & refining, for the Metbot case is included in Table 7.

Table 7: Coding Structure: Goal setting & refining (intrinsic drivers) for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Formal agreements	*Goal_setting*	1,2
Clear brief and clear goals		1
Early innovation ideas		1
Meeting goals		1
Keeping goals insight		1,2
The kick off meeting	*Project_management_tasks*	1
Agenda setting and project management tools		1,2,3
Successful collaboration	*Collaboration*	1
Early testing of innovation idea(s)		2

These were developed into comparative tables by adding relevant data from each case. As with the descriptive tables, data was grouped into either intrinsic drivers or barriers as observed from within the major theme/aggregate dimension. Therefore, it was possible to see exactly which phase the codes appeared in, enabling direct case comparison, as represented in Table 8.

Table 8: Coding structure: Goal setting & refining barriers for all cases

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Setting goals	*Expectations*		2			2	
Risk taking			1	1	1	1	1
A new process				1,2			1
Challenges	*Project_management*	1	2	1	1	2	2
Time consuming processes		2		1	1		1
Overestimating the company business plan which impacted on the innovation delivery schedule					1,2		
Inefficient communication	*Power/dependence*						2,3
Lack of power distribution							1
Financial investment	*Resource_requirements*		1				
Commercialisation and monetisation of games				1,2			

All the tables included major themes or aggregate dimensions, thus providing the basis for analysis of RQ1. This was developed by focusing on the management activities in the innovation development phases and analysing the descriptive tables alongside the comparative tables. Note that the integral drivers and barriers involved in each major theme were separated, accordingly, in both table types. This enabled direct case comparison in order to answer RQ2. To answer RQ3 both radical and incremental innovations were included in the comparative tables.

Other factors which appeared in the data (in the specific phases, but not in the management activities) were captured, analysed, and interpreted. In this study, three new major themes were identified: learning, knowledge creation & transfer, shared values & beliefs and network stability & embeddedness. While the first relates to management activities, the latter two relate to the additional factors which emerged. Comparisons between cases were then made by creating matrices like Table 8. Note that details for these major themes are provided in chapters 4 and 6.

Once all the data were gathered, the conceptual framework was revisited. By illustrating the concepts and the relationships between them, the conceptual framework helped to determine: how concepts might be related, unexpected connections, and the connections which appear among them (Maxwell et al., 2012). The conceptual framework was drawn on a whiteboard and the new themes were listed alongside. This helped to visualise the developments. The connections were added; each attempt to picture the connections was photographed, to show the trail of work, and then wiped away. The photograph trail helped to understand how the ideas changed with the additional intention to prevent creating the same mistakes. This process went through many iterations before deciding on the most appropriate configuration. The resulting framework is therefore a simplified model of the complex reality under study. A full description of the updated conceptual framework is presented at the end of chapter 6.

3.5.3 Quality evaluation of the case studies

Thorough and credible research requires an assessment of methodological validity and reliabilty (Riege, 2003; Miles, Huberman and Saldana, 2014). Validity denotes whether the research measures what it proposed and reliability signifies whether the resulting outcomes are replicable (Bryman and Bell, 2015). Qualitative researchers, including Lincoln and Guba (1985) and Miles, Huberman and Saldana, (2014) contend that the positivistic, conventional criteria of validity and reliability are not appropriate, as they fail to respond to the contextual nuances and conditional nature of qualitative studies. Taking this stance further, Wolcott (1990) rebuffed validity in qualitative research, claiming that qualitative researchers should instead seek a deep understanding. Recognising the disparities in research goals and interpretations of the different qualitative and quantitative approaches to research, alternative measures have been proposed to assess the reliability of qualitative research. These measures include: confirmability, dependability, credibility and transferability (Bryman and Bell, 2015; Miles, Huberman and Saldana, 2014).

Dubois and Gadde (2002), Riege (2003) and Miles, Huberman and Saldana, (2014) argue that the trustworthiness of case studies should be evaluated. This was done using “best practice” methods (Piekkari, Plakoyiannaki and Welch, 2010, p. 113), see below.

Confirmability refers to the relative neutrality of researchers, their objectivity and relative freedom from unacknowledged researcher biases (Miles, Huberman and Saldana, 2014). Lincoln and Guba (1985) suggest that an outsider should be able to examine the data; therefore it must be detailed, clear and well-structured. Furthermore, it must be interpreted without prejudice using common sense and reason (Riege, 2003) (see Table 9).

Table 9: Quality evaluation of the research – confirmability

Case study technique	Applying the technique
Abductive reasoning (Dubois and Gadde, 2002)	The findings and extant literature on innovation, networks and management activities was reflected upon frequently. This was supported by three academic experts who reviewed drafts of the findings and discussion chapters (5-8).
Chain of evidence	The findings and discussion chapters highlight conclusions which connect directly with the data. NVivo 11 was used which created an audit trail. This comprised the interview transcripts, codes, memos and comments/annotations.
Comprehensive and detailed description of methods and procedures followed	Provided a thorough account in chapter 3, including how coding was conducted.

Dependability is comparable to the concept of reliability in quantitative research (Miles, Huberman and Saldana, 2014). The findings should reveal meaningful similarities across data sources and show that the process of data gathering is stable, coherent and consistent over time (Miles, Huberman and Saldana, 2014) (see Table 10). To address quality and integrity, Miles, Huberman and Saldana, (2014, p. 312) propose asking: "Have things been done with reasonable care?"

Table 10: Quality evaluation of the research – dependability

Case study technique	Applying the technique
Full explanation of theories and ideas	Chapter 2 (Literature Review), includes the research questions which were clearly defined. Additionally, chapter 3 outlines methodological perspectives.
Semi-structured interview guide	The interview guide was improved after conducting the pilot interviews. The interview data was audio recorded.
Confidence that significant parallels were discovered from the numerous data sources	Verbatim comments, illustrating points of view were included from many different interviewees. These comments were compared against documents received from interviewees, company website information, observation notes and corroborated.
The study design was compatible with the research questions	Chapter 3 provides an overview of the approaches implemented in data collection. The analysis phases were also detailed in the analysis sections.

Examination and supervision from academic experts	Three experienced academics supervised the following phases: • data collection; • analysis; and • Findings from the empirical data.

Credibility seeks to clarify whether the findings are coherent and realistic and whether an accurate representation provides, “an authentic portrait” (Miles, Huberman and Saldana, 2014, p. 312). Internal validity aligns with credibility and entails the endorsement of reseach findings by interviewees and/or peers, as ‘realities’ maybe interpreted differently (Riege, 2003) (see Table 11).

Table 11: Quality evaluation of the research - credibility

Case study technique	**Applying the technique**
Triangulation (Denzin, 2001)	Information was validated from interview data by reviewing the observation notes and double-checking documents. Uniting viewpoints and perspectives from three data sources (for example between two suppliers and the orchestrator firm) were acknowledged. If differences appeared, they were discussed.
Pattern matching	Pattern matching (the comparison of a predicted theoretical pattern with an observed empirical pattern) was carried out during the case study analysis and subsequent cross-case analysis.
Data display	Tables and figures were used to support the explanation and description of empirical data.
Verification of negative evidence	If negative evidence appeared, it was confirmed using extant literature and acknowledged in the writing up process. (e.g. why power and influence is not always perceived to be harmful, sometimes it is thought to be necessary).

Transferability indicates the degree to which the findings maybe employed in an alternative context. In quantitative reseach this construct is refered to as generalisability or external validity. Easton (2010) and Miles, Huberman and Saldana, (2014) contend that determining transferability in qualitative research must offer vigilant interpretation, with detailed and convincing accounts, as opposed to statistical generalisability (see Table 12).

Table 12: Quality evaluation of the research - transferability

Case study technique	Applying the technique
“Thick description” (Geertz, 1973, p. 6)	Offered a sufficiently, “thick” description of the research context and findings, enabling readers to assess the possible transferability to alternative settings.
Theoretically diverse sampling was included to assist applicability, if appropriate	While the focus of the setting was in one industry, multiple case studies were employed and, different specialist firms were selected. A variety of local and international firms were included.
The research setting and sample were fully elaborated	Chapters 4 and 5 provide a detailed picture including industry background and case reports, which allow for comparison. Additionally, the boundaries of the research are outlined.

4 Chapter Four: Exemplar Case Study Analysis of Metbot

4.1 Introduction

An exemplar case study of the short-term interorganisational innovation project Metbot, a Twitter-based, weather-forecasting software application is presented here. Metbot was selected because it reflects the characteristics of an exemplar case as identified by Yin (2018). Firstly, it is significant as it is unusual and distinctive. Secondly, it was one of the first innovations to be created via a new approach to developing digital innovations; alternative perspectives from within the short-term interorganisational innovation project team are therefore provided (from both management and subordinates). Thirdly, it is a complete case study. Fourthly, Metbot ran for two full years; longer than anticipated, revealing its acceptance in the marketplace. Fifthly, it was modified into a new innovation, which was accepted in a fresh marketplace; highlighing its longer term value. Finally, it was a technologically discontinuous, radical innovation (Veryzer, 1998), revealing complex characteristics.

A short description of the case is presented in section 4.2. This provides an overview of the short-term interorganisational innovation project. Descriptions of the three firms involved in Metbot's development: Scarlett (public research university), President (web design agency) and Red (British broadcaster) are included.

Section 4.3 onwards discusses the management of the innovation process, from envisioning to disseminating. In addition to the management activities identified in the conceptual framework (Figure 3), the following themes emerged from the data: learning, knowledge creation & transfer, shared values & beliefs; and network stability & embeddedness. These are presented first.

The focus of the research is on specific driver and barrier activities intrinsic to the management activities, in section 4.3. Drivers include factors which instigate or contribute to a particular phenomenon, i.e., items which cause activities involved in the innovation development to occur or develop. Barriers include factors which hinder a particular phenomenon, i.e. factors which challenge, hinder or halt management activities. In order to answer the research question(s), the drivers and barriers found in this case study are outlined and discussed using tables and supporting quotations. Section 4.4 presents the other factors that are important in short-term interorganisational innovation projects.

4.2 Metbot case study description

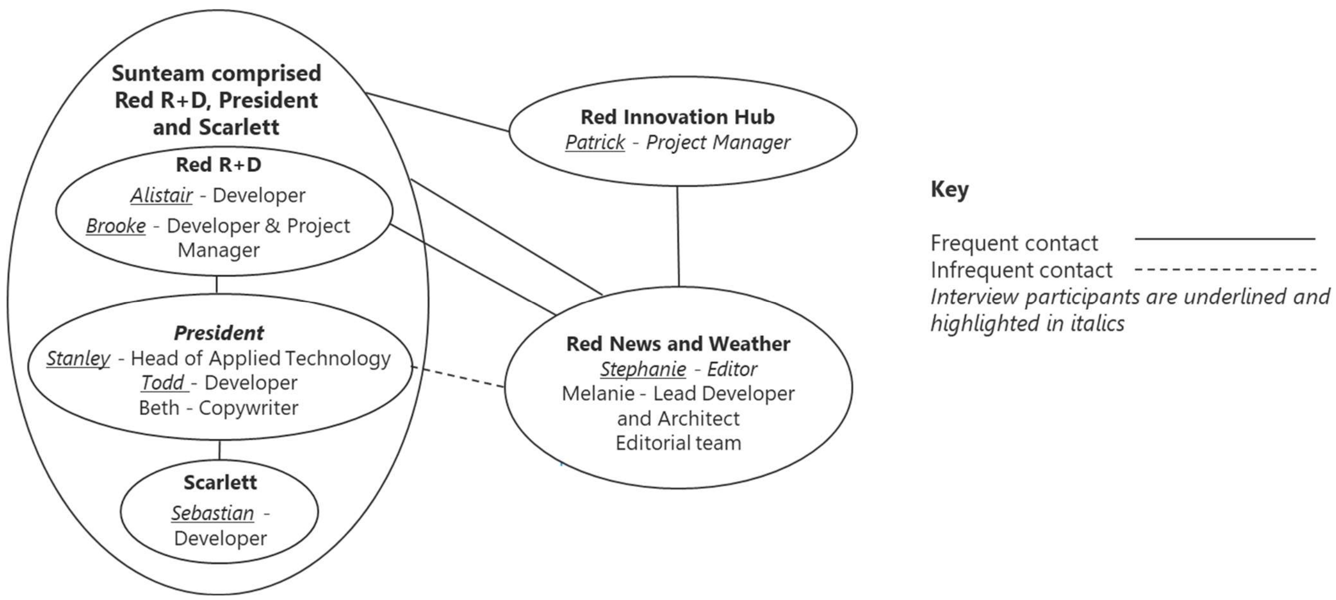
Metbot was an automated bot[3] that generated responses to tweets it received. Specifically, it was a bot that could simulate a conversation. The tweet had to include a location and a time (within the following three days). Metbot selected relevant text from the tweet using geo-specific information to extract data from Red-Weather's website, responding to audiences via social media with a short, personal weather forecast.

The innovation was created with new technologies and new ways of working. At the point Metbot was introduced, no bot like it had ever been created before; using a Twitter feed to communicate about the weather which was a technologically discontinuous innovation.

Figure 5, which follows, is a network picture which illustrates the relationship among the three firms that collaborated to form 'Sunteam'.

[3] A bot is an application that performs an automated task, such as searching online, setting an alarm, or describing the weather, as demonstrated here. Bots are found everywhere in technology, ranging from malicious bots that come with a virus, to search engine spiders that crawl the Internet looking for new Web pages to add.

Figure 5: Metbot Network picture



Brief descriptions of each firm involved in Sunteam[4]:

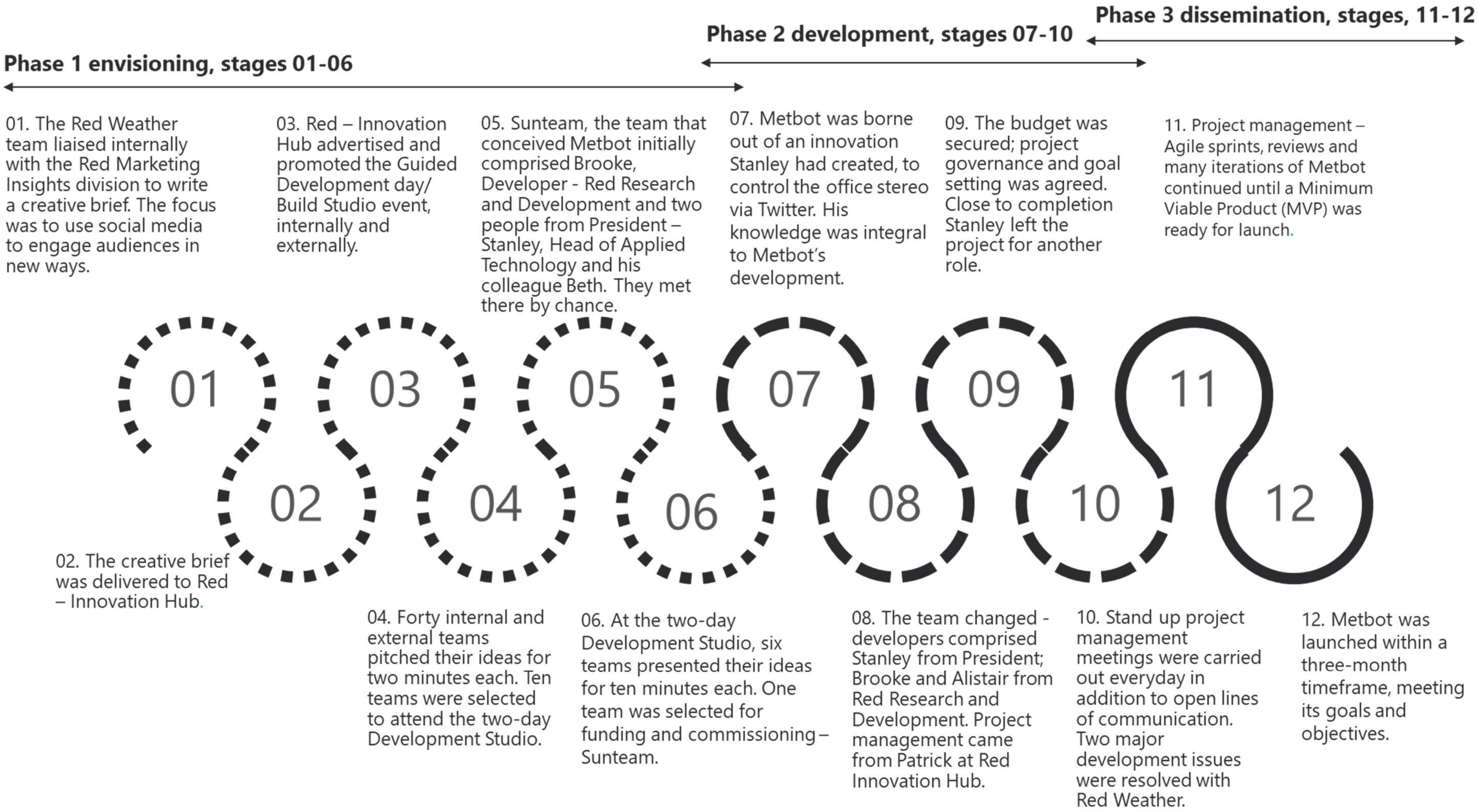
- Scarlett is a public research university based in Sussex, England. The university received its Royal Charter in August 1961. It was a founding member of the 1994 Group of research-intensive universities. The institution has a diverse community of over 17,000 students and over 2,600 academics. The annual income of the institution for 2016–17 was £286.1m.
- President was a marketing-led web design agency based in the south of the UK and set up in 2001. In 2013, at the time Metbot was being created, President was a Hub 100 fast track growth company, with 12 employees. The business was dramatically restructured into various independent initiatives in 2015 and ceased to trade under its original name.
- Red is a British broadcaster with its headquarters in London. It was established in 1922 under a Royal Charter and operates its agreement with the UK Secretary of State for Culture, Media, and Sport. Revenues were £4.96 billion (2016/17). Red is a sizable organisation with many different commercial and operational divisions and over 20,000 employees.

[4] It was not possible to interview all the people involved in Metbot's development. President ceased to trade in 2015, prior to the interviewing period. As an example, Beth, President's copywriter, was not interviewed as it was difficult to locate her. To give a clear illustration of how many people were involved in the innovation development, all roles are included in the network picture, Figure 5.

4.2.1 Envisioning

The weather department within Red wanted an innovation to serve their social media savvy audience. The result was Metbot, a Red innovation that was conceived, pitched and prototyped at two guided development process events hosted by Red-Innovation-Hub (a Red division) in June 2013. At the event, known as a Build Studio, Red-Innovation-Hub facilitated the idea generation process and the ideas were pitched for pilot consideration. The innovation development of Metbot is shown in Figure 6. The early phases described here are included in phase 1.

Figure 6: Metbot innovation development



Forty teams attended this one-day workshop and at this event two people from President, Stanley and Beth, met a Red employee, Brooke. They started discussing their approach to the brief and decided to form a team, 'Sunteam'. From the original cohort six teams, including Sunteam, were selected to attend the subsequent two-day Development Studio event, which occurred three weeks later.

Red-Innovation-Hub has an operational focus of keeping Red at the forefront of digital innovation. It was set up as part of the Red R&D department, focusing on short to mid-term innovation. The intention is that it facilitates and delivers innovative digital experiences across Red, through collaboration within the organisation and the wider industry. Red-Innovation-Hub uses audience research and market insights to develop briefs around digital content. The briefs are then published for internal and external teams to submit their proposals. Ideas that are relevant to the brief and meet the selection criteria are chosen and receive funding to be developed into pilots. The pilots are produced with support from Red-Innovation-Hub.

The Development Studio event was a two-day 'hackathon', involving development of the proof concept. Each team coded together to create a demonstration of how their innovation idea might work. At this point, the winning team made a mock-up of their interface design and took it to a secondary school for early user testing. This initiative helped refine their idea and demonstrated commitment to the innovation. At the Development Studio event, each team rehearsed and delivered a ten-minute pitch about their innovation idea. The participants were aware that a maximum of two teams would see their idea go through to the pilot phase. In the event, one team, 'Sunteam' was selected.

4.2.2 Developing

Metbot interpreted weather-based tweets to give users accurate local weather forecasts. For example, someone would tweet Metbot, '*show me the weather in Manchester tonight*'. It would automatically and instantly tweet back the weather forecast, for example: '*we expect grey cloud with a minimum temperature of 1°C, stay cosy*'. It would also send a link to the Red-Weather website for Manchester. As far as the user was concerned, it was just a case of tweeting and getting an instant reply. However, it was a software application that was generating the message without any human intervention.

Sunteam used Python[5] to create Metbot. At the time Python was not supported by Red, which was, initially, a significant challenge. Java was used for the Natural Language Processing (NLP) functions and Ruby on Rails software was used for project management and administration; enabling Red-Weather and Sunteam to be in touch easily. Metbot was a piece of software that sat in between two tried and tested pieces of software, the first being on the front end: Twitter. This was used as the user interface. The back end was Red's online weather service. The technology to support Metbot already existed. It powered Red's online weather homepage, so if a user had accessed the website and typed into the search engine '*London, weather'* it would give the recipient the weather forecast for London.

The first step required a user to send a tweet to the @Metbot account. Once received, Metbot would use natural language processing to extract the location and time window from the tweet. It was not necessary to provide additional location information such as a postcode or area in the tweet. One significant challenge was overcoming issues regarding name places. For example, there are ten places in the UK called Newport. To be relevant Metbot needed to reply using the correct location. The developers addressed the challenge using locational data contained in the requesting Tweet's metadata.

Once processed, Metbot would issue a data request to Red's weather service for the specified location, converting the information into a string of data to *feed* to the Red-Weather automated service via its application program interface (API). The Red-Weather platform would then process this data and respond with the correct weather forecast as a long string of data which Metbot would then tailor.

[5] Python is an interpreted high-level programming language for general-purpose programming.

Sunteam needed to ensure Metbot was selective in its response as Twitter only allowed 140 characters. Each response would include the windspeed in mph, the temperature in degrees Celsius and a weather code (a number between 0 and 32) which the Met Office[6] and the Red-Weather service used to represent different types of weather. For example, code 32 represented a tropical storm. Once the three pieces of data were received, it would be turned into a sentence with the Metbot algorithm appending a quip to give it character. This was the element that advised the recipient to, '*stay cosy*' or '*bring a brolly*' if it was raining. This process happened quickly to ensure that the recipient received their forecast instantly.

4.2.3 Disseminating

The user feedback from the three-month closed trial of Metbot was very positive. This involved three hundred people in August 2013. Metbot was then soft launched in November 2013, for a period of three months, to a limited audience as a pilot. It was then formally commissioned to become part of the Red-Weather suite of products, for a minimum of twelve months. The innovation was launched in June 2014 and remained in service until 13th June 2016 when a supporting technology became obsolete. Therefore, from the soft launch period, Metbot was in operation for more than two and a half years; fully outpacing all the expectations of the innovation. The data revealed that the key team members involved in Metbot were personally invested in it and were hugely proud of their achievement. Furthermore, the source code within Metbot was adapted to become an Electionbot, producing automated constituency results for the 2015 UK General Election, revealing its usefulness in a new marketplace.

4.3 Drivers and barriers of each major theme/management activity

Drivers and barriers were noted to be interaction specific as they evolved from the interaction in the innovation development and were influenced by the people involved in Metbot. Management activity barriers were not observed to inhibit the innovation

[6] The United Kingdom's national weather service.

processes and halt Metbot's development. Barriers were ad-hoc and could not be grouped into significant clusters, thus illustrating the overarching observation of successful innovation development. Table 13 shows the key to the coding structure and contents for each major theme/management activity, outlining the presentation of this section.

Table 13: Key to the coding structure and contents for each major theme/management activity

Concept	Description	Contents
Major themes	Ten items are included: • learning, knowledge creation & transfer; • shared values & beliefs; • network stability & embeddedness; • leveraging; • motivating & rewarding; • resourcing; • goal setting & refining; • consolidating; • coordinating; and • controlling; separated into drivers and barriers. Definitions are provided.	• Each major theme is introduced.
Second order themes	Level two codes: concepts which are linked in meaning were brought together.	• In the coding structure tables, 'second order themes' is a heading. • In each of the following sections a minimum of one and maximum of five second order driver themes are presented, in each table. • Barriers were not present in all the major themes. Where barriers appeared a minimum of one and maximum of three second order barrier themes are presented.
First order concepts	Level one codes: specific concepts which relate directly to innovation development in a case.	• In the coding structure tables, first order themes is a heading. • Due to limitations of space not all the drivers and barriers are described in detail. The ones that are discussed are highlighted in yellow.
Phase	Illustrating in which innovation phase each of the first order concepts appeared. The three phases include: 1 (envisioning), 2 (developing) and 3 (dissemination).	• In the coding structure tables, phase is a heading. • Innovation phases are described in relation to first order concepts. Important patterns are highlighted.

4.3.1 Learning, knowledge creation & transfer: drivers and barriers

The acquisition of knowledge, skills, facts, and information through being taught or by partnering with experienced people in the short-term interorganisational innovation projects is shown by the term learning, knowledge creation & transfer. Knowledge is passed on, transferred or created and developed. While not explicitly observed as a management activity (Aarikka-Stenroos et al., 2017) and not included in the conceptual framework, this does concur with Dyer and Nobeoka's (2000) dynamic learning capability. In their study, new combinations of knowledge were created, recombined, and transferred within a network (Dyer and Nobeoka, 2000). While barriers were not discovered in this management activity, drivers were found as discussed below.

4.3.1.1 *Drivers*

There were many drivers to learning, knowledge creation & transfer which occurred throughout Metbot's innovation development (see Table 14).

Table 14: Learning, knowledge creation & transfer drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
(drivers to knowledge transfer)		
Combination of unique skill sets		2
Approaches to software development		2
Excellent kick off meeting		2,3
(drivers to knowledge creation)	***Cooperation***	
Specialist actors		1,2
Flexible project management tools (facilitating knowledge creation)		2
Developing a new component		1,2,3
(drivers to learning)		
Red_Innovation_Hub_Events - Developing an approach to the process of innovation	***Facilitating_processes***	2
Shared insight to work in a similar way		2,3
Judging and assessment criteria		1
(drivers to learning)		
Specialist actors	***Specialist_knowledge_resources***	1
Latent knowledge		3
Learning from the trials and test marketing		2

Cooperation, Facilitating_processes *and* ***Specialist_knowledge_resources*** were all important drivers to Learning, knowledge creation & transfer. For example, ***Cooperation*** was a driver to knowledge transfer. Stanley provided a combination of unique skill sets to Sunteam. Having experimented in President's office, he had created a Twitter tool which became the backbone of Metbot. He had the knowledge and insight to communicate his vision to Sunteam (which he was part of). The other developers built upon his idea in the first innovation phase. Their prototype won the Development Studio event. Other drivers to knowledge transfer included meaningful approaches to software development. When Metbot was first being developed, Sebastian was a PhD student. He was part of a peer assisted learning scheme at his university. Through the scheme he met Oliver, a colleague of Stanley's at President. Oliver knew that Sebastian's knowledge might facilitate early innovation ideas. Sebastian recalled his discussion with Oliver:

"…do you have anything that can interpret natural language dates and geolocate references to places?"

Sebastian suggested a Python package and a Yahoo geocoding API. When Sunteam won the Red-Innovation-Hub Development Studio event, Oliver got in touch again to ask for his support to develop Metbot.

Specialists in Metbot's development, helped to drive knowledge creation. Todd highlighted this:

"…it was successful to inspire… different approaches to software development…"

The new approaches enabled the teams to quickly develop modules and combine them with Sebastian's ideas. Todd developed his argument:

"…Metbot was an excellent experiment in natural language processing and human computer interactions."

It was the first pilot commissioned from the Red-Innovation-Hub programme and it was the first to progress to productisation.

There were many aspects of the innovation that were leading edge, involving novel ideas with support from specialists who were pioneering new technologies. The unique combination allowed them to learn from one another and develop Metbot with few complications.

The use of flexible project management tools facilitated the process of knowledge creation. Brooke highlighted the use of Agile[7] methodologies:

> *"…rather than… planning absolutely everything up front you say, 'these are our list of priorities, let's figure out what we're going to work on for these two weeks,' and then by the end of the two weeks our priorities might have changed..."*

Metbot used project management tools actively and effectively.

Facilitating_processes were significant to Metbot's development. The Red-Innovation-Hub events provided a structured approach to the process of innovation:

> *"…the inspiration, support and platform to keep Red at the cutting edge of online innovation and a world leader at delivering engaging, digital broadcast experiences…work programmes…lead to the production of innovative digital pilots…"* Red's website.

Thus, the development of a new approach to the process of innovation and the drivers to learning was important in Metbot's development.

4.3.2 Shared values & beliefs: drivers and barriers

Shared assumptions, values, and beliefs govern how people behave in organisations. These shared values have a strong influence on the people in the organisation and dictate how they dress, act, and perform their jobs. While no barriers appeared in this theme drivers occurred.

[7] Agile software development describes an approach to software development under which requirements and solutions evolve through the collaborative effort of self-organising cross-functional teams and their customers or end users.

4.3.2.1 *Drivers*

Drivers to shared values & beliefs emerged in the first phase of Metbot's innovation development (Table 15).

Table 15: Shared values & beliefs drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Shared values (focused on altruism)		1
Shared values and shared beliefs	***Closeness***	1
Shared culture towards innovation		1

The central driver to Shared values & beliefs was ***Closeness***, which appeared in the first phase of innovation development. As Red is a public service company, the social gains resulting from innovations are created from the public benefitting from them directly. Brooke highlighted Red's altruistic values:

> *"Research and development are at the heart of Red's commitment to innovate and its mission to inform, educate and entertain."*

Altruism can be understood as a driver. Red aspires for all their employees to share six values which represent the:

> *"…expectations we have for ourselves and each other, they guide our day-to-day decisions and the way we behave."* Red's website.

Indeed, Red's altruistic motivations appeared to flow through the mindset of the project team; the cultural fit between them was notable, there was a desire to work on projects for the greater good of society.

Metbot was an innovation that engaged with early social media audiences who wanted to interact with different kinds of media. As new, technologies, methods of distribution and, ways of consuming media caught the attention of Red's audiences; Red sought to compete effectively and be at the forefront of innovation. There were shared values and beliefs between the project team, Stanley said:

> *"…the idea was good, and I think that what also worked well is that it was a collaborative effort between Red R&D and the agency that I was employed by at the time. So it wasn't just Red and it wasn't just an agency, it was really those…groups coming together."*

In the first innovation phase, likeminded people came together to create a winning prototype. Therefore, the shared culture towards innovation was in evidence. Additionally, Stanley said that the process used at the Red-Innovation-Hub events was conducive to creating ideas, he said:

> *"…so it was this initial kind of brainstorm, come up with an idea; pitch this product. After selection, there was a next stage, two day more intense hackathon to build a prototype..."*

Team members within President had experienced similar processes many times before as the firm was on Red's procurement register. However, this was a new process; collaborating with Red employees, other firms, organisations, and people within their own company. A good cultural fit, therefore, was in evidence. There was a shared culture towards innovation from the outset, clearly demonstrated in the first phase of innovation (see Table 15) which permeated the short-term interorganisational innovation project.

4.3.3 Network stability & embeddedness: drivers and barriers

Network stability concerns the quality and strength of ties between the focal firm and its transaction partners (buyers, sellers, service providers). As the ties were reinvoked in the short-term interorganisational innovation project they were characterised by trust, open communication, joint problem-solving skills and were strongly embedded. No barriers to network stability & embeddedness appeared. While there were challenges, none presented as barriers; they did not affect Metbot's delivery nor overall embeddedness and stability of the network. Interorganisational project embeddedness refers to the impact of embeddedness in business relationships regarding firm behaviour and performance. It concerns the interconnected relationship between individuals and companies and their dependence within a network.

Common values and cooperation were exhibited. The shadow of the future was long and multiplexity was demonstrated (frequent and intense encounters spanning a diversity of interactions in other contexts) thereby strengthening network ties. This theme also includes mutual dependencies, obligations, and tie formation including the creation of contracts. In this setting, network embeddedness and stability diffuse into Metbot as a short-term interorganisational innovation project.

4.3.3.1 *Drivers*

As seen in Table 16, examples of drivers to network stability & embeddedness occurred throughout Metbot's innovation development, these comprised: ***Ties, Collaboration, Cooperation***, and ***Closeness***.

Table 16: Network stability & embeddedness drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Strength of ties (and years known)		1
Working with specialist actors		1
Geographical location	***Ties***	2
Latent knowledge (award winning)		1,2
Actor expertise		2
Strong rapport	***Collaboration***	1,2,3
Long established relationships – characterised by trust		1
Contracting, strategic alliances		1,2,3
Multiplexity	***Cooperation***	2
Mutual benefit, dependencies and obligations		2
The shadow of the future	***Closeness***	3
Strong and stable network despite lack of multiplexity		3

Ties were especially strong between Brooke and Red-Weather. Individuals within Red were able to develop their expertise and expand their knowledge by working in different areas of the organisation, via temporary secondments. There was a strong internal network, encouraged by the Red executive. Both Brooke and Alistair had taken up the opportunity of secondments long before Metbot was initiated. Alistair commented:

> *"[the scheme] allows people to go off for a couple of weeks and… work in another area of Red…"*

These opportunities had given Alistair and Brooke a deep appreciation of Red's purpose and openings to network with people in departments they were not previously close to. Ties therefore became stronger.

Metbot's short-term interorganisational innovation project comprised team members who had relevant specialist skills. Brooke mentioned Stanley:

"Stanley had a good idea for what the architecture of the innovation would look like and what technology and what libraries we'd use…"

Sebastian discussed Stanley's use of Heroku:

"…it was the new kid on the block at the time (new software), he was good at using that…".

Therefore, Red R&D accessed specialist actor skills by collaborating with President. Their people used the latest technology and were also able to access niche specialists.

Individual actors were active members of the short-term interorganisational innovation project, working together to achieve a common goal. ***Collaboration*** was important. Their rapport was strong; communication was open and honest and long-established relationships were characterised by trust. In the early innovation development phase Brooke noted strong rapport between herself, Stanley, and Beth at the Build Studio event:

"…Beth came over… we started chatting and her colleague Stanley joined her and therefore me and... that was it really…"

They met by chance and established a strong rapport. Additionally, Todd had an excellent rapport with Melanie who was the senior technical architect for Red-Innovation-Hub. Having worked closely on previous projects, their relationship was well established. This smoothed the innovation development process. Furthermore, previous company collaborations involved people with long established relationships which were characterised by trust. Stanley said that although he had not, other employees of President had worked with Red in the past. Therefore, there was some common understanding and rapport between certain individuals.

Building upon the collaborative nature of the project team, formal agreements created a sense of structure, expectation and ***Cooperation***; four formal agreements were negotiated and agreed between the Metbot team members. The agreements with Todd (V and VI) came after the dissemination phase when Metbot underwent further changes. Therefore, for the development of Metbot, the following written agreements included a defined understanding of the business relationship(s) and scope of work:

I. Red and President (for Stanley's work);
II. Red, Brooke and Alistair (for their work);
III. Red and President (for Todd's work);
IV. President and Scarlett (for Sebastian's work);
V. Red-Weather and Todd for the second development of Metbot; and
VI. Red-News and Todd for the development of Metbot to the Electionbot.

These laid out expectations with the intention to prevent misunderstandings.

There was one intervention by Todd, which Red-Weather commissioned. Todd said:

> *"… some additional work was commissioned… to do things like make the content and some of the settings… accessible to a curator…"*

Todd built a content management system for Metbot. Additionally, scaling work was required to migrate from Heroku to a new system. The written agreements clearly helped to ensure that the requirements were well explicated, producing an excellent overall outcome; Metbot required no additional maintenance support in its lifetime.

4.3.4 Leveraging: drivers and barriers

Leveraging, denotes purposely organising actors for the upcoming innovation. The definition presented in 2.7.8 from Aarikka-Stenroos et. al. (2017) is relevant. Leveraging was essential for innovation development and critical to realise the dissemination phase (Aarikka-

Stenroos et. al., 2017). It was especially important in Metbot. Radical innovations require far-reaching changes in established norms and standards to enable and prepare customer groups, in this case the Red-Weather audience, to easily adopt the novelty. Leveraging provoked changes in user needs and desires, thereby creating demand for Metbot.

4.3.4.1 *Drivers*

Leveraging drivers appeared (see Table 17) in each of Metbot's innovation development phases.

Table 17: Leveraging drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Charismatic, assertive communication style	***Entrepreneurial_skills***	1,2,3
Ability to pitch ideas		1
Oral communication - formal	***Team_interaction***	1
Oral communication - informal		2,3
Red innovation hub events		1
Facilitating progress		1,2,3
Written documentation/contracts	***Project_management_tasks***	1,2,3
Oral communication - discussions held		2,3
Insight to develop an opportunity	***Opportunity_recognition_skills***	1
Connecting actors	***Commitment***	2,3

The key drivers to Leveraging included: ***Entrepreneurial_skills***, ***Team_interaction, Project_management tasks, Opportunity_recognition_skills*** and ***Commitment***. This quotation from Patrick exemplifies his observation of Brooke's charismatic, assertive communication style which forms part of ***Entrepreneurial_skills***:

> *"I was really impressed by her…"*

Brooke instilled confidence and trust in those around her. She used words which induced clarity and inspiration. Patrick noted that Brooke's personality was well suited to her role. She was incredibly sociable, energetic, and conscientious with an ability to persuade people of her point of view. She projected her passion for Metbot through her mannerisms and open body language.

Communicating skills were key to leveraging. Stanley discussed the ability of team members to pitch ideas at the Red-Innovation-Hub Development Studio event:

> *"…I remember we got a reaction (from the most senior judge) she just uttered the words, 'oh wow,' when we pitched the idea."*

As the immediate reaction was positive to Metbot and the judges were impressed, the whole team were motivated to progress. ***Team_interaction*** was evidenced by informal and formal communication. This contributed to leveraging throughout Metbot's innovation development. Despite the developers being geographically distanced across three sites, Brooke said they were:

> *"…very well connected."*

She mentioned formal communication. They had a,

> *"…stand up call every day."*

This was in addition to informal communication:

> *"We would be on Skype in group chat all day long… so we'd be in contact all of the time."*

A balance of both informal and formal contact was helpful to the developers. They created a supportive and trusting environment where they could easily make suggestions to one another for improvements and changes to Metbot.

4.3.4.2 *Barriers*

While barriers emerged (Table 18), their impact did not inhibit innovation progress.

Table 18: Leveraging barriers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Barriers to fluid oral communication (& lack of contact)	***Intransigence***	3

Metbot was a successful project; the innovation was delivered on time and to budget. The only barrier of significance was related to Sebastian who felt alone and frustrated. This is encapsulated in the second order barrier theme, ***Intransigence*** which included barriers to oral communication. In the later project phases, he worked from home, without regular team contact. He said:

> *"…a symptom of me not actually going in and sitting down and being as connected to the project."*

By then the development team met less frequently online. He did get over his frustrations and he said that the problems were,

> *"…fixed quite quickly…"*

Therefore, while the second phase of the project initially did not work out well for Sebastian, the problems were eventually resolved.

4.3.5 Motivating & rewarding: drivers and barriers

Motivation is a process which is used to inspire and increase stamina by increasing mental satisfaction among individual actors in the workplace; it is something which inspires them to work self-intentionally. The themes which emerged as motivations included social and personal incentives which stimulate and reward actors to innovate. While rewarding was found to be a key aspect of motivating in accordance with Aarikka-Stenroos et al's., (2017) definition, financial incentives were not observed to motivate and reward team members.

4.3.5.1 *Drivers*

The key drivers to motivating & rewarding included: ***Social_incentives_activities, Social_incentives_actors, Personal_incentives_actors, Personal_incentives_expectations, Personal_incentives_closeness*** and ***Stage_gate_activity.*** This management activity appeared mainly in the early innovation development process (see Table 19) when the individual actors were enthusiastic about starting a new project.

Table 19: Motivating & rewarding drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Kick off and planning meetings	*Social_incentives_activities*	1
Hosting_a_series_of_events_to_accelerate_innovation		1
Winning the Red-Innovation hub event	*Social_incentives_actors*	1
Altruistic activities		1
Actors were inspired by other actors		1,2
Personal motivation	*Personal_incentives_actors*	1,2
Summer employment		1,2
Excellent prototype	*Personal_incentives_expectations*	1
Positive feedback	*Personal_incentives_closeness*	1
Novel idea		1
Early goal setting	*Stage_gate_activity*	1
Delivering the innovation		3

Social_incentives_activities describes their motivation to collaborate and organise early activities to progress innovation, such as the kick-off and planning meetings. These were a motivational step in the joint goal setting process. Brooke described the first meeting:

> *"…that was an excellent, excellent day…"*

A kick-off meeting using the Agile approach has specific meaning. It is used when a team is starting a major, new, initiative, when a significant number of team members are new. As well as face to face introductions, agenda items included: scope and deliverables, core and desired capabilities, collaboration, communication, and risks. The meetings provided inspiration and opportunities for discussion and debate for all team members.

The team were inspired by winning events designed to accelerate innovation. The Red-Innovation-Hub events were well planned, structured and had successful outputs. Each innovation was commissioned by a Red department for a specific goal and there were tight deadlines to meet. Patrick discussed the importance of the events:

> *"…the process was really well run…. It was what it was meant to be. Brilliant."*

Alistair also described the process as motivational. He said:

> *"… it's completely ground-breaking, because they've got a bunch of people with enquiring minds that are thinking about things that maybe Red-Weather hadn't thought of…"*

The events accelerated innovation, were well planned and had support and resources from senior Red executives. They were based on pertinent market insights and engaged a diverse and talented pool of people who were driven by the challenge of innovation.

Altruistic activities were also found to be motivational. Stephanie was motivated to ensure that Metbot was true to Red's values and the selfless concern for the well-being of the audience. She said:

> *"Audiences are at the heart of everything we do."*

The team often referred to Red's website:

> *"R&D is at the heart of Red's commitment to innovate, and its mission to inform, educate and entertain."*

Red is a public service company and the social gains result directly from the innovations benefitting the public. Altruism can be understood as a driver because Red's innovations are created for the 'greater good' of society; to increase audience connections through different channels, providing pertinent educational information.

Creating Metbot was critical, to maintain positive relationships with the changing needs of a diverse audience. The team referred to the importance of altruism. Involvement in the landmark project motivated them; they felt that they were contributing to the greater good of society. This was perceived as their reward. They did not mention any other type of reward such as a bonus, pay rise, team building activity or party for example.

Despite Stanley's impending move to the USA in phase two, he was personally motivated to see Metbot succeed. He said that:

> *"… [Metbot was] really borne out of a previous innovation that I wrote… it was a similar service that you could communicate with via text and just request songs to be played by our office stereo."*

The concept was that anyone around the world with access to Twitter could control President's office stereo by interacting with its Twitter account. Stanley worked closely with

Brooke and Alistair to complete the innovation development. As he had developed the initial innovation Stanley said that he was:

> *"…so personally invested in it…it felt like this was my baby."*

Both Alistair and Stanley had market insight and specialist technical knowledge that meant that they could apply themselves to Metbot's innovation development quickly and with great skill.

Thus, Metbot was more than a one-off project to him. The 'baby' metaphor implies his nurturing, caring and supportive attachment to the project.

4.3.5.2 *Barriers*

The identified barrier to motivating & rewarding (Table 20) related to editorial issues and design functionality problems, both relating to the 140 Twitter character quips planned in the original version of Metbot. However, this design element was eventually removed.

Table 20: Motivating & rewarding barriers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Editorial issues	***Power/dependence***	2

Stephanie and Brooke had opposing views about the quips. Brooke disclosed that:

> *"…we originally wanted it (the bot) to have a bit of personality and it would tell you what you could wear or take along with you for the day.... It got cut off the final product… the weather team didn't like it."*

Stephanie said:

"Editorially it could prove to be complex."

Red-Weather were concerned how the public would interpret the quip. Brooke understood the concerns:

"…for some people rain might be annoying, but to others it might mean a flood…"

Initially, Sunteam was disappointed that Red-Weather had asked them to design a function to turn the quips on or off. Brooke said:

"...that was part of the compromise, we made the button to turn the quips on or off, so there was something that could be used in an emergency."

(Brooke's reference to an emergency was a weather disaster that may impact on the British population). However, once the development module was completed and the final product launched, the button remained permanently off. This was a barrier for Sunteam who felt undermined. Their interpretation of the comprise was that the button would be turned on at some point. This never happened. Therefore, the compromise appeared to have little value to Sunteam. The code they had written for this feature was never employed.

4.3.6 Resourcing: drivers and barriers

In this study, resources are money, materials, people, and other assets that were brought together to create the innovation. Resourcing predominantly appeared in the second phase of innovation development in relation to the management of resources. This occurred when defining and committing resources to the short-term interorganisational innovation project, while also tracking use.

4.3.6.1 *Drivers*

Actor_resources, Empowerment, Combining_and_changing_resources and ***Brand_and_legacy*** were all important drivers to resourcing (see Table 21).

Table 21: Resourcing drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Actors identified relevant resources and involved the actors that possessed them	***Actor_resources***	2
Team commitment		2
Knowledge resources	***Empowerment***	2
Resources were combined	***Combining_and_changing_resources***	2
Resource needs changed		1,2
Resource legacy	***Brand_and_legacy***	3
International recognition of Twitter		1,2

Actor_resources were a significant consideration during innovation development. For the Metbot case, this included identifying relevant actor resources and team commitment. Alistair discussed this:

> *"…so the actual language processing… we had help from a university… it's quite a complex subject…we didn't have the skills..."*

Sebastian was identified, by President, to support this element of the innovation development.

Brooke commented on team commitment within Sunteam:

> *"…it remains one of the most efficient development teams I've ever been part of…we had such a hard deadline…there wasn't really any scope for not finishing…"*

The team were strongly connected with the brief. They did not waiver from their commitment to deliver Metbot on time.

Empowerment appeared in Metbot's development in terms of Knowledge_resources, Alistair said:

> *"…there are all kinds of restrictions that might cause issues, so while we were programming, we had to consider these dynamic aspects that might mean we had to tailor the message..."*

Thus, the developers used their knowledge to develop Metbot, in a particular way. They felt empowered to carry out the software and coding design to a specification that they believed was appropriate. Sunteam were keen to use internal resources, as external resources often have rate limits which would restrict their freedom to develop Metbot in the way they aspired to[8]. Also, using external resources would potentially give future constraints; any changes made to them by external developers would impact on the code created for Metbot. They did not want to incur future unknown problems. Sebastian said:

> "*…we wanted to take the results from our logic and process them… although it was a lot more work, having an in-house API was preferable because you can control all of it, that's much more of a known factor."*

The implication was that if it worked, the client (Red-Weather), would be accepting of the in-house API solution. In fact, this was the outcome. The solution was robust and flexible once fully developed.

[8] A rate limit is a way of controlling the number of requests processed by a website's API.

4.3.6.2 *Barriers*

Barriers to resourcing appeared predominantly during the second and third phases of Metbot's innovation development (see Table 22) including: ***Constraints, Actor_resources,*** and ***Brand_and_Legacy***.

Table 22: Resourcing barriers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Resource constraints	*Constraints*	2
Budgetary constraints		2,3
Concerns about bot maintenance		3
Resource needs changed		1,2
Team continuity	***Actor_resources***	2
Promoting the innovation	***Brand_and_legacy***	3

According to the Oxford dictionary, a constraint is something that exists rather than something that is made, although it may exist because of someone's decision. Constraint means to make something smaller or less. Therefore, a shortage of funds can be described as a budgetary constraint. A major resource problem in the second phase concerned the constraints of Twitter, this was a resource constraint. The structure of Metbot initially appeared to be simple, Brooke said:

> *"…we used the Red-Weather API as our back end and Twitter as our front end, and… software that goes in the middle that links the two together…But… it does have… restrictions…"*

Metbot was constrained by Twitter's rules. If more than 6000 people tweeted it, it would reply 6000 times, then it would not function for the rest of the day. Twitter's rationale behind this was to stop nuisance bots churning out tweets. Due to the constraints Red-Weather felt uneasy about promoting it. Stephanie said:

> *"…we did not want future problems…".*

Todd also discussed the difficulties of promoting Metbot:

> *"…the complexity it had with natural language processing…then to do it so tons and tons of people can get responses from it quickly…was challenging…"*

Metbot could, therefore, only be promoted in a restricted way. There were instances where the Red marketing and communications team promoted Metbot. However, these instances were restricted to short bursts of activity so as not to damage the brand and incur high costs.

4.3.7 Goal setting & refining: drivers and barriers

Goal setting is defined in this research, by the ambition and effort required to create the desired innovation. Goals were set in accordance with the scope of the short-term interorganisational innovation projects, with appropriate milestones targeted at meeting each innovation phase. Refinements to the goal setting process occurred throughout the innovation process due to the changing nature of innovation development.

4.3.7.1 *Drivers*

Goal setting & refining driver activities appeared predominantly in the first phase of Metbot's innovation development (Table 23), when goals were set and commitments were made between the team members.

Table 23: Goal setting & refining drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Formal agreements		1,2
Clear brief and clear goals		1
Early innovation ideas	*Goal_setting*	1
Meeting goals		1
Keeping goals insight		1,2
The kick off meeting	*Project_management_tasks*	1
Agenda setting and project management tools		1,2,3
Successful collaboration	*Collaboration*	1
Early testing of innovation idea(s)		2

The key drivers to Goal setting & refining included: ***Goal_setting, Project_management_tasks*** and ***Collaboration.*** As radical innovation tends to involve higher levels of uncertainty when compared to incremental innovation, goals were found to be important to benchmark project progress and forecast outcomes. Goals were made more specific by: quantification (making goals measurable) and enumeration (defining tasks that must be completed to achieve goals).

Patrick remarked on the governance applied to the innovation development, thus contributing to formal agreements:

> *"Metbot was one of the first projects Red-Innovation-Hub set up. It had all the correct governance in place."*

He had expected some teething problems in the development of Metbot and was surprised at how smoothly it had progressed.

Brooke discussed the early briefing phase which contributed to a clear brief and clear goals. She said:

"…they gave us a brief which was about using weather data in new ways, trying to reach new audiences…there were exercises…about idea generation, to come up with ideas…"

Thus, Red-Innovation-Hub had thoroughly planned the process to enable the generation of relevant ideas from the outset. Developing on from this, Stanley commented on Sunteam's idea which he perceived to be novel and unique:

"…I know that it was a strong idea which worked in our favour, no one had anything like it."

Therefore, clear, realistic goals enabled Sunteam to focus on the innovation development. Sebastian said:

"We kept that original goal in sight…".

A practical and pragmatic approach to goal setting enabled Sunteam to maintain their focus and ensure that innovation development stayed on track.

The kick-off and planning meetings also supported goal setting processes. Brooke highlighted the types of activities discussed:

"…we talked about what we would do and what we would build and how we would measure its successes…".

The project management tasks involved agenda setting and project management tools. Agile software development was used. Requirements and solutions evolved from the collaborative effort of the team. Agile encourages adaptive planning, evolutionary development, early delivery and continuous improvement. It also promotes fast and flexible response to change. Metbot used goal setting with Agile principles.

4.3.7.2 *Barriers*

Goal setting & refining barriers included ***Expectations***, occurring in the first and second phases of innovation development (see Table 24).

Table 24: Goal setting & refining barriers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Setting goals	*Expectations*	2
Risk taking		1

Sebastian discussed a specific barrier related to his work which was difficult to goal set. He said that it was:

> *"...intricate (work)..."*

The work was challenging and more complicated than he had originally anticipated. While it was problematic for him to resolve easily, he persevered and eventually overcame the complications he had encountered.

4.3.8 Consolidating: drivers and barriers

In this study, consolidating involves making the innovation more coherent and structured by combining many things (actors, resources, activities) through trust. Without trust, it is difficult to build an effective innovation. The creation and building of trust is relevant in innovating, as the boundaries of collaboration and competition are often unclear (Aarikka-Stenroos et al., 2017). Indeed, Aarikka-Stenroos et al., (2017) noted that consolidating included the implementation of philosophies and methods to facilitate discourse and collaboration. Drivers and barriers to consolidating centred on ***Trust***.

4.3.8.1 *Drivers*

Consolidating drivers appeared throughout innovation development, in all phases (see Table 25).

Table 25: Consolidating drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Fostering interpersonal trust	***Trust***	1,2,3
Fostering interpersonal trust leading to interorganisational trust		2

The central driver to Consolidating was ***Trust***. An example of fostering interpersonal trust includes Sebastian's reemployment on the project. After he had completed the initial development module, he commented that he was later engaged, to,

> *"…tie off any loose ends and make it [Metbot] a bit more production ready...".*

Due to his excellent work on the development module, Sebastian's expertise was needed to complete Metbot.

The collaboration between President and the Red R&D team members was strong and trusting. Brooke mentioned that although some people within Red R&D may have had direct experience of making a bot, she did not and neither did Alistair. Therefore, President brought the know-how and Red R&D brought time and resources to create Metbot. The combination of skills and interpersonal trust helped to create the innovation.

Stanley also mentioned the collaboration. He said:

> *"…a collaboration between Red and the agency I was employed by at the time. So, it wasn't just Red, and it wasn't just an agency, it was really those two groups coming together."*

The interpersonal trust therefore fed into interorganisational trust.

4.3.8.2 *Barriers*

Consolidating barriers were problematic for Sunteam and centred on ***Low_Trust***. However, they were surmountable, only occurring in the early phases of the project (see Table 26).

Table 26: Consolidating barriers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Low interpersonal trust	***Low_trust***	1,2

An example of low interpersonal trust was highlighted by the difference between Sunteam and Red-Weather regarding the inclusion of popular Red television personalities in Metbot's design. In the original prototype, Sunteam included an option for the Twitter message to come back in the language style of a popular Red television personality. This element was removed by Red-Weather Alistair said:

> *"…certain bits…were trimmed back…"*

This was the second major challenge to overcome after resolving the issue over the weather quips. It caused frustration in Sunteam as effort had been made to include the Red television personalities in Metbot's design. However, Sunteam understood that Red-Weather perceived that the inclusion of the television characters was inappropriate; it could potentially dilute important brand associations between Red-Weather and Metbot.

4.3.9 Coordinating: drivers and barriers

Coordinating, includes connecting and integrating different team members and their resources to innovate. Task division and communication are important areas of coordination. Individual actors and resources need to be connected and integrated using coordination (Aarikka-Stenroos et al., 2017). Project management featured strongly in this management activity. There was an intention to create unity of action between individual actors and harmony when carrying out various tasks, to achieve the innovation goals efficiently. There were many drivers and barriers to coordinating which appeared throughout Metbot's innovation development.

4.3.9.1 *Drivers*

Drivers included ***Project_management_actors, Roles, Tools*** and ***Project_management_tasks*** (see Table 27).

Table 27: Coordinating drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Project management implementation (skills, phases, modules, planning and kick off meetings)	***Project_management_actors***	1,2,3
Orchestrator role	***Roles***	1,2,3
Project management tools (including Agile)	***Tools***	1,2,3
User testing	***Project_management_tasks***	2
Accelerating processes		1,2
Planning and engagement		1,2,3
Oral communication - regular contact phone calls		2,3
Oral communication – discussions		2
Oral communication - demonstrations		1
Oral communication - feedback		2

An example from ***Project_management_actors***, reveals how Sunteam planned a series of discrete modules that were created by each developer. Alistair gave an example of three modules (stages the bot worked through):

> *"…extract the text from the original tweet; then interact with the weather APIs; then send out the tweet to the user."*

Sunteam defined the interface to each of the modules. They also planned how the modules would communicate with one another. Alistair continued:

> *"…once we'd done that, we could go off and develop a module ourselves…".*

Brooke mentioned how the work was managed:

> *"…beyond Stanley taking care of most of the architecture of it, we then split up the different modules."*

The independent work illustrated by the module development was well planned and managed.

User testing was critical to Metbot's development. User trials were set up via an agency who recruited approximately two hundred people to trial Metbot for a period of two weeks. It was not open to all Twitter users. Selected participants used their Twitter account to communicate with Metbot. Over the trial period, feedback was gathered on how useful participants found it. Alistair said:

> *"…we were interested in ways they used it where they wouldn't have used something like that before or they were engaging with weather when they wouldn't have done previously…".*

A body of knowledge, therefore, was created to ascertain Metbot's use. The user testing involved a large volume of feedback. This was onerous to work through. However, it was not complex and did not form a destructive barrier as it was professionally managed.

4.3.9.2 *Barriers*

Numerous barriers to Coordinating occurred in the second innovation development phase and included: ***Reprioritisation*** and ***Constraints_resources*** (see Table 28).

Table 28: Coordinating barriers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Slow sign off Role reprioritisation and confusion	***Reprioritisation***	2 2
Geographical location	***Constraints_resources***	2

The outcome of the Red-Innovation-Hub process was slow from Stanley's point of view. From the viewpoint of a small agency, he said,

> *"…we were kind of thinking, is this opportunity going to land? When are they going to let us know?".*

This issue presented at the end of phase one. He had to persuade President's finance director that Red were likely to commission the project, but he said, he remembered,

> *"…people doubting me,"* within President.

During Metbot's development phase, the workload was erratic; work was not constant over time. Alistair mentioned that each team member worked on their incumbent role (in some capacity) in addition to Metbot. He said:

> *"I was certainly doing a full-time day job with that on the side.... Brooke spent a lot more time directly involved with the project, but even so I don't think it was constant over that period."*

As the work suffered from peaks and troughs it was not always easy to manage the development time.

4.3.10 Controlling: drivers and barriers

Controlling includes establishing rules and roles for innovating and collaborating. Power distribution is an important management factor in this theme.

4.3.10.1 *Drivers*

Drivers to controlling appeared throughout innovation development, in all of the innovation phases (see Table 29). The key drivers to controlling included: ***Roles, Power/dependence,*** and ***Commitment.***

Table 29: Controlling drivers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Developer role Orchestrator role Project management role	***Roles***	1,2,3 1,2,3 1,2,3
Rules and roles were established Actor commitment – formal roles Actor commitment – informal roles	***Power/dependence***	1 2,3 2,3
Teamwork and collaboration	***Commitment***	1,2,3

Establishing roles was important in Metbot's development. Alistair discussed his role:

> *"I was at the first event that they had in London… at that stage it was a case of designing what we were trying to put together…and creating a prototype."*

Roles were specified and understood; team members knew what they had to achieve. Sebastian's role was also clearly defined. He said:

"…my task was fairly constrained; in that it was a module that tried to figure out… place names… and then resolved that to a latitude/ longitude coordinate so that could then be passed to the Red-Weather API."

The direction provided by Brooke was essential. She saw herself as an informal orchestrator. Her role was unique, combining both orchestrator and developer roles. Project management was critical to the process of innovation development. The team members were trained in project management processes and were accustomed to project management work styles. This was exhibited in their behaviour and practice. Brooke said:

"I also had a sort of project management type of role, but informally I suppose."

Brooke would lead and liaise with the Red-Innovation-Hub project manager. She attended meetings with the Red-Weather team. She continued:

"So, I… firmly had a foot on the Red side, with the product, the client as it were, I suppose, who was Red-Weather and in the development itself."

Patrick had a formal project management role. He oversaw the Red-Innovation-Hub innovations. He supported Sunteam when they were ready to integrate Metbot code with the Red systems. Brooke said:

"…that's what he was really good for.".

The immediate team of three developers self-managed the innovation directly. Referring to herself, Stanley, and Alistair, Brooke said:

"…day to day in terms of what we needed to get done by the end of this week or that week, we did that ourselves."

Brooke discussed Patrick's project management role in terms of facilitating progress,

> *"…if there were [formal] blockers on the Red-Weather side, he'd make it his business to sort through those..."*

Brooke also said that Patrick was good at connecting people, describing his role with Melanie, the technical architect, she said:

> *"…Patrick would have the edge with that…"*

As Metbot's dedicated project manager, Patrick had a formal role to ensure the smooth running of the project. This included contract negotiation:

> *"…part of my role was to ensure the successful completion of contracts with third parties. Contractually the relationship with President ended when the bot was delivered."*

However, the strong ties between the team members remained and when Red-Weather decided to develop Metbot further, they came back together and met the task. Thus, commitment was strong.

4.3.10.2 *Barriers*

Barriers to controlling featured in the second and third phases of innovation development, including ***Roles*** and ***Expectations_actors*** (see Table 30).

Table 30: Controlling barriers for Metbot

First order concepts (level one codes)	Second order themes (level two codes)	Phase
Tensions	*Roles*	2
Informal roles		2,3
Risks	*Expectations_actors*	2

Tensions occurred when the team members had been working together for some time; relationships were established and their rational debates had resolved many problematic issues. In the main, issues were dealt with pragmatically but on occasion, tensions occurred. For example, when Stanley left Sunteam team continuity was lacking. Todd was hired to cover aspects of Stanley's role sometime after Stanley had left President. Todd commented:

> *"…there was no handover with Stanley because of the nature of my hiring….".*

However, there was full documentation for Todd to work through and he had several calls with Stanley. Todd said, he was told by his line manager:

> *"…Red is interested in doing some work on this, get up to speed…"*

Todd used his knowledge and skills to piece together the history of Metbot's development. There was no formal handover. While this caused some tensions and time for Todd to understand the background to the project and learn specific details about Metbot's coding, due to the collegiality of the people involved, there were no major difficulties experienced.

Additionally, barriers experienced between team members occurred because Sunteam perceived Red-Weather to be risk averse. This includes the use of Red television personalities and the quips in the Metbot build. Alistair said:

> *"Red-Weather are very risk averse."*

The issue was that information used in Metbot needed to be conveyed in basic terms. Stephanie said they needed to avoid poor communication, where

> *"…things can be misconstrued or interpreted in the wrong way…"*

Alistair continued:

> *"…as it turned out, when these features were stripped out, it was just reporting the information. Otherwise, it was left to us to put it together in the way that we saw fit, technically…"*

Red-Weather were content for Sunteam to continue with full control on Metbot's design as long as it communicated simply and accurately.

4.4 Factors that influence project management in short-term interorganisational innovation projects

The findings provide insight into how Metbot came into being. The first five factors are now presented. Firstly, as evidenced in section 4.3.3, despite the temporary nature of the project (it disbanded once Metbot was disseminated and then evolved into a new project) network stability was maintained throughout innovation development due to the hub firm support. Secondly, as shown in each of the barrier sections of the major themes/management activities (see sections 4.3.1 - 4.3.10), there were drawbacks from the complex nature of creating a radical innovation. However, the barriers were not significant enough to halt innovation development. Thirdly, as highlighted in six management activities (see sections 4.3.1.1, 4.3.2.1, 4.3.4.1, 4.3.5.1, 4.3.7.1 and 4.3.10.1) the Red-Innovation-Hub was a successful institutional mechanism, facilitating and guiding the development of Metbot, in addition to information and knowledge exchange. Fourthly, project management was critical to Metbot's innovation development. Specifically, the implementation of Stage-gate and Agile methodologies were key, as presented in the management activities coordinating

(4.3.9) and controlling (4.3.10). Fifthly, factors which promote effective teamwork and project management were in evidence in the short-term interorganisational innovation project. This included factors evidenced by Tidd and Bessant (2018) such as: clear goal(s), results focused, shared commitment, a climate supporting collaboration, norms including excellent standards, support and encouragement, moral leadership, apt team utilisation, involvement in decision making, team spirit, respect, friendships, and acceptance of change. These factors are evidenced in goal setting & refining (see section 4.3.7) coordinating (see section 4.3.9) and controlling (see section 4.3.10).

The following sections present five further factors that influenced project management in Metbot. Connections are made with each of the major themes/management activities.

4.4.1 The prevalence of management activities

Activities such as motivating & rewarding, and goal setting & refining appeared in the early phases of innovation development; they were critical to establish the innovation. Although instances of drivers to resourcing, consolidating, coordinating, and controlling appeared in the early innovation phases, there were more examples in the second phases of innovation with instances also appearing in the dissemination and commercialisation phase. Hence, they were noted to be instrumental throughout.

In line with drivers to goal setting & refining and motivating & rewarding, the newly identified management activity: learning, knowledge creation & transfer was important to the process of innovation development; highlighted with many examples in the early phases of innovation. Examples also appeared in the second and third phases of innovation, illustrating their sustained importance throughout the development phases.

No barriers were observed to learning, knowledge creation & transfer, shared values & beliefs nor to network stability & embeddedness. For the other management activities, few barriers appeared in phase one; illustrating that development was not significantly impeded. Barriers dominated innovation development in phase two, perhaps reflecting the complexity of radical innovation development. By the third phase the barriers had largely fallen away, moreover there were no barriers to consolidating in this phase, revealing the high levels of trust between the team members and the prevalence of drivers. Thus, there was an overriding desire to surmount challenges, gain knowledge, increase understanding, and drive the innovation forward.

Of key importance are the exemplary coordinating activities and the excellent utilisation of project management. This is in addition to the experience and specialist expertise of the people involved in the short-term interorganisational innovation project, which was paramount to innovation development.

4.4.1.1 *An efficient work pace*

The essence of innovation speed can be captured by exploring the choices taken by the people in the short-term interorganisational innovation project; the successful implementation of these decisions and the pace of activities which were completed well. Table 31 shows the factors which contributed to an efficient work pace and in which management activity they appeared. Successful delivery of each innovation phase contributed to timely delivery of the innovation.

Table 31: Factors contributing to an efficient work pace

Factors contributing to an efficient pace and therefore timely innovation delivery	Linking management activity
Timely innovation based on true need	Goal setting & refining
The integration of quality at every stage; saving time in the long run as it was not necessary to revert to a past stage	Goal setting & refining
Engaging efficient cross functional teams of people	Resourcing
Delivering a few important projects as opposed to spreading resources too thinly	Coordinating

Utilising Agile and Stage-gate methodologies	Coordinating, controlling, leveraging, goal setting & refining, motivating & rewarding, and resourcing
Commencing and completing tasks simultaneously	Coordinating

(Adapted from Cooper, 2019)

Due to the way Metbot was set up and created, it increased the likelihood of success and directly impacted on the timeliness that innovation occurred. The project team members did not take shortcuts nor compromise on quality to ensure a fast route to market. This would have been viewed as detrimental to the high standards of innovation development employed. True innovation was sought. Metbot was designed to satisfy specific customer needs. Agile and Stage-gate methodologies played a major role to ensure smooth project management, enabling considered and effective innovation development.

4.4.2 The importance of individual actors (people), their micro-level interactions and dense social networks (contributing to consolidating, section 4.3.8)

People were noted to be significant, explicitly, the influence of individuals in the interaction process was important. The network approach builds on the belief that firms encourage interdependent relationships with many actors, this was also found to be true in this short-term interorganisational innovation project. Therefore, the individual people and the relationships that they initiated, grew, and developed, were fundamentally important. The micro-relationships between individuals were significant; personal relationships were just as important as professional ones.

Many of the people involved in the short-term interorganisational innovation project had known each other for many years and had become ‘friend-like’. The people working in the project had existing involvement in MCD&MS networks. These dense social networks led to strong and reciprocal collaboration, linking with network stability & embeddedness. Therefore, the short-term interorganisational innovation project emerged from within an already loosely connected industry network.

4.4.3 Cognitive abrasion, tacit and explicit knowledge (contributing to learning, knowledge creation & transfer, section 4.3.1)

Managing the process of cognitive abrasion was difficult in Metbot. Cognitive abrasion comprises idea generation, disclosure/advocacy, and convergence activities (Skilton and Dooley, 2010). Teams must produce a variety of concepts in the ideation phase of innovation to resolve the problem(s) that they face (idea generation). In the second phase, disclosure and advocacy, teams must be clear about their ideas and build transparent cases for them, being aware that divergent ideas must be resolved and jointly negotiated to allow the team to move onto the execution or convergence stage. The findings show that cognitive abrasion was significant. The people involved in Metbot shared their ideas (idea generation); provided justifications for their opinions (disclosure and advocacy) and collaborated on feedback activities to reach agreement (convergence).

As observed, cognitive abrasion allowed the people interacting in Metbot to communicate tacit knowledge by accessing unspoken knowledge including: individual viewpoints, perspectives, concepts and opinions, which helped them to conceive different strategies and engineer new solutions (Leonard and Sensiper, 1998; Nonaka, 1994; Spender, 1996). Often the tacit knowledge of individuals in Metbot was mobilised via cognitive abrasion involving personal insight, instinct and sparks of creativity. In the context of innovation development, this is crucial (Leiponen, 2006).

Generally, the people working on Metbot understood the innovation goals and objectives. They were wholeheartedly on board, openly communicating with one another. They felt accountable and understood what had to be achieved to meet the goals and the accompanying timetables. If there were differences between people, as the overarching goals and commitments were clear and acknowledged, they accepted the relevance of honouring one another’s differences.

4.4.4 The importance of strong and weak ties, trust, and actor diversity (contributing to consolidating, section 4.3.8)

Brooke had a central, leadership, position as an orchestrator; providing direction, governance, and guidance. The composition of the short-term interorganisational innovation project was important. Two actors with a strong rapport formed the bedrock of the project. Additional actors joined the initial dyad, comprising actor organisations as well as individual people. A third principal actor, and subsequently others, provided diversity (new perspectives were brought forward, challenging embedded thought processes); allowing difference of opinion and new ideas to evolve.

4.4.5 Atmosphere in the short-term interorganisational innovation projects

A prominent finding was the importance of the relationship atmosphere; the emotional setting or backdrop of a business relationship (Håkansson, 1982; Eggert and Helm, 2003). The literature suggests that relationship atmosphere is a product of the relationship as well as a factor contributing to future relationship development (Eggert and Helm, 2003). The relationship atmosphere comprises:

- companies' mutual expectations;
- overall closeness or distance of the relationship;
- balance of power and dependence of the relationship;
- trust or opportunism exhibited (Eggert and Helm, 2003; Ford et al., 1998; Håkansson, 1982); and
- state of conflict or cooperation.

These individual relationship features may have an important influence on inter-firm interaction (Håkansson, 1982) and, therefore, on innovation development. While subsequent writing has proposed additions and refinements to these five dimensions, they have achieved widespread acceptance as a framework useful for purposes of description and classification of relationship atmospheres. It has therefore become accepted that these five dimensions are adequate to explain and even to predict the likelihood that a relationship will or will not be formed between parties and that the dimensions will also be useful in understanding the developing character of an emergent relationship over time. In this research it was observed that the atmosphere of the business relationships conditions the management activities and was found to be a central factor when developing relationships between firms, in addition to shaping the relationship characteristics over time.

5 Chapter Five: Case summaries

5.1 Introduction

This chapter describes the remaining five cases; it comprises details about the organisations and the team members involved in each short-term interorganisational innovation project. Appendix 1, presents the Thematic Analysis Tables (see, 10.1); these show the coding structure and contents for each major theme/management activity.

A case study for each short-term interorganisational innovation project (hereinafter termed 'innovations' in this chapter) is provided. The cases include the main activities, details of the short-term interorganisational innovation project, the team members involved and diagrams illustrating:

1. The background to the project.
2. The innovation development phases.
3. Network pictures illustrating how many people were involved in each innovation development; all roles are included, and the interviewees are highlighted in italics.

The incremental innovations: CodingGame (5.2), Demonland (5.3) and ARVR-Staging (5.4) are presented first. These incremental product innovations provided improvement or modification within an existing market (Garcia and Calantone, 2002). They are followed by the radical innovations: Mediaworks (5.5) and Audiolizer (5.6). Analogous with Metbot, the radical innovations are considered as technologically discontinuous (Veryzer, 1998). Appendix 4 (see, 10.4) provides a Glossary of terms relating to television production.

5.1.1 Background to the cases

The chapter starts with short descriptions of the innovations, provided in Table 32.

Table 32: Short case descriptions

Innovation	Radical/incremental	Description
CodingGame	Incremental	CodingGame was a free to use, platform computer game that taught basic computer programming skills by letting users take control of DJ characters at RadioX (Red's radio station for 15 to 29-year-olds). The game encouraged users to code the DJs to jump, slide and break through levels on their journey to the radio station's main summer event. The intention was to encourage RadioX's audience to think more about coding without it feeling like a school lesson.
Demonland	Incremental	Demonland was a strategic role-playing game, based on the Freemium concept; allowing customers to receive basic play services for free and requiring them to pay for additional services deemed to be premium. Demonland invited players to build and maintain their own island fortress. A key difference was that participants were characterised as villains. Tactical attacks were necessary to combat enemy bases, where users could loot resources to upgrade their own stronghold.
ARVR-Staging	Incremental	By offering virtual as opposed to physical television studio sets, ARVR-Staging has the potential to shake up the UK broadcast industry considerably. By combining: AR and VR graphics tools, Blue's in-house knowledge and buying in third-party technical know-how, a new virtual studio package has been created. Blue will initially offer ARVR-Staging to Red's sport division – Red-Sport, extending the proposition to new production companies in the future.
Mediaworks	Radical	Mediaworks was a remote digital media ingest service designed for the broadcast sector. It was

		intended to be used by production companies filming on location. The service enabled a speedier and economical option in the shoot to edit process by facilitating location-based media management and file ingest over IP (internet protocol). Mediaworks was a laptop-based solution that offered back-up of camera card media to portable hard drives, viewing of popular camera file formats, internet speed connection testing and a choice of workflows to send native or a choice of proxy formats to Blue's private cloud platform at MediaCityUK. Once content was received, clients could use Blue's remote production tools and post-production services to complete their workflow.
Audiolizer	Radical	Audiolizer was a music visualiser, a tool for creating audio reactive music visualisations and lyric videos on desktop tablet and mobile. Media player software was written which generated animated imagery based on a piece of music. Users could choose a music track and then create their own visuals by adding graphics, lyrics, and special effects. The visual imagery was generated and rendered in real time. It also synchronised with the music as it played. At the time of launch it was a new concept which disrupted the sector and was radical. Mixit was created as a new platform which Audiolizer was launched from. It was a website dedicated to encouraging young people to embrace digital technology including some of Red's best-known brands. The ambition was to simplify digital making and take it mainstream.

Brief firm biographies are presented in Table 33. Note that each firm is aligned with at least one short-term interorganisational innovation project (denoted with brackets). The participant data tables presented in chapter 3 (Table 2 and Table 3) show which firms are involved in each short-term interorganisational innovation project. Furthermore, as Red was involved in the development of Metbot a brief firm biography is included in the Metbot Network picture, Figure 5 in chapter 4. As Red was part of the short-term interorganisational innovation projects Audiolizer and ARVR-Staging, the biography applies to them.

Table 33: Brief firm biographies

Firms	Firm descriptions
CodeClub (CodingGame)	CodeClub was founded in 2011. It is a global volunteer-led community of free programming clubs for children aged between 7 and 17. It is a grassroots organisation with individual clubs (named "Dojos") acting independently. Supporters of the enterprise believe it is part of the solution to address the global shortage of programmers, by exposing young people to computer technology at a young age. The movement has seen significant growth since its inception with new Dojos being created every week. In 2017 their headcount was over six hundred.
Pine (CodingGame)	Pine was founded in 2001. It is an independent game development studio with a reputation for creating original games with high production values. They create high quality games, apps & educational content using HTML5, WebGL, Unity, VR and C++. Pine develops cross-platform games from concept through to delivery. They work (often confidentially) with clients such as advertising agencies, design agencies, marketing agencies, media owners and on occasion, other games companies. In 2017 they employed approximately twenty permanent staff members.
Platinum (Demonland)	Platinum designs, develops, and publishes high quality games for online and mobile, social, platforms worldwide. It was incorporated in August 2011. In Spring 2018 it had six employees and three games live on Facebook. The business was formed to take advantage of the burgeoning online and mobile games market. The experienced management team has over twelve years gaming experience. Over the last seven years they have created games for the constantly evolving Facebook platforms. Prior to this, the

	team worked for many years in the mobile sector, configuring the code for landmark computer game titles to enable them to become playable on mobile devices for the first time. Platinum are based at MediaCityUK, in The Landing - a technology enterprise incubator for high-growth companies. It comprises, workspace, a community of like-minded businesses, business support, user experience testing labs, a maker lab and regular social events. The space was originally set up in 2013 with a consortium comprising: European Regional Development Fund (ERDF), the North West Development Agency (NWDA) and Salford City Council. The intention was to create a community of attuned SMEs and start-up businesses.
Gold (Demonland)	Gold compose music for commercials, television, film, radio, computer games and B2B needs. Their aim is to create music content that combines great composition ideas with high production values. Their three central values are: quality, trust, and value for money. Clients include Red, Blue and creative agencies in Manchester including Platinum. Gold was created in 2015 and moved to The Landing, MediaCityUK, in late 2015. In 2017 they had six employees.
Sapphire and Aqua (Demonland)	Sapphire is the Glasgow-based games publishing arm of Aqua; a British public service television broadcaster that began transmission in the 1980s. It is publicly owned although, largely commercially funded. Sapphire was formed in 2015 to provide support to small, talented independent developers in the mobile games sector. The executive team have over sixty years of collective experience and a genuine passion for gaming. Sapphire's label is built upon Aqua's reputation as an ally for independent creatives, by helping developers to launch games to a global audience. Sapphire commission up to six games a year in association with its flagship programme brands which have achieved large global audiences, international nominations and wins at BAFTA, Digital Emmy, Broadcast Digital and BIMA awards. In 2017, Sapphire employed approximately ten people and Aqua employed over eight hundred.
Flame (ARVR-Staging)	Flame's business is based on the creation of a new product; a real-time photo-realistic 3D Virtual Studio and AR solution, with advanced real-time compositing tools and its own keying

	technology. Their new product has a powerful integrated toolset, providing solutions for all types of VR and AR production workflows, including data driven graphics. The business, based in Izmir, Turkey, was incorporated in 2013. It comprises a small team of approximately forty individuals with many years of experience in production, post-production, and visual effects. They are expanding quickly due to the dramatic uplift in sales of their flagship product.
Moss (ARVR-Staging)	Moss designs and builds camera technology products for the film and broadcast sectors. Their product range includes remote camera heads, motion control, broadcast robotics, mechanical and optical camera tracking for AR and VR, in addition to on-set visualisation. The firm was established in 2000 and in 2017 employed forty people. Their products and services are designed to help television production companies maintain low budgets and keep shoot times to a minimum. These values form the basis of their approach to innovation and have enabled them to grow their presence on the global stage – delivering products to key firms in the broadcast industry.
Blue (ARVR-Staging and Mediaworks)	A leading digital media services provider offering television studio & post-production facilities. Blue provides broadcast technology solutions across the full content production workflow including HD television studios, digital post-production, cloud media management services and advanced connectivity options. The firm is based at MediaCityUK in Manchester. Blue's studio and post-production clients include Red and many large independent production companies. The business oversees all stages of the content lifecycle, from creation to archiving. They support clients with tape-based and digital distribution. Blue, while established, is a relatively new firm which launched in January 2008. It was set up with service level agreements fixed with Red for ten years, with an annual guaranteed revenue exceeding £10m. In 2017 it had over eighty employees. Consequently, unlike most start-up businesses, Blue had the backing and future work commitments from the outset. It is wholly owned by one of

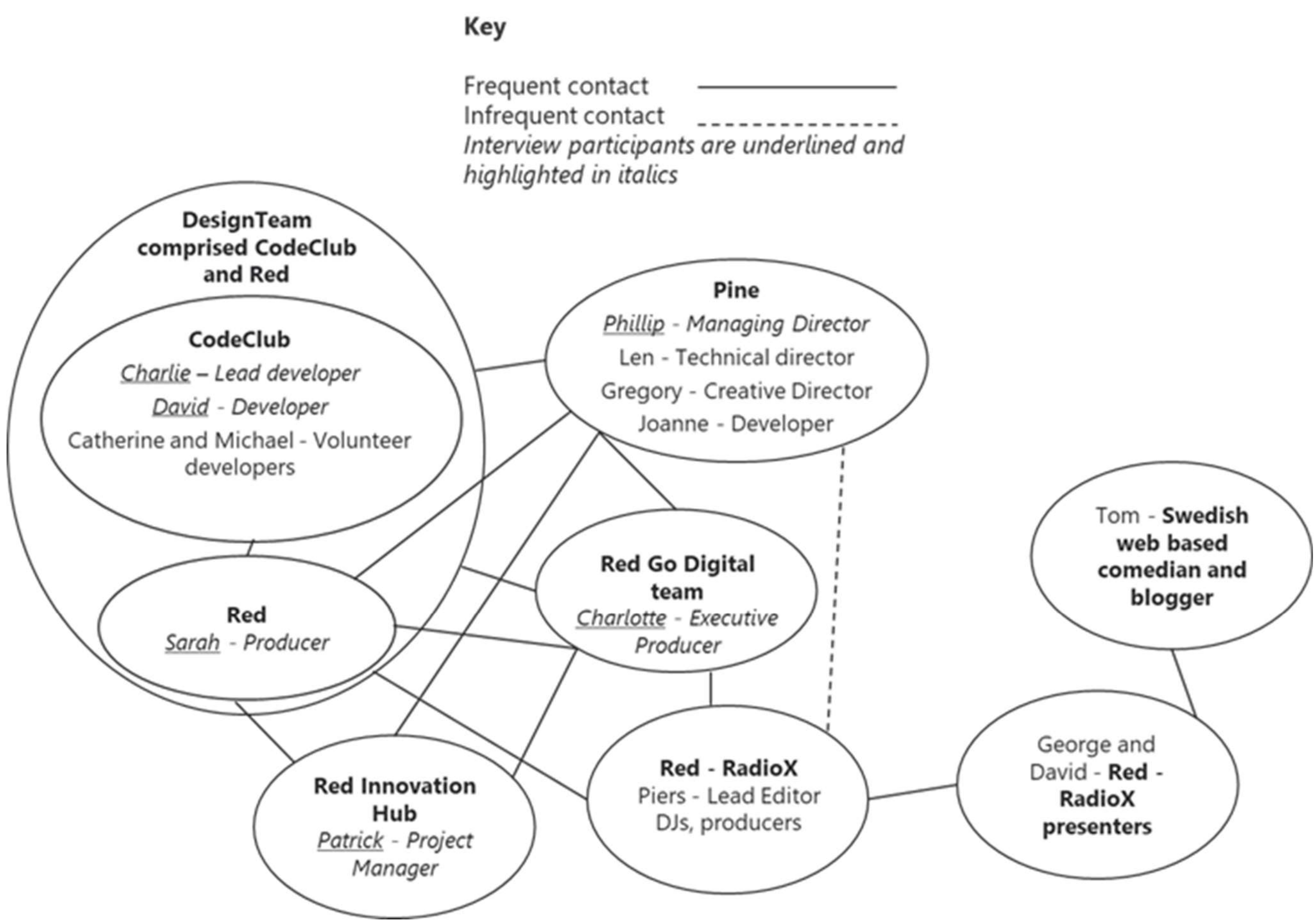
	the UK's notable privately-owned investment enterprises, embracing a broad range of sectors including land and property; transport and logistics; retail and leisure; energy and media (£6.6bn assets, in 2011).
Morph (Audiolizer)	Formed in 1972 and based in Bristol, Morph is an award-winning (Golden Globe, Academy Awards and Annie Awards) animation studio creating film, broadcast, advertising, and interactive entertainment. Morph licence and distribute their own brands. In 2017 the firm employed approximately five hundred people.
Air (Audiolizer)	Air has built industry leading campaigns, websites, products, and mobile apps for more than twenty years (established in 1998), for blue chip clients. Based in Wiltshire, they were highlighted as a top ten UK innovation team in 2017, with a headcount of over twenty-five people.
Amber (Mediaworks)	Amber is a technology and multimedia business based in the USA. It was founded in 1987. Their products and services are used in the television and video industry to create television programmes, feature films and advertisements. The business specialises in audio and video; specifically, digital non-linear editing systems, in addition to management and distribution services. Amber's flagship product is a professional software based non-linear editing system. Non-GAAP Revenue for the business in 2016 was $525m and they employed over 2,700 people.
Liquorice (Mediaworks)	Liquorice is based in Belgium and was established in March 2010. It was conceived by three founders: Matthew, Chief Executive Officer (CEO), Nicholas, Vice President Product and Duncan, Chief Technology Officer (CTO) - a group of entrepreneurs that had met and worked in the broadcast industry for more than twenty years. Its headcount was forty people in 2016 and had revenues of £7m.

5.2 CodingGame

5.2.1 Introduction

The people that were involved in the development of CodingGame are represented in Figure 7.

Figure 7: CodingGame Network picture



DesignTeam, the team that conceived CodingGame, comprised four people initially: a children's television producer from Red and her assistant, in addition to two developers from CodeClub. They had all previously worked together to create a suite of Flash games for a landmark children's television series, focused on explaining basic concepts of computational thinking. The relationship continued when they developed games for the

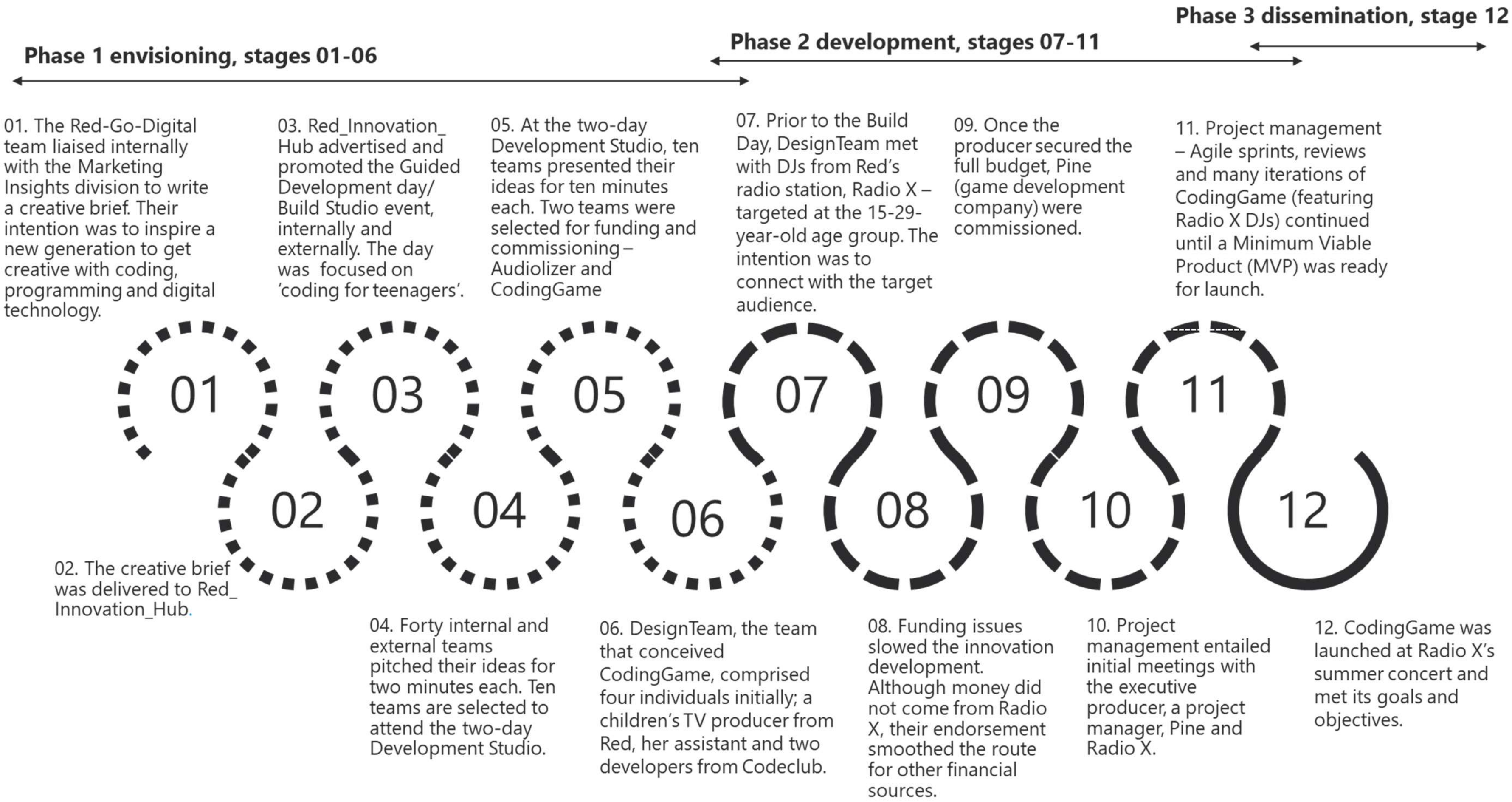
Red-Children's television website using HTML5[9], which, at the time was considered experimental; few developers were using it in a conventional way. Consequently, as the team had so much relevant experience to contribute, the line manager of the children's television producer suggested the team put forward a pitch for the Red-Go-Digital brief.

Red-Go-Digital was Red's major UK wide campaign to inspire teenagers to develop digital technologies via coding and programming. Red-Go-Digital aimed to inspire audiences about digital creativity through world-class television, radio, and online content. They aimed to help younger audiences discover their creative potential and take their first steps into the digital arena. Further details about Red-Go-Digital can be found in Appendix 5 (see 10.5).

The background to the development of CodingGame is represented in Figure 8, showing the three phases of innovation development.

[9] HTML5 (hypertext mark-up language) is used for structuring and presenting content on the World Wide Web. It is the fifth and current major version of the HTML standard.

Figure 8: CodingGame innovation development

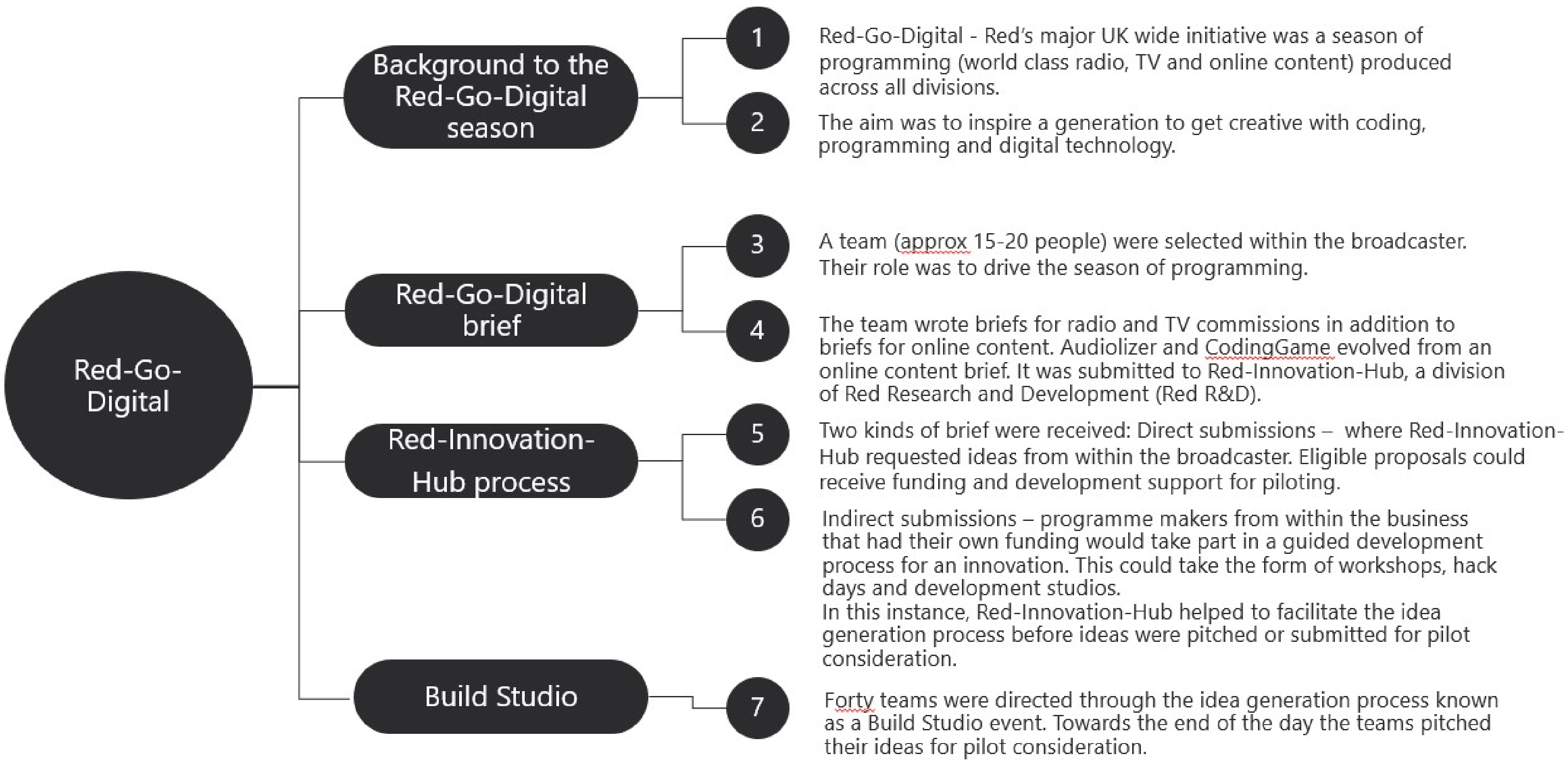


5.2.2 Envisioning

Prior to the Red-Innovation-Hub Build Studio[10] event, the CodeClub developers took the opportunity to meet with some DJs from Red's radio station, RadioX (a Red radio station which also broadcasts internationally). The CodeClub developers felt that RadioX had a good connection with the target audience (15-29 years) and linked their innovation ideas around it. Its remit is to entertain and engage a broad range of young listeners with a distinctive mix of contemporary music and speech. With an average audience of over 10m people tuning in every week, the potential link was incredibly advantageous. DesignTeam wanted to appeal to the target group's love of music, dance, lyrics and give them something entertaining that subtly leveraged an understanding of basic programming skills. They felt that 'hacking' was a good analogy to attract the target audience, as it naturally felt subversive and fun for teenagers to break conventional rules. Figure 9 provides a breakdown for the initial phase one, envisioning, for Red-Go-Digital.

[10] At the Build Studio event, teams pitched their ideas for pilot consideration. These were narrowed down to approximately six teams and their associated ideas. The teams then returned for a two-day Development Studio event a few weeks later, giving each team time to develop and refine their proposals (see Metbot exemplar case).

Figure 9: Red-Go-Digital



DesignTeam felt there was an inherent risk that even mentioning the words *computers* or *programming* would turn a large section of the audience away. Therefore, they sought to present an interface that was focused on the organisation of fun instructions and ordering natural processes (in natural language) so it could follow the same rules as programming but not move into code language. The main aims of CodingGame were to: introduce basic coding skills to a broad audience; promote the annual event; leverage Red's talent; and act as a gateway to further digital skills. When DesignTeam were invited back to the Development Studio event, they interviewed some RadioX DJs, who were fully supportive of their ideas for the Red-Go-Digital pitch.

This helped to create a bank of video footage demonstrating the DJs' commitment to DesignTeam's ideas; it was portrayed as if Red-Go-Digital had already commissioned them. DesignTeam, therefore, had demonstrated direct endorsement from the DJs, acknowledging that any project involving RadioX required their backing. DJs promote and discuss topics at their discretion during their shows, hence without their support, DesignTeam's ideas would not succeed. Additionally, DesignTeam had exemplary experience and novel ideas, which were demonstrated in their considered and well-articulated pitch.

Coincidently, the executive producer for the brief at Red-Go-Digital had recently left RadioX on secondment. Red-Go-Digital had given her the task of tying an innovation up with the radio station. When DesignTeam presented CodingGame, she saw the potential link. As she had strong relationships with the RadioX production team, she was their direct liaison. Her dual role was to represent them and champion the innovation for Red-Go-Digital.

DesignTeam were proud to have won the Development Studio event but concerned that the budget would be split[11]. Consequently, although funding never came from RadioX, their endorsement smoothed the route for other financial sources within Red, which the project champion secured.

[11] The win was shared with Red-Femteam (see 5.6)

5.2.3 Developing

DesignTeam were put in touch, through the project champion, with people providing additional support, including a project manager. They had already worked with a game development company, Pine, on previous HTML5 games. The project champion knew the agency, and introductions were made to pitch for the development and design work. The producer, who had commitments at the Red-Children's television channel was given a dedicated contract for her role on the development of CodingGame. Her main role was backfilled. CodeClub was contracted as consultant on the project, to ensure that the educational elements of the game were sense checked. They also tested the code. The project champion worked with the producer to feedback to RadioX, to ensure that the appropriate promotional support was given from the DJs. Hence, both Red-Go-Digital and RadioX gave their full support to engage the audience.

The game play incorporated key principles of computer programming, meaning that players developed basic computational skills as they played. It was not the purpose of CodingGame to be a coding teaching tool; rather the game intended to gently introduce basic skills, to make computing concepts accessible and to inspire audiences to try something new.

On the surface, the game was a side-scrolling platformer[12]. The auto-running levels featured classic jump, duck, and bash controls, they were easy to pick up and play straight away. This was key to maximising the appeal of the game for the target audience. The intention was to run different DJs through a classic platform environment and when players hit trouble, hack their way out by tweaking gameplay values like jump height and forward movement. It was playable on various platforms, two modes catered for different tastes. One had many levels and the other was an endless runner. Every time the player completed a hack, their actions were represented in pseudo-code, adding another visual level to

[12] A side-scrolling game is one in which the gameplay action is viewed from a side-view camera angle. In this case the onscreen characters moved from the left side of the screen to the right. Side-scrolling games have been succeeded by 3D games; however, they continue to be made, often for handheld devices or for digital-only releases.

reinforce the fact that (just by playing) the player had written a piece of code which in turn affected the gameplay.

5.2.4 Disseminating

CodingGame was launched in the run-up to RadioX's successful annual summer event (May 2015) providing excellent brand association. The DJs also encouraged their guests to play CodingGame. Indeed, one of the biggest YouTubers in the world played CodingGame live on air. The recording was shared via email and social media to millions of people online. This resulted in poignant, engaging discussions about the game, emphasising player enjoyment and experiences on high rating radio shows. The DJs further generated interest by posting their own gaming scores on key social media channels, which continued to build excitement amongst the listenership.

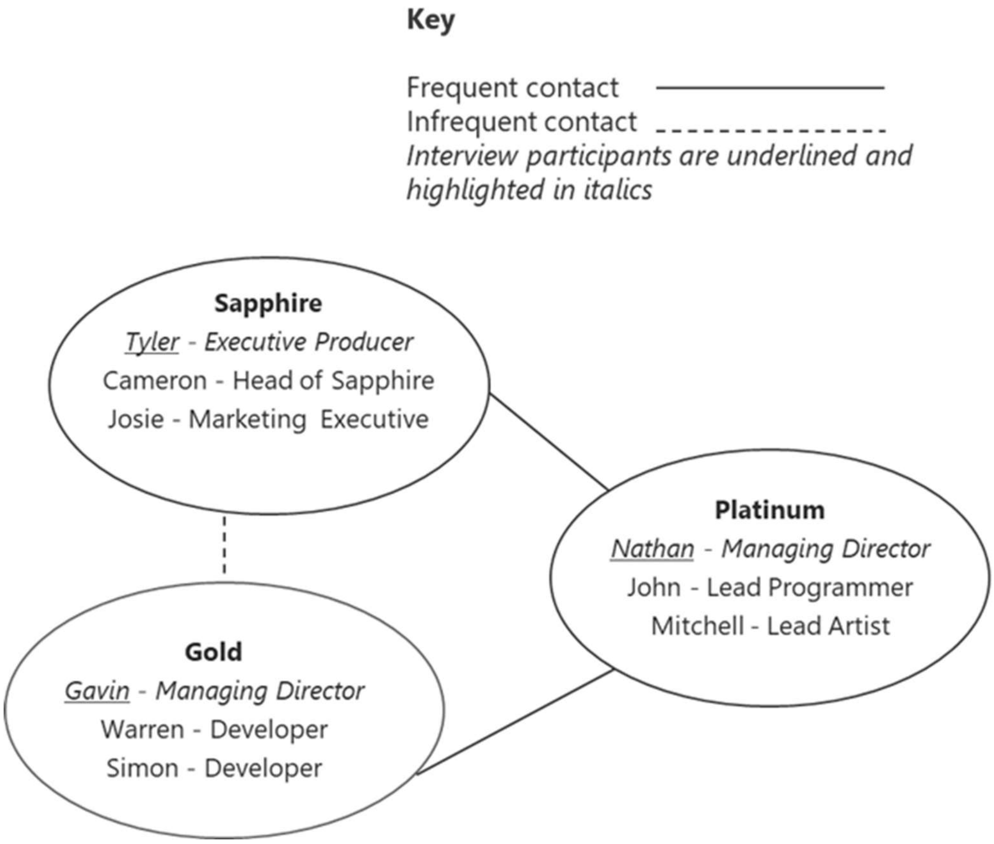
Successful dissemination was demonstrated as over one million levels were played on CodingGame in the launch week. Furthermore, thousands of tweets showed that the game was popular. Player numbers increased as demonstrations were subsequently given at a series of planned music events and festivals over the summer period. As anticipated, engagement waned in the autumn months when active marketing activities ceased. CodingGame therefore met its potential and achieved the goals set.

5.3 Demonland

5.3.1 Introduction

Those involved in the development of Demonland are represented in Figure 10.

Figure 10: Demonland Network picture



Demonland was a collaboration between Sapphire and Platinum. It is a strategic base building and battle game, designed for people that were brought up watching James Bond films; players take on the role of an archetypical super villain, craving world domination. They have an opportunity to build their empire and keep it running as smoothly as possible. Features of the game include a unique trading cards element that optimises combat performance to assist players to win battles. The soundtrack was specially composed by Gold with the intention to transport players into the heart of a world of espionage.

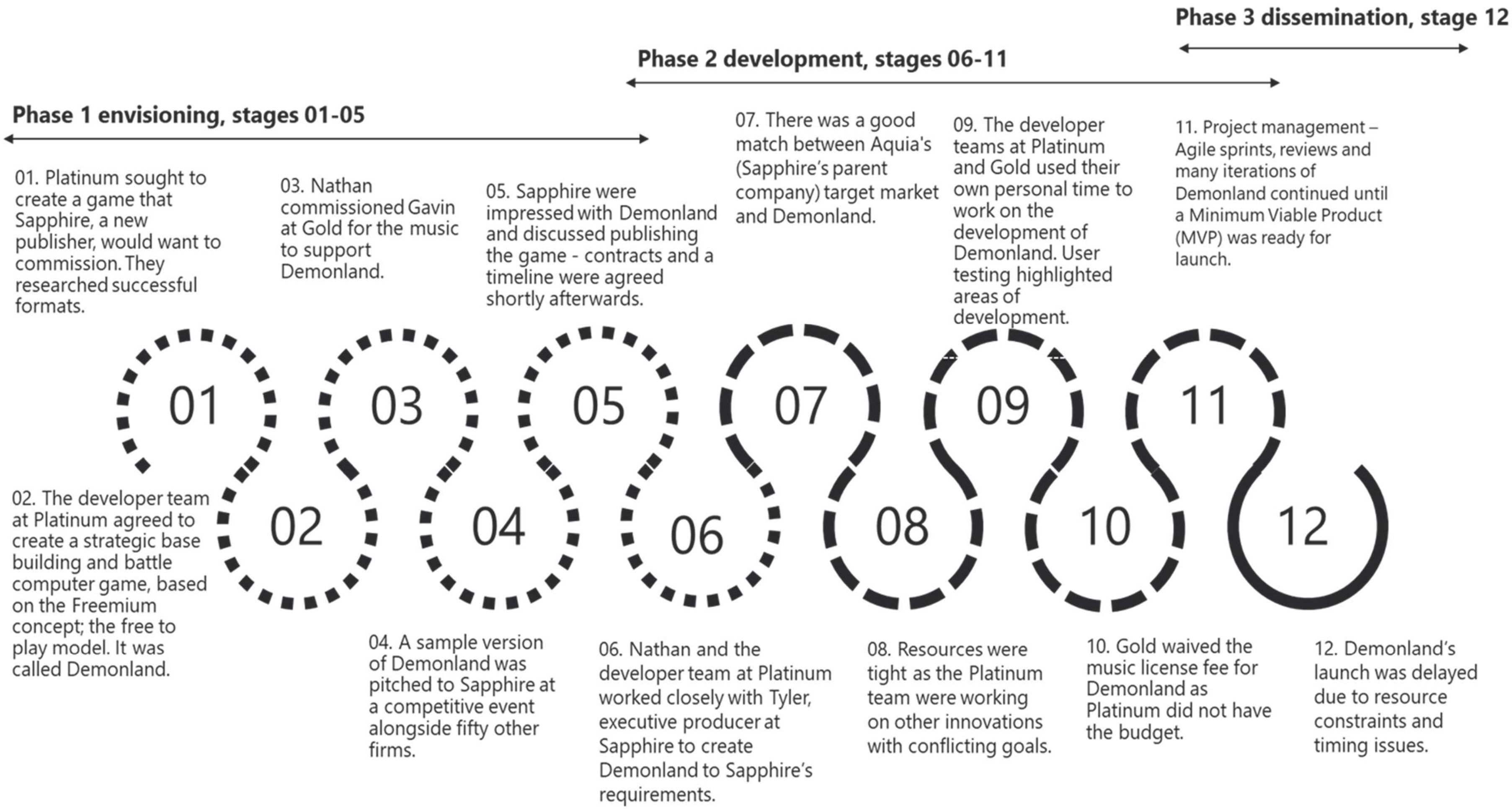
Gold were commissioned by Platinum for the incidental music. At the time of launch, the music gave Demonland an edge that was not found in any comparable game in the sector.

Most games have some form of music, but often it is selected from relatively inexpensive sources for effects and background.

5.3.2 Developing

Platinum's aim was to constantly innovate, adopting the latest technological advances, driving quality higher. Platinum demonstrated Demonland to Sapphire, with its dynamic accompanying incidental music, intended as a key differentiator. Following the demonstration, Sapphire commissioned Platinum to produce the game, committing it to an agreed launch deadline, with the publisher, Aqua, Sapphire's parent company. Liaison to create Demonland was primarily between Platinum and Sapphire; Platinum and Gold. Sapphire met Gold on a few occasions, for an introduction and milestone meetings until completion. In the main, Sapphire relayed any concerns about the music to Platinum, who resolved them through regular consultation. Figure 11 shows the innovation development of Demonland.

Figure 11: Demonland innovation development



Platinum worked closely with Gold on all aspects of the game's sound. This involved an initial pitch focused on sound composition. The Platinum development team liaised closely with the sound engineers at Gold. The final composition was high-quality incidental music with echoes of a James Bond theme (without copyright issues) enhancing the gameplay. Platinum also commissioned Gold to generate the hundreds of additional sound effects required in each element of the gameplay.

Gold exceeded Platinum's expectations with the quality and depth of sound. The intention was to instil the James Bond themed music in the users' sub-conscious mind, with the hope that they would engage and return to the game more frequently.

5.3.3 Disseminating

Demonland's soft launch phase was in early 2017. The feedback was very positive, with users frequently returning to the game and following through to purchase 'premium' services. Platinum's aspiration was that players would be drawn to Demonland with the employment of a high value marketing campaign. Once hooked, users received push notifications regarding future levels which they hoped users would download as well as updates and upsells. The full launch followed in May 2017 when it was available to download for free in the Apple, Google, and Amazon app stores. It was hoped that Demonland's sound would be a key differentiator and unique selling point. The game was available for a full two years, highlighting its longevity and success in the highly competitive marketplace.

5.4 ARVR-Staging

5.4.1 Introduction

Red holds the television and radio UK broadcasting rights to several sports, broadcasting the sport live or alongside flagship analysis programmes. Red-Sport is a department of the Red North division providing national sports coverage for Red television, radio and online. Results, analysis, and coverage is also added to the Red-Sport Website. During the summer of 2017, Red-Sport sought a new AR and VR television set design for their three football shows, to be introduced in August 2018. As both a supplier and television production partner to Red, Blue saw this unique opportunity to create a flexible solution which could be created and delivered for use by Red initially and subsequently other customer groups.

Blue would need to supply the full solution, thereby creating the ARVR-Staging innovation. Specifically, the innovation was a combination of three different technologies:

- camera tracking technology;
- rendering software; and
- graphics software, to create the new AR and VR set design and consequently, create the new package.

Solutions for the camera tracking technology and rendering software were launched in 2017 and were designed to work in a television production setting; however, at the time, the graphics software only existed in the gaming sector. The solution required a significant capital investment, time to explore the options available and training and staff recruitment, as the knowledge and skills required did not exist in house to pull all the technologies together into one innovation.

By acquiring the technology and skills to deliver studio-based AR/VR solutions to Red, Blue realised that they would be in a strong position to offer these services to other Red departments and third-party production companies. No other facility of this size offered this solution, in the UK, at the time; Blue recognised that they would be offering a brand-new solution, ahead of their competitors. They wanted to ensure that they maximised opportunities, first by offering Blue clients a creative way to add innovative and creative solutions to their productions and secondly, by attracting new clients with a one-stop shop AR and VR package.

The intention was to offer an AR and VR solution which would be capable of being deployed to any studio within Blue's facilities. The aspiration was that the innovation would be capable of being deployed throughout the building Blue operates in; eight television studios, in addition to specific public spaces at MediaCityUK. However, as the new system would primarily facilitate the Red-Sport contract, it would not be available to other productions when in use by Red-Sport (approximately eighty production days per year in addition to preparation and turnaround time).

Blue agreed the commercial principle with Red-Sport in August 2017. As the intention was to maintain an open, co-operative relationship, Red-Sport were fully engaged in the pitching process. Red-Sport met with Blue and the new potential suppliers and they saw the quotes for the capital requirements. They also agreed to the proposed rate card recovery principle (the rate-card provided by Blue to Red-Sport listed the fair and profitable remuneration agreement). It covered all aspects of the new set design and meant that Blue would not incur costs in phases one and two of the project, while it was being scoped out and agreed.

5.4.2 Developing

The process in August 2017 resulted in two suppliers, Moss (supplier of the camera tracking solution) and Flame (supplier of the rendering technology) being chosen to provide parts of the new solution. At the time, Flame was a new business with no established history. While Blue had been working with the market leader, their offering was not as sophisticated nor flexible. Flame's solution worked well with Moss's camera tracking system; combined they aligned well with the selected graphics software. By the end of December 2017, with the support of staff from Blue's television studio, visual effects and post-production teams, in addition to freelance graphics experts, who pulled all the technologies together, Blue was able to demonstrate the solution to Red-Sport, who signed it off.

Figure 12 illustrates the network picture for ARVR-Staging and Figure 13 shows the different phases of innovation development.

Figure 12: ARVR-Staging Network picture

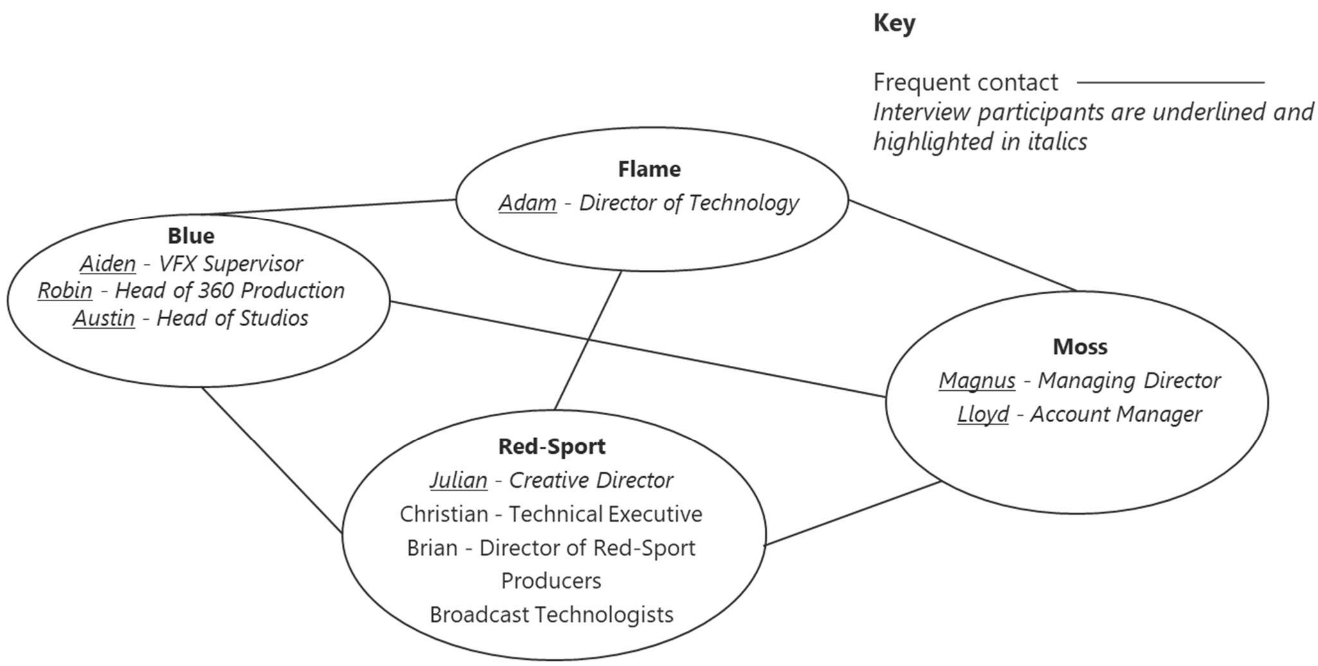
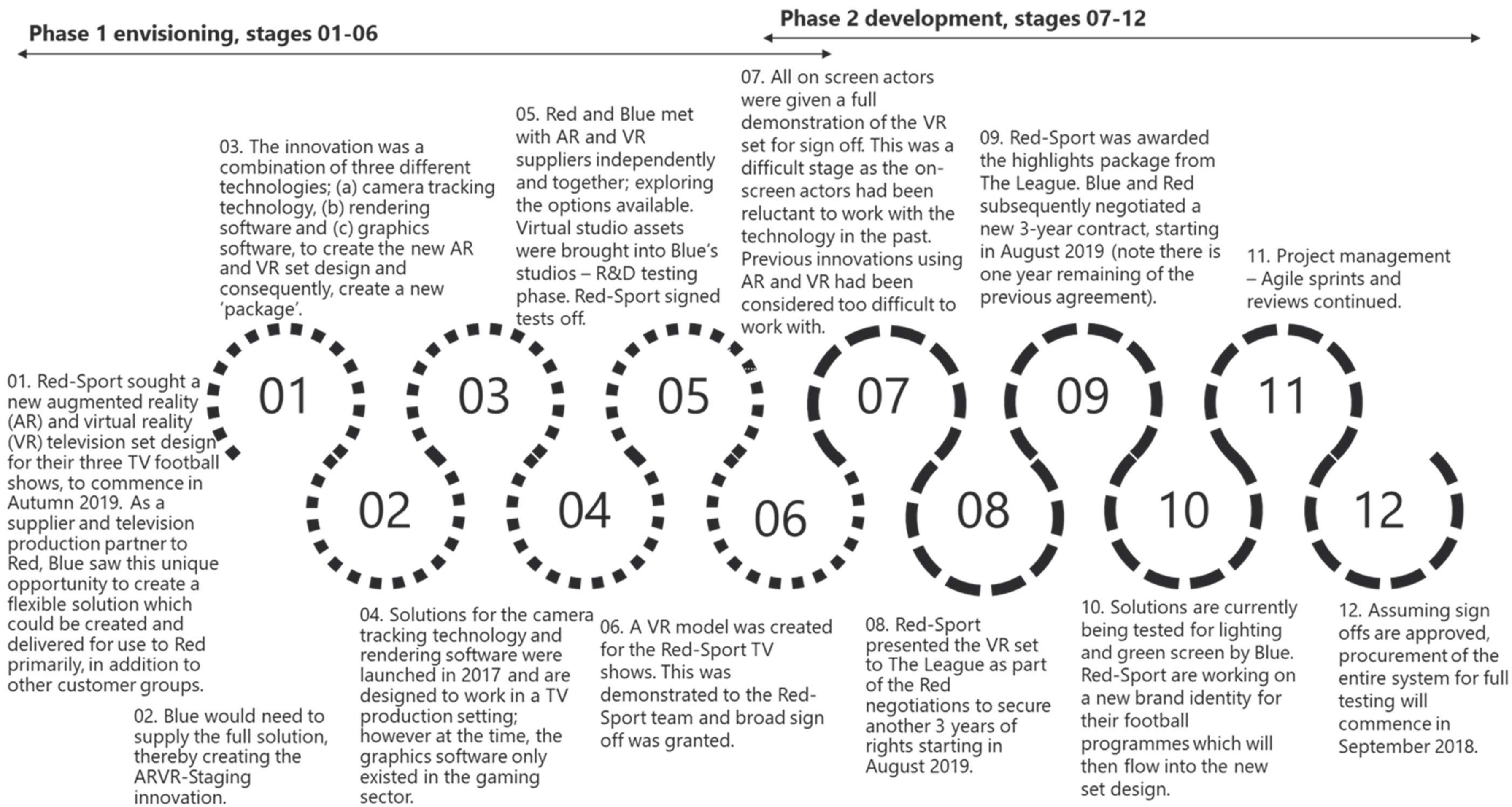


Figure 13: ARVR-Staging innovation development



5.4.3 Disseminating

The interviews occurred prior to dissemination. It looked likely that the innovation would succeed. At the time, Blue was in the fortunate position of having a single client, Red, who could commit and underwrite much of the capital investment; allowing a low cost of entry into the market to grow with third parties. The innovation enabled continuous improvement of Blue's television studio offering, bringing innovative technology to its clients, ensuring its ongoing customer base could stay in-house for all future AR/VR needs[13].

5.5 Mediaworks

5.5.1 Introduction

Mediaworks is a radical innovation. The business model was brand new and there was no comparable product or service offering in the sector at the time. Blue was well known for its television studios and post-production offering. By introducing Mediaworks to the market it created disruption and change.

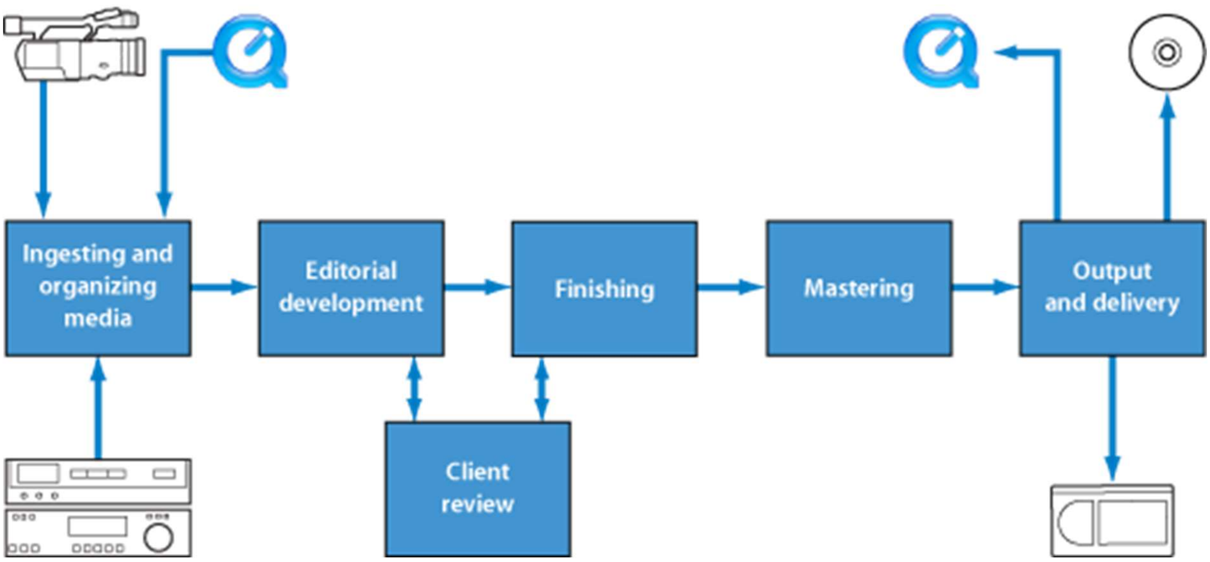
Blue needed to meet the expectations of its shareholders to continue growing the business and extend its reach beyond the boundary of MediaCityUK. The first thought was to leverage the technological infrastructure that has been developed at MediaCityUK comprising: connectivity and the fibre network. This would enable its services to be available to new clients and existing ones further afield and facilitate Blue offering its services to its clients on a national and eventually international basis.

Historically its post-production clients would have carried out their initial filming on tape, in the field. The industry has now moved to a file-based world. This entails new ways of working and cost efficiencies in the long run. However, there are immediate problems of getting the saved rushes (a file) into an edit suite to manipulate it, add sound, effects, metadata, and get it ready for its final destination (an archive, a broadcaster, post-

[13] ARVR-Staging was successfully disseminated in August 2019.

production house etc). This provided an opportunity to Blue. The intention was to visualise a product that could be used by production companies in the field, overcoming the challenges of getting media (captured in the field) back into an editing environment for post-production, content, and file delivery. To aid background understanding, traditional workflows prior to Mediaworks are shown in Figure 14.

Figure 14: The traditional post-production workflow



5.5.2 Envisioning

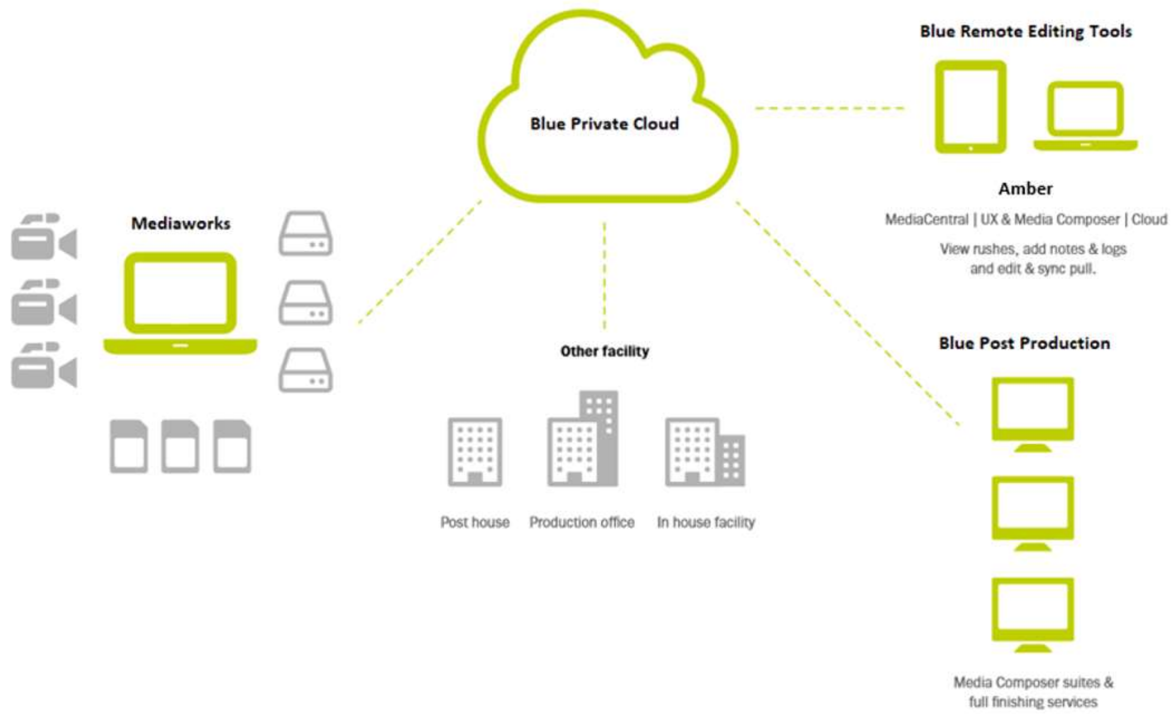
The innovation was designed to solve the problem a television production company faces when it has saved all its rushes on digital media card and needs to get them quickly to an edit suite in a safe and efficient manner. The historical workflow would be from the field, via a courier to a post-production house. The post production house would duplicate them and then ingest[14] them onto a server for later editing. It is expensive and time consuming.

[14] Ingest is a post-production term. It is the backbone of video content management. Without it, editors would be lost in a sea of files and unintelligible names. At its core, video ingestion is the process of capturing, transferring, and storing video files in an organised manner for simple identification and location in the future.

5.5.3 Developing

The new workflow was developed as follows: a special tool, 'Mediaworks' (a laptop with dedicated functionality) would be provided to a television production company in the field, thus enabling them to back up their rushes to hard disk. The rushes could then be reviewed in the field using a media player on Mediaworks. A low-resolution proxy version (transcode) of the rushes could then be transferred to an editing facility (over a broadband or 4G mobile connection), as shown in Figure 15.

Figure 15: The Mediaworks production workflow



The high-resolution file of the rushes would be transcoded to a low-resolution proxy file, using Mediaworks. The files would then be transferred to central servers in the cloud which would, therefore, then be available to network-connected colleagues to start editing wherever they may be based. Mediaworks would then enable the transfer of the low-resolution proxy file (via broadband or 4G mobile connection) to Blue's servers. At Blue they could send the file via the fibre network anywhere in the world or it could be imported into Blue's Amber server system to be reviewed, edited, and made ready for broadcast.

Subsequently, when the high-resolution file is ingested into the Blue servers, any changes applied to the proxy file would be applied to the high-resolution file. This means that the television production team could edit the rushes straight away, all the changes would then be saved, and no time is lost. The result is a quicker speed to edit, highly sought after in television news or sport production. Therefore, using this new technology, a programme can start to be produced almost immediately, while in the past, the high-resolution media would still be travelling back in the traditional way, via a courier.

Blue worked very closely with two firms Amber and Liquorice to create Mediaworks. Figure 16 illustrates the network picture of the people involved in innovation development.

Figure 16: Mediaworks Network picture

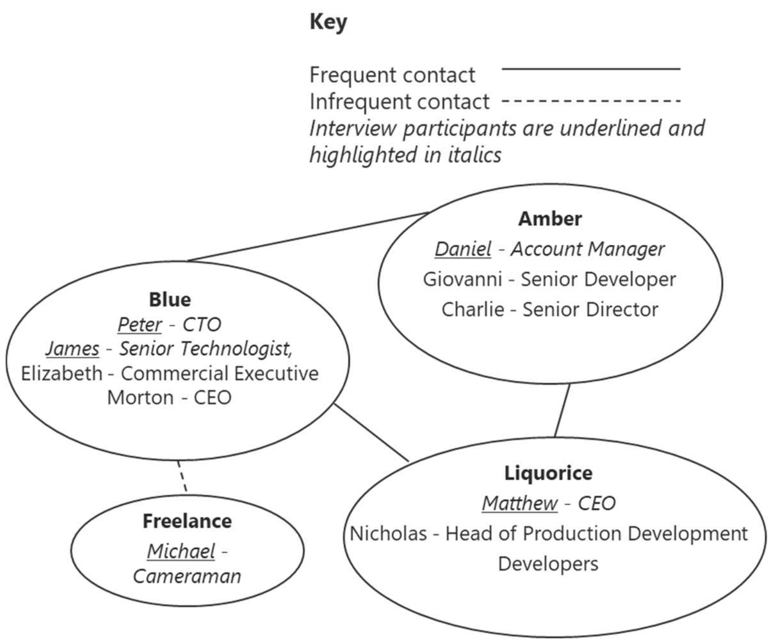
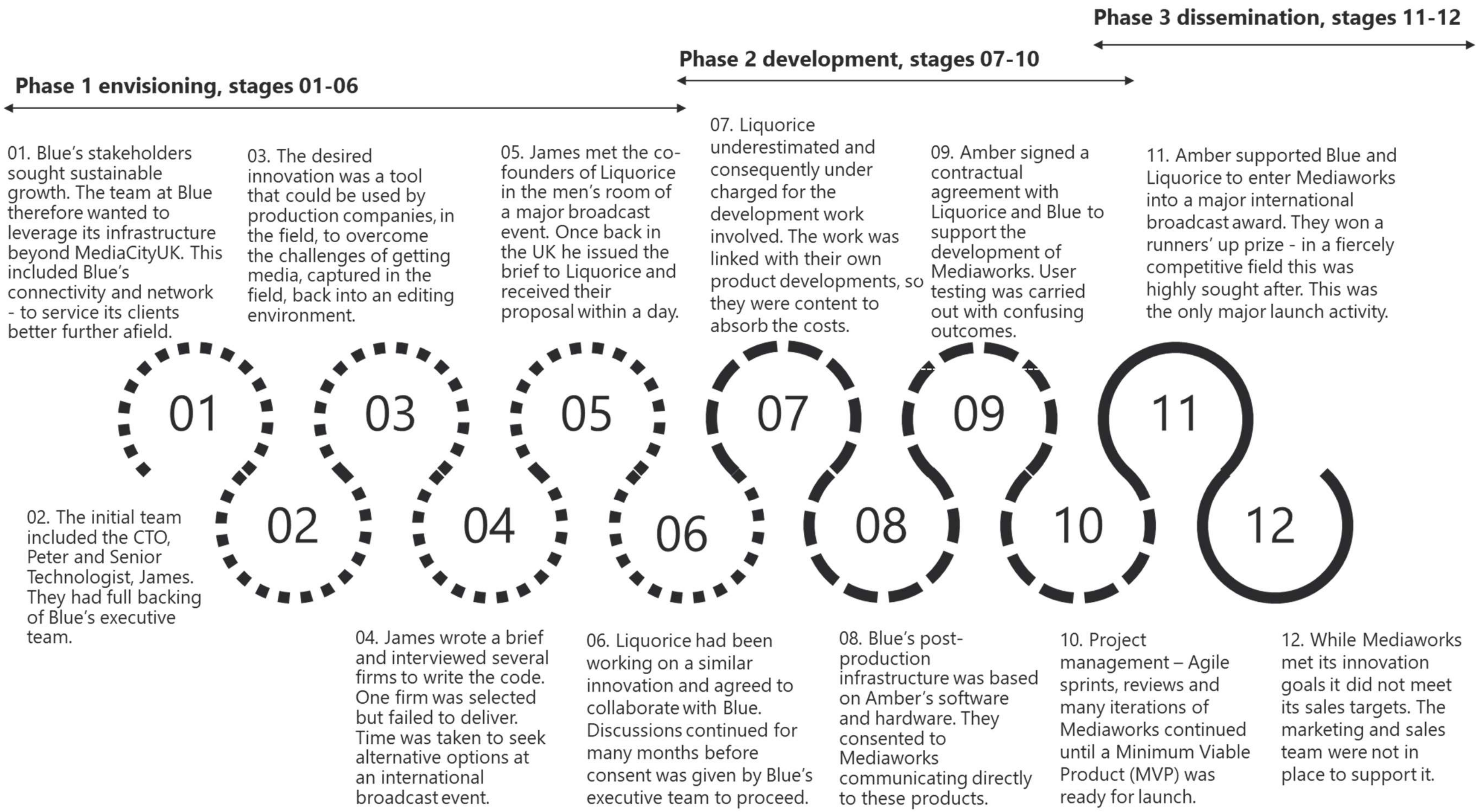


Figure 17 represents the innovation development of Mediaworks. All the firms involved in the production of Mediaworks are leaders in their field. There were high levels of co-operation and mutual support.

Figure 17: Mediaworks innovation development



Liquorice has always been focused on technological innovation, thus business commonalities existed in the interorganisational innovation project. The premise of Liquorice is based on a radical innovation, 'Flow'. This is a complete media production platform deployed in the cloud. The platform requires no installation or maintenance and is available online. This means that for television production companies located in different regions to their partners, there is no need to travel with hard discs containing important data or rushes. Their solution means that production facilities, producers and broadcasters can build their private cloud with their workflow solution which is seamlessly integrated with storage and media asset management services. The insight and knowledge gained through creating this ground-breaking innovation enabled them to be a supportive and engaging supplier to Blue for Mediaworks.

5.5.4 Disseminating

Mediaworks was formally launched at an annual trade show for the world's influential media, entertainment, and technology specialists including broadcasters, content creators and providers, equipment manufacturers, professional and technical associations. The trade show celebrates firms who have demonstrated innovation through technology partnerships. Mediaworks was shortlisted in the content management category of the trade show's 2015 awards and was presented with a runner up prize. This was a major achievement as attendees instantly made direct comparisons with the two other world leading broadcast technology firms in the category. Thus, providing Blue with kudos and esteem, elevating the brand. However, while Mediaworks had been acknowledged as a landmark innovation at the event, at the time of interview, it had not been readily accepted in the marketplace[15].

[15] It has taken five years for the industry to accept Mediaworks. This is reflective of the change required for radical innovations to be embraced.

5.6 Audiolizer

5.6.1 Introduction

At the Red-Innovation-Hub Build Studio event, all the teams had eight hours to come up with a brilliant idea and pitch it, in the hope of getting invited back to a two-day Development Studio event to make a prototype. Red-Femteam, a group of five technical women were keen to give more girls the opportunity to fall in love with technology the way they had. They discussed what interested them about technology and what inspired them to be employed in the broadcast sector, what they enjoyed doing as teenagers and what, looking back, they wish they had had to help them unlock their digital creativity. The Red-Go-Digital process that this team experienced was the same as for CodingGame and is highlighted in Figure 9.

A common theme in Red-Femteam's discussion the was the gratification of making a change and seeing it instantly reflected whether editing HTML and refreshing a webpage or tweaking parameters in image editing software and seeing the transformation. They wanted to capture the feeling of gradually understanding that you are in control, that you can make machines do whatever you want, if only you can learn to speak their language.

Red-Femteam also discussed the importance of self-expression and how defining music can be for teenagers. At the time of creation, there was no useful HTML5 music visual creator. Red-Femteam hoped to fill this niche and teach digital creativity by giving teenagers the tools to express themselves to their favourite songs. They came up with the idea of a music visualisation tool, where customised graphics could be 'programmed' to react to audio input, creating a personalised music video which could be shared. This idea eventually become Audiolizer.

Audiolizer became a sophisticated innovation for creating audio reactive music visualisations and lyric videos on desktop, tablet and mobile. Featuring artwork from leading popular music artists, the tool teaches digital creativity while also enabling users to make amazing creations via three styles, with pop music, poetry, and classical music. The innovation allows children and teenagers to 'visualise' music and the spoken word. It was launched on the Mixit platform in 2015.

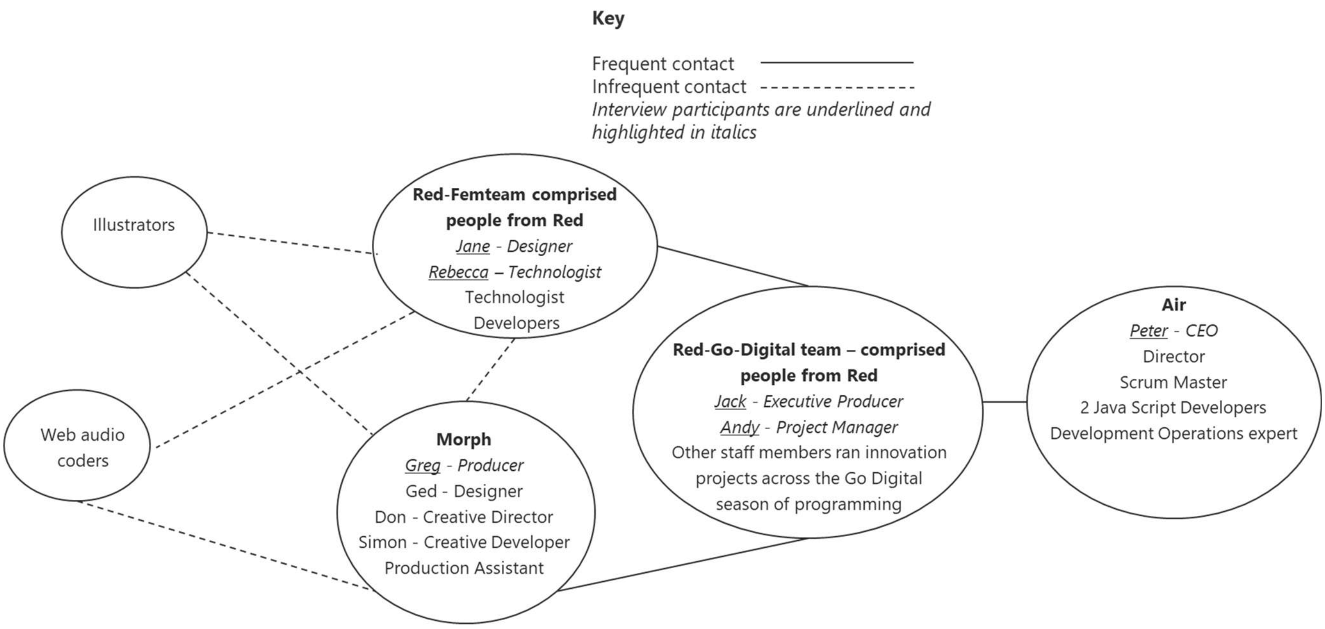
Red-Femteam comprised a designer, two developers and two technologists. Their combination of skills covered all critical areas. At the Development Studio event, Red-Femteam's designer mocked up the User Interface (UI) and the rest of the team worked on the code. Two weeks after the event, Red-Femteam learned of the judges' decision; they were one of two teams selected to progress to funding and commissioning. While this was a significant achievement after spending months preparing their first pitches, it meant that the allocated budget would be split, which Red-Femteam found disappointing.

5.6.2 Developing

Red-Femteam were put in touch with Jack, a judge, and the executive producer of Red-Go-Digital, a key force behind the campaign. He teamed them up with a project manager and external suppliers; developers (Morph) and Mixit platform developers (Air). Jack had already developed a digital maker kit (DMK) with Techno (a tool which lets children make and showcase their own games). This framework was the basis upon which Audiolizer was built. It gave a consistent UI and workflow, as well as an existing set of features. However, it also meant some compromises to fit in with the code base.

In the early build stages Red-Femteam were involved in workshops with Morph, Air, internal contacts in Red and web audio coders. This was to refine priorities and user stories for Audiolizer. They also worked with several illustrators to create visual assets to illustrate the music. The people involved in the main development of Audiolizer are represented in Figure 18.

Figure 18: Audiolizer Network picture

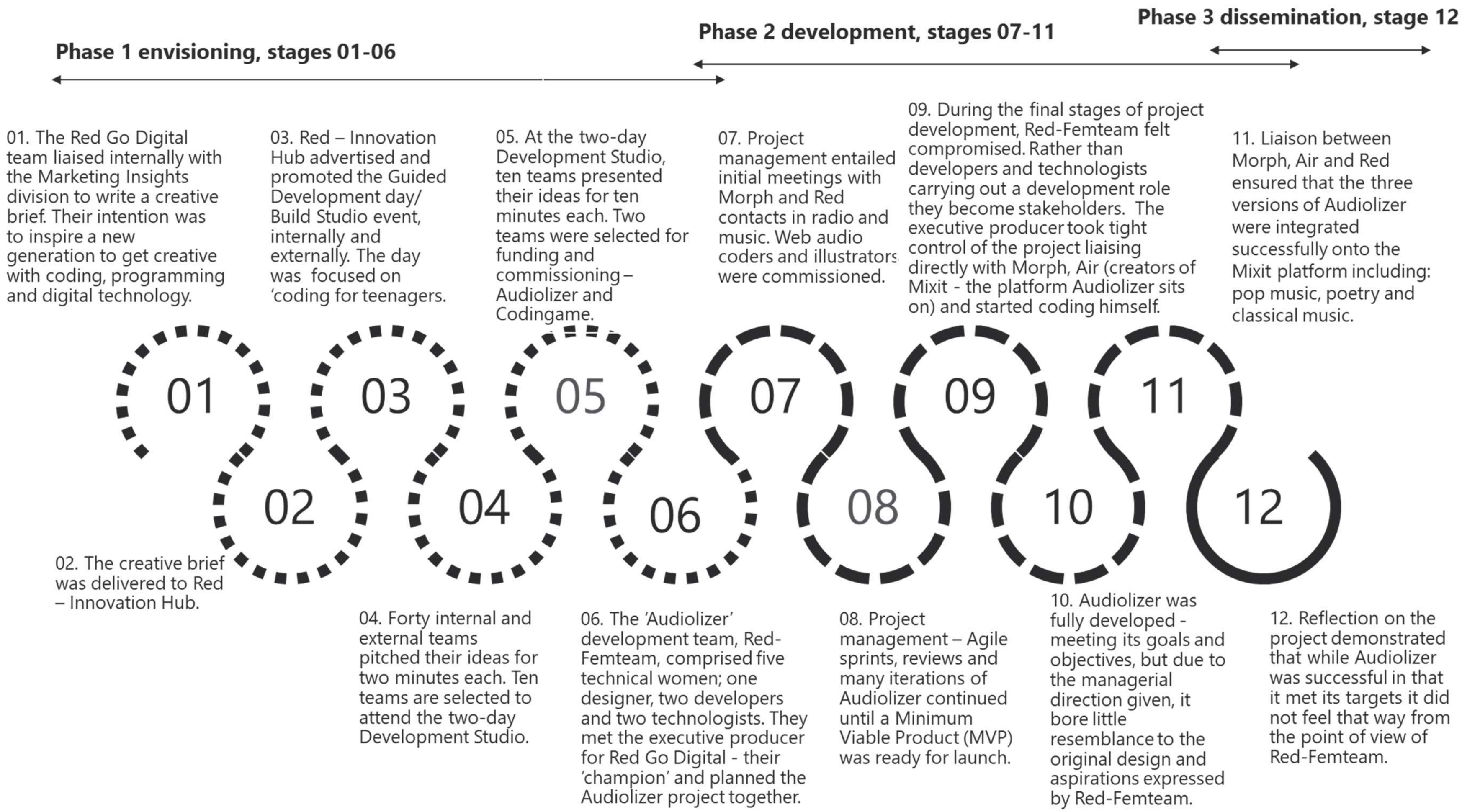


Audiolizer allowed users to develop visualisations in three areas:

- pop music which featured undiscovered musical talent, allowing users to create music and lyrics to videos;
- poetry aimed to allow the creation of visuals that respond to rhythm and verse with typography bringing spoken word and beat poetry to life; and
- classical music, where users can explore, express, and share their own interpretation visually with sweeping elements from nature and classical music culture.

After many sprints (one development cycle used in Agile Engineering practices), reviews and iterations, a Minimum Viable Product (MVP) was created which was then integrated with the other tools being created as part of the Red-Go-Digital campaign. Further details about Red-Go-Digital can be found in Appendix 5 (see 10.5). The early innovation development of Audiolizer (akin to CodingGame) is shown in Figure 9 and the full innovation development is shown in Figure 19.

Figure 19: Audiolizer innovation development



5.6.3 Disseminating

Audiolizer was launched in the summer of 2015. It was one of the first visualisers on the Mixit platform. As CodingGame already had the brand association and historical connections with RadioX, Audiolizer could not also be associated with it. This was unfortunate for the team creating Audiolizer as potentially it would have made a dramatic increase in uptake. However, once launched in a UK demonstration tour, the take up by female teenagers was good. Users were encouraged to use Audiolizer to create their own music visualisations (known as creatives) which other users (known as consumers) would then play. At its height of use, creatives were in the tens of thousands and consumers were in the hundreds of thousands.

The team knew that due to the lack of a strong online brand association with a Red product (television programme, radio station for example) Audiolizer would not receive the same uptake as CodingGame. Therefore, different versions were prototyped. Not all of them went live; there were licencing issues for example. The result was that at least ten different versions were created, all associated with major Red television brands, events, and radio stations. Across the Mixit site users made over 700,000 creations and more than 15 million consumers went onto use them. These different visualisation tools were discussed and tweeted about for more than two years. Thus, inspiring the digital visionaries of the future, helping digital creatives to embrace coding, programming, and digital creativity, and directly meeting the goals of the Red-Go-Digital campaign.

6 Chapter Six: Cross-Case Comparisons

6.1 Introduction

This chapter presents examples of systematic cross-case comparisons of the short-term interorganisational innovation projects, with respect to the management of the complete innovation process. The analysis provides a detailed examination of the key drivers and barriers of the management activities and three new major themes which are presented first: learning, knowledge creation & transfer (6.2.1) (a new management activity), shared values & beliefs (6.2.2) and network stability & embeddedness (6.2.3). The remaining themes (sections 0 to 6.2.10) support the management activities already identified in the literature.

An explanation of the presentation of the sections for each major theme /management activity is given below:

- Each major theme is divided into drivers and barriers.
- Some second order themes appear in more than one major theme and are discussed where the context merits it.

In each of the following sections:
- Between one and five second order driver themes are included.
- Between one and three second order barrier themes are included. [16]
- Some of the first order concepts are presented. [16]

On four occasions, a short example from a case is presented because the barriers were more prevalent in comparison to the others:

- ARVR-Staging presented in:
    - Learning, knowledge creation & transfer barriers (section 6.2.1.2); and
- Audiolizer, presented in:
    - Shared values & beliefs barriers (section 6.2.2.2),
    - Network stability & embeddedness barriers (section 6.2.3.2); and

- Motivating & rewarding barriers (6.2.5.2).

The analysis is developed from the exemplar case (chapter 4) and expanded by exploring differences, links, and notable additions to the major themes/management activities, including drivers and barriers in the five cases presented in chapter 5. Note that, the definitions of each major theme presented in chapter 4 are relevant to the cross-case analysis unless stated otherwise. This is followed by the factors that are important in short-term interorganisational innovation projects (section 6.3) and the development of the conceptual framework (section 6.4).

The analysis presented in section 6.2 includes coding structure tables which lists the data for each major theme/management activity. An explanation of the presentation of the coding structure tables is given in Table 34 and is an addition to Table 13 in chapter 4. Furthermore, full supporting Thematic Analysis Tables are found in Appendix 1 (see, 10.1).

Table 34: Explanation of the presentation of the coding structure tables

	Table content
Second order themes (level two codes)	The second order themes which are presented in each section are highlighted in the associated table in yellow.[16]
First order concepts (level one codes)	The first order concepts which are presented in each section are highlighted in the associated table in yellow. [16]
Phase	The three phases are: 1 (envisioning), 2 (developing) and 3 (dissemination). They illustrate in which innovation phase each of the first order concepts appear. Incremental innovations and radical innovations are presented separately, subordinate to phase.
Short example from a case	The four examples of barriers presented are highlighted in blue in each associated table.

[16] Not all first and second order concepts are presented due to the space available.

6.2 Drivers and barriers of the management activities and major themes

6.2.1 Learning, knowledge creation & transfer: drivers and barriers

For this major theme, more evidence of drivers appeared in the exemplar case. In each short-term interorganisational innovation project, the environment in which innovation takes place was observed to be conducive to supporting drivers to learning, knowledge creation & transfer. Barriers were specific to innovation development. Overarching barriers that could stall the innovation process were not observed.

6.2.1.1 *Drivers*

Cooperation and ***Specialist_knowledge_resources*** again appeared as significant drivers (

Table **35**), as discussed below.

Table 35: Learning, knowledge creation & transfer drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
(drivers to knowledge transfer)	*Cooperation*						
Excellent kick off meeting		1,2	1,2	1,2	1,2	1,2	1,2
Combination of unique skill sets		1				2	1,2,3
Use of appropriate advertising			3				
Using learned insight		3					
Listening to and acting on advice			2				
Training demonstrations				2			
Gaining knowledge from early AR and VR experiments				2			
Building sector knowledge			2	2			
Approaches to software development						2	2,3
(drivers to knowledge creation)							
Flexible approach			2,3	2			
Expertise merging between the studios provider & production company				2			
Creating a more refined service					2		
Developing a new component						2	
Specialist actors						2,3	
(facilitating knowledge creation)							
Flexible project management tools		1,2,3			1,2,3	1,2,3	1,2,3
(drivers to learning)	*Specialist_knowledge_resources*						
Specialist actors		1,2	2,3	2	1,2	1	1
Learning from the trials and test marketing		3	2,3	2	2	2	2
Latent knowledge		3				3	3
(drivers to learning)	*Facilitating_processes*						
Developing an approach to the process of innovation			2		3	2	2
Shared insight to work in a similar way						2,3	1
Judging and assessment criteria		1				1	1

Drivers to learning, knowledge creation & transfer were numerous for both innovation types; notably evidences were noted for radical innovations and appeared predominantly in the first two innovation phases with few appearing in the third phase. This emphasises the appetite and desire for learning in the first phase of innovation development, allowing for knowledge creation and transfer.

C*ooperation* highlighted the significance of cooperative behaviours. A cooperative atmosphere is one in which activities are embarked upon and completed for mutual benefit. Working cooperatively, people were able to capitalise on the network resources and skills (seeking information, evaluating one another's ideas, monitoring one another's work; linking with the management activity resourcing). Furthermore, the role of orchestrator was enhanced as the environment was facilitative; the short-term interorganisational innovation projects were successful when the team members succeeded. While the approach was demanding, it was also creative, open-ended, and gave the people involved satisfaction, linking with the management activity, motivating & rewarding.

The following drivers featured in each short-term interorganisational innovation project, throughout innovation development. Thus, revealing that the innovations were similarly set up with specialists contributing significantly to innovation development.

- Excellent kick off meeting (drivers to knowledge transfer);
- Specialist actors (drivers to learning); and
- Learning from the trials and test marketing (drivers to learning).

The latter two level one codes contributed to the level two codes:
Specialist_knowledge_resources. This includes non-tangible organisational resources; such as human resources and refers to team members and their attributes, including knowledge, abilities, skills, experiences, and innovativeness which are critical resources for innovation development. It also refers to how specialists supported others in the short-term interorganisational innovation project with their knowledge and skills. Finally, it covers the creation of special bonds between actors due to common interests and a desire to work with people who had devoted their time to developing niche or specialist skills where they were leaders in their field.

6.2.1.2 *Barriers*

Three, new, barrier themes which revealed problematic challenging issues were discovered: ***Power/dependence***, ***Ability***, and ***Resource_limitations*** (Table 36). These are discussed below.

Table 36: Learning, knowledge creation & transfer barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
(barriers to learning)							
Siloed disciplines				2			
The size and influence of the TV Season Red-Go-Digital	*Power/dependence*	3					
Scepticism of trade show demonstrations				1			
(barriers to knowledge transfer)							
Difficulty to assert an opinion							2
(barriers to learning)							
Skills gap	*Ability*			2			
Steep learning curve				2			
The ability to accept and embrace change			2				
(barriers to learning)							
No direct legacy from the stand-alone game		3					
Time constraints	*Resource_limitations*			2			
(barriers to knowledge creation)							
Stamina and perseverance				2			

Power/dependence showed how, in niche areas, atmosphere created conditions where some team members were resistant to change and others were heavily dependent on influential team members. It also appeared in leveraging barriers (section 6.2.4.2), motivating & rewarding barriers (section 6.2.5.2), goal setting & refining barriers (section 6.2.7.2) and controlling barriers (section 6.2.10.2). ***Ability*** revealed that although the team members had ability, there were areas where a particular talent, skill or proficiency was lacking; a steep learning curve was required to overcome this, in addition to accepting change. Finally, ***Resource_limitations*** underscored resource limitations such as time constraints, lack of legacy from the innovation and low stamina & perseverance from team members.

Barriers to learning, knowledge creation & transfer (Table 36) were reported mainly in the incremental innovation ARVR-Staging; where, six barriers were identified. This was potentially due to a lack of creativity from the people in the incremental short-term interorganisational innovation project to overcome all the obstacles presented to learning, knowledge creation & transfer. Being creative generating ingenious ideas and an awareness of how science and technology can help to overcome issues. However, it may also reflect when the interviews took place.

As the ARVR-Staging innovation was still under development, the barriers may have been experienced recently by the people involved and therefore easier to recall during the interviews. No barriers were identified for the radical innovations Metbot and Mediaworks and only one for Audiolizer. Four barriers emerged for the other, mainly incremental, innovations. It is possible that time dulled the memories of the people engaged in these short-term interorganisational innovation projects or more likely that the barriers to this major theme were very low highlighting the importance of a smooth learning experience allowing for early knowledge creation and transfer.

6.2.2 Shared values & beliefs: drivers and barriers

The exemplar case revealed the driver ***Closeness***. Additionally, the cross-case analysis suggested that ***Cooperation***, was also a driver to shared values & beliefs, thus developing understanding of this major theme. The adhocratic, market orientated cultures and shared altruistic ethos, heavily influenced and shaped the resulting short-term interorganisational innovation projects, impacting on both radical and incremental innovation development.

6.2.2.1 *Drivers*

While facets of ***Cooperation*** are found in learning, knowledge creation & transfer drivers, additional evidence revealing how nuances to this also drive shared values & beliefs is included below and referred to in Table 37.

Table 37: Shared values & beliefs drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Shared values (focused on altruism)	*Closeness*	1	1			1	1
Shared values and shared beliefs		1,2	1		1	1	1,2
Shared culture towards innovation		1		1	1	1	1
A common approach to identifying challenges in the broadcast sector					1		
Seeking excellence and perfection			2,3				
Similar mission and vision statements					1		
Similar company structures				1,2,3			
Openness and sharing	*Cooperation*		1	1,2	1,2,3		
Proactive approach & pragmatism			2,3		1		
Music rights waivered			2				

The driver ***Closeness*** revealed the importance of the emotional setting in which innovation development occurs. An atmosphere featuring both drivers, ***Closeness*** and ***Cooperation*** was conducive to smooth and successful innovation development. The team members all considered themselves to be valued contributors, with an ambition to create a friend-like group of people. Moreover, the team members felt that they had the freedom to fail, meaning that they had the ability and the freedom to push themselves to create new ideas and pursue innovation(s) that they believed in. They also trusted each other in their belief that they would eventually succeed even if activities did not initially go to plan.

Examples of ***Closeness*** appeared in all the short-term interorganisational innovation projects, revealing their importance across both incremental and radical innovation development. Shared values include explicit or implicit fundamental beliefs, concepts and principles that underlie the culture of the firms in each short-term interorganisational innovation project. They guide decisions and behaviour of the team members. This driver also includes common approaches towards sector challenges. The shared culture towards innovation refers to the ways of working and thought patterns between the people in the short-term interorganisational innovation projects and similar parent firm organisational structure(s). Furthermore, shared values which were focused on altruism appeared in four of the short-term interorganisational innovation projects (two incremental and two radical) where it was considered important to create an innovation for the greater good of society. While the other two short-term interorganisational innovation projects did not explicitly exhibit altruism, the parent hub firm(s) worked closely with public service broadcasters and the altruistic behaviours of these close working relationships were implicit.

Drivers to shared values & beliefs were prevalent for radical innovations; mainly in the first phase of innovation with few instances in the second and third phases. The strongly embedded shared assumptions, values, and beliefs among the people involved in the radical short-term interorganisational innovation projects empowered them from the start, driving their motivation to succeed, revealing strong links with the motivating & rewarding management activity. The people were utterly driven and persistent in their aspiration to complete the innovations to the agreed deadlines.

Furthermore, a shared culture towards innovation was observed in all the short-term interorganisational innovation projects, apart from the incremental innovation Demonland (this was observed as a barrier, see 6.2.2.2). Therefore, the people involved were happy to share their opinions, make mistakes and learn from others. With influence from an orchestrator, the better ideas naturally evolved. Rather than focusing on whose idea was being developed, the team members pursued overall concept development. This helped to create a setting where an enormously clever and bright group of people were content to share and articulate their creativity and work collaboratively.

Establishing the right creative culture was important; it allowed the people to let go of worries or doubts about failing. Additionally, the tone was set to encourage the people to take responsibility for their actions. The people believed that, on occasion, if they embraced challenges that failed, by collectively resolving problems and taking responsibility they would control the issues encountered in innovation development. Consequently, over time they generated relevant ideas and overcame challenges. Thus, adding further resilience to their behaviour.

Developing the notion of culture, three of the short-term interorganisational innovation projects (Audiolizer, Metbot and CodingGame) exhibited a culture that was primarily adhocratic. Note that the hub firm for these three projects was Red. This adhocratic culture was based on informality, flexibility and efficient problem solving. The emphasis on risk-taking and pioneering activities experienced in the early innovation development processes (see leveraging 0 and the firm engagement process) supported both innovation types but particularly encouraged radical innovation development. The other three short-term interorganisational innovation projects (ARVR-Staging, Mediaworks and Demonland) exhibited a combination of market and adhocratic-oriented characteristics. While Mediaworks was a radical innovation, the market orientation of its hub firm may have impacted on its inability to fully commercialise, as market-oriented firms tend to produce incremental innovations.

6.2.2.2 *Barriers*

Barriers to shared values & beliefs were discovered, encompassing: ***Distance, Resource_constraints*** and ***Expectations*** (Table 38). These three barrier themes are presented and as many barriers were reported for Audiolizer they are specifically explored below.

Table 38: Shared values & beliefs barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Lack of shared understanding	***Distance***						2
Intransigent broadcast market sector					1,2,3		
Different visions preventing Red-Femteam from developing the innovation they envisaged							1
Lack of role formalisation within the network							1,2,3
Different perceptions of what was to be achieved							2
Lack of shared vision							2
The vision of the innovation differed							1,2,3
Lack of direct communication							1
Lack of shared expertise		1,2					
Widespread office locations		2,3					
Lack of understanding about music composition	***Resource_constraints***		1				
Lack of expertise to commercialise games			1				
Request for no brand connections in the early stage innovation ideas	***Expectations***	1					

A lack of shared vision, beliefs, connections and understanding between team members is depicted by the second order theme, ***Distance***. A lack of individual actor knowledge and experience is signified by the second order theme ***Resource_constraints*** and the final, third, second order theme, ***Expectations,*** denotes team member expectations which were set on a specific path. These three barriers highlighted overarching challenges where a lack of common ground between individual actors was exposed.

Barriers to shared values & beliefs appeared mainly for the radical innovation, Audiolizer, where seven individual barriers emerged as part of ***Distance***. These included challenges which focused on distant team member relationships and the ensuing friction. In the main, they occurred in the first and second phases of innovation with few instances in the third phase. Some barriers were noted for Mediaworks and none for Metbot and ARVR-Staging. Although Audiolizer was completed and launched, these issues were never completely resolved. Importantly, a blame culture did not arise, and the people involved in Audiolizer, who struggled to trust, always put their irritations to one side for the benefit of innovation development.

In common with many of the other management activities, there were few, strong, overarching links between drivers and barriers for all of the short-term interorganisational innovation projects. However, some links were observed. An example is now given revealing insight into the shared values and beliefs of the people involved in Demonland's development. In the early innovation phases, a lack of shared understanding existed between the people at Gold and Platinum. Nathan had never prioritised music in game development. He had preconceived ideas about the cost of a specially composed piece of music, lacking understanding about music composition, believing it would be incredibly expensive. Consequently, when he commissioned Gold, he had high expectations and sought perfection. He was clear about his demands which initially caused friction. Irrespective of this, both Platinum and Gold sought to create a game that was excellent in all respects. Once complete, Gold aspired to showcase and demonstrate Demonland to other potential customers; to highlight their success at supporting Platinum with sound design that illuminated the strengths of Demonland's gameplay. Additionally, Gavin offered to waiver the music rights, allowing Platinum to use the music without incurring further costs. Normally, a high fee was attached. Therefore, despite the initial preconceived ideas that Nathan had about embedding novel music into a game, he became aware of the benefits and the consequent ties between them became strong.

6.2.3 Network stability & embeddedness: drivers and barriers

Each short-term interorganisational innovation projects' embeddedness and stability was found to evolve from the respective hub firm. This theme captures the importance of working in a supportive and stable business environment to achieve successful innovation results.

6.2.3.1 *Drivers*

The exemplar case revealed the same key drivers, encompassing ***Ties, Collaboration, Cooperation***, and ***Closeness*** (Table 39) all of which are presented below.

Table 39: Network stability & embeddedness drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Strength of ties (and years known)	***Ties***	2,3	1	2,3	1,2,3	1	1,2,3
Geographical location		1	1	1		1	1
Working with specialist actors		2	2	1,2	1,2	2	2,3
Latent knowledge (award winning)		2	2	1,2	1	1,2	1
Actor expertise		2	2	2	2	2	1,2,3
Actor insight and passion to deliver		2	2		2,3		
Open communication	***Collaboration***	2	2	1,2			
Strong rapport		1,2,3	2	1,2		1,2,3	1,2,3
Long established relationships – characterised by trust		1,2		2	1,2,3	1	2,3
Multiplexity	***Cooperation***			1,2	1,2,3	1,2,3	1,2,3
Strategic alignment		1,2	1,2		2		1,2
Contracting, strategic alliances		2	2	2	2	2	2
Mutual benefit, dependencies and obligations					1,2,3	2	
The shadow of the future	***Closeness***			2	3	3	2,3
Strong and stable network despite lack of multiplexity		1,2,3	1,2,3			3	

Network stability & embeddedness appeared to be equally important to radical and incremental innovations (Table 39). The path for interconnected relationships which featured in all the short-term interorganisational innovation projects was illustrated by the many drivers to network stability & embeddedness, which featured predominantly in the first two innovation phases, with fewer instances in the third phase.

Ties highlights the time spent in a relationship, including the depth and the closeness or intensity of the relationship between team members. An important feature of ***Ties*** included the strength of ties among all the people in the short-term interorganisational innovation projects (for both innovation types), which was strong and of a high quality, often built from their specialist skill sets. Many of the team members had known each other for more than fifteen years in the sector but had worked for different firms; revealing that identifiable relationships were between individual people, i.e. interorganisational rather than intraorganisational.

Collaboration reveals that the people involved are active members of a group, working together to achieve a common goal. The rapport between team members was strong; communication was open and honest and long-established relationships were characterised by trust (linking with consolidating). While open communication appeared important for both innovation types it was not as evident for the radical innovations. This could be because attributes of the orchestrator role were found to be more dominant and complex in radical innovations, rather than a genuine open collaborative approach exhibited by the people involved in incremental innovation development (see barriers to controlling, 6.2.10.2).

Cooperation also appeared in learning, knowledge creation & transfer (section 6.2.1.1) and shared values & beliefs (section 6.2.2.1). With respect to network stability & embeddedness, it includes multiplexity, which refers to the interaction of exchange within and across relationships (Bliemel, McCarthy and Maine, 2014). For example, a connection between two individual actors is multiplex when they interact with each other in multiple different contexts (Bliemel, McCarthy and Maine, 2014). In this research it refers to the numerous and intense interactions, between different team members, in addition to the principal innovation development. This code also included factors such as strategic alignment, signed contracts and examples of mutual benefits, dependencies, and obligations.

The fourth driver in this major theme is ***Closeness*** which also featured in shared values & beliefs (section 6.2.2.1). In addition to the account provided there, ***Closeness*** acknowledges the existence of strong and stable networks despite some instances of limited or no multiplexity. For the radical innovations, the shadow of the future was long and there was multiplexity. In this research, the team members met each other in additional situations (focused on other projects or innovations), which gave supplementary opportunities to engage. However, for CodingGame and Demonland (incremental) the opposite was true; there were no future working opportunities identified and the team members did not collaborate on future innovations. Despite the lack of multiplexity and limited shadow of the future for both short-term interorganisational innovation projects; they were stable throughout innovation development. For Demonland this was largely due to the relationship between the orchestrator firm (Platinum) and publisher (Sapphire) who not only gave commitment but advice and support in addition to access to their parent company (Aqua). CodingGame gained stability from its parent company (Red); the Red-Innovation-Hub process and Red-Go-Digital. As the third short-term interorganisational innovation project, ARVR-Staging was still being developed when the case study took place, direct comparisons could not be made. However, within the short-term interorganisational innovation project, the relationship between the orchestrator firm (Blue) and Red-Sport was strong (having just signed a further five-year contract for television studios hire and post-production).

6.2.3.2 *Barriers*

Barriers to network stability & embeddedness were discovered and centred on ***Distance*** (Table 40). This section concludes with the third short case example.

Table 40: Network stability & embeddedness barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Network ties became weaker					1,2,3		3
Strategic alliances - dismissive approach					2		2,3
The shadow of the future was short and no multiplexity	*Distance*	3	3				
Isolation within the network							2,3
Factors leading to weak ties		2					2,3

As explained in shared values & beliefs barriers (section 6.2.3.2) ***Distance*** refers to the lack of understanding and shared connections between team members. Developing this notion, for network stability & embeddedness, it additionally reveals instances where ties became weaker. The background to this was an atmosphere of uncertainty. Thus, revealing the importance of the emotional setting in which innovation development occurs. Consequently, some of the team members' relationships became increasingly distant; instances of isolation occurred and a dismissive approach to strategic alliances appeared.

Most of the barriers to network stability & embeddedness appeared in the second and third phases of innovation development; slowing down the innovation process, with problematic, complex, issues to resolve (Table 40). There were more difficult barriers noted for the radical innovations than for incremental innovations. For example, the difficulties experienced by the team developing the radical innovation Audiolizer were fundamentally more challenging than those experienced by the other short-term interorganisational innovation projects. These challenges, however, did not affect the delivery of the innovations nor overall stability and embeddedness of the short-term interorganisational innovation projects. Overall, barriers were far less numerous than drivers.

6.2.4 Leveraging: drivers and barriers

The cross-case analysis reveals that leveraging was relevant in all phases of the innovation process and necessary for dissemination and commercialisation of the innovation(s). Leveraging activities were required to facilitate necessary changes in each respective marketplace for the innovations to be accepted and accommodated. Note that three of the innovations were created by Red; a hub firm with a public service (not for profit) remit. Therefore, three of the studied short-term interorganisational innovation projects created innovations (Audiolizer, CodingGame and Metbot) which were not sold to customers; they were freely available via the hub firm's website. Two were commercial innovations (ARVR-Staging and Mediaworks) sold to (including public service) B2B customers and finally, Demonland was sold to consumers (B2C). The analysis revealed that leveraging activities were necessary, in each of the short-term interorganisational innovation projects, for the innovations to be launched and gain the best chance of acceptance in the respective marketplaces.

Many of the leveraging drivers appeared for both radical and incremental innovations, mainly in the first and second phases of innovation development, with few in the third phase. More barriers emerged for radical innovations than incremental innovations, highlighting the numerous, weighty challenges that radical innovations face during innovation development. Indeed, leveraging was more significant for radical than incremental innovation(s) where broad and fundamental changes are required to prepare customer groups to adopt the novelties. Creating the optimum conditions to enable smooth adoption of a novelty, therefore, can be problematic. The emergence of leveraging in the data is significant to change mindsets, opinions, and open relevant markets up to new ways of thinking. It was, therefore, important for individuals in the short-term interorganisational innovation projects to align the innovations with the priorities of the key decision makers (customers and users). Connecting with the market and pragmatism were as important as flexibility and appropriate imagery use, enabling the novelties to be understood in context.

6.2.4.1 *Drivers*

The cross-case analysis revealed the same five second order theme drivers as the exemplar case (Table 41) encompassing: ***Opportunity_recognition_skills, Entrepreneurial_Skills, Team_interaction***, ***Project_management_tasks and Commitment***. The first three of these are presented fully, for their importance to leveraging.

Table 41: Leveraging drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Insight to develop an opportunity	*Opportunity_recognition_skills*	1,2	1,2	1,2	1	1	1,2
Listening - customer needs					1		
Ability to connect with the target market		2	3				
Ability to open communication lines up with other departments				1,2	2,3		2
Visualisation / envisioning skills	*Entrepreneurial_skills*	1	1	1	1		1
Charismatic, assertive communication style		1		1,2	1,2	1	1
Ability to communicate at different levels		1,2,3		1,2,3			
Making early introductions			1	1			
Ability to pitch ideas						1	1,2
Ability to persuade influencers to vlog		3					
Ability to engage with actors		2,3	1,2				
Firm engagement processes	*Team_interaction*	1	1	1	1	1	1
Flexible approach			1,2	2			
Facilitating progress			2,3			2,3	
Oral communication - informal				1		1	1
Written documentation	*Project_management_tasks*		2		2	1	
Oral communication - discussions held				1,2	2	2	
Connecting actors	*Commitment*				1,2,3	2,3	1,2

The ability to recognise and develop opportunities to develop innovation(s), initiating open conversations, listening, and connecting with team members was signified by ***Opportunity_recognition_skills***. An example includes insight to develop the opportunity where evidence was seen in all six short-term interorganisational innovation projects. This was an important skill identified in all the innovations, in the early phases. This comprised:

accurate and deep understanding of the background to the innovation plus entrepreneurial conviction to persist and undertake it.

Entrepreneurial_skills included team members with a charismatic communication style. This ability was often successfully employed by the orchestrators to win over people's opinions. Many of the orchestrators had charisma and were able to instil confidence and trust in those around them. They used words which induced clarity and inspiration. Other abilities included: engaging with team members, communicating at different levels, making early introductions, pitching and persuasion skills, visualisation, and envisioning skills. Visualisation/envisioning skills, appeared in all the short-term interorganisational innovation projects, in the first phase of innovation development. This provided a clear picture of an individual's ambitious but realistic innovation ideas to other team members. Additionally, a charismatic assertive communication style, identified in the exemplar case, appeared in five short-term interorganisational innovation projects. Moreover, further evidence appeared in radical than incremental innovations, indicating that individuals within radical innovation projects had a stronger ability to persuade others of their argument.

Team_Interaction suggests that activities were embarked upon and completed for mutual benefit. Facilitation was an essential component of team interaction in addition to: maintaining a flexible approach, the use of informal communication and the excellent firm engagement processes employed in all of the short-term interorganisational innovation projects. In each one, these processes revealed that organisations were invited to play a role in the early phases of innovation. For Metbot, Audiolizer and CodingGame this was via the Red-Innovation-Hub process. Sapphire created a process which encouraged firm participation (resulting in Demonland). Furthermore, Blue, the hub firm for the innovations ARVR-Staging and Mediaworks, also set up a thorough firm engagement process which smoothed and facilitated the path for ensuing innovation phases. All three firm engagement processes contributed primarily to leveraging, but also to resourcing (see 6.2.6), consolidating (see 6.2.8) and coordinating (see 6.2.9) activities, prior to the main phase one engagement.

Finally, the activities (tasks) involved in the organisation and management of resources that are necessary to complete projects are represented by ***Project_management_tasks***. These are discussed in goal setting drivers (section 6.2.7.1) and coordinating drivers (section 6.2.9.1). ***Project_management_tasks*** is also referred to from the barrier perspective in leveraging (section 6.2.4.2), and coordinating (section 6.2.9.2). Finally, ***Commitment*** conveys how team members in Metbot, Mediaworks and Audiolizer were committed to the common goal of radical innovation; giving value and a meaningful reason to connect and work together. This second order theme is also relevant to controlling drivers (section 6.2.10.1) where further detail can be found.

6.2.4.2 *Barriers*

While the only barrier to leveraging, ***Intransigence,*** was identified for Metbot, three more barriers appeared in the cross-case analysis, encompassing: ***Resource_limitations, Power/dependence***, and ***Project_managment_tasks*** (Table 42). Further detail is provided for ***Intransigence*** and high-level evidence is presented for the remaining barriers.

Table 42: Leveraging barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Barriers to fluid oral communication (& lack of contact)	***Intransigence***	1,2	2			2,3	2
Poor communication and time management	***Resource_limitations***		2				
Campaign messages		3					
Vision - misaligned	***Power/dependence***						2,3
Negotiating the commercial terms					2		
Lack of organisational communication about potential barriers							2
Tense discussions in the early network formation					1		
Written documentation - brief	***Project_management_tasks***				2		

The four second order leveraging barriers denote, for example, the complications imposed by lack of resources and difference of opinion between team members, which typically produced tensions. Explicitly, ***Intransigence*** reveals the barriers to fluid oral communication which included semantic barriers (language related and body language); psychological or emotional barriers; organisational barriers and personal barriers. Barriers to fluid oral communication were observed in both innovation types including CodingGame, Demonland, Metbot and Audiolizer. These barriers occurred at different points in the innovation process, slowing it down. However, they were not so significant as to stall innovation development completely. On occasion, leveraging barriers were created intentionally by people working on the radical innovations Mediaworks and Audiolizer; serving a purpose for a specific period. For example, in the development of Audiolizer, barriers to the free-flow of communication were instigated by Andy whose original intention had been to protect Morph (enabling focus on core activities) from initial ad-hoc requests by Red-Femteam. This caused Red-Femteam offence and consequently created a barrier. Red-Femteam felt excluded and less inclined to readily engage. One significant point, for the radical innovations, however, is that the people orchestrating Mediaworks and Audiolizer had ego personalities, in comparison Metbot's orchestrator, was more diplomatic and consultative. Interestingly, the first two innovations encountered more thorny problems which were difficult to resolve. While the orchestrators were less flexible in their approach generally, this was counterbalanced with their other personality character traits including their energy, determination and passion which helped to nurture the radical innovations in the first instance.

The remaining three second order leveraging barriers are now briefly explored. Factors such as ineffective time management and difficulties encountered to present simple campaign messages was signified by ***Resource limitations***. ***Power/dependence*** highlights how slow innovation development resulted from an atmosphere which was not conducive to productivity. Finally, although ***Project_management_tasks*** has been already been shown as a driver, it was also discovered to be a barrier resulting from tasks which were poorly communicated; resulting in tasks which were inadequately executed, thereby introducing complications and delays curtailing innovation development. It is discussed further in coordinating barriers (6.2.9.2).

6.2.5 Motivating & rewarding: drivers and barriers

The motivating & rewarding management activity was important for both innovation types. The main difference was that the motivational drivers, goals, and desire for success in radical innovation(s) appeared to function as a source of intrinsic motivation for the orchestrators. In contrast, for incremental innovations, team members could anticipate the expected benefits of creating and delivering the innovation and so the motivational drivers were less dominant.

6.2.5.1 *Drivers*

The cross-case analysis identified three additional drivers to motivating & rewarding: ***Insight to develop, Social_incentives_power,*** and ***Brand & legacy*** (Table 43). These are briefly presented first. Additional insight into: ***Social_incentives_actors*** and ***Personal_incentives_actors*** is also given.

Table 43: Motivating & rewarding drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Insight to develop the opportunity			1				
Actor perceptions of the ARVR demonstrations	***Insight_to_develop***			1			
Unique selling proposition			1				
Association with a national broadcaster	***Social_incentives_power***			1,2,3			
Attracting mainstream customers					1		
Award nomination	***Brand_&_legacy***				2		
Potential to update Red Sport's programme brand identities				1,2			
Working with specialist actors		1,2			1,2		1
Actors were inspired by other actors	***Social_incentives_actors***				1	1,2	1,2
Winning the Red-Innovation hub event		1				1	1
Altruistic activities		1,2	1			1	1,2
Personal motivation & empowerment		1	2	1,2	1	1,2	1
Summer employment						1,2	
Connecting with the project brief							1
Developing new skills and greater versatility			2	2			
Commitment to create a new game			1				
Working at the forefront of technology	***Personal_incentives_actors***			1,2			
Benefits of VR headsets				3			
Aspiration to fulfil the potential of the innovation				1,2			
The challenge of creating the innovation							1
Original music composition			1				
Positive feedback						1	
Novel idea	***Personal_incentives_closeness***					1	
Attraction to the new technologies				1			
Trying new approaches to innovation					2,3		
Determination to succeed	***Personal_incentives_expectations***		3				
Excellent prototype						1	
Kick off and planning meetings	***Social_incentives_activities***	1,2	1,2	1	1	1	1
Hosting a series of events to accelerate innovation		1				1	1
Support from network actors		3			2		
Early goal setting			1		1	1	
Getting featured on a new platform	***Stage_gate***		1				
Conclusion of the trials				2			
Delivering the innovation					3	3	

Insight_to_develop highlighted actor motivation; from the accurate and deep understanding of the background to the innovation along with entrepreneurial conviction to persist and pursue it. ***Social incentives_power*** captures how association with a powerful partner can bring benefits and broaden a customer base and ***Brand_and_legacy*** shows the motivation created by innovation endorsement from a major brand. It also covers the motivation developed from an opportunity to develop an influential brand in a unique and distinctive way.

Two further important motivating & rewarding drivers were, ***Social_incentives_actors*** and ***Personal_incentives_actors***. ***Social_incentives_actors*** highlights how appropriate actors needed to be identified, located, and sourced before any major stages of innovation development and resource allocation could occur. Indeed, securing the right mix of specialists with relevant knowledge was the first key step to innovation development. Working with specialist actors reveals how, once in place the actors inspired and motivated each other in the respective short-term interorganisational innovation projects. Additionally, meaningful personal relationships between actors were striking motivators; initiating, retaining, and nurturing relationships which enabled innovation development. In many of the relationships, partnerships were treasured, and actors were inspired by other actors that they identified with.

The satisfaction from being involved in the innovation development with like-minded people was significant. Personal networks were, therefore, important. The individual actors thoroughly enjoyed working together; winning events such as the Red-Innovation-Hub, which were designed to accelerate innovation was another major driver to actor motivation. These relationships were, therefore, important on two levels, for both individual and team motivations. The interaction of these relationships was required to make the innovations successful.

Where firms had altruistic foundations (noted in both innovation types with the driver altruistic activities), individual actors were passionately motivated by them; they were evangelists of the innovation(s) they were involved in, passing energy, drive and motivation onto others. The motivations came from the inter-group behaviour. Team members identified with others in the short-term interorganisational innovation projects, they were committed to them and worked hard to create and deliver the innovations because of it.

Finally, ***Personal_incentives_actors*** relates to how individual actors were personally motivated by each other. Many of them had previous positive experiences of working together and were encouraged by this. There was enthusiasm, conviction, and years of collaboration dedicated towards achievements which the innovation(s) benefited from. Team members collaborated diligently, to agreed phases of innovation development, to meet specific deadlines. Group activities, therefore, acted as a motivator. Interestingly, financial rewards were less significant for motivation & rewarding. Team members were motivated as they were empowered; they had a personal will and desire to be involved. In all the short-term interorganisational innovation projects, especially the three innovations created from Red-Innovation-Hub (Metbot and Audiolizer (radical) and CodingGame (incremental)) team members were encouraged, invested, and supported to create the innovations. Empowerment was, therefore, a considerable motivational driver.

All these motivational drivers primarily appeared in phase one. This is because motivation is a critical driver in early innovation development. Without it there would be little desire to kick start and initiate innovation. Although fewer instances were in evidence during phases two and three, motivational drivers did appear in the data. This demonstrates that motivation is required throughout innovation development for successful innovation to occur.

The orchestrators in each short-term interorganisational innovation project appeared to be personally motivated by the innovations they were involved in. This materialised as an important factor in successful innovation development. Furthermore, those working on radical innovations were perceived to be more driven and personally motivated than those involved in incremental innovations. The orchestrators were excited by working in pressured conditions where the risks were high, and the outcomes were less certain (see controlling 6.2.10).

Moreover, the drivers: ***Social_incentives_power, Personal_incentives_closeness*** and ***Personal_incentives_expectations*** all linked with atmosphere. ***Social_incentives_power*** described how the association with a powerful partner, such as a national broadcaster can bring benefits and broaden a customer base. ***Personal_incentives_closeness*** depicted how atmosphere stimulated close relationships between individual actors and ***Personal_incentives_expectations*** revealed how atmosphere motivated the team members. Individual actors expected positive outcomes from the innovation(s) to reflect well on the organisations involved. Therefore, atmosphere was pertinent to the cross-case analysis; developing the notion that it was a focal feature of the short-term interorganisational innovation projects. It was noted to motivate the team members; developing the close relationships that existed in addition to nurturing the relationships that were less established.

6.2.5.2 *Barriers*

While ***Power/dependence*** was observed as a barrier to motivating & rewarding in the exemplar case, the cross-case analysis revealed a further four barriers. These are: ***Reprioritisation, Power/expectations, Power/dependence,*** and ***Firm_structure***, as highlighted in Table 44; they are all described and a short case example is presented.

Table 44: Motivating & rewarding barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Constraints from using the existing user interface (UI) and project design	*Firm_structure*						1,2
Lack of a sales and marketing function					2,3		
Lack of involvement – role confusion							1,2
Negotiating, administration and bureaucracy	*Power/dependence*						2
Lack of organisational alignment							2,3
Outdated perceptions of VR				1			
Ambitions were not realised		1					1,2
Long term involvement in similar projects							2
Editorial issues						2	
The innovation conveyor					2,3		
Creating games			1				
Lack of understanding	*Expectations*			1			
Negative firm perceptions					2		
Fierce competition and high standards			2,3				
The size and influence of the TV (Red Go Digital) season							2,3
Retaining game appeal			3				
Actor perceptions of the demonstrations				1			
The legalities of running a competition		2					
Failing to meet set revenue targets					2		
Lack of team interest			1				
Time consuming process	*Reprioritisation*		1,2				
Delayed launch			2,3				
Heavy workload							2,3

Four barriers presented major challenges to both radical and incremental innovation short-term interorganisational innovation projects. For the incremental innovations, largely, the barriers were resolved with improved information and longer development time. The barriers to radical innovations were perceived to be more challenging to resolve than incremental innovations perhaps as the barriers had often never been encountered before, requiring expert problem-solving skills, deep knowledge, creativity, and imagination.

Firm_structure represents difficulties which were predominantly generated from the hub firm's structure encompassing complications brought about by existing infrastructures. These included proprietary digital infrastructures which impacted on interface design, for example, which needed to be incorporated and factored into innovation design ideas.

Power/dependence reveals that atmosphere was resistant to change in niche areas and heavily dependent on influential actors. ***Expectations*** from certain team members in the short-term interorganisational innovation projects were high. This impacted in different ways encompassing; lack of individual actor and team interest as atmosphere was not conducive to brainstorming new ideas regarding how a specific innovation might be promoted; external legal implications and; meeting revenue targets. ***Reprioritisation*** encompassed the reprioritisation of activities due to time consuming processes; delayed innovation launch dates and; heavy workloads. More barriers to motivation appeared for the radical innovation Audiolizer than any other innovation. A key factor was that half the project team had worked together before, forming strong actor bonds, and the other half had not. The orchestrator did not actively encourage collaboration between the different groupings. He had a long, successful, and active relationship with Morph and continued to do so long after the innovation was delivered. The relationship with Red-Femteam, in his mind, was simply for the creation of one innovation, Audiolizer. Therefore, it appeared that he did not see the benefits of developing strong actor bonds with Red-Femteam as he considered it to be a one-off relationship.

The links between the barriers and drivers to motivation primarily were specific to the innovations concerned. It was not possible to group them into meaningful patterns or themes. The barriers were surmountable as each of the innovations studied was created and disseminated. It is notable that barriers did not slow the path of innovation to a standstill nor produce a failed innovation. The motivational drivers were prevalent and were observed in the data throughout innovation development and although they were more numerous in the first phases of innovation, they appeared in every phase.

6.2.6 Resourcing: drivers and barriers

The cross-case analysis revealed the same drivers and barriers as the exemplar case study. Resourcing was fundamental throughout the innovation process to both innovation types, throughout development. In radical innovation, resourcing sometimes changed drastically due to the evolving innovation goal(s). Although specialists were initially secured for radical innovations, critical resources were not always easily identified from the outset. Resourcing needs, therefore, were often better known for incremental than radical innovations.

Effective resourcing was an important contributor to efficient innovation development. This was enabled for both incremental and radical innovations with the implementation of control processes. Connections were observed between resourcing and each of:

consolidating, motivating & rewarding, goal setting & refining and leveraging management activities.

6.2.6.1 *Drivers*

Three second order driver themes are presented: ***Actor_resources, Combining_and_changing_resources*** and ***Empowerment*** (see Table 45).

Table 45: Resourcing drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Actors identified relevant resources and involved the actors that possessed them	*Actor_resources*	1,2	1,2	1,2	1	2	1,2
Team commitment		1,2	1,2,3			2	1,2
Social ambassadors			3				
Music consultation advice			2				
Resources were combined	*Combining_and_changing_resources*	1		1,2	2,3	2	1,2
High quality, complementary resources			2	2			
Resource needs changed						1,2	
Knowledge resources	*Empowerment*	1	1,2,3	1,2	2	2	1,2
Financial resources		2		1	2		
Managing resources well		2,3					2
Brand endorsement	*Brand_and_legacy*	2			2		
Resource legacy		3				3	3
International recognition of Twitter						1,2	

Actor_resources were a significant and necessary consideration during innovation development, including identifying relevant actor resources; commitment from the people in the short-term interorganisational innovation projects; as well as support from social ambassadors to deliver critical aspects of innovation project development. The first and second phases of innovation development were particularly important for resourcing driver activities (Table 45). All cases highlighted the significance of team members that identified relevant resources and involved the actors that possessed them. Securing both individual and organisational actors with the required expertise and specialist knowledge was, therefore, a vital first stage. Team commitment was observed in four innovations (two radical and two incremental). It was identified as a resource because it translated into efficiency, dedication, devotion, and loyalty towards innovation development. Therefore, team commitment could be thought of as tacit rather than a tangible asset. The teams involved in innovation development identified with the innovations they were developing and were dedicated to completing and disseminating them, tying in with intrinsic motivation and therefore the management activity motivating & rewarding.

The firm engagement process presented in leveraging (6.2.4)contributed to the smooth process of resourcing. These processes enabled many key resources to be secured in phase one from the wider network. The hub firms were aware, from experience, that without securing relevant resources early on, resource contributions would have been missing which would, in turn, cause difficulties in subsequent innovation phases. This was more difficult and complex for radical innovations. Although relevant actors (both individuals and organisations) were initially secured, on occasion, other important resources were not easily identified and acquired from the outset; hub firms acknowledged this by implementing project management processes intended to create flexibility and agility, hence there were connections with the management activity coordinating. Identifying and combining resources transpired through collaboration in the short-term interorganisational innovation projects. All the team members helped to refine and shape the innovation goals. Connections, therefore, were also noted with the goal setting & refining management activity.

In the third innovation phase, connections between resourcing and the management activity leveraging were observed. Resources were leveraged to create the innovation(s). In each innovation, resources were leveraged via soft means. Individual actors brought their knowledge and expertise to the short-term interorganisational innovation projects in addition to access to specialists that provided additional support to develop the innovations, including:

- CodingGame supported by RadioX, giving context to their innovation idea through the creation of a short video. This helped to win the Red-Innovation-Hub event. RadioX subsequently supported the short-term interorganisational innovation project throughout innovation development.
- Sapphire supported Platinum with all aspects of Demonland's game development, through all innovation phases.

- Regarding ARVR-Staging, Red and Blue made introductions to Moss who had a direct relationship with Flame. All four actor organisations then collaborated on the innovation.
- Liquorice's developers used new knowledge from developing their own product, to benefit Mediaworks' development.
- Stanley had access to Sebastian (Sapphire University) who had expert knowledge in a specialist area without which Metbot would have been difficult to create.
- Morph had access to expert coder Simon (Audiolizer). He was a leader in his field, with his own network of technical specialists.

Combining_and_changing_resources, highlights how resources were combined, changed and on occasion exploited. In each of the innovations new resources were combined, which impacted on all phases of innovation development, shaping, and developing them. Furthermore, the specialists influenced the dissemination phase. As they each had knowledge of the market, they influenced the introduction and launch of the innovations, changing team members' viewpoints via education, involving influential stakeholders at key development stages, and supporting facilitating, testing and research phases.

Indeed, working at the task level, individual actors with access to knowledge resources, financial resources, and resource management, could guide their respective innovation development process in a specific direction with some influence, thus exhibiting power. Hence, ***Empowerment*** was illustrated by the knowledge resources used by team members, for example; when creating the innovations; with employment of financial resources and; excellent resource management. Power is closely aligned with combining and changing resources. This was because the same team members were able to combine resources as they had access to them for the benefit of innovation development. Furthermore, all the studied innovations involved control processes whereby combinations of resources were put together without detrimentally impacting on the hub firms' existing operations and procedures. Thus, enabling efficient innovation development.

6.2.6.2 *Barriers*

Constraints and ***Limitations*** comprise the important barrier themes, presented below (Table 46). Notably, more individual barriers to resourcing were observed for incremental than radical innovations; specific issues integral to incremental innovation development caused obstacles and delays.

Table 46: Resourcing barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Budgetary constraints	*Constraints*	1	2			2,3	
Technical resource issues		2		2	2		
Time consuming process		1	2	2			
Resource needs changed		2	2			1,2	2
Music rights		2	2				
Contract negotiations				1,2			
Resource constraints			2		2	2	2
Concerns about bot maintenance						2	
Competing demands for team resources			2	2			2
Start up firm (financial stability)				1,2	1,2		
Difficult process				2			
Resistance to embrace VR				1			
Constant game refresh			2				
Film – the quality reference				2			
Music rights	*Limitations*						2
Resource limitations					2	2	2
Complex software & functionality issues				2			
Team continuity	*Actor_resources*					2	
Poor project planning resulting high development costs & long leads times					2		
Team exhaustion			2				2
Promoting the innovation	*Brand_and_legacy*					3	
Strong brand loyalties			2				

An important barrier for resourcing was ***Constraints***. As noted in the exemplar case, constraints refer to the degree to which something slows down or is made smaller. Thus, causing difficulties rather than a complete block. Constraints were compounded by resource needs which changed during innovation development; the resulting challenges caused frustrations for team members to overcome. Examples for incremental innovations include:

- finalising the budget (CodingGame);
- resolving technical problems (ARVR-Staging); and
- the time-consuming nature of game modifications (Demonland). This meant that timelines were revised and extended, increasing innovation development time, which in turn increased costs (impacting the budget).

While, both radical and incremental innovation development experienced onerous challenges related to changing resource requirements, radical innovations were hit harder as the problems encountered were more thorny, complex, and demanding to resolve. This is highlighted by the resourcing barrier, ***Limitations***, which encompassed a lack of physical resources; limitations due to technical considerations; choice of originating software tools; and lack of time to complete processes. It included factors which could not be changed nor overcome easily, illustrating issues which had a determined outcome, examples included:

- The impact of the hub firm's music rights negotiations (Audiolizer);
- The principal developer leaving (Metbot).
- Underestimating total developer time due to changing requirements. For Audiolizer developer resources were finite. Additionally, to maintain control, the orchestrator, carried out the remaining developer work, prioritising this above other tasks.

Furthermore, for both incremental and radical innovations, employees were often stretched; due to existing commitments (to other projects) and the demands of the innovation(s) concerned. Due to competent project management, demands were generally well managed (although sometimes resulting in delays) with tasks successfully allocated and partitioned. This resulted in positive outcomes, highlighting the connection with the management activity, coordinating.

6.2.7 Goal setting & refining: drivers and barriers

Goal setting & refining was a vital management activity for both radical and incremental innovations. It featured throughout all phases of innovation, with more prevalence in the early phases. Project goals set out what the short-term interorganisational innovation projects should achieve from the outset. Refining activities happened later when the course of events changed, and the goals needed to be adjusted to reflect the new circumstances.

Goal setting was a crucial initial step in innovation development relating to the definition of the key milestones determining the project deliverables. The milestones included scheduled dates to regularly reflect on the milestones that had been achieved and determine how to meet those which had not been. Goal refining activities tended to occur during later innovation phases to support changing project needs. They were often related to resourcing requirements.

The short-term interorganisational innovation projects implemented Agile and Stage-gate software management principles to facilitate achieving the project goals. While this helped to smooth the process for both types of innovation development; primarily it helped to mitigate against the unpredictable nature of radical innovation development where goal setting was more problematic. Modifications to radical innovation goals were more extreme than incremental innovation as many aspects of innovation development were initially unknown. Goal setting for radical innovations, therefore, required flexibility to deal with things that were known about but for which there was no current solution or things that were not anticipated or known to cause a significant problem. Consequently, goal setting was more difficult for radical innovations.

6.2.7.1 *Drivers*

The exemplar case revealed the following drivers: ***Collaboration, Goal_setting,*** and ***Project_management_tasks*** of which, the latter two are discussed below. Additionally, ***Goal_alignment*** (Table 47) emerged in the cross-case analysis and is also explained.

Table 47: Goal setting & refining drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Early goal setting	***Goal_alignment***		1	1			
Giving direction and framing the agenda							1,2,3
Good target audience fit			1				
Company goals & alignment			1,2				
Early innovation ideas	***Goal_setting***			1	1	1	
Meeting goals		2,3				1	
High actor expectations			2				
Keeping goals insight						1,2	
Goals linked to revenues			1		1	1	
Brand building				2			
Clear brief and clear goals			1			1	
Formal agreements				2	2	1,2	
The kick off meeting	***Project_management_tasks***	1	1	1	1	1	1
Agenda setting and project management tools		1,2,3	1,2,3	1,2,3	1,2,3	1,2,3	1,2,3
Successful collaboration	***Collaboration***	1,2	2			1	1,2
Early testing of innovation idea(s)						2	

Goal_alignment involves the processes of aligning individual employee goals with the larger overarching goals of the organisation and short-term interorganisational innovation project. Such processes help to ensure that each employee has visibility into the direction of the business and how their specific role contributes to that direction. This driver revealed the importance of early goal setting, where milestones and specifications were set and agreed: thereby securing team member involvement by aligning employee goals with those of the respective parent organisations. Furthermore, ***Goal_setting*** highlighted how goals were made more specific by quantification (making goals measurable) and enumeration (defining tasks that must be completed to achieve the goal). Goal setting was also undertaken with respect to early innovation ideas, which were quantified and enumerated; an important part of the selection process.

Team member involvement, from every individual throughout the goal setting process was an important, intrinsic, feature. For example, the kick-off meeting which included goal setting, was a significant first stage in the early innovation phases. The determination of individual actors as part of the project team, to achieve and meet the agreed goals was noted as an important motivational influence. This illustrates a connection between goal setting & refining and motivating & rewarding management activities. For both innovation types, time was needed to finalise agreed sets of goals and objectives which suited all parties.

In the context of goal setting & refining, ***Project_management_tasks*** were found to be essential for all innovations. They depict the way team members organise and manage resources that are necessary to complete a project in addition to scheduling task delivery. Agenda setting and project management tools were key to this. Agile and Stage-gate software management principles allow for changing needs, assisting with the coordination of activities and consequently meeting the set goals. Thus, showing the links with between the following management activities: leveraging, coordinating, resourcing, and controlling with goal setting & refining. These links are discussed in section 6.3.1, in relation to their contribution to an efficient work pace.

Although goals evolved, there was stability in the short-term interorganisational innovation projects; new actors (both individuals and organisations) were only introduced to evolve innovation to the next phase. Individual actors did not leave after a stable project was formed due to friction. They only left due to personal circumstances unrelated to the project. This highlights a connection with network stability & embeddedness (6.2.3) as team members felt supported to achieve their innovation goals.

6.2.7.2 *Barriers*

Relevant to the cross-case and the exemplar case analysis, the barrier ***Expectations*** is clarified. Furthermore, barriers in the cross-case analysis included: ***Project_management, Power/dependence*** and ***Resource_requirements*** (Table 48), all of which are explicated below.

Table 48: Goal setting & refining barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Setting goals	***Expectations***		2			2	
Risk taking			1	1	1	1	1
A new process				1,2			1
Challenges	***Project_management***	1	2	1	1	2	2
Time consuming processes		2		1	1		1
Overestimating the company business plan which impacted on the innovation delivery schedule					1,2		
Inefficient communication	***Power/dependence***						2,3
Lack of power distribution							1
Financial investment	***Resource_requirements***		1				
Commercialisation and monetisation of games				1,2			

Numerous barriers to goal setting emerged for both incremental and radical innovations. Connections between drivers and barriers across all the innovations revealed the complexity inherent in the management activity. However, barriers were not so significant as to hinder progress. For example, a barrier to goal setting & refining was ***Expectations***. A fear of taking potential risks was a factor for some team members in addition to concerns about implementing new processes and setting ambitious goals. For example, formal agreements were implemented to support development of Mediaworks and Demonland; however, the people delivering them did not fully appreciate the time required to deliver their own company products and services. The underestimation of time to realise these obligations, by default, slowed down their own processes and subsequently innovation delivery. However, neither project suffered so heavily that innovations failed.

Moreover, three further barriers to goal setting & refining were problematic for both innovation types. Firstly, the challenges to effective goal setting & refining required in ***Project_management*** included numerous difficulties to overcome, such as: goals which were too broad; unrealistic deadlines; scope creep; deficient team member skills; improper communication; and geographically dispersed teams. Secondly, ***Power/dependence*** highlighted how a controlling and authoritarian atmosphere contributed to inefficient communication in addition to a lack of power distribution in Audiolizer. Thirdly, ***Resource_requirements*** included the difficulties of goal setting where resource requirements were deficient and inadequate knowledge resources needed to commercialise games was evident.

6.2.8 Consolidating: drivers and barriers

Consolidating featured throughout all phases of innovation. It was found to be particularly important in the early phases of innovation development because the team members' commitment to the process and their constructive teamwork impacted encouragingly on the direction of the short-term interorganisational innovation project(s). This helped to sustain innovation development, which resulted in positive innovation outcomes. All cases contained consolidating activities, augmenting trust between the actors involved. It was evident that without trust, it is difficult to build a considered, successful innovation. Consolidating, therefore played a sizable role in innovation development and was critical to both innovation types. All the innovations evolved from a similar inclusive process which helped to build and cement trust. Shared understanding and mutual commitment to innovation development grew from solid foundations. Consequently, when significant challenges arose for the radical innovations, innovation development progressed.

6.2.8.1 *Drivers*

Atmosphere was a principal feature of consolidating, exposed in the development of relationships between the companies in the short-term interorganisational innovation projects, as evidenced by the driver, ***Trust*** (see Table 49). This builds on the Metbot case (see 4.3.8.1) where examples of fostering interpersonal trust and how fostering interpersonal trust can lead to interorganisational trust are given.

Table 49: Consolidating drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Fostering interpersonal trust	***Trust***	2	1	1,2,3	1,2	1,2,3	1
Interorganisational trust was strong		2			3		
Fostering interpersonal trust leading to interorganisational trust			2		1,2	2	
Fostering interorganisational trust			1	1,2	1,2		
Intra-organisational (& inter-personal) trust			1,2,3		1		1,2

Trust reveals that team members who work in an atmosphere of trust can collaborate productively and get things done efficiently. It links with Leveraging (see 6.2.4.1) as it appeared that communication works best when people are trusting and when they are candid, inclusive, and cooperative. Effective communication helps to create inter-dependency between people, thus building strong alliances. Additionally, it improves relationships and creates an effective atmosphere that further promotes teamwork and consensus. Indeed, fostering interpersonal trust is evidenced by the early innovation firm engagement processes (see leveraging 6.2.4) which facilitated opportunities for the different actor groupings to build commitment, preparing them for future work. Essential for those people that had not worked together before, this 'getting to know each other phase', smoothed the path for subsequent innovation activities. Once the innovation development phases started in earnest, the short-term interorganisational innovation projects (for both innovation types), started out in the same way, with goal setting activities, which were mutually agreed and directed by the hub firms. Commitment to carry this out was therefore fully accepted. Open discussions, first at the kick-off meeting and then subsequent planned project meetings, helped to build trust and commitment. This also facilitated resourcing. Therefore, joint decision making to set goals, cooperation with the orchestrator on task partitioning and motivating (highlighting management activity links with goal setting & refining and resourcing), combined to build and shape consolidating in the early innovation phases.

6.2.8.2 *Barriers*

Short-term interorganisational innovation projects which experienced ***Low_trust*** between team members exhibited weak management, bureaucracy, and destructive politics (see Table 50).

Table 50: Consolidating barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Low interpersonal trust	***Low_trust***		1		2	1,2	1,2
Game latency, causing potential lack of trust with gamers			2,3				

In these projects, factors including protocols, titles, deferential behaviour, status issues, jealousy, office politics and egos interfered with communicating important information. Additionally, team members' neither enjoyed their work nor worked well. Suspicion and micromanagement poison trust, consequently the atmosphere is not conducive to collaboration and support to get things done.

Overall, drivers to consolidating were more numerous than barriers, illustrating that, largely, trust was strong between the team members. However, low interpersonal trust became problematic between some team members involved in radical innovations. While trust was fully re-established between team members involved in Metbot (see 4.3.8.2) after the issue about the quips and television personalities was resolved. Issues resulting from mistrust in the short-term interorganisational innovation projects developing Mediaworks and Audiolizer, were difficult to resolve. Due to the complexity of the problems encountered when creating the radical innovations, the tensions and friction were elevated. For example, within team members creating Audiolizer; relationships between Red-Go-Digital and Morph were strong and had been well established over many years. The relationships between Red-Go-Digital and Red-Femteam started positively. Red-Femteam were inspired by the charismatic, entrepreneurial style of the executive producer (linking with the leveraging management activity). However, due to the compromises Red-Femteam made to their original innovation idea, their trust towards him waivered and diminished by the dissemination phase. The executive producer remained unaware, having achieved all that he set out to accomplish. Lack of trust was evident for Red-Femteam. However, it was not so significant that people failed to be involved in the innovation development. Moreover, a blame culture did not arise.

6.2.9 Coordinating: drivers and barriers

Coordinating was critical to the complete innovation process for both innovation types. Due to the complexity of radical innovation development, coordinating, at times, was observed to be more difficult to resolve for radical than incremental innovations. Furthermore, although role confusion was a barrier for the radical innovation, Audiolizer; fundamentally, the barriers to innovation for all six cases were not significant enough to hinder innovation development.

6.2.9.1 *Drivers*

Developing concepts from the exemplar case, the drivers, ***Project_managment_actors, Project_management_tasks***, ***Roles*** and ***Tools,*** (Table 51) all appeared in the cross-case analysis and are discussed below.

Table 51: Coordinating drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Project management implementation (skills, phases, modules, planning and kick off meetings)	***Project_management_actors***	1,2,3	1,2,3	1,2	1,2,3	1,2,3	1,2,3
Planning and engagement	***Project_management_tasks***	1,2,3	2,3	2	2	1,2,3	1,2
User testing		2	2	2		2	2
Marketing		2	2,3		2		
User experience		2	2				
Set design				2			
Pre-production work				2			
A bespoke demonstration				2			
Dual running process				2			
Oral communication - regular contact phone calls					2,3	2,3	
Oral communication – discussions			2	1,2	1,2	2	
Oral communication - demonstrations			2	1		1	
Oral communication - feedback			2			2	
Orchestrator role	***Roles***	1,2,3	1,2,3	1,2	1,2,3	1,2,3	1,2,3
Project management tools (including Agile)	***Tools***	2,3	2,3	1,2	1,2,3	1,2,3	1,2,3

As effective project management involves successful activity coordination (in addition to planning and resource management) to ensure that a project successfully reaches its goals within the agreed constraints; project management featured heavily in this management activity. Project management was observed in all six cases, for both innovation types[17].

Project management was highlighted by:

- ***Project_management_*actors**; the way an actor organises and manages resources that are necessary to complete a project; the actors that carry out this work are skilled in project management and project management implementation including skills, phases, modules planning and kick off meetings;
- ***Project_management_tasks;*** and
- ***Tools***; the resources required for project management.

Delivering ***Project_management_tasks*** helped to create structure and a systematic approach, with the intention to avoid mistakes and increase performance; thereby ensuring that each innovation phase was completed well and to deadline. Without planning and engagement there would have been a lack of direction. Importantly, effective use of project management enabled the short-term interorganisational innovation projects to be wholly goal focused, linking the management activities leveraging, coordinating and goal setting & refining.

Another example of the driver ***Project_management_tasks*** was user testing, which referred to a procedure in the design process to evaluate a product, feature, or prototype with real users. It allowed the team members to identify friction in the user experience, ensuring that it could be addressed prior to building innovation(s). Identifying such issues helped to reduce long-term cost implications. It appeared in five short-term interorganisational innovation projects, for both innovation types revealing the importance of applying knowledge from the testing process to improve each innovation and facilitate innovation advancement. Furthermore, user testing appeared as both a driver and a barrier for some short-term interorganisational innovation projects, thus highlighting the complexity of

[17] This excludes the dissemination phase of ARVR-Staging as it had not occurred at the time of data collection.

setting user testing up well and successfully interpreting the results. Barriers related to user testing are described in the section 6.2.9.2.

The final driver presented is ***Roles***. It refers to positions that actors in the short-term interorganisational innovation project assume or they are assigned. The responsibilities are the specific tasks or duties that individuals carry out in relation to their role. Orchestrator roles were observed in all the radical and incremental innovations; orchestrators were responsible for carefully organising and planning innovation development. The orchestrator role demonstrated the importance of a central hub firm motivating actors and organising innovation development (linking with the management activity motivating & rewarding). The hub firms had influence and power to carry out a leadership role; thereby drawing together the resources and capabilities of other actors in the short-term interorganisational innovation projects. Specifically, in each project there was one person who carried out this role (see controlling, 6.2.10).

6.2.9.2 *Barriers*

The two barriers identified in the cross-case analysis: ***Reprioritisation*** and ***Constraints_resources*** also appeared in the exemplar case analysis. Additionally, ***Project_management_tasks*** appeared as a barrier (Table 52). Both ***Reprioritisation*** and ***Project_management_tasks*** are discussed in depth because of their importance as barriers in this theme.

Table 52: Coordinating barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
User testing	*Project_management_tasks*	2	2	2	2		2
Development challenges			2	2	2		
Delayed timetable			2	2			
Managing the cost base			2	2			
Scope creep			2				
The pricing structure of Mediaworks was difficult to gauge					2		
Heavy workload		2	2	2			2
Role reprioritisation and confusion	*Reprioritisation*	2		2		2	2
Slow sign off		2		2		2	
Sales and marketing effort required	*Constraints_resources*				2		
Geographical location						2	
Resource requirements				2	2		

Major challenges to coordinating resulted from problems which started to evolve in the first innovation development phase. Consequently, the barriers for both innovation types appeared in phase two (Table 52). The barrier, ***Project_management_tasks*** comprised time consuming activities and processes which slowed down innovation development. An example of this is user testing which was problematic for five cases, barring Metbot where user testing was carried out as planned. In the second innovation development phase, in all three incremental innovations (CodingGame, Demonland and ARVR-Staging) heavy workloads were experienced in addition to time pressures to implement changes quickly after user testing was implemented. These commitments proved difficult to meet when juggling responsibilities to other projects. This also impacted on both goal setting and resourcing as the original goals could not be met. Therefore, goals had to be changed and refined, reflecting the new situation. The barriers related to the user testing of radical innovations Audiolizer and Mediaworks were more complicated. For Mediaworks, user testing involved processes which were ineffective in the first instance, thus producing inconclusive results. Audiolizer's user testing incurred multiple phases instigated by different actor groupings, for different purposes. As both the orchestrator and Red-Femteam set up user testing, the resulting lack of coordination was problematic.

Overall, in the second innovation development phase more barriers to the coordination of innovation appeared for incremental innovations than radical innovations. However, the barriers that did appear for radical innovations were less obvious and more challenging to resolve than those experienced for incremental short-term interorganisational innovation projects.

The barrier, ***Reprioritisation*** included innovation development activities that contributed to slow progress and provoked team members to reprioritise. This included role confusion resulting from reprioritisation activities in four of the short-term interorganisational innovation projects. In Audiolizer, role confusion acted as a barrier for Red-Femteam. Their expectations in the early project phase were to:

- manage the project themselves in conjunction with the Red-Innovation team;
- be, 'hands on', directly involved in the coding and development of Audiolizer; and

- in receipt of the full budget.

As stated, (see 5.6.1), the budget had been split 50:50 with CodingGame, resulting in bitter disappointment for Red-Femteam. The rules had changed from previous Red-Innovation Build and Development Studio events and the people in Red-Femteam were confused by them. Thus, their frustrations grew into a barrier. To realise the full innovation development, additional funding was required. Although the money was sourced, it added to the general downward spiral of anxiety and worry experienced by Red-Femteam. Furthermore, due to the executive producer's forceful and entrepreneurial character, as orchestrator, he directed the innovation development on a path that supported his personal aspirations.

6.2.10 Controlling: drivers and barriers

Controlling was a vital management activity observed for all cases and both innovation types. The orchestrator role was a significant driver: to help establish clear rules and roles ensuring that the people involved in each short-term interorganisational innovation project understood how to contribute and, with guidance, to progress the activities required to establish the path of innovation success. Furthermore, the power distribution within each project was important. Where power manipulation existed, the day to day challenges presented during innovation development were exacerbated, slowing down the process. Moreover, in the early innovation phases, for both innovation types; where goal setting had been facilitated well, along with expedient resourcing and consolidating activities, there was less need for controlling activities. Thus, controlling featured in all phases of innovation. In the first phase it related to setting the expectations for the people involved in innovation development and in the second and third phases there were more examples of controlling activities intended to intentionally direct innovation development.

6.2.10.1 *Drivers*

While more evidence was discovered for controlling in the cross-case analysis, the exemplar case revealed the same second order controlling drivers encompassing: ***Roles, Power/dependence*** and ***Commitment*** (Table 53) all of which are presented below.

Table 53: Controlling drivers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Orchestrator role	***Roles***	1,2,3	1,2,3	1,2	1,2,3	1,2,3	1,2,3
Developer role		1,2,3	1,2,3	1,2	1,2,3	1,2,3	1,2,3
Project management role		1,2,3	1,2,3	1,2	1,2,3	1,2,3	1,2,3
Rules and roles were established	***Power/dependence***	2,3	1	1,2	1,2	1	2,3
Actor commitment – formal roles		2,3				2,3	
Actor commitment – informal roles		2,3				2,3	
Merging sectors				1,2			
Clear boundaries					2		
Teamwork and collaboration	***Commitment***	2,3	1,2,3	2		1,2,3	1
Open approach			3	2	1,2		

A definition of ***Roles*** is provided (section 6.2.9.1). This driver highlights the importance of the orchestrator role which appeared in both innovation types and throughout all innovation phases. The concept of roles is also relevant to ***Power/dependence***. Here roles relate to establishing roles both formally and informally, specific rules and roles were established when particular individual actor skills were required in different innovation phases. Rules and roles within the projects were established early in the innovation development cycle to ensure that team members understood expectations of them and how their roles fitted into the wider innovation development. Furthermore, it was observed that the hub firms orchestrated innovation development activities. This was achieved by enabling coordination and innovation development via influence rather than dictating, in the main. Thus, the orchestrator role was a prominent first order concept, appearing in all phases of innovation, in every case (see also coordinating 6.2.9). It was noted that an individual within the hub firm carried out the responsibilities of the orchestrator role. Their attributes included:

- successful communication; explaining clearly everything from specific tasks to innovation goals; to be able to communicate on different levels; one on one; to team members in the short-term interorganisational innovation projects and collaborators;
- self-management of workload and goals; retaining awareness of personal bias and strengths and weaknesses;
- acting strategically and managing complexity; to be forward thinking, open minded and flexible;

- accountability and responsibility; using power and authority appropriately;
- persistence and perseverance; to set and achieve goals;
- establishing a clear vision for the innovation; understood by all actors;
- promoting teamwork and team building;
- flexibility and agility in their approach; and
- fostering experimentation and creativity in innovation; by supporting team members with their ideas and managing risks.

Exceptional people possessed these abilities. Execution of these special attributes appeared to have a strong link with innovation success. However, it was observed that in some situations the orchestrators did not consistently perform well; these instances consequently appeared as barriers to innovation and are presented in the next section (6.2.10.2).

Building on the definition of ***Commitment*** as presented in leveraging drivers (section 6.2.4.1), the team members were enthusiastic and committed to carrying out the tasks assigned to them. Controlling activities helped to guide innovation development. Additionally, team members had a sense of responsibility towards completing assigned tasks. Control was projected by the actors involved and via project management plans due to the need for efficiency and effectiveness in innovation development. An example includes an open approach, which describes the ability of team members in the short-term interorganisational innovation projects to get access to and share information and resources. Finally, teamwork and collaboration denote a mix of interpersonal, problem solving, and communication skills required from team members to work towards common goals.

6.2.10.2 *Barriers*

Regarding barriers to controlling, ***Roles*** and ***Expectation_actors*** appeared in both the exemplar case and cross-case analysis. A new barrier discovered in the cross-case analysis was ***Power/dependence*** (see Table 54)***.*** Attention is therefore given to this second order theme in addition to showing how ***Roles*** appeared as a barrier.

Table 54: Controlling barriers

First order concepts (level one codes)	Second order themes (level two codes)	Phase					
		Incremental innovations			Radical innovations		
		Coding Game	Demon-land	ARVR-Staging	Media-works	Metbot	Audiolizer
Lack of power delegation							2,3
Accountability					2,3		
Conflicting innovation goals	***Power/dependence***	2	2				2
Constraints of the established user interface (UI) design							2,3
Start up firm (financial stability)					2,3		
Limited experience (in some areas) as a new firm					2		
Tensions		2,3	2	2	2	2	2
Informal roles	***Roles***	2,3				2,3	2,3
Formal roles		1					
Lack of roles and resources			2		2,3		
Misaligned decision making				1			2
Team decision making – taking responsibility			2				
Lack of compliance to rules and roles	***Expectations_actors***		2				
Over protective nature towards specific actors					2,3		
Risks			2	2		2	
Compliance		2		2			

Barriers to controlling appeared more frequently in the second and third phases of innovation development, often when the intended progress had not been realised in the way the orchestrator had anticipated. The barrier ***Power/dependence*** builds on the evidence presented in learning, knowledge creation & transfer barriers (section 6.2.1.2), leveraging barriers (section 6.2.4.2), motivating & rewarding barriers (section 6.2.5.2) and goal setting & refining barriers (section 6.2.7.2). Here, ***Power/dependence*** reveals that, on occasion, this element of atmosphere prevented ease of innovation development and controlling factors prevailed. This included a lack of power delegation. For example, Jack was the orchestrator of Audiolizer. He had many strengths; however, he did not always maximise the abilities and teamwork of Red-Femteam in the creation of Audiolizer. Interorganisational power was in the hands of the senior team at Red-Go-Digital which included Jack. They led the whole season of programming, including Audiolizer and all related television, radio, and online activity. Red-Femteam did not know how to react to this team (which they perceived as powerful), to achieve their aspirations for what they saw as their innovation, having won the Build and Development Studio events. Although rules and roles had been established (see Table 53) and were set in the early innovation phases, Jack did not delegate power. This frustrated Red-Femteam and consequently diminished their commitment to innovation development. Despite this, Audiolizer was successful. However, if Red-Femteam had been fully involved, it is likely that more constructive input would have been given; perhaps Audiolizer would have contained more innovative qualities and greater success.

Another example of the ***Power/dependence*** barrier relates to an inability to execute the orchestrator role well. It appeared in the Mediaworks short-term interorganisational innovation project and reveals the orchestrator's lack of accountability. He was not able to achieve consistent productive teamwork because he did not feel empowered to do so. Due to Blue's overriding firm culture, effective teamwork was lacking. This may partly explain why Mediaworks did not realise its full potential. Despite this, in all cases, social controls were in evidence. This relates to the social pressure in the projects for team members to work and behave in a certain way and aligns to the major theme, shared values & beliefs as the social controls were embedded in actor behaviour.

The second and final barrier to be explained is ***Roles***. As well as appearing as a driver (see goal setting & refining (section 6.2.7.1) coordinating (section 6.2.9.1) and controlling (section 6.2.10.1), ***Roles*** also acted as a barrier here. It appeared in all phases of innovation development for both innovation types; tensions arising from roles developed into barriers which caused problems. Here, tensions related to the team members that adopted informal roles which depended more on their character than specific knowledge, position or because the roles had not been clearly defined and the people assumed the role. There were additional tensions which arose between team members carrying out specific roles resulting from lack of resources (linked to the management activity resourcing); all contributing to slow development.

6.3 Factors that influence project management in short-term interorganisational innovation projects

This part of the cross-case analysis is a development of the exemplar case in chapter 4 (see 4.4) and builds upon the evidence presented there. As more evidence appeared in the cross-case analysis due to the greater number of cases studied, evidence which appeared for Metbot was generally applicable to all the radical short-term interorganisational innovation projects. Differences are highlighted here, especially in comparison to the incremental short-term interorganisational innovation projects. The organisation of this section of the chapter is similar to the format used in the Metbot chapter (section 4.4), with the second group of factors elaborated upon more fully in separate sections (6.3.1-6.3.6). Additional sections evolved from the cross-case comparison. This includes, similarities and differences between innovation types (6.3.5).

Firstly, although each short-term interorganisational innovation project had a temporary nature, they were all stable and embedded. This is evidenced in network stability & embeddedness (see 6.2.3 and 4.3.3). The embedded and stable nature of the wider network underpinned and evolved from the connections of each respective hub firm. Each case demonstrated how working in a secure business setting was conducive to realise successful innovation. Secondly, although the short-term interorganisational innovation projects creating radical innovations experienced more drawbacks (the innovation process was more complex) than incremental innovation; team members experienced confusion and misunderstanding at times resulting in information lop-sidedness, where partners had different understandings about the nature of the agreement. Overall, the barriers which featured in all the management activities and major themes did not prohibit successful innovation development and dissemination. This is evidenced in each of the respective barrier sections in this chapter (see sections 6.2.1.2, 6.2.2.2, 6.2.3.2, 6.2.4.2, 6.2.5.2, 6.2.6.2, 6.2.7.2, 6.2.8.2, 6.2.9.2, 6.2.10.2). Thirdly, the Metbot case showed the importance of the Red-Innovation-Hub process (see 4.4). Furthermore, the cross case analysis revealed that both innovation types evolved from effective firm engagement processes (see 6.2.2.1, 6.2.4.1, 6.2.6.1 and 6.2.8.1). This helped to facilitate and guide innovation development, as well as information and knowledge exchange. Fourthly, as presented in the management activities coordinating (4.3.9, 6.2.9) and controlling (4.3.10, 6.2.10), the implementation of Stage-gate and Agile methodologies were critical to the completion of innovation development phases. Fifthly, factors comprising effective teamwork and project management as put forward by Tidd and Bessant (2018) were discovered in all the cases (see 4.4) (contributing to goal setting & refining, see section 0, coordinating, see section 6.2.9 and controlling see section 6.2.10).

The next six sections (6.3.1-6.3.7) present six further factors which influence project management in short-term interorganisational innovation projects. Connections are highlighted with each of the major themes/management activities.

6.3.1 Successful delivery of the management activities contributing to an efficient work pace

An important observation, relevant to both incremental and radical innovation development, was the successful delivery of each innovation phase. This contributed to the timely delivery of the innovations in each short-term interorganisational innovation project. The processes that enabled an efficient work pace were crucial. As noted in chapter 4 (see 4.4.1.1 and Table 31), the six factors which contributed to this were all relevant to the cross-case analysis. The linking management activities included: goal setting & refining, resourcing, coordinating, motivating & rewarding, leveraging, and controlling.

Barriers to innovation which may have been considered impenetrable would have slowed things down; impacting on the beliefs of the people involved thereby decreasing motivation and their appetite to complete and disseminate innovations. However, the short-term interorganisational innovation projects were all considered truly innovative. They embraced innovation and the challenges it presented. True innovation was sought; whether pursuing incremental or radical innovation development. Team members did not seek to simply update existing products or services or add a line extension. All the innovations were designed to satisfy specific customer needs.

6.3.2 The importance of individual actors (people), their micro-level interactions and dense social networks (connecting primarily with consolidating, 6.2.8 and shared values & beliefs, 6.2.2)

Complex interdependencies appeared between the firms in each short-term interorganisational innovation project. These interdependencies are significant as they rule out beliefs that markets contain autonomous actors whose actions are driven by antagonism and competition. Individual people, and actor firms in the short-term interorganisational innovation projects, formed mutual close relationships, in business settings which co-evolved over time.

As in the exemplar case, the micro-relationships between individuals were important; both personal and professional relationships were key. The friend-like relationships evolved (see, 6.2.2.1) and developed in all the short-term interorganisational innovation projects. Team members maintained professional networks via online networking sites such as LinkedIn, in addition to regular social, informal meet-ups over lunch, for example, and professional industry engagements including conferences, exhibitions, breakfast meetings, social gatherings and awards ceremonies. The people in the industry knew each other well; communication, overall, was clear and open (see, 6.2.3.1, 6.2.4.1, 6.2.8.1, 6.2.10.1). If there was someone an individual actor wanted to meet, to learn more about or invite to a meeting, without prior introduction, it is likely that they would be two people or less away from a personal introduction. Indeed, all the short-term interorganisational innovation projects evolved from MCD&MS networks. Thus, demonstrating the importance of the dense social networks which led to robust, mutual collaborations.

6.3.3 Cognitive abrasion, tacit and explicit knowledge (primarily contributing to learning, knowledge creation & transfer, 6.2.1)

As observed in the exemplar case, the management of cognitive abrasion in the short-term interorganisational innovation projects was, on occasion, problematic. However, due to the historical relationships between the team members, there were clear unspoken rules regarding how individual actors communicated with each other; team members openly stated why they disagreed. This helped to make handling disagreements straightforward, except for instances observed in Audiolizer (examples include, leveraging 6.2.4, consolidating 6.2.8 and coordinating 6.2.9). When objections arose, the people listened, treated concerns as legitimate and gave reasons for their disagreement. These principles were understood as shared values & beliefs (6.2.2). Additionally, communication skills (see leveraging, 6.2.4.1) appeared in the data; team members used their cognition and, therefore, different communication styles to support their argument(s).

Another important principle was that people understood agenda setting, ensuring that there was enough time for both divergent (the opportunity to uncover imaginative ideas and alternatives for problem solving) and convergent discussion. Thus, people could select an option and collectively plan for its implementation.

Overall, team members in the short-term interorganisational innovation projects had the ability to understand different cognitive approaches. Red used this approach when training its middle management in leadership. They were aware that clear communication and the ability to be understood by adapting communication style can help with cognitive abrasion. Team members were aware that they were having an intellectual debate rather than a personal one. They learned to adapt their style for the benefit of the people in their project. This contributed to successful innovation development.

Innovation development appeared to require both divergent and convergent discussion. The people who were comfortable with ambiguity enjoyed divergent discussion, whereas the people that sought closure focused on convergent discussion. Opportunities were given for both discussion types by the people who facilitated, project managed and orchestrated the innovations (often the same person). Therefore, facilitation was critically important to openly encourage people to come forward with their views, opinions, and ideas.

In each short-term interorganisational innovation project, most of the time, team members were fully prepared to help and support each other; to create the best possible innovation. Both creative collaboration and creative abrasion were needed. They were able to exist as the orchestrators (who were skilled as creative facilitators) understood when it was best to allow each to flourish. Skilled creative facilitators recognised the benefits of creative abrasion and creative collaboration to accelerate each innovation. Creative abrasion was used in the ideation phase and brainstorming phases (part of envisioning, phase one) and creative collaboration was used when defining problem(s), refinement and solution gathering (as part of development, phase two).

Although innovation requires the cross-fertilisation of ideas, diverse cognitive preferences were observed to create tensions in the short-term interorganisational innovation projects. Both the orchestrator and the project team members were generally able to understand the different thinking and communication styles prevailing in each project; allowing for intellectual disagreements. However, Audiolizer showed that people that do not understand cognitive preferences can personalise conflict and avoid it (see, 6.2.2.2). In the other short-term interorganisational innovation projects, creating two-way communication helped to lead to a common understanding of the issues under discussion and therefore a shared solution. Hence the people that appreciated the benefit of someone with a different thinking style to their own, appeared to take disagreement less personally and were then better able to acknowledge that a different approach might improve their own ideas. As the pace of change was fast and the people were expected to work quickly to resolve problems, abrasion was, where possible, managed into creativity. Failure to understand and empathise was seen to cause conflict. Innovation was advanced by channelling the energy from the actors' different thought processes. These factors contributed to the completion of innovation phases in a timely manner.

6.3.4 The importance of strong and weak ties, trust, and actor diversity (contributing to consolidating, 6.2.8)

Three primary actor firms were involved in each short-term interorganisational innovation project. One individual from one of the hub firms had a central, leadership, position as an orchestrator. These people had a pivotal position providing guidance, direction and encouragement. The composition of the short-term interorganisational innovation projects appeared to be important. As with Metbot; a minimum of two actor firms with a proven, robust relationship formed each project. The historical relationship between the initial dyad of established actor firms provided structure and trust. Additional firms, organisations and individuals subsequently joined creating diversity. The impact of the new relationships was instrumental to innovation success; inspiring individuals to think in new ways, accepting difference of opinion and the consequent generation of new ideas. The combination of the different groups of people kick started new ideas and increased enthusiasm for innovation development.

6.3.5 Similarities and differences between innovation types

6.3.5.1 *Similarities and differences between innovation types and the prevalent management activity drivers and barriers*

Overall, more similarities than differences between incremental and radical short-term interorganisational innovation projects were observed. In all the innovations, there were major problems at times, however they were overcome. Significantly, for both innovation types, challenges related to innovation barriers did not dominate in each short-term interorganisational innovation project nor stall progress.

The main differences found between the two types of innovation were as follows. In phase one, for radical innovations, no barriers were observed to coordinating (Table 52), controlling (Table 54), or learning, knowledge creation & transfer (Table 36). Thus, illustrating the smooth nature of innovation development. Generally, barriers were low or did not exist in the first phase for radical innovations and were not seen to impede innovation development. Incremental innovations similarly presented with few barriers to innovation, additionally there were no barriers to network stability & embeddedness in phase one (Table 40) reflecting the inherently stable and embedded short-term interorganisational innovation projects.

By phase three the barriers fell away for both innovation types. Moreover, for radical innovations there were no barriers to consolidating (Table 50) and learning, knowledge creation & transfer (Table 36), illustrating the high trust between the people in the short-term interorganisational innovation projects and the appetite in the dissemination phase to continue learning from one another and to facilitate opportunities for knowledge creation and transfer. This shows the desire in the short-term interorganisational innovation projects to surmount innovation barriers, gain new knowledge and increase understanding.

No barriers were identified for incremental innovations in phase three for goal setting & refining (Table 48) and few for shared values & beliefs (Table 38) revealing that at the dissemination phase, the innovations were ready to launch; goals were met, and shared values & beliefs facilitated smooth progress. This reflects the simpler, less challenging process of incremental innovation development in comparison to radical innovation.

The type of drivers to radical innovation development observed for motivating & rewarding (Table 44), when compared to incremental innovation, in phases one and two, is significant. It reveals that radical innovation requires people who are steadfastly devoted and passionate about radical innovation, as it is generally considered far more difficult to implement than incremental innovation. Furthermore, in phase two, coordinating and resourcing were important management activities for radical innovation development in comparison to incremental innovation. This highlights that, generally, the complexity of radical innovation requires higher levels of coordination and more resources. Fewer controlling drivers (Table 53) were noted in radical innovation, as there were high levels of trust represented in consolidating (Table 49) and correspondingly high levels of coordinating drivers (Table 51). Resourcing drivers (Table 45) were also high in order to facilitate the demands of the radical innovations which were generally more demanding than incremental innovations due to their complex nature.

Finally, leveraging was noted to be important to both innovation types throughout innovation development in phases one and two with fewer examples observed in phase three. This is thought to be because the most difficult aspects of leveraging were identified and tackled in the earlier phases and maintained; drivers appeared in phase three (Table 41) but were low as the more onerous aspects had already been dealt with.

While the process of radical innovation development is generally far more difficult and complicated than incremental innovation development, as highlighted by the numerous challenges described in this chapter, overall, many similarities between both types of innovation in this sector were discovered. It is suggested that this is due to atmosphere. The years of experience from the hub firms were embedded, conditioning the atmosphere, and priming the people in the short-term interorganisational innovation projects (see section 6.3.6).

6.3.5.2 *Orchestrators*

Orchestrators occurred in both innovation types but behaved differently. Overall, they had characteristics of self-belief and determination and were single-mindedly focused, encountering setbacks with optimism. References to orchestrators include: 6.2.4.1, 6.2.5.1, 6.2.9.1 and 6.2.10.1. The people orchestrating radical innovations appeared to be more comfortable with risk. They had notable passion and conviction to see their innovations through to each development phase (see, 6.2.4.1). This in itself is significant; they saw the innovation(s) as theirs, whereas those orchestrating incremental innovations did not have the same connection, believing that the innovation belonged to everyone in the short-term interorganisational innovation project. The incremental innovations were created in a far more consultative, empathetic manner, with orchestrators who actively listened to the opinions of others in the short-term interorganisational innovation project and reacted to them.

Orchestrators of radical innovations had excellent abilities to visualise their ideas; communicating what they wanted to achieve; inspiring the people around them to do so, convincing others of their beliefs and passing on their infectious drive and enthusiasm (see, 6.2.4.1). By comparison, in incremental innovation there are many more known factors as the involved actors were essentially altering, adapting, or changing something which already exists. Consequently, there is less risk and the outcomes are more predictable, resulting in less passion and drive, in comparison to the project teams creating radical innovations.

The motivations and styles of the orchestrators between incremental and radical innovations were therefore different. In the radical innovations the orchestrator was someone who was an avid enthusiast about the innovation they were involved in; they had a personal desire to see it completed and disseminated. Their approaches were entrepreneurial and self-driven; on occasion they were dictatorial (see, 6.2.5.1). Whereas, in the main, orchestrators of incremental innovation were perceived to be more empathetic, resulting in a more consultative style and greater connection with the project team.

6.3.6 Atmosphere in the short-term interorganisational innovation projects

Management activities helped to build atmosphere, this in turn influenced future management activities. Indeed, relationship atmosphere motivated the team members, prompting close relationships, stimulating activity and trust. The close relationships enabled the short-term interorganisational innovation projects to achieve positive gains during innovation development. The data revealed many examples of the productive use of individual actor and firm competence, facilities, and other resources such as highly valued technical and commercial information. Two significant major themes discovered in the data, which are directly relevant to atmosphere of the projects, include: shared values & beliefs (6.2.2) and network stability & embeddedness (6.2.3). While the latter is a network characteristic and is not directly part of atmosphere, it surrounds and conditions it. Hence, the atmosphere is external to the management activities. Furthermore, as noted, barriers and drivers are external to the management activities, as drivers stimulate and barriers stall activities.

Atmosphere comprised many complex layers; on occasions where difficulties were encountered between team members during challenging phases of innovation development, personal emotional reactions were exhibited which acted as a damper to atmosphere; however, innovation development was not hindered. It seems the individual actors were so personally motivated to see the innovation development through to completion; they did not allow their personal feelings to dominate.

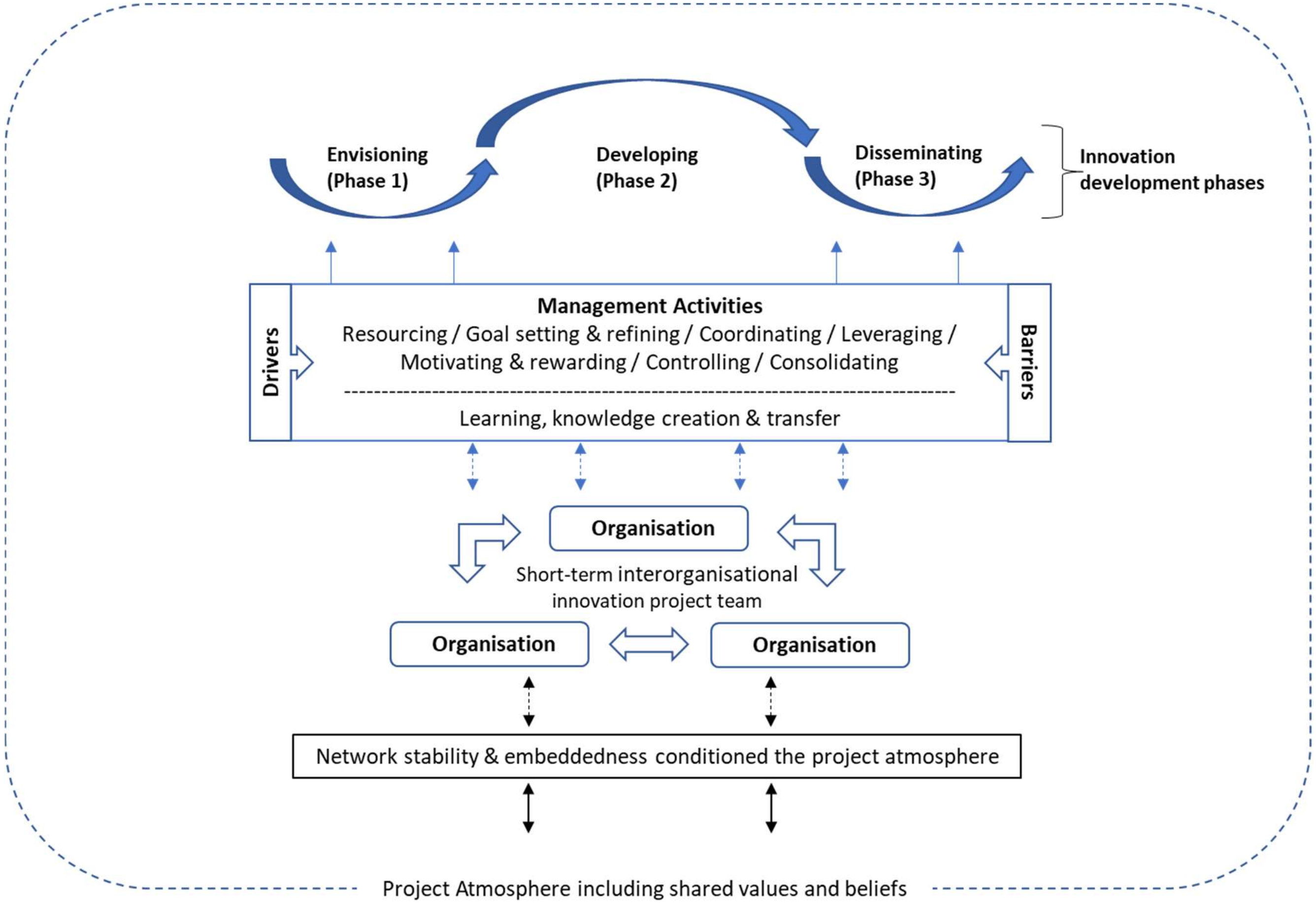
6.4 Developing the conceptual research framework

The conceptual research framework (

Figure 3) has been developed to reflect the findings, see Figure 20. In this figure, the rectangular block of management activities has been updated to include the second order management activities: learning, knowledge creation & transfer. The blue dotted rectangle which surrounds the research framework represents the atmosphere of the short-term interorganisational innovation projects, now referred to as project atmosphere. This includes shared values and beliefs. Network stability & embeddedness, which conditioned atmosphere (the relationship is represented with short, solid, double headed, black, arrows to project atmosphere) is connected with dashed, double headed, black arrows to the short-term interorganisational innovation project team.

The arrows between the short-term interorganisational innovation project team and the rectangular block of management activities have been updated to double headed arrows, to show the short-term interorganisational innovation project teams' utilisation of the management activities, which often appeared in more than one phase. Thus, revealing that the process of innovation is active and recurring; the phases blended and merged with activities which were intertwined. Thus, the analysis reveals that innovation development is constantly moving and active until the innovation is delivered and the short-term interorganisational innovation project(s) disbanded.

Figure 20: Overview of the empirical research framework



7 Chapter Seven: Discussion

7.1 Introduction

A short answer highlighting research contributions, where relevant, and an outline of the subsequent discussion is provided at the start of each section. This chapter discusses the findings. The research questions are addressed in turn (see 7.2, **Error! Reference source not found.** and 7.4). Note that, other important factors, which were found to be vital to short-term interorganisational innovation project delivery are discussed in 7.5.

7.2 RQ1: Which management activities manifest in short-term interorganisational innovation projects?

Prior research identified seven management activities: leveraging, motivating & rewarding, resourcing, goal setting & refining, consolidating, coordinating and controlling (Aarikka-Stenroos et al., 2017). This empirical research presented a more nuanced picture of the seven management activities, which are discussed in turn (sections 7.2.2-7.2.8). It also identified a second order management activity: learning, knowledge creation & transfer (6.2.1).

7.2.1 Learning, knowledge creation & transfer

Learning, knowledge creation & transfer (see 4.3.1 and 6.2.1) were highlighted as second order management activities (Winter, 2003). They were critical to the innovations observed in this study. a capability to learn, based upon creativity in addition to: cognitive processes, experiential experience; the acquisition, utilisation and sharing of knowledge were apparent across all the findings. Aarikka-Stenroos et al., (2017) did not describe learning, knowledge creation & transfer (see 4.3.1 and 6.2.1) as management activities. However, these activities were prominent in many respondents' descriptions of the innovation projects and were observed to be central to the success of the projects observed. In the management literature relating to dynamic capabilities a distinction is made between first and second-order capabilities (Winter, 2003). The distinction being that second-order dynamic capabilities reconfigure the routines (or activities) that constitute the first-order dynamic capabilities (Schilke, 2014). Organizational learning routines are central to second-order dynamic capabilities (Zollo and Winter, 2002). Therefore, it can be posited that learning, knowledge creation and transfer perform a similar function with respect to management activities and can be considered as second-order management activities or outcomes of management activities that extend, modify, redevelop or create ordinary management activities (cf. Winter, 2003). Learning, knowledge creation & transfer were critical to the innovations observed in this study; the acquisition, utilisation and sharing of knowledge were apparent across all the findings. These processes encouraged the development of new knowledge and ideas, in addition to the capacity to understand, appreciate and apply them.

Additionally, factors known to include the process of learning at the organisational level including searching for and exploring information, assimilating it, as well as developing and producing new information and knowledge were observed (Gunsel, Siachou and Acar, 2011). A strong, positive link between organisational learning and successful innovation was noted (Calantone, Cavusgil and Zhao, 2002; Tushman and Nadler, 1986). Moreover, findings such as: experimentation; continuous improvement; teamwork and group problem solving were important factors supporting the learning ability within the short-term interorganisational innovation projects. This concurs with the findings in the organisational learning capability (OLC) literature (Alegre and Chiva, 2008). A learning capability was also observed to be significant to recognise and respond to market cues and efficiently create and develop new products ahead of the competition (Prieto and Revilla, 2006; Sok, O'Cass and Sok, 2013). Indeed, the short-term interorganisational innovation projects, as a group of organisations (and consequently the employees within the firms) came together to learn as a group (Knight, 2002; Knight and Pye, 2005). Furthermore, the learning activity observed in the findings was influenced by the orchestrator, concurring with Knight's (2002) argument that network learning can be affected by a person, firm, dyad or via intra-network interaction (Knight, 2002). However, Knight's (2002) study did not connect with the extant innovation literature.

The findings emphasise the importance of ability or capacity to learn. This has been described as absorptive capacity (Cohen and Levinthal, 1990) and is based on the:

- knowledge base of the hub firm;
- learning skills of boundary spanning people;
- motivation for new discoveries; and
- ability of the hub firm to enable knowledge creation and transfer, concurring with Zahra and George (2002) and Zollo and Winter (2002).

Learning, knowledge creation & transfer was observed to link with motivating & rewarding. This was primarily due to the motivation of team members necessary to achieve the innovation. The learning that occurred enabled successful, productive, and relatively fast innovation development. The findings of this study reveal that both learning, knowledge creation & transfer and motivating & rewarding, are important for innovation development. The findings contrast with those of Aarikka-Stenroos et al., (2017), who suggested that 'motivating & rewarding' included learning and did not explicitly discuss knowledge creation and transfer. Thus, the findings from this research add depth to the innovation management literature.

Learning, knowledge creation & transfer was linked to network stability & embeddedness (see, 4.3.3 and 6.2.3) through the driver multiplexity. It was observed that team members involved in more than one short-term interorganisational innovation project had increased opportunities to learn; there were individual actor connections in addition to those described in each short-term interorganisational innovation project. These connections enabled the team members to develop their ability to gain and develop communication and learning skills; to make sense of and develop different types of knowledge.

Learning abilities including explorative techniques for rapid learning were observed in the management of the innovation process (Holholm and Araujo, 2017). The following two were observed in the short-term interorganisational innovation projects: service design theories (the activity of planning and organising people, communication, infrastructure etc.) and Agile software development (Holholm and Araujo, 2017).

In addition to building a core knowledge base and solidifying exchange relationships (Ahuja, 2000b; Corsaro et al., 2012b; Shaw, 1998) the short-term interorganisational innovation projects were able to enhance opportunities to learn (Biemans, 1991). Thus, the findings suggest that cooperating and exchanging information was important. Exchanging information comprises knowledge creation and transfer (key features of this management activity). It also includes knowledge mobility, which refers to the straightforwardness of gaining, sharing and employing knowledge (Dhanaraj and Parkhe, 2006). Knowledge mobility was observed to be relatively high in the short-term interorganisational innovation projects and knowledge exchange was uncomplicated. Mechanisms which supported efficient knowledge exchange and use were in place (Hurmelinna-Laukkanen and Puumalainen, 2007; Möller and Svahn, 2006). Bureaucracy, formal coordination, and restrictive governance arrangements were not found and therefore did not obstruct knowledge exchange. Furthermore, collaborative relationships between different individual actors including suppliers, customers, competitors, and research organisations (including a university in CodingGame) were observed to aid knowledge sharing and new market entry (often sought by the hub firms). Thus, expanding the hub firm's existing knowledge base and the improvement of its innovation capability (Clauss and Kesting, 2017; Freel, 2003; Luzzini et al., 2015; Zhou and Li, 2012). Thus, the findings agree with the literature that highlights its importance as a significant external indicator of NPD success (Alexiev, Volberda and Van den Bosch, 2016; Clauss and Kesting, 2017; Heirati et al., 2016).

The findings demonstrate that different partners improved the hub firms' innovation capability when its people had developed the ability to ascertain and obtain significant external knowledge. This aligns with the findings of Najafi-Tavani et al., (2018) who discovered that collaborative innovation networks (regarding product or process innovation) were impactful when absorptive capacity is manifested. However, their quantitative study was set in the Iranian high and medium technology manufacturing industries and did not compare radical versus incremental innovation. In this study, while learning, knowledge creation & transfer was vital to both the development of both innovation types it was more impactful in radical innovation development. Thus, filling the knowledge gap.

7.2.2 Leveraging

The findings reveal the importance of leveraging during the whole process of innovation development, with particular significance in the dissemination and commercialisation phase as it contributes to the awakening of customer needs and desires; this is in common with extant literature (Aarikka-Stenroos et al., 2017). The softer methods of change such as the use of negotiation and persuasion to change people's mindsets were evident and were used to achieve specific goals and create a full base of support within the short-term interorganisational innovation projects (Aarikka-Stenroos et al., 2017). However, in contrast to Aarikka-Stenroos et al. (2017) this study revealed that coercive means were not used to change opinions. Additionally, legislation and standards were not changed to directly impact on any of the innovations concerned.

Furthermore, two points highlight the lack of alignment with Cooper's (2019) findings regarding the importance of leveraging as a core competency driver for successful NPD. Firstly, leveraging was discussed at the strategic and organisational level rather than at a task focused, management activity level (Cooper, 2019). Secondly, Cooper (2019) did not acknowledge the short-term interorganisational innovation project creating the innovation and focused on the hub firm and its suppliers; no recognition was given to the collaboration between the web of actor firms, organisations and individuals involved in short-term interorganisational innovation project(s) and their attempts to persuade others to create demand for innovation(s) via persuasion, encouragement and reinforcement.

Indeed, the findings from this research highlights the importance of the people involved in this management activity. Their specialist expertise to deliver specific responsibilities was exemplary; without it, advantages would have been lost and leveraging opportunities missed. When leveraging was effective, the impact on the innovation outcome was improved; critically contributing to successful dissemination and commercialisation phases. Uniquely, leveraging links with each of the management activities, in addition to the factors which help to condition the management activities during innovation development, including:

- shared values and beliefs;
- network stability and embeddedness; and
- project atmosphere.

In summary, exempting Aarikka-Stenroos et al., (2017), literature focused on the task level of leveraging as a management activity is scant. In this study, it is noted for its importance throughout the whole innovation process; and for contributing to changing mindsets via influence and persuasion, opening markets to new perspectives and viewpoints, while facilitating increased appetite and demand for the innovation.

7.2.3 Motivating & rewarding

With respect to motivating & rewarding, both differences and similarities with the literature were identified. Motivating & rewarding activities appeared throughout innovation development, thus highlighting parallels with Aarikka-Stenroos et al.'s, (2017) study. The findings showed the strength of motivational drivers which were considerable in the early innovation phases. While they appeared throughout innovation development, they were less numerous in the later phases. Indeed, motivation was critically important in phase one, when it was observed to kick start new projects.

The findings revealed difference with the literature regarding rewarding, as features of formal and informal rewarding (Manser et al., 2016) were not observed in this study. Formal rewarding refers to the provision of agreed incentives when objectives are met and informal rewarding could be an impromptu party or bonus (Manser et al., 2016). Motivational rewards did not come from financial payments nor, from spur of the moment celebrations. In fact, empowerment was a key factor; the personal will and desire for involvement was critical. Meaningful personal relationships were also important for motivating & rewarding; project team members sought to work with like-minded people. They were inspired by other individual actors, firms and organisations they identified with. Additionally, where firms had altruistic motivations (relevant to both innovation types) team members were passionate and exuded enthusiasm. Hence, motivations came from inter-group behaviour. This appears not to have been highlighted in this setting before; the team members identified with the short-term interorganisational innovation projects that they worked in and strove to deliver the innovations because of their commitment, passion, energy, and drive to the cause. Thus, adding insight and developing knowledge to the innovation management literature.

Links were observed between motivating & rewarding and the management activities resourcing and goal setting. Firstly, individual actor knowledge was observed as a significant resource in the findings; obtaining the perfect balance of specialists was critical in early innovation development. Thus, aligning with Aarikka-Stenroos et al., (2017) who show that motivating helps to facilitate resourcing. Secondly, the study noted that via goal assignment and providing organisational support (relevant to coordinating activities), managers can influence levels of individual motivation towards radical innovation, in accordance with the study by Pihlajamaa (2017). Therefore, in this study, links are identified between the management activities: motivating & rewarding, goal setting & refining and coordinating.

7.2.4 Resourcing

Resourcing occurred throughout the innovation process. In agreement with the literature, relevant actors were identified and encouraged to participate, in addition to providing them with the resources needed for co-innovation (Aarikka-Stenroos et al., 2017). The findings also suggest that the resources of a solitary firm are not adequate to support the commercialisation of a new product, and therefore, resource interaction with other actors is imperative to achieve successful commercialisation and dissemination (Aarikka-Stenroos et al., 2017).

Parallels also exist with the literature which emphasises that resource sharing develops from task partitioning, where firms progressively connect through the exchange of resources (Perks and Moxey, 2011). The study showed that assets, knowledge, and staff were shared and exchanged. Furthermore, in each of the short-term interorganisational innovation projects, resource interaction was necessary for the innovations to progress through the third phase, confirming Aarikka-Stenroos and Sandberg's (2012) view. Resource leveraging, as identified by Ostendorf, Mouzas and Chakrabarti, (2014) was also observed in the findings. Moreover, different types of resource leveraging: coercive means including legislation and softer means such as changing an actor's viewpoint, were noted.

Similarities were also seen with the literature that advocates that control systems are important to firms, including those working on new ventures (Davila, Foster and Gupta, 2003; Davila, 2005; Granlund and Taipaleenmäki, 2005). For example, Baraldi and Strömsten (2009) state that firms aim to identify interdependencies between resources and use control mechanisms to exploit them. Their argument focused on Merchant's (1985) control mechanisms, including: "result, action and personnel," controls to position amalgamations of both physical and organisational resources (Baraldi and Strömsten, 2009, p. 542). Results controls resonated with this study as there was evidence of goals which were results oriented (Emmanuel, Otley and Merchant, 1990). Personnel controls including self-control and social control were also in evidence (Emmanuel, Otley and Merchant, 1990). In contrast to the literature, action controls such as patents and licencing agreements, intended to safeguard the firm against undesirable actions were not in evidence (Baraldi and Strömsten, 2009). It could be that the initial network creation processes conditioned the short-term interorganisational innovation projects. Consequently, action controls were not required as, intrinsically, team members understood the required behaviours. The actors' public sector background and altruism also play into this cultural philosophy. Hence, many similarities with the literature appeared. However, an interesting point of difference is noted regarding the control of resources. Control was effective as individual actors used resources within the short-term interorganisational innovation projects efficiently without jeopardising existing firm operations. Thus, revealing difference with the literature which suggests that the utilisation of control mechanisms can help to combine resources in innovation networks in specific ways (Baraldi and Strömsten, 2009). Baraldi and Strömsten, (2009) observed that, occasionally, conflict occurs due to incompatible goals between the network actors, leading to misunderstandings. These moments of tension can drive the innovation forward (Baraldi and Strömsten, 2009). In contrast, this study revealed more cooperation and collaboration for both innovation types.

7.2.5 Goal setting & refining

Building on the discussion above, in contrast to Baraldi and Strömsten (2009) the findings showed no major disputes regarding control over resources nor drastically differing goals and opinions of the actors involved. This may be due to the altruistic and public service nature of the firms involved in this study, which revealed that the processes were more collaborative and consultative, in contrast to Baraldi and Strömsten (2009) who suggested that different goals must be kept alive, as it is not certain which will be more advantageous in the long run.

All the studied short-term interorganisational innovation projects presented goals which were relatively harmonious with the hub firm and did not incur insurmountable issues in the dissemination phase. Thus, revealing disagreement with Corsaro and Snehota (2011) who suggested that some firms which collaborate in networks are obliged to follow their company objectives and goals rather than that of the short-term interorganisational innovation project they are involved in. In our cases, they were largely in congruence; the goals were either the same or there was strong endorsement from the hub firm to support the project goals. Collaboration was, therefore, evident. This aligns with Greenwood et al., (2010) who support the view that if innovation is to be fruitful then firms' priorities must be aligned in the network.

Additionally, there is agreement with the literature which suggests that project management in practice does not necessarily align with the principles of the iron triangle (Haniff and Salama, 2016) and that it is an oversimplification of practice (Van Wyngaard, Pretorius and Pretorius, 2012). This research showed that goal setting & refining is a complex management activity and while there were factors of commonality in the studied short-term interorganisational innovation projects, there were expected differences unique to the goals of each project (Pollack, Helm and Adler, 2018).

7.2.6 Consolidating

In agreement with the literature, all the innovations featured consolidating management activities throughout innovation development (Aarikka-Stenroos et al., 2017). In addition, there are strong commonalities with the literature which emphasises that trust is an important antecedent to network processes (Rampersad, Quester and Troshani, 2010). Furthermore, Cravens, Shipp and Cravens, (1994) argued that trust is associated with network success, which was also observed in this study. In the findings, trust manifested as individual actors' kept promises. Openness was, therefore, maintained, in congruence with Rampersad, Quester and Troshani, (2010). Moreover, the literature which suggests that trust can be used as a governance tool is relevant; as networks which feature higher levels of trust are less likely to need strong coordination (Powell, 1990; Rowley, Behrens and Krackhardt, 2000; Seppänen, Blomqvist and Sundqvist, 2007). Notably, the short-term interorganisational innovation projects were all similarly conditioned from the outset, which set the scene for future behaviour and actor expectations. Finally, there is commonality with the literature which suggests that actors in a trusting network may relinquish short-sighted goals, freely share opinions and focus on delivering collective tasks (Achrol and Kotler, 1999; Powell, 1990; Seppänen, Blomqvist and Sundqvist, 2007; Uzzi, 1996).

Alignment also exists with Story, Hart and O'Malley's (2009) argument that trust results from selecting partners with similar values. When firms lack shared history, they may subsequently lack trust, resulting in fractious innovation development (Story, Hart and O'Malley, 2009). The findings revealed a distinctive characteristic whereby a minimum of two firms in each short-term interorganisational innovation project had longstanding, trusting, working relationships. Consequently, they shared history. A third (and for the ARVR-Staging innovation, additionally, a fourth) new actor firm was brought into each project. This could have resulted in challenges. However, the chosen firms had similar values and disdain for opportunism and competition, which appeared to be a contributing factor towards the production of successful innovation.

Despite the largely trusting nature of the firms involved in each short-term interorganisational innovation project, contracts were used in all six cases. The literature reveals conflicting arguments, regarding contracts and trust. The contracts were found not to have a harmful effect on partner trust, highlighting difference with the literature (Larson, 1992; Ring and Van de Ven, 1994). Contracts are commonly used in MCD&MS and therefore not thought of as unusual or suspicious. Principally the contracts were a foundation on which specific actions were facilitated and served a purpose.

7.2.7 Coordinating

There is agreement with the literature which acknowledges the importance of coordinating in networked innovation development (Mohr, Fisher and Nevin, 1996; Van de Ven, 1976). Aspects of coordination which resonate with the findings, are suggested by Perks and

Moxey (2011). They propose that task division and communication are significant features of coordination. Manser et al., (2016) developed this theme, maintaining that communication is required in coordination; a necessity in successful innovation networks. This highlights the extent to which network actors discuss, negotiate, and advise one another to progress innovation development to agreed phases and standards, and was observed in all six cases. The short-term interorganisational innovation projects revealed high quality communication between the people and strong commitment between them. They were well organised and functioned efficiently. This concurs with Cooper (2011; 2013; 2017a; 2019); Nakata and Im (2010) and Valle and Avella (2003).

Furthermore, there are connections in the findings with the literature regarding the verification of clear roles and responsibilities; in addition to information sharing and observing recognised innovation development activities (Aarikka-Stenroos et al., 2017). Story, O'Malley and Hart, (2011, p. 95) noted the importance of roles in the development of radical innovations, specifically focussing on task and network focused roles, including: "connecting, integrating and endorsing". While this study did not categorise all the specific roles in each of the cases, the findings illustrate the importance of the orchestrator role in the coordinating management activity and the abilities of the involved people in the hub firms to carry out coordinating activities. Note that roles are also identified and discussed in the controlling management activity (see 7.2.8). The people carrying out the orchestrator role, had the attributes of connecting, integrating and endorsing; directly connecting with Story, O'Malley and Hart's (2011, p. 956) network-oriented roles. The orchestrator discretely influenced other firms in the network to carry out activities (not dictating but focusing on enabling and facilitating activities) which allow for innovation development via "knowledge exchange, value creation…" (Ritala, Hurmelinna-Laukkanen and Nätti, 2012, p. 325). In this study, such factors were found to be influential in successful innovation development.

Despite executing a study focused on the management of innovation processes, Aarikka-Stenroos et al., (2017) discussed the importance of coordinating activities but did not specifically mention the fundamental importance of project management as a key coordinating mechanism to innovation development; this is in contrast to the observations made in this study. The findings from this research suggest that the lack of attention given to project management, in the context of managing in networks, is problematic. Although Dhanaraj and Parkhe (2006) and Möller and Rajala (2007) both discussed the importance of network goals which can be achieved by managing networks as a project, the mechanisms to do this have been neglected. The findings of this research identify key project management activities that need to be considered. These include motivating network members as well as ensuring that administrative systems and processes are in place (Page, 2003; Turrini et al., 2010). Regular meetings were observed in the findings. These were set with clear, shared agendas, as discussed by Turrini et al., (2010); Spieth, Clauss and Landsperger, (2011) and Heidenreich, Landsperger and Spieth, (2016).

Möller and Halinen (2017, p. 20) claimed that in the management of specific network goals, "differentiated project management" maybe required. This was in reference to developing their NetFrame theory where further empirical evidence and validation to fine tune the model was sought (Möller and Halinen, 2017). However, there is no reference in extant industrial networks literature to the newer methods of project management as an important tool to coordinate activities in short-term interorganisational innovation projects, including systems and approaches used to manage the process of NPD such as Stage-gating systems, Agile development methodologies and ideation techniques, as considered in the innovation literature.

In accordance with Cooper (2013; 2017b; 2018), the short-term interorganisational innovation projects employed an approach called Stage-gate, observed in the innovation literature to support and maintain NPD (Edgett, 2011; Griffin, 1997; Lynn, Skov and Abel, 1999; Menke, 1997). Stage-gate systems are akin to a technology roadmap, designed to successfully guide NPD from idea generation to launch. Gating systems for principal projects were observed to breakdown the innovation process into periods with integral Stage-gates (Cooper, 2013; 2017b). Each gate can be thought of as a quality control checkpoint where the project team, met to seek approval for work achieved and to secure resources for the forthcoming period. The gates are simple procedures enabling the short-term interorganisational innovation projects to progress and designate the necessary resources to the next phase of innovation development.

Use of Agile was a significant contributor to the smooth delivery of each studied innovation. The incorporation of Agile methodology into routine gating models was a vital and indispensable tool for all of the short-term interorganisational innovation projects. Adjustments were made to the innovation process when adapting it to physical B2B products; with the creation of product demonstrations, produced in line with each Stage-gate to gather feedback (Cooper and Sommer, 2016). The rewards of Agile-Stage-gate in this study included timely innovation delivery produced from factors including dedicated teams, excellent communication (due to daily meetings) and constant feedback (Sommer et al., 2015). All of these factors were observed in each short-term interorganisational innovation project, in agreement with Cooper and Sommer (2016; 2018).

Links were noted between coordinating and other management activities. The findings suggest that when focus was applied to the motivating & rewarding and consolidating management activities, in early innovation development, resourcing and coordinating were better facilitated (Aarikka-Stenroos et al., 2017). This occurred through self-organisation and orchestrator guidance, which in turn, lessened the requirement for controlling activities. Furthermore, the contention that trust influences network coordination is also relevant to this study; thus, networks with greater levels of trust require less governance costs and coordination (Powell, 1990; Rowley, Behrens and Krackhardt, 2000; Seppänen, Blomqvist and Sundqvist, 2007).

7.2.8 Controlling

The findings show that controlling was not prominent. This may be as a result of successful coordination, fewer controlling activities were necessary. Hence, there is agreement with the literature which suggests that controlling activities are required less when consolidating and motivating activities are well established, in addition to active efforts in the network to agree and implement goal setting (Aarikka-Stenroos et al., 2017).

The overriding observation in the findings was that people pushed personal interests to one side and focused on collaboration, with the intention to deliver successful innovation(s) for the greater good, highlighting difference with Manser et al.'s (2016) study. In contrast to

Manser et al., (2016) which identified three modes of network management, the findings from this study suggest that, firstly, the basically coordinated mode is too simplistic by comparison to the findings. Secondly, the control-oriented mode; demonstrates a high level of sanctioning, both formally and informally, presenting major difference with the findings where a low level of informal sanctioning was observed in the short-term interorganisational innovation projects. Additionally, control-oriented suggests that personal interests outweigh shared interests; thus, working against common, agreed, innovation goals, again in contrast with the findings. Thirdly, the reward-oriented mode has strong similarities with the findings and the activities described including “communicating for stimulation” and “encouraging a solidarity atmosphere” (Manser et al., 2016, p. 191). However, the activities related to informal and formal rewarding (see 6.2.5) did not appear in the findings, thus highlighting disparity (Manser et al., 2016).

An explanation may come from the literature that suggests that actors share similar mental models. For example, Prahalad and Bettis (1986) suggest that actors may have shared similar experiences; having worked in the same industry. Roy (2012) notes that partner selection may evolve from criteria of intent, such as intrinsic motivation. These are both valuable findings in the studied cases, as networks of like-minded actors were all created from the same industry sector. Bridoux and Stoelhorst (2014) suggest that intrinsic motivation may function as a ‘proxy’ for mutual ideas regarding how projects are governed as well as explaining why networks have similar mental models. Close links with the literature which illustrate specific kinds of controlling mechanisms, therefore provide connections with the findings in this study.

Although parallels can be drawn with the literature which asserts that the principal actor objective is to improve and grow control in the network; as actors use their knowledge, experience and understanding of the network, in addition to their connections with others, to progress their networked position (Håkansson, 1987). Yet, this study showed that the people in the short-term interorganisational innovation projects recognised the importance of the orchestrator role; in the main they supported and endorsed it.

Dhanaraj and Parkhe (2006) refer to the orchestrator as a hub firm which enjoys, prominence (Wasserman, 1994) and power (Brass and Burkhardt, 1993). In innovation development, the literature suggests that traditional forms of management are not always achievable. Orchestration can be thought of as discrete direction of the network and is based on “knowledge mobility, network stability and innovation appropriability” (Dhanaraj and Parkhe, 2006, p. 660). Specifically, the role of orchestration is directly relevant to innovation and to the findings in this study (Dhanaraj and Parkhe, 2006; Kindström, Kowalkowski and Sandberg, 2013). In addition to the orchestrator role, the findings revealed the importance of project management roles, in congruence with the literature which states that the empowerment of project managers leads to better project performance, in particular for extremely innovative projects (Larson and Gobeli, 1989; Clark and Wheelwright, 1992; Patanakul et al., 2012).

In short, there are many parallels with the literature which is focused on controlling activities. The differences noted in this research relate to the special circumstances in which the short-term interorganisational innovation projects were created, with largely successful coordinating, consolidating, motivating & rewarding and goal setting & refining activities. Strong shared values & beliefs and high instances of network stability & embeddedness combined to make controlling less of a requirement. Hence, the structure of the short-term interorganisational innovation projects and project atmosphere impacted heavily on the controlling, management activity.

7.3 RQ2: What are the drivers and barriers of management activities involved in successful innovation project delivery?

The first part of this section presents drivers and barriers (7.3.1). It includes a discussion of the analysis which suggests that in MCD&MS innovation drivers and barriers can be perceived as ‘interaction specific’. Drivers are then expounded (7.3.2). A discussion about barriers (including the lack of insurmountable barriers) follows on (7.3.3).

7.3.1 Drivers and barriers

Specific drivers and barriers were examined, firstly in the exemplar case (4.3) and secondly in the cross-case comparison chapter (6.2). This is the first time these constructs have been examined within a multi-actor context. Much of the extant innovation literature is written in the context of drivers or barriers to innovation development. Furthermore, current knowledge often takes the perspective of the focal firm, in direct contrast to this study which focuses on short-term interorganisational innovation projects. For example, Hadjimanolis (2003) categorised barriers related to multiple actors as external, asserting that they cannot be influenced by the organisation. Furthermore, Becheikh, Landry and Amara (2006) and Dziallas and Blind (2019), in their research on drivers to innovation, grouped company-specific and contextual dimensions separately. Additionally, Hartono and Kusumawardhani (2019) noted that different industry sectors may perceive innovation barriers differently. Hence, the analysis arising from this research provides additional insight and suggests that in MCD&MS innovation drivers and barriers can be perceived as 'interaction specific' as they occurred during specific episodes of interaction during innovation development.

7.3.2 Drivers

Specific driver activities were studied (see 4.3.1.1, 4.3.2.1, 4.3.3.1, 4.3.4.1, 4.3.5.1, 4.3.6.1, 4.3.7.1, 4.3.8.1, 4.3.9.1, 4.3.10.1, 6.2.1.1, 6.2.2.1, 6.2.3.1, 6.2.4.1, 6.2.5.1, 6.2.6.1, 6.2.7.1, 6.2.8.1, 6.2.9.1 and 6.2.10.1). In contrast, extant literature focuses on specific innovation drivers. Difference is, therefore, noted in the way that the drivers are presented. For example, with focus on market orientation, entrepreneurial innovativeness (Boso, Cadogan and Story, 2013; Hameed, Counsell and Swift, 2012) and organisational characteristics (Ashurst et al., 2012; Ellonen, Wikström and Jantunen, 2009; Gunday et al., 2008; Hameed, Counsell and Swift, 2012).

There are, however, parallels with the research that supports the importance of knowledge, skills, and competencies (Gratton, 2000). Additionally, there is alignment with the literature which asserts that knowledge is a key resource to facilitate innovation (Gubbins and Dooley, 2014). Agreement also exists with the research that acknowledges the power of science and technology as influential drivers (Pantano and Viassone, 2014; Parrilli and Elola, 2012).

The findings extend the work of Dziallas and Blind (2019) and Becheikh, Landry and Amara (2006) by showing that many similar factors to the features comprising the company specific and contextual dimensions also exist in the short-term interorganisational innovation projects. However, Dziallas and Blind (2019) and Becheikh, Landry and Amara's (2006) systematic literature reviews comprise studies of firm-centric research. As this research was focused on short-term interorganisational innovation projects, the major difference is that the organisational structure of the hub firm was not considered. Furthermore, this study reveals variations between the drivers found in management activities for short-term interorganisational innovation projects creating radical and incremental innovations, thus highlighting difference with the extant literature which does not widely distinguish between the innovation types (Dziallas and Blind, 2019; Becheikh, Landry and Amara, 2006).

Additionally, Cooper's (2019) study did not differentiate between incremental and radical innovation nor was emphasis given to drivers required in specific innovation phases. However, in agreement with the success drivers identified by Cooper (2019), the importance given to the ideation processes, Stage-gating systems and Agile development cannot be underestimated in this study (see 4.3.9, 4.3.10, 6.2.9 and 6.2.10).

Finally, this study reveals that during each innovation phase, varying combinations of specific management activities and atmosphere, contributed to innovation development. For example, the relatively high number of drivers to radical innovation development observed for motivating & rewarding, when compared to incremental innovation in phase 1, suggests that radical innovation requires people who are steadfastly devoted and passionate about radical innovation (as it is considered far more difficult to implement than incremental innovation). Moreover, the lack of literature which exposes indicators in the early innovation phases was highlighted (Dziallas and Blind, 2019). Hence the insights provided in this study may help practitioners reflect upon their innovation decisions, in addition to improving knowledge in the project management, innovation management and industrial networks literatures.

7.3.3 Barriers

One of the most powerful insights is that barriers did not prevent innovation development (see 4.3.4.2, 4.3.5.2, 4.3.6.2, 4.3.7.2, 4.3.8.2, 4.3.9.2, 4.3.10.2, 6.2.1.2, 6.2.2.2, 6.2.3.2, 6.2.4.2, 6.2.5.2, 6.2.6.2, 6.2.7.2, 6.2.8.2, 6.2.9.2 and 6.2.10.2). The short-term interorganisational innovation projects were challenged by a number of 'revealed barriers' during innovation development (D'Este et al., 2012). The project teams identified the barriers, ranked them and agreed how they would be tackled. Their learning, knowledge creation & transfer skills were strengthened from the direct experience realised from surmounting the barriers (see 6.2.1.2). Extant literature that backs this perspective acknowledges that firms which innovate, associate barriers with importance and so barriers are pinpointed and prioritised. Hence, there is a positive connection in the literature between the perception of innovation barriers and the desire to innovate (Baldwin and Lin, 2002; Galia and Legros, 2004; Hadjimanolis, 1999; Iammarino, Sanna-Randaccio and Savona, 2009). There is also supporting evidence from innovation survey research including the Community Innovation Survey (CIS) which suggests that firms which identify innovation barriers and agree how they should be managed, are likely to have success at overcoming them (Baldwin and Lin, 2002; Tourigny and Le, 2004).

Factors which deter firms from engaging in innovation in the first instance, known as deterring factors, were not observed in the short-term interorganisational innovation projects (D'Este et al., 2012). It therefore appears that the short-term interorganisational innovation projects were comprised of highly innovative firms, as they placed importance on overcoming innovation barriers. The findings agree with the literature which suggests that this is because innovative firms may find ingenious ways to overcome barriers (Hartono and Kusumawardhani, 2019) while firms that are less innovative may misjudge or fail to fully appreciate or understand them (Hadjimanolis, 1999). While there are common threads with extant literature, the cited studies relate to firms as opposed to short-term interorganisational innovation projects, thus illustrating difference and exposing how short-term interorganisational innovation projects work, in MCD&MS, with conviction and collaboration to overcome innovation barriers. Thus, the short-term interorganisational innovation projects in MCD&MS seek to overcome barriers, developing their learning, knowledge creation & transfer abilities and skills, which in turn, contributed to their success.

In agreement with the literature, the significance of specific barriers differ depending on the context of the innovation and the activities within it (Hadjimanolis, 2003; Sandberg and Aarikka-Stenroos, 2014). More barriers appeared in the findings for radical innovations when compared to incremental innovations in phase 2, reflecting the complexity of radical innovation development. Therefore, in parallel with the literature, the extent of novelty (radical or incremental innovation) is related to the innovation challenges (Hadjimanolis, 2003). The focus here is on the perceived extent of novelty from the involved actors (Bessant and Tidd, 2013). By phase 3 many of the barriers fell away; significantly no barriers were noted for coordinating and learning, knowledge creation & transfer. Therefore, the desire in the short-term interorganisational innovation projects to surmount innovation barriers and gain new knowledge and understanding revealed the importance placed by the project teams on innovation. The short-term interorganisational innovation projects themselves were, consequently, highly innovative. Significantly, this has not been widely studied within extant literature, adding further insight to the reflection by Hartono and Kusumawardhani (2019) that different industry sectors perceive innovation barriers differently.

Largely, innovation barriers relate to industrial affiliation and firm size (Hölzl and Janger, 2012; Mohnen and Rosa, 2002). New and small firms often face challenges related to resource shortages (D'Este et al., 2012) including: knowledge and organisational skills, lacking technology expertise (Gort and Klepper, 1982; Katila and Shane, 2005) and insufficient finance (Katila and Shane, 2005; Schoonhoven, Eisenhardt and Lyman, 1990). However, in this study, due to the successful collaborative nature of the short-term interorganisational innovation projects developing both innovation types, such challenges were not encountered. Thus, highlighting the lack of insurmountable barriers to innovation in resourcing.

7.4 RQ3: What management activities are required in radical vs. incremental short-term interorganisational innovation projects?

All seven management activities: leveraging, motivating & rewarding, resourcing, goal setting & refining, consolidating, coordinating and controlling (Aarikka-Stenroos et al., 2017) are required in varying combinations for successful development of radical and incremental innovations in short-term interorganisational innovation projects. Differences and similarities between the employment of management activities in radical and incremental innovation are discussed in turn below (see **Error! Reference source not found.**-7.4.8).

7.4.1 Learning, knowledge creation & transfer

As highlighted in section 4.3.1, learning, knowledge creation & transfer does not fit with the definition of management activities explicated by Aarikka-Stenroos et al. (2017). However, this major theme can be explained in terms of second order management activities. These activities widen, adapt or create ordinary management activities (Schilke, 2014; Winter, 2003; Zollo and Winter, 2002) and thus, provide an important foundation for management activities.

The benefits of mutual learning have been discussed in relation to radical and incremental innovation development in coopetition. It has been suggested that mutual learning is likely to benefit incremental innovation development more than radical innovations. When exchanging information, more conflict is often generated (as radical innovation development is generally considered to be more difficult than incremental) hence it is easier for firms to focus on incremental as opposed to radical innovation developments (Ritala and Hurmelinna-Laukkanen, 2013). Furthermore, radical innovations were believed to profit from the early application of knowledge and were more lucrative in comparison to incremental innovations (Ritala and Hurmelinna-Laukkanen, 2013). In contrast, the analysis of this study revealed that due to the networked setting of both innovation types, the benefits of knowledge application were shared and learning was found to be an important activity in the development of innovation for both radical and incremental short-term interorganisational innovation projects.

Specifically, radical innovation development revealed more drivers to learning, these drivers appeared chiefly in the first two phases of innovation development whereas incremental innovation development revealed more driver opportunities for knowledge creation and transfer. Additionally, as radical innovations demonstrated minimal barrier activities to learning, knowledge creation & transfer in comparison to incremental innovations, the smooth learning experience and early knowledge creation and transfer is emphasised. These insights appear not to have been discussed in extant literature. The findings and analysis of this study, therefore, begin to fill the knowledge gap.

7.4.2 Leveraging

Principally, leveraging was significant to the whole innovation process, highlighting the importance of the management activity in both types of short-term interorganisational innovation project. However, the literature notes that leveraging experienced in radical innovation development necessitated more leveraging activities in the final phase of innovation (Aarikka-Stenroos et al., 2017). This is an important point of difference with the findings of this study. Aarikka-Stenroos et al., (2017) noted this was due to the expansive change needed to facilitate the introduction of radical innovation. In this study, the difference between leveraging experienced in both innovation types was negligible for the successful innovations. This is potentially because all of the management activities were largely well planned and executed and there was willingness from the hub-firms to invest. Whereas for the radical innovations Mediaworks and Audiolizer although they were disseminated there were problematic issues to resolve throughout innovation development. Leveraging activities (6.2.4.2) were required but not necessarily more than utilised in incremental innovation development. Thus, creating the best conditions for the introduction of both incremental and radical innovations, through use of leveraging activities, was noted to be important to innovation success.

7.4.3 Motivating & rewarding

Both differences and parallels were identified with the literature focused on motivating & rewarding. There are similarities with the studies by Manser et al., (2016) and Aarikka-

Stenroos et al., (2017) which both highlighted intrinsic motivation for radical innovations. Indeed, in this research, the motivational drivers, goals, and aspirations for successful radical innovation(s) functioned as a source of intrinsic motivation, whereas the expected benefits for incremental innovations can often be predicted, hence, motivational drivers were less dominant.

Differences with the motivating & rewarding literature included the observation that all three radical innovations sustained employee motivation despite the short-term interorganisational innovation projects involving the UK's largest broadcaster. This contrasts with the literature which notes that it is challenging to maintain employee motivation towards radical innovation in large established firms (Kelley et al., 2011; McDermott and O'Connor, 2002; Stringer, 2000). In the setting of this study, employee motivation was sustained by creating short-term interorganisational innovation projects and active encouragement of interactions with others. Furthermore, in radical innovation, extant research suggests that process management methods are not useful (Benner and Tushman, 2003; O'Connor, 2008); hence personnel should be given opportunities to experiment without restrictions. This again differs from the findings as the studied projects produced successful radical innovations via firm engagement processes. The Red-Innovation-Hub (employed in Audiolizer and Metbot) used processes which, additionally, motivated employees, contrasting with the assertion by Poskela and Martinsuo (2009) that employee motivation is readily accepted by firms and little is understood about how managers might influence them. The firm engagement processes (see 6.2.5.1) both supported and motivated personnel. The ability for people to interact in the project teams was therefore crucial.

In summary, the most striking differences are that extant literature does not validate the maintenance of employee motivation in large established firms for radical innovation via appropriate innovation management processes. Whereas in this study, the Red-Innovation-Hub and the other firm engagement processes positively influenced actors to innovate.

7.4.4 Resourcing

This study illustrates that management activities were combined to achieve specific goals. For example, resource leveraging shows how, throughout the innovation process, actors contributed their knowledge and expertise to develop the innovations from the outset, bringing additional networks and insight with them throughout the dissemination phase. This was achieved for both incremental and radical innovations via softer means, highlighting the difference with the Aarikka-Stenroos et al., (2017) study which suggested coercive methods were related to incremental innovations and softer approaches connected with radical innovation.

In this study, all the cases showed that orchestrator firms (in both radical and incremental innovations) participated actively (in early innovation phase) in an engagement process. This is in contrast to Aarikka-Stenroos et al.'s (2017) research which noted that this occurred for radical innovations only. Furthermore, the literature suggests that resourcing requirements were, better known for radical innovations than incremental innovations (Aarikka-Stenroos et al., 2017), revealing another point of difference with the findings. In this study, although the hub firms creating radical innovations were aware that relevant resources needed to be in place to achieve successful outcomes, and the initial actors were all in place in phase one, it was not always easy to identify the required resources from the outset. Acknowledging this challenge, project management tools were implemented in all cases. Notably project team members in each short-term interorganisational innovation project had been trained to use these tools. They shared a common language, similar ways of thinking and conviction to use the project management tools. While the benefits of the Agile and Stage-gate approaches to project management have been discussed in the innovation literature by Cooper (2016; 2017a); it appears not to have been considered in the IMP and network management literature. The most significant differences (regarding both radical and incremental innovation) include:

- using soft means for resource leveraging;
- hub firms actively encouraging firm participation in the early innovation phases;
- using project management tools to facilitate innovation development; and
- action controls were not observed.

The findings suggest that the culture, including the firms' public sector backgrounds combined with altruistic mindsets, encouraged network collaboration and effective resource allocation and coordination.

7.4.5 Goal setting & refining

Shared goals were observed to be an important driver for cooperation in the innovation process, thus supporting Aarikka-Stenroos and Sandberg's (2012) study. Similarities also exist with the literature that suggests that the third phase of innovation can develop major challenges; if innovation goals differ, the innovation may collapse (Heikkinen et al., 2007). Thus, illustrating the importance of shared goals to the innovation process. Regarding Mediaworks, while the radical innovation was completed, disseminated, and won a leading industry award, it did not attain the ambitious sales goals set by the hub firm. Additionally, incremental innovation, Demonland, suffered issues related to rationalising in-house and external goals resulting in the delayed innovation process. Thus, while the innovations did not collapse, they support Masulis and Nahata's (2011) findings that, variation in goals can result in poor innovation outcomes.

Similarities with the literature were also observed regarding goals which were well defined and understood by the actors in the incremental short-term interorganisational innovation projects (Aarikka-Stenroos et al., 2017). Such goals facilitated successful innovations. Another parallel with Aarikka-Stenroos et al.'s, (2017) study highlighted that goals for incremental innovations were generally more precise than radical innovations. However, a point of difference with the literature revealed that in both radical and incremental innovation development, the hub firms were able to steer the complete innovation process, via an orchestrator. In contrast, Baraldi and Strömsten (2009) noted that no single actor unilaterally controlled the innovation process. Furthermore, in contrast with the findings of this study, the literature acknowledges that a new network structure is required in radical innovation development (Aarikka-Stenroos et al., 2017). Indeed, in this study, an orchestrator, collaboration, and querying goals and resources were found to be necessary for development of both types of innovation. Thus, knowledge about managing the different types of innovation is developed, in the context of this study.

Goal refining activities were observed to be essential, as unforeseen challenges arose along the development path; in agreement with Aarikka-Stenroos et al., (2017). Further supporting the literature, goal refinements for radical innovation were more far-reaching than incremental innovations (Aarikka-Stenroos et al., 2017). However, connections were not made with the management of this uncertainty via project management tools, such as Agile in the Aarikka-Stenroos et al., 2017 study. The Agile approach highlights that goals must be: specific, measurable, attainable, realistic and timely. The intention is to galvanise people in the short-term interorganisational innovation projects into action via the employment of Stage-gate and Agile methodologies rather than dictating (see 6.2.7.1). When small sections of activity are completed, time is allocated to reflect on achievements before the next iteration. Thus, improving efficiency and highlighting the importance of goal setting & refining to the process of innovation development. Differences with the Aarikka-Stenroos et al., (2017) study were noted in this research. Firstly, an orchestrator was observed to drive innovation forward for both incremental and radical innovations; utilising goal setting, in addition to task partitioning via coordinating (see 6.2.9.1) and controlling (6.2.10.1) management activities. Secondly, that the Aarikka-Stenroos et al., (2017) study does not include a discussion about how the use of Agile methodologies results in goal setting refinements during innovation development.

7.4.6 Consolidating

While all the short-term interorganisational innovation projects, in the findings, featured consolidating management activities throughout innovation development, in common with Aarikka-Stenroos et al.'s (2017) research, difference was noted regarding how the consolidating management activities impacted the innovation process. The findings revealed that mutual agreements were evident in both incremental and radical innovation development, whereas Aarikka-Stenroos et al.'s (2017) study exposed that laws and sanctions were implemented as a controlling mechanism for incremental innovation. This was thought to contribute to misgivings and lack of responsibility amongst the actors (Aarikka-Stenroos et al., 2017, p. 101). In contrast, the findings showed a sense of belonging and mutual trust which appeared in the early phases of both innovation types.

This research also supports the argument that if precursors to trust are established between team members, access to resources will be easier (Aarikka-Stenroos et al., 2017). The findings of this research show that previous dyadic interactions such as R&D relationships and associations arising from reputational knowledge were precursors of trust, highlighting strong alignment with the extant literature (Jarillo, 1988; Larson, 1992; Partanen et al., 2008). Additionally, Aarikka-Stenroos et al., (2017) suggest that it is important to recognise the importance of the features of the consolidating management activity when the goal of mutual activities is hazy, as it often is in radical innovation and observed in this study (Möller, Rajala and Svahn, 2005).

There is also accord with the literature which proposes that networks that give focus to motivating and consolidating management activities may decrease requirements for controlling (Aarikka-Stenroos et al., 2017). This was true for four of the cases. However, for two of the radical innovations (Mediaworks and Audiolizer) the orchestrator used institutional power over the other actors, suggesting that consolidating and motivating were not as well embedded in the short-term interorganisational innovation projects in comparison to the other cases. The goals were observed to be achievable as both innovations progressed to the dissemination phase. However, for both projects, actor motivation was lacking which slowed innovation development. This shows difference with the literature as a similar experience was noted for incremental innovation in the Aarikka-Stenroos et al., (2017) study.

Another difference, which appears not to have been discussed in the literature for both innovation types, was the importance of the early innovation firm engagement processes; these processes are found to be an important consolidating management activity and a forerunner to innovation success in this research. The engagement processes facilitated openings between the different actor groupings; establishing relationships for those people that had not met before and further cementing relationships for those that knew each other well.

In summary, the findings relating to consolidating are consistent with much of the extant literature. However, the most notable differences are the numerous instances of consolidating activities, especially the early firm engagement processes, which set the scene for future behaviours. When, for example, challenges were encountered for the two radical innovations; Mediaworks and Audiolizer (although actor motivation perhaps contributed to a slower pace of innovation development) the effects of consolidating in the early phases guided the future direction of the innovations, resulting in, overall, successful outcomes.

7.4.7 Coordinating

Resonance exists with Aarikka-Stenroos et al.'s study, (2017, p. 100) with the notion that in radical innovation, "the dynamics of goals and tasks" are far more extensive (as they often change and evolve in the early innovation phases) in comparison to incremental innovation, which makes coordinating activities more demanding. However, there is divergence with the literature regarding how innovation goals impact on coordinating activities. For example, in incremental innovation, in addition to task partitioning and coordinating, an influential actor may endeavour to orchestrate the other actors involved, by instigating goal setting & refining activities (Aarikka-Stenroos et al., 2017). Evidently, it is more likely to occur in incremental innovation where innovation goals are often well defined, contrasting with radical innovation; where the path to innovation is ambiguous requiring collective action (Aarikka-Stenroos et al., 2017). Opposing this observation, an orchestrator role, as put forward by Dhanaraj and Parkhe (2006) was noted in the findings for both incremental and radical short-term interorganisational innovation projects. To assuage concerns regarding the difficulties of managing both incremental and the more challenging radical innovations, an Agile and Stage-gate project management process was implemented and embraced by all the actors in each short-term interorganisational innovation project. This enabled the actors to directly acknowledge that the process of innovation is demanding. Thus, relevant processes were implemented to engage and progress innovation development flexibly. This reveals disparity with Aarikka-Stenroos et al.'s study, (2017) which highlighted that in radical innovation development, coordinating efforts were passed to different actors depending upon how the goals evolved. It is suggested that the extensive experience, knowledge, and expertise of the people involved in the short-term interorganisational innovation projects, wholly, supported the process.

In summary, in this research, there is commonality with much of the extant knowledge about coordinating. The significant areas of difference feature the relevance in this study of the Agile and Stage-gate project management process to coordination. These processes acknowledge the challenges presented in innovation development, helping to facilitate progress. These processes were combined with the specialist, award winning experience and knowledge of the talented people involved in the short-term interorganisational innovation projects, who were instrumental to innovation development. The processes were also supported and instigated in each project by the orchestrator, a role which was observed to be fundamental, in all six cases, to the development of both radical and incremental innovation.

7.4.8 Controlling

In this research, the orchestrator firms maintained their hub firm positions and were able to influence others towards the desired outcomes. This is in contrast to Aarikka-Stenroos et al., (2017) who note that during the full innovation process there are episodes where it is possible for one actor to influence others to achieve the innovation goal and other occasions where it is not achievable.

The findings from this research contrast with the literature which argues that controlling is easier in incremental than radical innovation because, in radical innovation the resources and tasks involved are often unclear (Aarikka-Stenroos et al., 2017). However, in the findings Agile project management processes were instigated and embraced by the team members, in both radical and incremental short-term interorganisational innovation projects, thereby facilitating the development of innovation. Additionally, the early innovation firm engagement processes facilitated openings between the different actor groupings and helped to set the expectations for the future working behaviour, resulting in social controls (Manser et al., 2016). Appropriate structures and processes were implemented prior to innovation development supporting the emergence of both innovation types; highlighting difference with the literature.

7.5 Other important factors in short-term interorganisational innovation project delivery

Other factors appeared in the data and were important for successful short-term interorganisational innovation projects. Timely completion and atmosphere were both noteworthy and are described in this section. Indeed, the key factor that influenced project management in short-term interorganisational innovation projects included the timely completion of the various innovation phases (through effective implementation of the management activities) impacted on the speed of innovation development and consequently faster market entry (potentially resulting in improved returns). This is discussed in the first part of this section 7.5.1 and developed from the findings (4.4.1 and 6.3.1).

This research highlights how atmosphere conditions the short-term interorganisational innovation projects, as discussed in the second part of this section (7.5.2). The fifth contribution is the developed research framework, as presented in section 6.4, Figure 20 and discussed in section 7.5.2.3. Other important factors relevant to the development of short-term interorganisational innovation projects are included in 7.5.3 and comprise: the importance of individual actors (people) (7.5.3.1), how cognitive abrasion, tacit and explicit knowledge contributes to learning, knowledge creation & transfer (7.5.3.2) and the importance of strong and weak ties (7.5.3.3).

7.5.1 Successful delivery of the management activities contributing to an efficient work pace and innovation speed

The development of the innovations was swift for all the short-term interorganisational innovation projects. Thus, the processes and links between the management activities, that enabled timely and efficient innovation development were valuable to the short-term interorganisational innovation projects (see 6.2.1-6.2.10). The pace of innovation is the speed at which technological innovation takes place. Innovation speed can be conceptualised from three different perspectives, including: initial release, schedule tracking, and upgrading (Dong, Wu and Zhang, 2018).

The initial release perspective considers variations of the total project time from idea generation to market launch (Ali, Krapfel Jr and LaBahn, 1995; Clark, Fujimoto and Cook, 1991; Mansfield, 1988). The schedule tracking perspective highlights the extent to which a project met an agreed schedule (Keller, 1994; McDonough, 1993). The upgrading perspective (Tambe, Hitt and Brynjolfsson, 2012) refers to the degree to which marginal products are regularly weeded out and lastly, innovation speed can be hypothesised as time taken for new (upgraded) software releases (Padmanabhan, Rajiv and Srinivasan, 1997). The viewpoints which focused on upgrading are not applicable to this study as they focus specifically on software developments following an initial innovation launch. Initial release and schedule tracking are pertinent as they both refer to innovation schedules and timings which were set out and agreed in the short-term interorganisational innovation projects. While each short-term interorganisational innovation project suffered challenges and episodes of rescheduling, timely innovation dissemination was achieved.

Speed proffers the significant competitive advantage of being first to market. Fast market introduction has the upshot of rapid profit attainment and the introduction of innovation when the market is likely to be receptive (if it was well prepared with planned leveraging activities executed). Examples are provided in this research, see 4.3.4 and 0. However, significantly, factors which could be perceived to drive fast innovation development were not implemented (taking short-cuts or compromising on quality, see 4.4.1.1 and Table 31) often to the detriment of excellent innovation execution (Cooper, 2019). Moreover, as seen in the goal setting & refining management activity discussion (see 4.3.7 and 6.2.7) none of the short-term interorganisational innovation projects had an overriding goal to reduce the innovation development cycle time.

While speed can be thought of as an interim objective, the fundamental goal for commercially driven firms would be to achieve profitability. Speed and profitability are connected; however, the relationship is not linear (Griffin, 2002). Furthermore, the dark side to focusing on speed has been exposed (Crawford, 1992). Frequently, approaches implemented to shorten development time can be expensive and paradoxically can have the reverse effect. In agreement with Cooper (2019), the overriding objective for each short-term interorganisational innovation project was to achieve successful innovation rather than innovation failure(s). The literature suggests that speed directs some firms to routes which belittle NPD; while revisions to existing products and line extensions can be achieved quickly, true innovation is absent (Cooper, 2003). Cooper (2014) noted the following points which resonate with this study. These factors are noteworthy as it is likely that the innovation will arrive in the marketplace ahead of the competition when these six factors are achieved, resulting in competitive advantage gains of profitability. These factors appear not to have been the subject of discussion in the industrial networks literature to date:

- Develop timely innovation which is based on true need, experience, and fact.
- Integrate quality at every phase; thereby saving time in the long run as there is no need to revert.
- Engage, efficient, cross-functional teams, as highlighted by Peters (1988).
- Focus on a few projects with high value, to ensure that resources are focused.
- Operate Agile methodologies (Cooper and Sommer, 2016).
- Implement:
    - 'parallel processing' (commencing tasks simultaneously), overlapping and progressing phases with incomplete information.
    - Spiral or iterative development methodologies which help to achieve NPD earlier, prior to product testing.

Moderately fast initial releases or software updates indicate robust developer capability and high-quality software to the market (Dong, Wu and Zhang, 2018). This can, in turn, foster high user downloads. Conversely, a very high speed to market may provoke user concerns regarding the quality of the code, reducing its attractiveness. This insight suggests that users seeking a high-quality product are happy to wait for successful innovation, thus concurring both with the findings and Cooper (2019). The observation of Cooper's (2019) six factors in the findings (in relation to achieving innovation speed, see 4.4.1.1 and Table 31) fills the gap proposed by Waluszewski, Snehota and La Rocca, (2019) where knowledge of nuanced innovation characteristics, in the world of business, was sought.

7.5.2 Atmosphere in the short-term interorganisational innovation projects

This research shows that atmosphere conditions the management activities. It was a central factor when developing relationships between firms; shaping the relationship characteristics over time. The behavioural constructs described in the atmosphere of the Interaction model (Eggert and Helm, 2003; Ford et al., 1998; Håkansson, 1982; Sutton-Brady, 2000), are significant to understanding the complexity of how innovation evolves over time, in the short-term interorganisational innovation projects, in MCD&MS, thus developing the atmosphere feature of the Interaction model. This study showed that the dyadic context of atmosphere expressed in extant literature (Eggert and Helm, 2003; Ford et al., 1998; Håkansson, 1982; Sutton-Brady, 2000), needs to be expanded to the context of short-term interorganisational innovation projects.

The resulting project atmosphere shown in this study is therefore, greater than might be expected from the dyadic context employed in the atmosphere of the Interaction model (Eggert and Helm, 2003; Ford et al., 1998; Håkansson, 1982; Sutton-Brady, 2000) (see 6.3.6). Due to the way in which the way the short-term interorganisational innovation projects combine; atmosphere is developed. Indeed, the project atmosphere is more than the sum of the individual atmospheres developed from separate dyadic relationships between each of the involved organisations in the short-term interorganisational innovation project(s). Due to the shared values & beliefs exhibited, relationships were primarily cooperative and close. The short-term interorganisational innovation projects had overarching mutual expectations to produce successful innovations. Trust, in the main, was strong. The balance of power and dependence was heavily influenced by the network stability & embeddedness provided by the hub firm(s).

However, relationships comprise interdependencies and if expectations from the reciprocal interactions are not met, the relationship atmosphere will be negatively impacted (Håkansson, 1982; Hallén and Sandström, 1991). Interdependencies are, therefore, significant to the development of firm innovation, due to, “collaborative technological development,” (Freytag, Gadde and Harrison, 2017, p. 248). Concern is also expressed about the Janus nature of interdependencies, as both collaboration and tensions may arise

(Freytag, Gadde and Harrison, 2017). Therefore, although interdependencies are inescapable, the study showed that there was an overriding desire to collaborate in the short-term interorganisational innovation projects under study (for the most relevant evidence see 6.2.3.1, and also 6.2.5.1, 6.2.6.1, 6.2.8.1). This collaborative nature led to successful innovation development.

As short-term interorganisational innovation projects are temporary, the project atmosphere was transient (in use for a relatively short time). This resulted in the involved actors acknowledging the processes of innovation development as a means to an end. The project team members recognised that conflict can be a source of innovation (see 6.3.3). Therefore, while conflict was not permitted to accelerate and become dysfunctional (as the project team members were appropriately open-minded) it was possible to use conflict as an innovation source. This is discussed further in section 7.5.3.2.

7.5.2.1 *Shared values & beliefs*

The importance of integrating a culture of innovation in the hub firm's culture and consequently embedding it into the short-term interorganisational innovation projects cannot be underestimated. The significance of an innovation culture, to realise success, was noted in this study, in alignment with Bullinger, Bannert and Brunswicker, (2007). This includes aspects such as leadership, communication, motivational and cooperation behaviours (Sourisseaux, 1994).

The findings revealed that a positive culture of innovation was a significant factor of the whole innovation process for the short-term interorganisational innovation projects. A culture of innovation includes the, "values, norms, assumptions, beliefs and ways of living built up by a group of people and transmitted from one generation to another," (Bullinger, Bannert and Brunswicker, 2007, p. 21). Characteristics of the innovation culture are embodied, for example, in the way people in the short-term interorganisational innovation projects managed failure or resolved complex challenges, in addition to the desire to exchange and transfer knowledge. In all the short-term interorganisational innovation projects the people were tenacious, persevering and intrinsically motivated in their approach to innovation.

Company beliefs and values had a meaningful impact on actor behaviour towards innovation activities, acceptance of risk, personal development, and their aptitude and desire to execute novel ideas (Menzel, Aaltio and Ulijn, 2007). The strong culture of innovation observed aligned well with the literature analysis of innovation indicators put forward by Dziallas and Blind (2019), where an innovation culture was highly cited. This comprised 20% of the twelve categorised (driver) indicators, representing a major characteristic of successful innovation (Dziallas and Blind, 2019).

Despite the literature highlighting the importance of a culture of innovation to innovation success (Dziallas and Blind, 2019), recent studies have remarked on the lack of empirical research clarifying what types of culture enhance or inhibit innovation (Naranjo-Valencia, Jiménez-Jiménez and Sanz-Valle, 2016). The findings revealed that an adhocratic culture was a strong indicator of innovation and performance which agrees with the research conducted by Naranjo-Valencia, Jiménez-Jiménez and Sanz-Valle, (2016) and their study of 1600 Spanish firms. However, the Naranjo-Valencia, Jiménez-Jiménez and Sanz-Valle, (2016) research was not focused on short-term interorganisational innovation projects, but individual firms. Consequently, the setting is not directly comparable. This study provides additional clarity both from a different industry setting and from the perspective of short-term interorganisational innovation projects, thus developing knowledge.

An implicit culture of innovation was observed in the short-term interorganisational innovation projects; there were standards and guidelines set for people to follow and the organisational settings were such that innovation was supported by giving people opportunities to discuss new ideas and share information as well as coordinating work across work divisions. These discoveries reveal close alignment with Hogan and Coote (2014, p. 1611) in their assessment of value dimensions of organisational culture known to support innovation including, valuing: "success, openness and flexibility, internal communication, competence and professionalism, inter-functional cooperation, responsibility…, appreciation…, and risk taking." They remarked on the significance of underlying organisational values that nurture, inspire, and motivate innovative behaviours amongst employees in addition to implanting values and norms into organisational artefacts (Schein, 1992). In line with the findings, Hogan and Coote (2014) suggested these factors could potentially increase levels of innovation. However, the results are for one study, conducted in a legal environment: disparate from the setting of this study. Moreover, Hogan and Coote (2014) studied individual firms and their supporting suppliers. Therefore, as with Naranjo-Valencia, Jiménez-Jiménez and Sanz-Valle's (2016) study, the importance of the organisational culture was not placed on the shared values and beliefs between the different actors in a networked setting, as observed in this research.

Naranjo-Valencia, Jiménez-Jiménez and Sanz-Valle's, (2016) research noted the importance of an adhocratic culture to strong innovation and performance. Adhocracies (observed for Audiolizer, Metbot and CodingGame) were typified by flexibility, a capacity to adapt speedily to changing conditions, employee empowerment and prominence to individual initiatives. For three of the innovations, the hub firm was Red. At first impression, a hierarchical orientation (structured and controlled with a focus on efficiency, stability and 'doing things right') or market structure (results-oriented with a focus on competition and achievement) may appear to have more relevance (Cameron and Quinn, 2011).

Important advantages of the adhocratic culture (6.2.2.1) included: optimal use of the total knowledge available; a prevalent mindset of co-responsibility, mutual understanding, and respect and the promotion of creativity, open mindedness, and mutual learning (Cameron and Quinn, 2011). Thus, linking with the management activity, learning, knowledge creation & transfer (6.2.1). While an obvious disadvantage to this orientation might be lack of focus and difficulty to plan when resource allocating; the culture existed in the short-term interorganisational innovation projects alone. Stability prevailed in the overarching culture of the hub firms, which had the effect of making the people involved in the networks feel secure, linking directly with network stability & embeddedness. Additionally, the short-term interorganisational innovation projects were well orchestrated and overall responsibilities were expertly carried out, understood, and completed.

One final aspect, that appears not to have been discussed in extant literature, is the impact of altruism exhibited in short-term interorganisational innovation projects. This was a significant finding as the people involved in innovation development were intrinsically motivated by altruism and the associated, embedded, shared values & beliefs were rooted in the short-term interorganisational innovation projects.

In summary, the shared values & beliefs held by the people in the short-term interorganisational innovation projects shaped the innovation process and the resulting innovations strongly contributed to atmosphere. There are many connections with the broad, extant literature focused on organisational culture; including connections with the Naranjo-Valencia, Jiménez-Jiménez and Sanz-Valle, (2016) study which recognised that an adhocratic culture gives a strong indication of innovation and performance. However, there is a lack of extant literature highlighting specific aspects of organisational culture and innovation performance in relation to short-term interorganisational innovation projects. Additionally, there is an absence of literature illustrating atmosphere and how it impacts on short-term interorganisational innovation projects. Hence, this study provides insight, linking a strong, shared set of values & beliefs in a networked setting with successful innovation, in addition to the positive impact of altruism (see 6.2.2.1) on successful innovation processes and outcomes.

7.5.2.2 *Network stability & embeddedness*

In the findings, network stability was found to be an important factor for the creation of successful innovations; in common with the literature which notes that a loose network provides little value creation or extraction, plus a lack of unity can create challenges (Dhanaraj and Parkhe, 2006; Håkansson and Johanson, 1992; Van der Valk, Chappin and Gijsbers, 2011). Other findings including long-term relationships and related bonds observed between network actors were important aspects of network stability (Nätti, Hurmelinna-Laukkanen and Johnston, 2014). The bonds were established at different levels within the short-term interorganisational innovation projects, which helped to create robust connections. The project team members had intent to collaborate, with strong ambitions to see the innovations develop and succeed. The orchestrators built upon the individual actor aspirations and facilitated the innovation process by encouraging and supporting collaboration. Diverging from Davis and Eisenhardt (2007) the orchestrator was not observed to step aside, allowing other actors to orchestrate. Furthermore, the orchestrator preserved an appropriate level of diversity in the pool of knowledge, required to facilitate creativity (Nätti, Hurmelinna-Laukkanen and Johnston, 2014).

Network stability was also strengthened during the innovation journey with the sound shared identity observed in the short-term interorganisational innovation projects (Dyer and Nobeoka, 2000). Furthermore, the people working in the short-term interorganisational innovation projects identified themselves as team members, this led to the strengthening of bonds. An additional noteworthy factor was the altruism and volunteer-led nature of the projects (see 6.2.2.1). This connects well with the literature which suggests that a strong, common identity was important to innovation communities which were based on volunteers. The importance of trust, reciprocity, reputation and mutual interdependence are noted to be especially important to these groups (Larson, 1992; Turnbull, Ford and Cunningham, 1996).

When network stability was achieved within the short-term interorganisational innovation projects, the findings suggest that both innovation appropriability and absorptive capacity were improved (Hurmelinna-Laukkanen et al., 2012). Additionally, familiarity with people in the short-term interorganisational innovation projects was noted to increase the transfer of knowledge in addition to supporting equality and overall innovation success (Dhanaraj and Parkhe, 2006). Network stability was not noted to evolve into inactivity and stagnation; perhaps due to the introduction of the third (fourth and additional individual actors in each short-term interorganisational innovation project); which introduced energy, drive and enthusiasm and helped to maintain variety in the pool of knowledge. This, in turn, supported innovation development (Nätti, Hurmelinna-Laukkanen and Johnston, 2014).

Overall, there are many commonalities with extant research. However, possibly because both network embeddedness and network stability are recognised as being implicit in network research, there is little up-to-date literature which discusses the relevance of network embeddedness and its relationship with innovation development. The short-term interorganisational innovation projects were unique and distinctive. While they were all temporary, they benefited hugely from the intrinsically altruistic and motivationally driven people. Robust network identities were created which contributed to the unique project atmosphere(s) of each short-term interorganisational innovation project. These were significant contributors to the overarching network stability & embeddedness observed in the short-term interorganisational innovation projects, in addition to that created and facilitated by the hub firms. In line with shared values & beliefs, these particular characteristics appear not to have been written about before; thus, providing unique insight into the successful dynamics that are afforded to both radical and incremental innovations in this setting. Network embeddedness is now discussed in greater depth.

The findings highlight the importance of network embeddedness to both radical and incremental innovation, broadly connecting with the proposition by Granovetter (1985) that most company (commercial and economic) engagements are facilitated or restrained by an actor's social surroundings, which is characterised by a nexus of connections in many different settings and contexts. There are also links with the literature which highlights the importance of the extent to which a firm is connected to other firms (Echols and Tsai, 2005).

The consensus in the literature, also corroborates with the findings, that the embeddedness of a firm is of significance to both its economic and innovative performance (Ahuja, 2000a; Hagedoorn, 1993; Nooteboom, 1992; Owen-Smith and Powell, 2004; Powell, Koput and Smith-Doerr, 1996; Rowley, Behrens and Krackhardt, 2000). The importance of the relationship between network embeddedness and innovation is critical to this study. However, MCD&MS appears not to have been reviewed in extant literature. Network embeddedness has been discussed in the following settings: chemicals (Ahuja, 2000a), biotechnology (Baum, Calabrese and Silverman, 2000; Powell, Koput and Smith-Doerr, 1996), semiconductors (Stuart, 1998), textiles (Uzzi, 1997), personal computers (Hagedoorn and Duysters, 2002) and banking (Zaheer and Bell, 2005).

This study showed that strong ties (see 6.2.3.1) were important to both incremental and radical innovation, diverging from the literature which states that dense and strong ties do not provide the diversity required for learning and (especially radical) innovation; they also suggested that redundancy occurs with more ties available than are perhaps required for access to resources (Burt, 1992; Granovetter, 1973). For all the innovations, diversity was provided by a third (or fourth) new actor firm which was endorsed by the hub firm and provided access to new knowledge. There were, therefore, weaker ties between the third actor and the original dyad, however the trust exhibited from the hub firm to the project team members provided essential, underlying backing; giving the short-term interorganisational innovation projects strength. The content of the ties was shown to be especially important in the study, concurring with extant literature which gives the counter argument (Hansen, 1999; Uzzi, 1997). Both Hansen (1999) and Uzzi (1997) offered empirical confirmation, presenting the findings that strong ties endorse the transfer of *complex knowledge* and weak ties support the transfer of *simple knowledge*. Gilsing and Nooteboom (2005) proposed modifications to the 'strength of weak ties' arguing in support of ties in exploration (radical innovation) which are 'dense and strong' providing further support to the findings.

Important factors for radical and incremental innovation development included relational embeddedness (RE) and structural embeddedness (SE), which were both found to link with the strength of ties (Gilsing and Nooteboom, 2005). In line with extant literature RE refers to the interpersonal connections that the people involved in the network have mutually developed with each other (Nahapiet and Ghoshal, 1998; Yan, Zhang and Guan, 2019). SE is characterised by the structure of relationships including the pattern, formation of links and their density between the people in the network (Gilsing and Nooteboom, 2005; Granovetter, 1992; Gulati and Gargiulo, 1999; Tang, Rai and Wareham, 2011; Yan, Zhang and Guan, 2019). There are links with the findings and Yan, Zhang and Guan's (2019) study which highlights a positive connection between RE and SE and exploitative (incremental) innovation. However, Yan, Zhang and Guan's, (2019) research demonstrated an inverted U-shaped relationship for RE and SE with exploratory (radical) innovation. Therefore, high levels of SE and RE do not correlate well with radical innovation. Although, Yan, Zhang and Guan's (2019) study was quantitative and based on one energy firm in the U.S. Hence, perhaps it is unsurprising that there are anomalies with the findings of this study.

7.5.2.3 *The empirical research framework*

The empirical research framework (Figure 20) illustrates the culmination of the different attributes of this study, bringing together the new management activity, learning, knowledge creation & transfer (7.2.1), in addition to project atmosphere (6.4, 7.5.2), including shared values & beliefs (7.5.2.1) and network stability & embeddedness which conditioned atmosphere (7.5.2.2). It shows how the project team employed the management activities, during the three phases, to create and disseminate innovation(s) in short-term interorganisational innovation projects.

7.5.3 Other important factors important in short-term interorganisational innovation project delivery, including: (1) The importance of individual actors (7.5.3.1), (2) Cognitive abrasion, tacit and explicit knowledge (7.5.3.2) and (3) The importance of strong and weak ties (7.5.3.3)

7.5.3.1 *The importance of individual actors (people), their micro-level interactions and dense social networks (contributing to consolidating)*

The influence of individual actors in the interaction process was considerable. The interactions between project team members and individual actors in the wider networks were important to the growth and development of the short-term interorganisational innovation projects into thriving and successful functions which created successful innovation(s). The interaction between two firms can be investigated by exploring the interactions between two firms (as actors) or by analysing how particular resources, activities or individual actors interact (Håkansson et al., 2009). The industrial networks literature, however, rarely considers individual actors. Gonçalves, da Silva and Teixeira, (2019); Guercini et al., (2014) and La Rocca, Hoholm and Mørk, (2017) have all commented on the distinct lack of discussion regarding the impact of individual actors in the interaction process and focused their research on building this knowledge. La Rocca (2013) suggested that the lack of research into individual behaviours is perhaps due to the difficulty of observing and studying them empirically, thus highlighting the importance of the findings.

The dense social networks of individuals which led to reciprocal collaboration were noteworthy in the findings, in line with the study by Gonçalves, da Silva and Teixeira, (2019) which illustrates, with an empirical model, how individuals representing firms make sense of institutional logics of the network in supplier interactions. They suggest that business interactions are influenced via individual behaviour.

As discussed in the section on network stability & embeddedness, social network researchers have explored the role of weak versus strong ties (see 7.5.2.2 and 6.2.3) in an actor's pursuit of novel information, pertinent in innovation networks. This is crucial as the importance of strong ties is significant when transferring complex knowledge (Hansen, 1999). In line with Burt (2001), the knowledge and information gained from people in the short-term interorganisational innovation projects was largely confirmed and endorsed within it, which, in turn, induced a stronger sense of trust.

7.5.3.2 *Cognitive abrasion, tacit and explicit knowledge (contributing to learning, knowledge creation & transfer)*

Cognitive abrasion comprises: idea generation, disclosure/advocacy and convergence activities (Skilton and Dooley, 2010). Teams must produce a variety of concepts in the ideation phase of innovation in order to resolve the problem(s) that they face (idea generation). In the second phase, disclosure and advocacy, teams must be clear about their ideas and build transparent cases for them, being aware that divergent ideas must be resolved and jointly negotiated to allow the team to move onto the execution or convergence stage. The findings show that cognitive abrasion was noteworthy. The people in the short-term interorganisational innovation projects shared their ideas (idea generation); provided justifications for their opinions (disclosure and advocacy) and collaborated on feedback activities to reach agreement (convergence).

Creative abrasion is noted for its importance to team creativity. The promotion or hampering of cognitive abrasion is a major factor in innovation development (Leonard and Straus, 1997). Cognitive abrasion is an efficient way of guiding employee cognitive diversity for valuable knowledge creation in firms (Moreno-Luzón and Begoña Lloria, 2008). Indeed, cognitive abrasion facilitated the combination of knowledge, resolution of knotty problems and realisation of creative solutions throughout the difficult process of innovation. This finding contributes to a gap in the literature highlighted by Håkansson and Waluszewski (2013) where they encouraged researchers to more accurately illustrate, represent and characterise interactions between individual actors and their specific consequences for firms.

The findings revealed that cognitive abrasion allowed the people interacting in the short-term interorganisational innovation projects to communicate tacit knowledge by accessing unspoken knowledge including: individual viewpoints, perspectives, concepts and opinions, which helped them to conceive different strategies and engineer new solutions (Leonard and Sensiper, 1998; Nonaka, 1994; Spender, 1996). Often the tacit knowledge of individuals in the short-term interorganisational innovation projects was mobilised via cognitive abrasion involving personal insight, instinct and sparks of creativity. In the context of innovation development, this is crucial (Leiponen, 2006).

All the short-term interorganisational innovation projects included individuals from different backgrounds who worked together during each phase of innovation, drawing upon both tacit and explicit knowledge (Leonard and Sensiper, 1998). Whereas explicit knowledge concerns 'codified' knowledge, which is communicated formally and can be made available to people in addition to those producing it, tacit knowledge has qualities which make it difficult to communicate easily. It is intuitive and unarticulated and, therefore, a meaningful determining factor in innovation development. It has also been suggested that tacit as opposed to explicit knowledge is the foundation of innovation (Nonaka, 1994; Polanyi, 1966 and Von Krogh, Ichijo and Nonaka, 2000). Hence, tacit knowledge can be thought of as the essence of innovation (Hartono and Sheng, 2016; Sheng et al., 2015).

The relationship between knowledge and innovation is widely recognised in extant literature (Chen et al., 2017; Nielsen and Nielsen, 2009; Nonaka and Takeuchi, 1995). Furthermore, firms have been advised to innovate by seeking new knowledge or ways to better use existing knowledge (Galunic and Rodan, 1998). Firms must therefore, use current tacit and explicit knowledge to develop new knowledge, which in turn may lead to the development of new products or services (Nielsen and Nielsen, 2009; Smith, Collins and Clark, 2005; Urgal, Quintás and Arévalo-Tomé, 2013). However, the literature lacks definitive empirical findings regarding the nature of knowledge (tacit/explicit) and process (exchange and combination of knowledge) that explains innovation well (Del-Corte-Lora, Molina-Morales and Vallet-Bellmunt, 2016; Pérez-Luño, Alegre and Valle-Cabrera, 2019; Smith, Collins and Clark, 2005). Hence, there is still a need to understand more about the relationship between tacit and explicit knowledge and their role(s) in innovation creation and development.

Tackling this need, this study reveals that cognitive abrasion is a means for the transfer of tacit knowledge, assisting in the development of ideas for innovation development. In the context of MCD&MS, cognitive abrasion was noted to support people in the short-term interorganisational innovation projects to collaborate: learn and appreciate each other's perspectives, develop and grow their professional knowledge and appreciate each other's perspectives. This, in turn, supported the development of personal relationships and rapport and importantly innovation development. It is thought that as the pace of change was fast and the people were expected to work efficiently, innovation was advanced by channelling the energy from the actors' different thought processes. Thus, linking with the ability to create innovations effectively by carrying out efficient phased innovation development. This efficiency links directly with the development of timely innovation, another important finding (see 7.5.1).

7.5.3.3 *The importance of strong and weak ties, trust, and actor diversity (contributing to consolidating)*

Studies on innovation networks centre on collaboration with different actors, aspiring at innovation (Najafi-Tavani et al., 2018). Actors are therefore embedded in a multifaceted web of interconnected ties which enable them to access the resources required for innovation. This has relevance to the short-term interorganisational innovation projects as the wider networks were essential to gain access to relevant external sources of knowledge in this study (see 4.3.6.1, 6.2.6.1 and 6.3).

The short-term interorganisational innovation projects comprised an established close relationship between two partners who knew each other well and a third or fourth actor organisation that was new to the relationship. In collaboration, this arrangement was instrumental to innovation development. In accordance with Haythornthwaite (2002) the initial grouping comprised individual actors that were content to share information. Due to their strong ties, these individual actors worked in similar social circles and, therefore, had limited access to new information. The third principal actor, and subsequently others, provided diversity (new perspectives were brought forward, challenging embedded thought processes) allowing difference of opinion and new ideas to evolve; thus, enabling access to new information through weak ties, and improved knowledge access and creation. The findings suggest that, by creating an infrastructure of latent ties (ties that exist in principle but are not activated) and establishing the right conditions for them to develop and strengthen, it was possible for new ideas to be created (Haythornthwaite, 2002).

A large pool of actors increases the extent of resources available; necessary for innovation development (Aarikka-Stenroos and Sandberg, 2012; Baraldi and Strömsten, 2009). It can also expedite innovation success via learning and creativity (Corsaro, Cantù and Tunisini, 2012a; Driessen and Hillebrand, 2013; Reypens, Lievens and Blazevic, 2016). Extant literature highlights the importance of diverse actor groupings and their usefulness to grow innovation (Aarikka-Stenroos et al., 2017). In contrast, this research observed close groupings, with one hub firm and (a minimum of) two suppliers, one of which the hub firm, had already developed strong ties with. The actors who did not know each other well and who travelled in different circles, were able to access new information and generate novel ideas with the actors who had a strong, established relationship.

The findings revealed that while there were complications brought about by the diverse range of involved actors, none were so significant as to stall innovation development. This discovery is especially important to radical innovation where the literature illustrates that the additional complexities involved with the utilisation of diverse actors can cause interaction difficulties (Aarikka-Stenroos et al., 2017). Actor diversity is known to produce a variety of and, sometimes, conflicting knowledge, power, competencies and logics (Corsaro, Cantù and Tunisini, 2012a; Öberg and Shih, 2014). It can, therefore, have the effect of complicating innovation development; with the increased miscellany of involved actors, different terminologies, expressions, technologies and goals can create tensions, increase ambiguity and create misunderstandings (Aarikka-Stenroos and Sandberg, 2012; Corsaro, Cantù and Tunisini, 2012a; Corsaro et al., 2012b). While the findings acknowledge the extra difficulties involved in innovation development from actor diversity, it is important to emphasise that both radical and incremental innovations were not markedly hindered; the benefits of the close actor groupings generated successful, novel ideas and innovation(s).

This study observed that a combination of pertinent management activity utilisation and particular network characteristics produced successful innovation(s). Thus, there are commonalities with Hadida, Heide and Bell, (2019) who focused research on the nature of temporal marketing organisations, known to be prevalent in NPD (Brown and Eisenhardt, 1995; Ibert, 2004). They sought to identify particular aspects of variance in temporal marketing organisations which produce positive outcomes. Their study proposed: the development of a single index of team diversity, finding the right balance of "embeddedness, task novelty and project duration" and the employment of either a "hybrid" or "fully embedded temporary organisation" Hadida, Heide and Bell, (2019, p. 12). While there is resonance with this work, Hadida, Heide and Bell, (2019) did not include management activities in their research; it is therefore problematic to draw direct conclusions.

8 Chapter Eight: Conclusion

8.1 Introduction

This research investigates the management activities employed within short-term interorganisational innovation projects. It draws upon the theories of the innovation process, phased innovation development (Cooper and Kleinschmidt, 1995; Gassmann, 2006; Aarikka-Stenroos, Sandberg and Lehtimäki, 2014; Coviello and Joseph, 2012; Lynn, Morone and Paulson, 1996) and the management activities proposed by Aarikka-Stenroos et al. (2017). It also investigates the drivers and barriers within management activities, building on the literature dedicated to innovation barriers (see Hartono and Kusumawardhani, 2019) and innovation drivers (see Dziallas and Blind, 2019). Furthermore, it engages with projects literature (Barker and Cole, 2007; Haniff and Salama, 2016; Winter et al., 2006) and its management (Turner, Ledwith and Kelly, 2010; Winter et al., 2006). This concluding chapter presents the principal contributions of the research providing both theoretical (8.2) and managerial implications (8.3). It also considers the research limitations and future research directions (8.4).

8.2 Theoretical contributions

This research makes five contributions to extant literature on management activities, short-term interorganisational innovation projects and the innovation process. The first contribution is the identification of the second order management activity: learning, knowledge creation & transfer (see 8.2.1) and the importance of the differences observed in the management activities, particularly leveraging. The second contribution reveals how the timely completion of the various innovation phases (through effective implementation of the management activities) impacts on the speed of innovation development and consequently faster market entry (potentially resulting in improved returns) (see 8.2.2). The third contribution of this study highlights the lack of insurmountable barriers to the innovation process and adds nuance to our understanding through the identification of interaction-specific drivers and barriers (see 8.2.3). The fourth contribution of this research shows how the atmosphere conditions the short-term interorganisational innovation projects (see 8.2.4). The fifth and final contribution is the empirical research framework (see 8.2.5).

8.2.1 Learning, knowledge creation & transfer and how the new management activities manifested

This empirical research identified a second order management activity (Winter, 2003): learning, knowledge creation & transfer and a more nuanced picture of the seven management activities (Aarikka-Stenroos et al., 2017) was presented (see 7.2 and 7.4). Of which, the most important is leveraging and is also discussed below.

Of the eight major themes, the management activity leveraging and second order management activity learning, knowledge creation & transfer appeared with more prevalence in the data (see 6.2.1.1). When leveraging was effectively carried out, innovation outcomes were improved (see 6.2.4.1). Leveraging linked with each of the other management activities in addition to the factors which conditioned them; thus, contributing to effective innovation dissemination. Furthermore, while leveraging was discussed at the strategic and organisational level (Cooper, 2019), there is little extant literature focused on the role of leveraging at the task level. Although Aarikka-Stenroos et al. (2017) noted the significance of leveraging as an emergent outcome, this research highlights the importance of leveraging, using soft means via clearly understood communication, throughout the innovation process. In this study, leveraging was noted to play a role in changing mindsets via persuasion and influence; thus, opening new markets up for the novelties, facilitating demand. The people involved were key to leveraging; without their influence and expertise, opportunities and consequently, advantages and leveraging opportunities would have been missed. This goes beyond the discussion in Aarikka-Stenroos et al. (2017) revealing the significance of leveraging in the context of short-term interorganisational innovation projects.

This study highlights that given the context of innovation development a broader number of management activities must be embraced for successful innovation development. Management activities are not widely evidenced for their importance in the project management literature as only goals and some management activities are covered. For example, the employment of ICT systems (Gemünden, Lehner and Kock, 2018) utilised in project management supports planning, controlling, coordinating and decision-making functions. Project management literature also identifies the importance of business goals (Turner and Zolin, 2012; Serrador and Turner, 2015). The project management literature lacks insight regarding the breadth of management activities required in successful innovation delivery and when they must be used in the process of innovation development.

Successful orchestration was an important catalyst to learning, knowledge creation & transfer in the short-term interorganisational innovation projects studied. Largely, team members' belief in the orchestrator(s) helped to dissipate stress and worries experienced by the managers. Excluding radical innovation, Mediaworks (which experienced commercialisation issues) and incremental innovation ARVR-Staging (where the outcomes were not known at the time of interview), the markets readily accepted the innovations, linking with the management activity leveraging as the markets were well prepared. The empirical findings thus, emphasise the importance of orchestration in successful short-term interorganisational innovation projects, thus, extending the knowledge provided in the Aarikka-Stenroos et al., (2017) research.

Overall, the short-term interorganisational innovation projects were created in unique circumstances, with largely successful coordinating, consolidating, motivating & rewarding and goal setting & refining activities. Additionally, there were strong sets of shared values & beliefs between project team members and high instances of network stability & embeddedness, which resulted in a reduced requirement for controlling activities. Specifically, the successful implementation of Agile and Stage-gate project management methodologies, in addition to the early firm engagement processes necessitated less controlling management activities. Therefore, the inception and organisation of the short-term interorganisational innovation projects, combined with project atmosphere, demanded fewer controlling activities, thus providing greater detail and insight which go beyond Aarikka-Stenroos et al's., (2017) findings.

8.2.2 The speed of innovation

This study's third contribution involves the speed of innovation. The lack of attention given to innovation speed in extant research is problematic because speed offers the significant advantage of being first to market when the target market is potentially more receptive (if successfully leveraged), with consequent rapid profit realisation. In innovation network research, the newer methods of project management including Stage-gating systems, Agile development methodologies and ideation techniques as discussed by Cooper (2019) are not considered. See for example, Aarikka-Stenroos et al., (2017); Baraldi and Strömsten., (2009) and Manser et al., (2016). However, this study showed that favourable results were achieved using the Agile-Stage-gate process, in agreement with Cooper and Sommer (2016, 2018) and suggests that these systems need to be considered in the discourse about management activities. Furthermore, this research strengthens Sommer et al.'s, (2015) findings who highlight the rewards of the Agile-Stage-gate process including: speed, dedicated teams determined to deliver innovation, excellent communication, and constant feedback. These attributes were observed in the short-term interorganisational innovation projects. However, the studies by Cooper (2019) and Cooper and Sommer (2016, 2018) are focused on the firm only and do not relate to an interorganisational setting.

The empirical findings extend Cooper and Sommer's (2016, 2018) and Cooper's (2019) research, highlighting that an interorganisational setting provides opportunities to carry out the described functions of successful innovation development efficiently and effectively which in turn impacts on speed (see 4.4.1.1, 6.3.1 and 7.5.1).

The use of an orchestrator was crucial in this study (see 6.3.5.2). A role which was observed in all six cases, developing both radical and incremental innovation. In this research, orchestrators were not seen to dictate, rather project team members in the short-term interorganisational innovation projects were stimulated into action; once activity sections were signed off, time was allocated to reflect on achievements prior to the next iteration, thereby improving efficiency and in turn creating innovations at speed (see 4.4.1.1, 6.3.1 and 7.5.1). The orchestrator was observed to drive innovation forwards with determination, providing focus to project team members; utilising goal setting & refining in addition to task partitioning via coordinating and controlling management activities, in contrast with the industrial networks literature which contends that networks cannot be orchestrated, and one actor is not in control (Håkansson and Ford, 2002).

8.2.3 The lack of insurmountable barriers

The fourth contribution is identifying the lack of insurmountable barriers experienced in innovation development in these short-term interorganisational innovation projects. Extant literature highlights that innovation barriers often relate to industrial affiliation and firm size (Hölzl and Janger, 2012; Mohnen and Rosa, 2002). Scarce resources are often cited by new and small firms as a major challenge (D'Este et al., 2012) including: knowledge and organisational skills, lack of technology expertise (Gort and Klepper, 1982; Katila and Shane, 2005) and deficient finance (Katila and Shane, 2005; Schoonhoven, Eisenhardt and Lyman, 1990). However, due to the collaborative nature of the short-term interorganisational innovation projects, this study revealed that such challenges were overcome and not considered as significant. Thus, highlighting the lack of resourcing barriers to innovation development.

Furthermore, the empirical findings in this study provide a new understanding; as the identified drivers and barriers to innovation were formed during interactions they cannot be classified as internal or external. Specifically, they were noted to be interaction specific because they grew from the interaction in the short-term interorganisational innovation projects. As multiple actors (individuals, firms and organisations) were involved in each short-term interorganisational innovation project, the barriers, and drivers (identified in each management activity) were multifaceted, dynamic, complex and embedded in the projects.

Significantly, for both radical and incremental innovations, challenges related to barriers to innovation were not considered to be insuperable in each short-term interorganisational innovation project nor stall progress. In all the short-term interorganisational innovation projects, both radical and incremental, there were major problems at times, however, they were overcome. This is in stark contrast with the extant innovation management and industrial networks literature which cites radical innovation development as generally more difficult and more obstacles to overcome than incremental innovations (D'Este et al., 2012, Sommer, Dukovska-Popovska and Steger-Jensen, 2014, Sandberg and Aarikka-Stenroos, 2014; Öberg and Shih, 2014; Madrid-Guijarro, Garcia and Van Auken, 2009). Significantly, the identified barriers to innovation did not terminate development for either innovation type. Moreover, barriers were noted to be ad-hoc and could not be grouped into meaningful, phased, clusters. Thus, this research extends the industrial networks and innovation management literature by showing that when barriers are anticipated, not perceived as insurmountable and addressed as challenges, successful innovation development can occur.

Project management literature deals with barriers tactically in the context of delivering a project within the parameters of the iron triangle (Haniff and Salama, 2016). It does not explore barriers strategically in the context of innovation development. Thus, this study provides insight into the successful completion and delivery of phased innovation management; adding depth to the project management literature and deepening knowledge.

8.2.4 Project atmosphere

This research identified project atmosphere to be a greater contributor to successful innovation than the individual atmospheres developed from separate dyadic relationships between each of the involved firms in each short-term interorganisational innovation project. This is a development of the Interaction model (Eggert and Helm, 2003; Ford et al., 1998; Håkansson, 1982; Sutton-Brady, 2000) from a dyadic to a project context; thus, providing a new understanding of atmosphere in a networked setting. Section 7.5.2 showed that project atmosphere is greater than the sum of the individual atmospheres created from the separate dyadic relationships.

Furthermore, this research links a strong set of shared values & beliefs in a networked setting with successful innovation development, this is in addition to the affirmative impact of altruism with successful innovation processes and outcomes. Moreover, in the setting of MCD&MS, insight is given to the network dynamics experienced in short-term interorganisational innovation projects. Conceivably, because network stability & embeddedness are recognised as being implicit in network research, there is scant current literature which discusses the relevance of network embeddedness and its relationship with innovation development. Although the short-term interorganisational innovation projects were temporary, they each had a distinctive character which was driven by intrinsically motivated and altruistic people. Furthermore, each short-term interorganisational innovation project had a robust character which contributed to the atmosphere(s) of each project. These specific characteristics have not been discussed before in extant industrial networks literature (Eggert and Helm, 2003; Ford et al., 1998; Håkansson, 1982; Sutton-Brady, 2000).

In this study the project atmosphere (in conjunction with the actors' shared values & beliefs) and network stability & embeddedness was significant to the completion of phased innovation development. This combination enabled the short-term interorganisational innovation projects to progress in a timely manner through to each innovation phase (see 8.2.2). Moreover, the implications for both innovation management and project management literatures are that soft factors, such as atmosphere must be considered in the development of successful short-term interorganisational innovation project delivery.

The importance of atmosphere was, therefore, identified as a central factor in developing the relationships between firms in each short-term interorganisational innovation project and in shaping the characteristics of those relationships over time. As such, project atmosphere motivated the actors, prompting close relationships, stimulating activity and trust. The close relationships enabled the short-term interorganisational innovation projects to achieve positive gains during innovation development. These results add to the expanding industrial networks literature; thus, it extends the application of the Interaction model (Eggert and Helm, 2003; Ford et al., 1998; Håkansson, 1982; Sutton-Brady, 2000).

8.2.5 The empirical research framework

The findings extend the conceptual framework (
Figure 3); see the empirical research framework (Figure 20). A noteworthy contribution is the incorporation of project atmosphere. Two further major themes were identified: network stability & embeddedness and shared values & beliefs, which directly contributed

to project atmosphere (see 6.4). The processes necessary to drive innovation were therefore identified in the framework. Thus, supporting Waluszewski, Snehota and La Rocca's (2019) requirement for conceptual developments which illustrate business activities from novel perspectives (see 2.8).

8.3 Managerial implications

The insights gained from this research can enlighten managers involved in innovation development by informing their choices and strategies associated with short-term interorganisational innovation projects. Six characteristics which managers should consider include: developing timely innovation grounded on genuine need, employing relevant institutional mechanisms to facilitate early innovation development, encouraging relevant actor involvement, fostering a collaborative climate, implementing project management processes and ensuring the existence of a robust set of shared values & beliefs between actors. These are discussed in further detail below.

The short-term interorganisational innovation projects all produced timely innovations. Four of the innovations studied were known to be successful after the initial launch[18]. Managers must encourage project team members to be exceptionally curious, with uncompromising abilities to explore and reflect, relentless in the knowledge that their innovation(s) must satisfy market demand. Managers must constantly question how things can be done differently and assess where improvements can be made.

To ensure that innovation has the best possible start, managers must employ relevant institutional mechanisms including the coordination of well-advertised early idea generating events which attract involvement from the most appropriate actors. All the short-term interorganisational innovation projects employed established methods to initiate innovation development; such methods were proven for effectiveness in their respective sectors.

[18] Note: (1) Mediaworks was not commercialised successfully at the start. Although the innovation met a market gap, the early phase leveraging activities were not performed well, consequently the market was not ready to receive it. (2) ARVR-Staging was not disseminated at the time of data collection.

Managers must organise meetings and brainstorming sessions which are open and collaborative. They must also encourage participants to generate ideas and solutions to defined problems which can then be presented to senior managers. These ideas can then be developed, endorsed and supported through rounds of feedback and filtering mechanisms such as voting. Hence, managers must ensure that communication is clear and well understood within the short-term interorganisational innovation project(s); for example, to change peoples' mindsets; (ensuring full support for the novelty).

It is imperative to ensure that the most appropriate project team members are involved. Relevant actor involvement was found to be imperative to create excellent team dynamics. Additionally, engaging proactive and motivated people who were talented high achievers was important to drive the innovation forward and motivate other project team members. Managers must also ensure that the project team members are happy to honour one another's differences while successfully managing through cognitive and creative abrasion processes and tacit and explicit knowledge sharing. Developing the concept of engaged, proactive and motivated people, in each of the short-term interorganisational innovation projects, the team members contributed to additional projects and innovations which crossed over. Therefore, managers must facilitate social networks, creating opportunities for chance encounters between the project team members and further meeting opportunities. Such meetings build upon initial motivations for innovation development, creating dynamism, attachment, and commitment between the project team members.

Fostering a collaborative climate included four supporting characteristics. Firstly, managers must nurture effective teamwork. A second aspect was the enablement of micro-level interactions to occur easily between individuals. Individual people and actor firms in the short-term interorganisational innovation projects, were able to form mutual, close, relationships which co-evolved over time. These personal relationships were just as important as the professional ones. Thus, managers must enable the micro-level interactions between individuals to occur easily, as the complex interdependencies between individual actors were significant to innovation success. Thirdly, while it testing, managers must engage efficient cross functional teams of people in the short-term interorganisational innovation projects, with the aim to encourage diversity, challenge conventions, kick start ideas, thereby increasing enthusiasm for innovation development. The fourth aspect was the environment in which innovation takes place. Managers must ensure that it is conducive to support learning, knowledge creation & transfer. Therefore, managers must be aware that in the most appropriate setting, learning is likely to occur more naturally and with their new skills the involved actors may more easily create and transfer knowledge.

Managers must implement project management processes (including Agile methodology into routine gating models). This was critical to innovation development in each short-term interorganisational innovation project and significant to the shared values & beliefs mindset within MCD&MS. Such methods allow for starting and completing independent tasks simultaneously. These processes created dynamism and a sense of achievement amongst the team members in the short-term interorganisational innovation projects. Furthermore, quality was integrated at every stage. This saved time as it was not necessary to revert to a past phase.

Finally, the study specifically showed that a robust set of shared values & beliefs links directly to successful innovation, in a networked setting. An overarching connection between project team members through shared values & beliefs enables smooth innovation development. Therefore, mangers must involve team members with this mindset. In the setting of MCD&MS this included the positive impact of altruism which acted as a motivational influence.

8.4 Limitations and future research

In line with all research there are some limitations with this study. With regard to generalising the findings to theory, Yin, (2012) notes that case studies are not aimed to generalise from "samples to universes" (p.18), as quantitative surveys might be. Statistically, claims developed from cases cannot be deemed as proof. Instead, they construct theoretical ideas which may create meaning for situations similar to the one researched. Similarly, if additional case studies reveal approximating outcomes, they may support the hypotheses and form evidence to construct theory (Yin, 2012). This is "analytic generalization" (Lincoln and Guba, 2000, p. 112; Yin, 2012, p. 18). Therefore, additional cases studies may provide further evidence to help build theory.

The researcher recognises the different temporal perspectives, for example reflective (for the five innovations which had occurred in the past) as opposed to real time (as ARVR-Staging had not been disseminated at the time of interviewing) in the data gathering process, which potentially shaped or biased the researcher's interpretations (Halinen, Medlin and Törnroos, 2012; Hoholm and Araujo, 2011). Future research could therefore focus on one time period.

When challenges are encountered during innovation development they may feel raw and very problematic to the interviewees, if they had occurred recently and not been easy to overcome. The distance of time allows for periods of reflection and balanced judgements. The researcher therefore needed to maintain a balanced perspective. Future research could minimise this bias by focusing on historical, longitudinal cases.

Another avenue for future research could explore the management activities required in both radical and incremental innovation development in different research contexts. The aim would be to explore the capabilities and competencies required for innovation management and the linkages between different management activities in particular innovation development phases, including the importance of leveraging (Aarikka-Stenroos et al., 2017) and learning, knowledge creation & transfer. The different underlying forces, at work, require further exploration in different contexts.

Future research directions also include the utilisation of the empirical framework presented in this research. It was created to better understand the different management activities necessary for innovation development and their prevalence in particular phases of innovation development, for both radical and incremental innovations. A larger sample of short-term interorganisational innovation projects could be sought which could be studied quantitatively. A large sample could, potentially, provide more accurate mean values, identify outliers that might skew the data in a smaller sample and provide a smaller margin of error. Larger sample sizes mean that the research can usually be replicated or repeated given its high reliability. The results from this type of research could be compared against the findings discussed in this study. Also, the empirical framework could potentially be tested in the context of other similar markets and sectors. The UK's entertainment and media sector is expected to grow dramatically, comprising, amongst others, video games, digital games and VR. It is a growing area and of strategic financial importance to the UK. If sectors such as these were researched, it would be possible to make comparisons between the importance of the different management activities in the different innovation phases, the significance of project atmosphere, in addition to making comparisons between radical and incremental innovations.

The specific details of project atmosphere could be studied in fine detail, to give a full picture of how the particular features of atmosphere impact on the innovation development in the studied short-term interorganisational innovation projects. The micro-level picture would provide further insight and comparisons could be made to ascertain if there were mutual expectations observed in the newly studied short-term interorganisational innovation projects; trust is strong and if the balance of power and dependence is influenced by network and stability & embeddedness provided by the hub firms.

Finally, the field of successful innovation development requires more investigation. Cooper (2019) notes that the pace of innovation is increasing, the world is more global and abstruse; constantly presenting fresh challenges for product developers. Since the early scholarly articles on innovation, many new practices including Agile development have been created, the impacts of which, thus far, have not been comprehensively researched. Therefore, studies into the drivers and barriers to the development of new products and services, in addition to NPD systems are necessary. As innovation is so strongly connected with economic growth and prosperity (Tidd and Bessant, 2018), the field must not be neglected. While there are many studies which explore the background to successful innovation, the key requirements for success remain obscure.

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10 Appendices

10.1 Appendix 1: Thematic Analysis Tables

In these tables, illustrative quotations from the interviews are represented with an incremental innovation first (white background) followed by a radical innovation (grey background), variations to this reflect the data set. Therefore, in some instances data is given exclusively for radical or incremental innovations as evidence was not found for both innovation types.

10.1.1 Learning, knowledge creation & transfer description (drivers)

Second order themes (level two codes)		**First order concepts (level one codes)**
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Cooperation	A cooperative atmosphere: where activities are embarked upon and completed for mutual benefit.	*Building_sector_knowledge:* Actors at Gold explored how the sound would be heard on many different hand-held devices (smart phones and tablets). There was concern that they could spend many hours working on the sound, but ultimately it was only as good as the device gamers played Demonland on: "*…we looked at the features on hand-held devices…how quickly it [the sound] is being generated…what your signal is and what your reception's like, in addition to the speaker…*" Gavin, Managing Director, Gold-Demonland. Gold actors had limited experience in this area. They felt it was important to learn as much as they could. *Combination_of_unique_skill_sets:* Knowledge, experience and insight about the pitching process was transferred from Sarah's line manager to Charlie and the network:

		"…we got some guidance, she came down and gave us tips about what Red look for in these types of thing…it's not just about the idea, it's how to present it and the way of going about it." Charlie, Developer, CodeClub, CodingGame. Morph employed an actor who had experience with music visualisation. He was instrumental in the development of Audiolizer. Greg described him as: *"…the perfect person. He already comes with lots and lots of latent knowledge about how to make things work like that. I don't think we would have found or known anyone who would know enough about the project to do all that he did."* Greg, Producer, Morph-Audiolizer.
Specialist_knowledge_resources	Non-tangible organisational resources (human resources referring to actors and their attributes including: knowledge, abilities, skills, experiences and innovativeness. These are critical resources for innovation development). It describes how specialist actors supported others in the innovation network with their knowledge and skills. In addition to creating special bonds with actors due to common	*Specialist_actors:* *"… if you're looking at it from a pure gameplay point of view… the guys at Pine brought a lot to it in terms of their knowledge of what's playable, what interfaces do people react with, do people prefer running and jumping games to puzzles…"* Sarah, Red-Children's Developer-CodingGame. Three separate actors mentioned Simon, a creative developer, who freelanced for Morph during the creation of Audiolizer. Simon's skills were a world class blend of specialist technology and creativity: *"…Simon worked with us on the first prototype version of the DMK… he was recommended to us as someone who was very good at doing that kind of work… he's a creative developer. He figures out lots of problems and would build new technology for things... I don't think we would have found or known anyone who would know enough*

	interests and a desire to work with people who had devoted their time to developing niche or specialist skills; where they were leaders in their field.	*about the project to do all that he did. He was the perfect person*." Greg, Producer, Morph-Audiolizer.
Facilitating_processes	Processes which produce clear results that are commonly understood and supported by all the involved actors.	*Developing_an_approach_to_the_process_of_innovation:* James enjoyed the process of developing Mediaworks: "*…if we can get to a point where there are defined stages and there's a handover… I know Peter is working on it, that innovation pipeline… we've learnt so much by doing Mediaworks..*." James, Senior Technologist, Blue-Mediaworks. James developed his line of thought and said that it had taken the business from not really understanding the approach they would take, to: "*...knowing a lot more than we did… three years ago…springboard to the next innovation*." James, Senior Technologist, Blue-Mediaworks. James also suggested that from the learning process they would tackle innovation differently. James viewed this as a commercial team that would be: "*…analysing what we're doing…to see if it's marketable…if we can sell it… if that's what our clients want…*" James, Senior Technologist, Blue-Mediaworks. The Red-Innovation-Hub events provided a very structured approach to the process of innovation. This applies to the three innovations: Metbot, Audiolizer and CodingGame: "*…it provides the inspiration, support and platform to keep Red at the cutting edge of online innovation and a world leader at delivering engaging, digital broadcast experiences…work programmes and events that lead to the production of innovative digital pilots. These programmes include workshops and creative sessions designed to*

		guide people through the idea generation process, before further support is given to develop selected projects into pilots…" Red's website. Supporting quotations can also be found in the management theme *leveraging* (6.2.1).

10.1.2 Learning, knowledge creation & transfer description (barriers)

Second order themes (level two codes)		**First order concepts (level one codes)**
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Power/dependence	The atmosphere was resistant to change in niche areas and heavily dependent on influential actors.	*Siloed_disciplines_(barriers _to_learning):* This code directly relates to the ARVR-Staging innovation. It focuses on the three sectors within the broadcast industry; film, television and gaming. They are all distinct, the disciplines had never merged before. The innovation brought sector technologies together for the first time. Aiden described the actors working in the distinct sectors: "*… traditionally they have all been very separate, everyone has their own expertise and they didn't particularly like each other*." Aiden, VFX Supervisor, Blue, ARVR-Staging. Aiden highlighted that, to develop the innovation, the three disciplines must "*…coexist, however…there are links that are missing*." Aiden, VFX Supervisor, Blue, ARVR-Staging. Consequently, there were barriers to the creation of the new roles required to develop the innovation. Aiden's approach to this was to: "*…fight the path of least resistance*." Aiden, VFX Supervisor, Blue, ARVR-Staging. He noted that the significant factor was to identify the training gap: "*…we need to see which bit is the hardest to learn… find those people that have learned that…"* Aiden, VFX Supervisor, Blue, ARVR-Staging. Aiden identified gaming first and television post-production as the second most difficult discipline to learn.

		"*…that's the training I would do, get a guy who has got a gaming background and train that smaller bit…I'd get someone who has an affinity with building games and…experience of using [post-production software] …"* Aiden, VFX Supervisor, Blue, ARVR-Staging.
Ability	Although the involved actors had ability, there were areas where talent, skill or proficiency was lacking. A steep learning curve was required to overcome this, in addition to accepting change.	*Skills_gap_(barriers_to_learning):* This theme illustrates the skills gap, noted in the ARVR-Staging innovation by Robin, who commented: "*…we need to start learning. There is still quite a steep learning curve….*" Robin, Head of 360 Production, Blue, ARVR-Staging. He was concerned that it was leading to a, "*…skills gap in the industry."* They need actors to understand: "*…broadcast engineering, compositing and the gaming world*." Robin, Head of 360 Production, Blue, ARVR-Staging. There are very few people that understand all these specialisms. Additionally, he visited three universities to understand how their courses were integrated. He discovered that they were not. For example: "*…games engine (students) should be developing VR TV sets for the broadcast students."* Robin, Head of 360 Production, Blue, ARVR-Staging. Robin was keen to get the students working together and the courses aligned. He had a proactive approach and desired the pool of talent to be trained optimally to serve future needs.
Resource_limitations	The resource limitations of: time, legacy from the innovation and actor stamina & perseverance.	*No_direct_legacy_from_the_stand-alone_game_(barriers_to_learning):*

		Charlotte reflected on the overall Red-Go-Digital initiative. She considered that they were seeking the audience to engage and be creative in a digital space. CodingGame achieved this: "*…you could say, job well done. But what I think we're trying to achieve with Red-Go-Digital is long term behaviour change… That takes a long time…you can't expect one thing to make that change."* Charlotte, Executive Producer, Red-Go-Digital, CodingGame. Charlotte continued to reflect that CodingGame did not set out to achieve transformational change; it was one part of the Red-Go-Digital television season. However, these issues kept her awake at night: "*…it's one of the things I think about a lot…"* Charlotte, Executive Producer, Red-Go-Digital, CodingGame. She was concerned that the learnings she had experienced from this element of the Red-Go-Digital television season should be considered by the innovation network. She said that she hoped the audience using CodingGame would be savvy enough to: *"...join the dots themselves*…". Charlotte, Executive Producer, Red-Go-Digital, CodingGame. Implying that this was the start of their learning journey. However, if their use of CodingGame was a one off, it was disappointing. There was no direct legacy from the game: "*I can't see it currently being resurrected, mostly because Red's focus on what its big season is, has moved away from coding and computer science into other things.*" Charlotte, Executive Producer, Red-Go-Digital, CodingGame. Therefore, due to the change in direction from the broadcaster, it was unlikely that CodingGame would be launched again in a different form. However, there were learnings from the way it was created, which, if relevant, would be implemented in future projects that the individual actors were involved in.

10.1.3 Shared values & beliefs description (drivers)

Second order themes (level two codes)		First order concepts (level one codes)
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Closeness	Shared values include explicit or implicit fundamental beliefs, concepts and principles that underlie the culture of the firms in each innovation network. They guide decisions and behaviour of the actors. This code also includes common approaches towards sector challenges.	*Shared_values_(focused_on_altruism)* Philip discussed shared values between his firm, Pine, and Red: "*…the educational stuff is really interesting to us, we did some bits for Red-Children's television and then we started doing smaller games for Red… that's how we met Sarah…*" Philip, Managing Director, Pine, CodingGame. Sapphire has altruistic values which are born from the parent company Aqua. The business was created with a unique model as a 'publisher-broadcaster'; commissioning content from production companies throughout the UK. Sapphire is self-sufficient and reinvests profits back into the business. Aqua, has a public service remit, which comprises fifteen principles, including: "*…innovative and distinctive; stimulate public debate on contemporary issues; reflect the cultural diversity of the UK; champion alternative points of view; inspire change in people's lives and nurture new and existing talent.*" Tyler, Executive Producer, Sapphire, Demonland. These values relate well to the two other firms in the innovation network, Platinum and Gold, SMEs; created by specialist actors with a desire to creative innovative games. As Red is a public service company, the social gains resulting from innovations are created from the public benefitting from them directly. Altruism can be understood as a driver. Audiolizer and CodingGame were created for the 'greater good' as part of the Red-Go-Digital campaign, to increase awareness of digital technologies, specifically encouraging teenage girls to develop coding skills. As Red is not a commercial entity, there was no profit motive. The altruistic motivations from Red appeared to flow through the mind-set of the actors in the Audiolizer innovation network, Phoebe described the cultural fit between Air and Red; a desire to work on projects for the greater good, discussing clients, Phoebe said:

		"…*almost all our clients (including Red) … their predominant output is for the benefit of others*." Phoebe, CEO, Air-Audiolizer. As described, Audiolizer, Metbot and CodingGame were born from the Red-Innovation-Hub process. Sunteam included developers from Red R&D who were engineers. This quotation is taken from Red's website: "*R&D is at the heart of Red's commitment to innovate, and its mission to inform, educate and entertain*."
Cooperation	Emphasising the qualities of sharing information, collaboration and transparency. A group of actors working together are likely to produce a better outcome than an individual. To collaborate, actors must share ideas, insights, suggestions and failures. Experiences from ideas that failed were sometimes more important than those that were successful.	*Openness_and_sharing* Tyler discussed Sapphire's flexible approach in the development of Demonland: "*… as long as we feel it's relatable to the channel… then we're open to suggestion*." Tyler, Executive Producer, Sapphire, Demonland. There was an open approach towards the development of Mediaworks. When the development was complete and signed off, Liquorice proposed developing it further. "*…we share the roadmap; the roadmap is open for discussion…I believe that's a modern approach which is more scalable than traditional software development.*" Matthew, CEO, Liquorice, Mediaworks.

10.1.4 Shared values & beliefs description (barriers)

Second order themes (level two codes)		**First order concepts (level one codes)**
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Distance	The lack of shared vision, beliefs and understanding between actors.	*Lack_of_shared_understanding_(lack_of_shared_vision):* *"I think it just took a long time for us to understand the kind of restrictions we were facing because we were part of this bigger thing…" Rebecca, Technologist, Red-Femteam Audiolizer.* Recent years have seen significant challenges and change within Red. Issues regarding harassment and bullying in the workplace in 2013/14 resulted in new training, an engagement policy and process improvements. A culture built on respect between colleagues is being created. This programme coincided with the launch of Audiolizer and may help to explain why there were barriers to shared beliefs, visions and understandings.
Resource_constraints	Lack of actor knowledge.	*Lack_of_understanding_about_music_composition:* At first there was a lack of shared understanding between Gold and Platinum: "*Nathan will tell you, they normally used library music, which is cheap and cheerful, precomposed to a pre-agreed brief.*" Gavin, Managing Director, Gold-Demonland. According to Gavin, Nathan also had preconceived ideas about the cost of a specially composed piece of music. *"…he didn't understand the process."* Gavin, Managing Director, Gold-Demonland.
Expectations	Actor expectations were set on a specific path.	*Request_for_no_brand_connections_in_the_early_phase_innovation_ideas:* This applied to CodingGame, Metbot and Audiolizer. At the Build Studio event, the facilitators stated that they wanted teams to create a working prototype, but they did not want it to be tied in

		with a Red brand as the teams would not necessarily realise the endorsement. DesignTeam worked around this barrier: "… *we ignored that advice and thought, RadioX is probably the best Red channel that Red has for interacting with that demographic*…" David, Developer, CodeClub, CodingGame. DesignTeam, had already decided on the name of the game which had an important connection with the RadioX brand and the target audience. They also knew that they wanted the game to have a connection with RadioX and music. Instead of creating a prototype, they spent the two days working on a story, illustrating what it would look and feel like. Sarah used her connections at RadioX to seek brand endorsement for their idea, which was consented.

10.1.5 Network stability & embeddedness description (drivers)

Second order themes (level two codes)		**First order concepts (level one codes)**
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Ties	The time spent in a relationship; the depth and the closeness or intensity of the relationship between actors.	*Strength_of_ties_(and_years_known):* Charlie, Sarah and Philip had worked together for approximately five years prior to CodingGame. Also, CodingGame's development revealed strong commitment to support the innovation from the RadioX DJs in addition to radio trails and associated promotional marketing activities: "*…they couldn't give us lots of money, but they committed to saying they'd get all the DJs to be in the game, they'd get them to talk about it, they'd do voices for the game for that whole week and they'd include it as part of every show…*" Charlie, Developer, CodeClub, CodingGame. The Metbot innovation network demonstrated strong actor ties: "*…one thing we try to do with newer engineers in Red R&D is to allow them to get exposure to various aspects of the business."* Alistair, Developer, Scarlett-Metbot. Typically, at the end of a two-year trainee scheme employees would work in another Red department for three months. The intention was to broaden understanding and develop technical expertise in a new area. Both Brooke and Alistair had taken up this opportunity. They had worked with actors in Red-Weather and met Stephanie there.
Collaboration	Actors are active members of a group, working together to achieve a common goal. The rapport between actors was strong; communication was open and honest & long-	*Strong_rapport:* Brooke noted strong rapport between herself, Stanley and Beth (from President) at the Build Studio event: "*…Beth came over…we started chatting and her colleague Stanley joined her and therefore me, and…that was it really…*" Brooke, Developer, Red R&D, Metbot. They met by chance and established a strong rapport.

	established relationships were characterised by trust.	Greg described his relationship with Jack and Andy: "*…they understand the nature of building these kinds of things it just makes it easier. It has always been a good working relationship with those guys*." Greg, Producer, Morph-Audiolizer. Red-Femteam developed a strong rapport with Jack: "*…Jack's definitely the kind of enthusiastic and very vocal champion of this… I think he was…shouting from the rooftops and saying, 'we need to do this next'*…" Jane, Designer, Red-Femteam Audiolizer.
Cooperation	Multiplexity includes numerous and intense interactions, between different actors, in addition to the principal innovation development. This code also included strategic alignment, signed contracts, examples of mutual benefits, dependencies and obligations.	*Multiplexity:* For the past five years, Blue had created a customer-focused innovation day event: "*…we ask our engineers and CTO when they attend trade shows, if they see any equipment, kit or innovation which they think our customers would be interested in…creatively interesting to come along*…" Austin, Head of Studios, Blue, ARVR-Staging. Magnus, also highlighted multiplexity, he commented that, Blue: "*…invited us to the innovation day…that was really good for… our exposure."* Magnus, Managing Director, Moss, ARVR-Staging. Moss attended and exhibited at the 2016 event. It has been a key fixture in their calendar ever since. Julian commented that the ARVR-Staging innovation: "*...it's started a whole kind of domino effect… there are other departments that are thinking about it…"* Julian, Creative Director, Red-Sport, ARVR-Staging. Julian referred to departments within Red. In turn this was potentially exciting for Blue, for future sales opportunities.

		Peter highlighted the multiplexity of the relationship between Blue and Liquorice in addition to the development of Mediaworks: "*Blue is the exclusive reseller of Liquorice products within the UK, so it's about promoting the Liquorice brand and raising the Liquorice profile… (regarding Mediaworks) Blue derives the largest commercial benefit from this, it is its innovation.*" Peter, CTO, Blue-Mediaworks. When Blue first developed their television studios, they purchased a broadcast infrastructure with Amber's products at the heart. Daniel referred to the stability of the relationship: "*…it is a very customer friendly site for Amber…they have nearly one of everything that we do if not more…it's one of the best places that we could turn to, to say what does the market want*?" Daniel, Account Manager, Amber-Mediaworks. "*… not having that fear of failure means that we can keep a lot of doors open… The Red-Go-Digital team are very small, so we can move very quickly… if we spot an opportunity, we can jump on it and get it up and running very quickly*." Jack, Executive Producer, Red-Go-Digital. As Jack was on the Red-Go-Digital judging panel he saw the opportunity to work with Red-Femteam and grasped it.
Closeness	The atmosphere stimulated close relationships between individual actors. This code also acknowledges the existence of strong and stable innovation networks despite lack of multiplexity.	*The_shadow_of_the_future_was_long.* Adam discussed the demonstrations of the ARVR-Staging innovation: "*…making us more and more connections and solidifying our network more and more…*" Adam, Director of Technology, Flame, ARVR-Staging. It was likely that after the launch of the ARVR-Staging innovation, additional television production companies would use it. "*I mean Jack is very good within Red for finding potential partners, brand partners and saying, 'hey we could do this for you and it's not going to cost you very much money … which is how we've got to so many different versions (of the DMK).*" More than twenty products were made from the original code base.

10.1.6 Network stability & embeddedness description (barriers)

Second order themes (level two codes)		First order concepts (level one codes)
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Distance	This code includes instances where network ties became weaker. The background to this was an atmosphere of uncertainty, consequently the actors' relationships became increasingly distant. Isolation within the network; a dismissive approach to strategic alliances and factors leading to weak ties were also included.	*Network_ties_became_weaker:* Blue were concerned about the financial stability of Liquorice and asked actors there to complete a thorough financial check. This led to an initial weakening of ties; the Liquorice actors were aggrieved that the process was required. However, actors at Blue had reservations about commissioning a relatively small company to carry out a significant piece of software development: "*…we were seriously examined*." Matthew, CEO, Liquorice-Mediaworks. Matthew commented on the early adopter demands from Blue and described the actors as: "*…extremely demanding…they know very well what they want, and their primary objective is to raise the bar and to change the rules of the game."* Matthew, CEO, Liquorice. As an early adopter of new technology Liquorice expected the demands but found delivering to them difficult. Matthew commented on the challenges for Liquorice, as a start-up firm, which lead to weak ties: "*…running a technology company… where we don't have too much capital, is an incredible challenge*." Matthew, CEO, Liquorice-Mediaworks. Furthermore, the length of time that it took Liquorice to develop their own software to the dissemination phase was a challenge. "*…we knew it was going to be challenging, with three or four-years development time; in the meanwhile, it is six years…*" Matthew, CEO, Liquorice-Mediaworks.

		They underestimated the development time for their own company software. The same software code was used in the development of Mediaworks (useful for the product development) however; Liquorice's resources were overextended. This tested the strength of the relationship. Due to the underlying problems with music licensing, Audiolizer was launched on a bespoke website. This was not anticipated at the start of innovation development. Phoebe expressed her frustration that Audiolizer was not built on the main Red website, network ties therefore became weaker at Audiolizer's launch: "*…it just made everything harder and unfortunately, it slowed us down to the point where the numbers we were getting to visit the stuff was … thousands of times less than it would have been on the Red website, which is obviously a negative because we wanted a lot of throughput, we wanted a lot of people actually benefitting from these things…*" Phoebe, CEO, Air-Audiolizer.

10.1.7 Leveraging description (drivers)

Second order themes (level two codes)		First order concepts (level one codes)
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Opportunity_recognition_skills	The ability to recognise and develop opportunities to develop innovation(s).	*Insight_to_develop_an_opportunity:* "*…with the right people, in the right environment and the right creative guidance you can actually create these (TV) sets very quickly…if you can create them quickly you can create them relatively cheaply*." Austin, Head of Studios, Blue, ARVR-Staging. Stanley discussed the initial pitch for Metbot at the Development Studio event: "*I know that it was a strong idea which worked in our favour, no one else had anything like it*." The idea had evolved from an innovation he had created at President. Stanley, Head of Applied Technology, President-Metbot.
Entrepreneurial_skills	This code features entrepreneurial skills comprising a charismatic communication style that was successfully employed by the orchestrators. The actors had charisma, instilling confidence and trust in those around them. They used words which induced clarity and inspiration. Other abilities included: engaging with actors,	*Charismatic_assertive_communication_style:* Peter commented that James was a conscientious character. He had an ability to persuade people to support him in the development of Mediaworks. "*…he brings people on board and gets things done*." Peter, CTO, Blue-Mediaworks. Red-Femteam commented on the charismatic, assertive communication style of Jack, Audiolizer's executive producer: "*…he's very self-motivated in the way he goes about making stuff himself, so he had quite a similar approach to us I think in the way that, you know, he wants something built, he'll start building it himself to show other people, 'this is what I mean, can you make it…'*." Jane, Designer, Red-Femteam Audiolizer.

	communicating at different levels, making early introductions, pitching and persuasion skills, visualisation and envisioning skills.	
Team_interaction	A cooperative atmosphere is one where activities are embarked upon and completed for mutual benefit. The Red-Innovation-Hub events were an important feature of this code in addition to facilitating progress; a flexible approach and informal communication.	*Firm_engagement_processes:* Alistair discussed the Red-Innovation-Hub events. Highlighting that as Red is such a large organisation it was often difficult to ensure that teams were inspired to pursue a proactive approach to innovation day to day. "*… that sort of initiative can help sometimes, just to reignite some of that, even if it's technically there every day*." Alistair, Developer, Scarlett-Metbot.
Project_management_tasks	The activities (tasks) involved in the organisation and management of resources that are necessary to complete a project.	*Written_documentation:* Nathan created a document highlighting costings, characters and levels in Demonland. He compared the document to a spreadsheet calculation which summarised how the game would leverage revenue(s); a gamer would get to the first level and spend a certain sum on ammunition and weapons. As they progressed through the levels, the ammunition and weapons became more powerful and other elements were added, vehicles for example, all of which the gamer must buy. Alternatively, the gamer would wait for time to pass. The developer would determine the length of these phases as part of the gameplay design. The gamers' urgency to spend comes when they become hooked and immediately seek the next level.

		Daniel referred to Amber's release notes and guidelines which developers must adhere to: "*…for what Liquorice needed to do in order to develop for the platform… whenever you upgrade a system there will always be some release notes*." Daniel, Account Manager, Amber-Mediaworks.
Commitment	Actors were committed to the common goal of innovation; giving value and a meaningful reason for actors to connect and collaborate.	*Connecting_actors:* Peter discussed the strategic approach taken with the direction of Mediaworks. The senior executives in the innovation network at Amber, Blue and Liquorice, were well connected and had a firm agreement on the direction of Mediaworks. "*…it is a strategic relationship, with CEOs and CTOs talking to each other."* Peter, CTO, Blue-Mediaworks. Brooke noted that Patrick had an ability to connect actors in the development of Metbot: "*…there was a guy called Mike, a technical architect, he works across many projects, and if we needed his time to have a look at something…to integrate what we'd built…Patrick would have the edge with that…"* Brooke, Red R&D, Metbot.

10.1.8 Leveraging description (barriers)

Second order themes (level two codes)		**First order concepts (level one codes)**
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Intransigence	Barriers to fluid oral communication included semantic barriers (language related and body language); psychological or emotional barriers; organisational barriers and personal barriers.	*Barriers_to_fluid_oral_communication_(&_lack_of_contact):* The creatives found it difficult to be dispassionate and change Demonland in line with results from user testing. They found it challenging to communicate and reason their arguments. They needed time to reflect. *"…you are too close… you know when you're so close to the actual design of it…"* Nathan, Managing Director, Platinum-Demonland. During Audiolizer's development, barriers to the free-flow of communication were instigated by Andy. His intention had been to protect Morph from ad hoc requests by Red-Femteam, causing offence and creating a barrier: *"…there were some barriers put up between the communication, between us and Morph at certain points and that didn't necessarily help resolve some of the first issues we had…"* Jane, Designer, Red-Femteam Audiolizer.
Resource_limitations	Resource limitations resulting in ineffective time management and difficulties to present simple campaign messages.	*Poor_ communication_and_time_management:* Platinum had just finished another game which they had been developing. Due to poor communication with the publisher there was a misunderstanding about the launch timings. The publisher notified Nathan via email at 5am one morning, highlighting their readiness. In case mass use of the game resulted in bug fixes, Nathan encouraged his team into the office for an early start. However, Platinum later discovered that the publisher had overlooked the promotional messages to launch the game which were then sent at 3.30pm that day.

		"…*we didn't need to do the five o'clock start*…" Nathan, Managing Director, Platinum-Demonland. This meant that Nathan's team stayed in the office much later than anticipated. They were unnecessarily fatigued from the unusually long day, which then impacted on their ability to meet planned activities for Demonland.
Power/dependence	The atmosphere was not conducive to productivity, resulting in slow innovation development.	*Vision_misaligned:* Red, has a specific communications strategy; to deliver the public the benefits of emerging communications technologies and services. This was the very focus of Audiolizer; providing an innovation to young people encouraging them to code and communicate using digital content on a range of digital platforms and devices. Although all businesses in the innovation network were media and communications entities, the communication between the actors was not always smooth. The main issues were poor communication (Red-Femteam & Morph) (Red-Femteam & Red-Go-Digital), where misunderstandings and lack of vision alignment were noted. "…*something that we found very difficult was balancing our vision with the vision of the Red-Go Digital team*." Rebecca, Technologist, Red-Femteam Audiolizer. "…*they obviously had a clear vision in their mind about how this whole thing was going to play out, which was different to how previous Red-Innovation-Hub products have played out and we didn't realise it was going to be different, so I think that's where the problem was…"* Rebecca, Technologist, Red-Femteam Audiolizer.
Project_management_tasks	The activities (tasks) involved in the organisation and management of resources that are	*Written_documentation_brief:* In the early meetings between Amber and Liquorice, Daniel mentioned that actors from Blue were not included. He was confused about the orchestrator of the original idea:

	necessary to complete a project.	"*… then… Blue were brought back into the interaction because it became clear that Liquorice weren't developing this alone. They were developing against a Blue requirement*." Daniel, Account Manager, Amber-Mediaworks. Daniel had not read the brief Blue had written.

10.1.9 Motivating & rewarding description (drivers)

Second order themes (level two codes)		First order concepts (level one codes)
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Insight_to_develop	Accurate and deep understanding of the background to the innovation; entrepreneurial conviction to persist and undertake it.	*Actor_perceptions_of_the_ARVR-Staging_demonstrations:* Early innovation ideas gave Red-Sport concepts to trial on the television set at the 2018 World Cup in Russia, ahead of the ARVR-Staging innovation implementation. Lloyd noted the studio demonstrations: "*…all of Red-Sport came, the Head…she loved it and she got it as soon as she saw it*." Lloyd, Account Manager, Moss, ARVR-Staging.
Social_incentives_power	This code captures how association with a powerful partner can bring benefits and broaden a customer base.	*Association_with_a_national_broadcaster:* Adam was motivated to be part of the collaboration creating the ARVR-Staging innovation. There was prestige for Flame, a start-up firm, having notable association with Red: *"… it's an opportunity for us, having the name Red-Sport as a customer*." Adam, Director of Technology, Flame, ARVR-Staging.
Brand_&_legacy	Raising firm and brand identity of television programmes via the innovation.	*Award_nomination:* James was motivated by the IBC Innovation Award entry. The marketing and communications team at Amber supported him: *"…that was a great achievement for us..."* James, Senior Technologist, Blue.
Social_incentives_actors	Actors were inspired by other actors that they identified with; partnerships were	*Actors_were_inspired_by_other_actors:* "*I met some amazing people at Red, some truly inspirational people… you feel you're with, 'your sort of people'*". Phoebe, CEO, Air-Audiolizer.

	treasured; altruism was important to many actors and winning events designed to accelerate innovation.	*"…having the opportunity to do something a little different from our day job… working with an external company to … try something that Red wouldn't normally do, was interesting."* Alistair, Developer, Red R&D, Metbot.
Personal_incentives_actors	Personal actor motivation includes: previous positive experiences of working together, encouragement from line management, enthusiasm, conviction and years dedicated towards the innovation.	*Personal_motivation_&_empowerment:* *"… I always…found that the virtual studio was very interesting and exciting."* Adam, Director of Technology, Flame, ARVR-Staging. "*…I've got a personal vested interest in seeing this through as a success…*" Peter, CTO, Blue-Mediaworks.
Personal_incentives_closeness	The atmosphere stimulated close relationships between individual actors.	*Positive_feedback:* Regarding the Development Studio event, Stanley discussed the conclusion of the event, he was given insight that Sunteam may have won: "*…we left that two-day event feeling really good and at this point I know that we definitely didn't know whether we had funding or not, but I do remember someone from Red [judging panel] said to us in confidence, 'oh yeah, these guys might want to fast track your project,'….*" Stanley, Head of Applied Technology, President, CodingGame. The judge was so impressed by the concept of Metbot that she let her feelings known. The unintentional feedback motivated Stanley.
Personal_incentives_expectations	The atmosphere motivated the actors. Individual actors	*Trying_new_approaches_to_innovation:*

	expected positive outcomes from the innovation(s) to reflect well on the firms involved.	*"… try new innovative approaches, I think is superb. I'd love to see Blue take that path and start to appreciate the benefits of doing this…the credibility and the impact to the business…"* James, Senior Technologist, Blue-Mediaworks.
Social_incentives_activities	The motivation of actors to collaborate and organise early activities to progress innovation.	*Kick_off_and_planning_meetings:* "*…we spent a day… planning how it might work [CodingGame] and that's when we actually came up with the idea of the endless runner style game…*" Charlie, Developer, CodeClub, CodingGame. He spoke with enthusiasm when he recalled the meetings. "*…that was an excellent, excellent day…*" Jane, Designer, Red-Femteam Audiolizer. Note: kick off and planning meetings also featured in the management themes: goal setting & refining; coordinating and learning, knowledge creation & transfer.
Stage_gate	Stage_gate denotes the distinct phases separated by decision points in the project management process.	*Early_goal_setting:* "*…it's the reputation of being an innovative business… it enables us to address new markets and extend Blue's reach beyond MediaCityUK."* Peter, CTO, Blue-Mediaworks. Stephanie was motivated that Twitter could be used for more personalised weather reporting: *"It was much better then purely factual weather reporting*." Stephanie, Editor, Red-Weather Metbot.

10.1.10 Motivating & rewarding description (barriers)

Second order themes (level two codes)		First order concepts (level one codes)
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Firm_structure	Resource constraints included: using the existing user interface and existing project design; lack of a sales & marketing function; and lack of involvement – inducing role confusion.	*Constraints_from_using_the_existing_user_interface_(UI)_and_project_design:* Jack saw an opportunity to work with Red-Femteam at the Red-Innovation-Hub, Build and Development Studio events. He had already developed the Digital Maker Kit (DMK) with Techno (a tool which allowed children to make and showcase their own games. He believed that Red-Femteam had a fantastic idea which he could build upon. While Jack hoped that this route would save time; give a consistent user interface (UI); workflow and an existing set of features, it also meant many concessions to fit in with the code base. The DMK was built as a platform from which many game products could be created. Audiolizer was the first. The outcome showed Audiolizer was among more than twenty games, of which some supported principal brands in Red's portfolio of television programming output. Jack was proud of this overall achievement. Although they had agreed to use the existing DMK as a base to build Audiolizer from, Red-Femteam considered that using it compromised the idea(s) they had developed which had won the Build and Development Studio events. This was a significant demotivator for them. Red-Femteam's technologist, Rebecca, mentioned the project design constraints in terms of irritation: "*… we had to work within this underlying framework of the DMK… that was one of our biggest frustrations…*". Rebecca, Technologist, Red-Femteam Audiolizer. She also commented: "*…we had this user feedback, we know what we can do to make this better, but we're tied because of the system that we have to work within… we didn't realise when we… agreed to that, that would lead to so many restrictions…*".
Power/dependence	The personal ambitions of the involved actors were not realised; influential actors exerted power over	*Negotiating, administration_and_bureaucracy:*

	others to develop innovations to their vision. Power and dependence were exhibited within the broadcaster Red and the media and broadcasting sector. The resulting barriers and high workload caused tensions and frustration. Outdated perceptions of new technologies manifested in the sector.	Jack commented on the (DMK) platform he had created for Audiolizer with support from Air. His tone of voice expressed his exasperation: "*… it's a new participation model… it took many hours of sitting with legal teams and lawyers and people… to ensure they were rewriting some of the legal methods…there was quite a lot of bureaucracy*." Jack, Executive Producer, Red-Go-Digital. *Ambitions_were _not_realised:* Charlie was demotivated that CodingGame may never be created. To realise the full innovation development, additional funding was required. He commented on winning the Red-Innovation-Hub competition and then finding out that the budget would be split with Red-Femteam: "*… if you can imagine you'd won a competition…well essentially, you win but you might not be able to produce your innovation because of the new situation…*" Charlie, Developer, CodeClub, CodingGame. An issue resulted from the Red-Innovation-Hub events, which was never resolved for the actors at Red-Femteam; involved in the creation of Audiolizer. "*…because of some of the compromises, we were a little bit less invested in it, and we did want to see…I suppose it's always a dichotomy, you want to see it available for people, and you know, we knew that it wasn't necessarily going to be a fully polished experience as we wanted it to be*." Jane, Designer, Red-Femteam Audiolizer.
Expectations	There were high expectations. This impacted in different ways: Amongst involved actors regarding how a specific innovation might be promoted, incurring external legal implications.	*The_legalities_of_running_a_competition:* This was a significant barrier code for CodingGame, Charlotte was the driver behind the competition idea and referred to the legal issues: "*I'd had a desire that CodingGame would become the competition mechanic of the giveaway of RadioX's Big Weekend tickets…they'd do a mass giveaway and then they'd just run a competition for those last few tickets… but it just got too complicated…*" Charlotte, Executive Producer, Red-Go-Digital, CodingGame.

	To meet revenue targets. Lack of actor/team interest as the atmosphere was not conducive to brainstorming new ideas.	At the time, Red were under scrutiny, due to issues from historical competitions. The firm needed to ensure the competition rules were scrupulous (adhering to data protection laws) in addition to administration and management of the competition. Due to the firm's position in society the concern was not just about meeting legal regulations but setting an example through exemplary practise. Fairness was paramount. Sarah was also frustrated by the inclusion of the competition.
Reprioritisation	Reprioritisation of activities due to time consuming processes; delayed innovation launch dates and heavy workloads.	*Time_consuming_process:* As the initial launch date approached, Nathan noted Demonland was not finished: "*…if I was being brutally honest, it's just not good enough to capture the imagination.*" Nathan, Managing Director, Platinum-Demonland. The first user experience issues needed to be fixed before working on other areas. It was a time-consuming process.

10.1.11 Resourcing description (drivers)

Second order themes (level two codes)		First order concepts (level one codes)
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Actor_resources	Actor resources were a significant consideration during innovation development. This included: identifying relevant actor resources; commitment amongst the innovation team actors; social ambassadors and music consultation advice.	*Actors_identified_relevant_resources_and_involved_the_actors_that_possessed_them* Actors at Blue identified that Amber was a key firm necessary to the innovation development. Daniel commented on his involvement with the project and the resources that were involved: "*…it was pretty clear cut from my perspective – it was limited to the level of support that we could provide*." Daniel, Account Manager, Amber-Mediaworks. Mediaworks communicated with a set of application programme interfaces (APIs) or software development kits (SDKs) to and from Amber's equipment which was based in Blue's studios. Alistair noted how resources were identified in Metbot's development: "*…the actual language processing… we had help from a university…That was because it's quite a complex subject and we didn't have the skills necessarily to achieve something that would match a large proportion of people's requests to the Metbot."* Alistair, Developer, Red R&D, Metbot.
Combining_and_changing_resources	Resources were combined, changed and on occasion exploited.	*Resources_were_combined:* "*…we reformed the team that we'd worked with, and I brought in new people … who'd volunteered, …that was when we started to put together the pitch...*" Charlie, Developer, CodeClub, CodingGame.

		"…we looked at the technology and better systems and that's how we came up with Moss and Flame, that's the equation of our solution right now." Aiden, VFX Supervisor, Blue, ARVR-Staging.
Empowerment	Resource power; actor knowledge resources used when creating the innovations; financial resources and managing resources well.	*Knowledge_resources:* Knowledge resources were important to Demonland's development. Sapphire supported Platinum with the game's soft launch. Information metrics were gathered, which were extrapolated to the global launch of the game. This included retention figures; for the first day after soft launch, day seven and so on (average revenue per daily active user (ARPDAU)). The app store(s) could then decide if they wanted to make the game available or not. Tyler said, it would help: *"…gauge appeal… this kernel of information will help them to feature it…If you get a feature from Apple or Google, for a free game that will result in a large number of downloads…"* Tyler, Executive Producer, Sapphire-Demonland. With respect to Audiolizer, Morph had latent knowledge and award-winning experience from an innovation that had won a BAFTA: *"…as part of the interactive team…we made these online Flash tools for kids to create their characters and animations and submit their ideas…that was really, really successful….*" Greg, Producer, Morph-Audiolizer.
Brand_and_legacy	Innovation endorsement from a significant brand and innovation legacy.	*Brand_endorsement:* Although RadioX were unable to fund CodingGame, they did commit to endorsing it with support from the DJs. James referred to the Mediaworks award nomination in terms of an endorsement: *"…it's given us a great deal of credibility…people see us in a different light, as soon as I demo Mediaworks to them. It's almost priceless…it's great*." James, Senior Technologist, Blue-Mediaworks.

10.1.12 Resourcing description (barriers)

Second order themes (level two codes)		First order concepts (level one codes)
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Constraints	Resources needs changed during innovation development. This resulted in difficulties and frustrations for actors to overcome.	*Resource_needs_changed:* David mentioned that the early ideas for CodingGame involved creating many small games: *"… when we got to the point of producing it, the sort of money pot available wasn't sufficiently large to create lots of discrete individual challenges…"* David, Developer, CodeClub, CodingGame. *"…early adopters tend to be extremely demanding…"* Matthew, CEO, Liquorice-Mediaworks.
Limitations	Lack of physical resources; limitations due to technical considerations or choice of originating software tools and lack of time to complete processes.	*Resource_limitations* *"We had to wind back on some of our ambitions, which always hurts…I ended up doing a huge amount of the work myself… we commissioned Morph to do some of the build work for us, but then when it came to it, putting a kit together and constructing it and getting it to work [on Red's website], I ended up having to roll my sleeves up and get stuck in…"* Jack, Executive Producer, Red-Go-Digital Audiolizer. Due to the lack of resources, Jack drew on his own abilities and effort to see the innovation develop in the way that he aspired.
Actor_resources	Lack of team continuity throughout the innovation development; poor project planning resulting in high development costs & long lead times and team	*Team_continuity:* The shape of the team changed when Stanley announced that he was leaving President for a new role in the USA. He mentioned that he remembered updating Patrick about it: *"…he took it in his stride. When he got off the phone with me, he may have been swearing, I don't know (laughs…)."* Stanley, Head of Applied Technology, President-Metbot. Stanley, Alistair and Brooke were an incredibly tight team, fully cognisant of the fact that Stanley was going to work on the project for a relatively short time.

	exhaustion due to a heavy workload.	
Brand_and_legacy	Strong brand loyalties to other games resulted in barriers to access markets; potential players and limitations to promote an innovation.	*Promoting_the_innovation:* "*…it really had to operate at true scale but could it?*". Todd, Developer, President-Metbot. The implication was that a normal marketing campaign would include many channels (radio, television, online) and Metbot would be promoted appropriately on each of them. However, Metbot could only ever be promoted in a restricted way. At the time, Twitter imposed a limit on the number tweets an individual account could send out in one day. The rationale behind this was to stop nuisance bots churning out tweets and breaking the internet. If more than 6000 people tweeted Metbot, it would reply 6000 times, and would not function for the rest of the day. Due to the constraints the Red-Weather team felt uneasy about promoting it.

10.1.13 Goal setting & refining description (drivers)

Second order themes (level two codes)		First order concepts (level one codes)
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Goal_alignment	The process of aligning individual employee goals with the larger overarching goals of the organisation and innovation network for innovation development. This helps to ensure that each employee has visibility into the direction of the business and how their specific role contributes to that direction.	*Early_goal_setting:* "*… go back probably two years ago, we had to decide what was going into the pipeline for the next game.*" Nathan, Managing Director, Platinum-Demonland. Nathan was concerned to spread risk. Rather than focusing on genres where the firm had triumphed, he explored other genres. The base, battle and build games had experienced longevity and success in the sector: "*…it was what interested everybody in the office*." Nathan, Managing Director, Platinum-Demonland. With employee buy-in Nathan aligned company and employee goals. "*…there's a certain amount of capital that you can recoup through the rate-card and through Red…*". Robin, Head of 360 Production, Blue, ARVR-Staging. Over the four-year period, this would equate to around eighty percent of the capital. Robin was aware that he needed: "*…to find that 20% shortfall*." His ambition was to deliver much more than the 20% over the four-year period.
Goal_setting	Goal setting included early innovation ideas, actor expectations and linking goals to brand and revenues.	*Early_innovation_ideas:* Robin suggested that broadcast commissioners no longer instruct television producers, for a new television series, from a conversation. The current commissioning process is challenging. The intention was that the ARVR-Staging innovation could be used to illustrate new television programme ideas cost effectively creating a new revenue stream for Blue.

	Goals were made more specific by: quantification (making goals measurable) and enumeration (defining tasks that must be completed to achieve the goal).	"…*offering cheaper solutions into the studios…(to) help them win a series…they will then hopefully bring it back to Blue and generate more revenue*." Robin, Head of 360 Production, Blue, ARVR-Staging. Regarding Metbot, Stephanie said that she was keen to instigate many high-quality early innovation ideas. Therefore, goal setting started at the early briefing stage: "*The independent sector was invited into pitch and get involved, as well as Red divisions. We identified what was needed…wrote a broad brief in conjunction with Red-Innovation-Hub. We wanted lots of companies to pitch*." Stephanie, Editor, Red-Weather, Metbot.
Project_management_tasks	The way an actor organises and manages resources that are necessary to complete a project. A project is a piece of work which is not a process or an operation; it includes goals and has a start and end date.	*Agenda_setting_and_project_management_tools:* Project management was one of the most significant goal setting driver codes. It featured in all six innovations (incremental and radical) in all three innovation phases. All the innovations used agenda setting. The resulting activities were facilitated with the use of Agile project management principles. If there was no assigned project manager, an orchestrator actor such as the Managing Director of the focal firm, in the case of Demonland, assumed responsibility. Agile encourages adaptive planning, evolutionary development, early delivery and continuous improvement. It also promotes fast and flexible response to change. All six innovations were created, and used goal setting, using Agile principles. This connects with the coordinating management activity.
Collaboration	Actors are active members of a group, working together to achieve a common goal. Being an active member includes participation in	*Successful_collaboration:* Charlotte sought support from actors at RadioX to promote CodingGame on air. Therefore, the DJs had essential roles in the initial goal setting process. "*… they had to like it, they had to believe in it, they had to be able to play it, to be able to talk about it*." Charlotte, Executive Producer, Red-Go-Digital, CodingGame. Charlotte's awareness of what was required to secure buy in from RadioX was significant. She knew that the DJs must be involved from the outset, during the initial goal setting meeting(s).

	conversations, meetings and group activity.	A different aspect of collaboration is demonstrated for Audiolizer. Ideas and goals were brought together, and the innovation was accelerated. "…*Audiolizer itself is a combination of two ideas. One was ours. We saw an opportunity to team up with the Audiolizer team. We were going to do a visualiser, they were doing a visualiser, so we teamed it up…we accelerated the idea by joining the two together*." Jack, Executive Producer, Red-Go-Digital Audiolizer.

10.1.14 Goal setting & refining description (barriers)

Second order themes (level two codes)		First order concepts (level one codes)
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Expectations	Actor expectations were numerous including: risk taking, setting innovation goals and a new process.	*Risk_taking:* Nathan had a desire to spread the risk of his business; specialising in the 'bubble bursting' genre where Platinum were market leaders was perceived to be precarious. "*…if that genre… (is) no longer the flavour of the day, you've got no business model*." Nathan, Managing Director, Platinum-Demonland. "*… to inspire…different approaches to software development, in an area that really, in weather, is a little bit bland…*" Todd, Developer, President. The reference highlights that there were few risks taken in Red-Weather up to this point. Metbot was an adventurous departure.
Project_management	Numerous project management challenges included: broad goals, unrealistic deadlines, scope creep, insufficient team skills, improper communication, geographically dispersed teams, risk management and issues within the innovation network.	*Challenges:* "*…we've got to be careful with The Match. It's a traditional brand and we can't be seen to put the public off. We've got to stay fairly traditional, but at the same time looking fresh*." Julian, Creative Director, Red-Sport, ARVR-Staging. A significant challenge to overcome in the development of Audiolizer related to personal data: "*… the largest actual challenge is data protection and the way that Red has to be restricted on how they handle personal data…"* Phoebe, CEO, Air-Audiolizer.
Power/dependence	An atmosphere of power contributed to inefficient communication and lack of	*Inefficient_communication:*

	power distribution in the innovation network.	Red-Go-Digital and Red-Femteam did not all have the same level of understanding or knowledge at the start of the Audiolizer build. Therefore, it was unlikely goals could be met, having started with different levels of knowledge. "*I think that we could have worked much better if we'd all been on the same page from the start*." Rebecca, Technologist, Red-Femteam Audiolizer.
Resource_requirements	Financial resource requirements were high and a need to build on knowledge to commercialise games.	*Financial_investment:* The financial outlay for the ARVR-Staging innovation was £600,000, a significant investment: "…*it's a big chunk of money that isn't going to return its investment in four years*…" Robin, Head of 360 Production, Blue, ARVR-Staging. His aspiration was to develop the wider platform. He had an instinct that there would be a: "…*general push from the market*…" to use VR.

10.1.15 Consolidating description (drivers)

Second order themes (level two codes)		First order concepts (level one codes)
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Trust	Actors that work in an atmosphere of trust can collaborate productively and things get done faster. Communication works best when people are candid, inclusive and cooperative. Trust is contagious. Communication helps break down departmental silos and creates interdependency between people thus, building strong workplace alliances. It improves relationships and creates an effective atmosphere that further promotes teamwork and consensus.	*Fostering_interpersonal_trust:* This code appeared in all six innovations, highlighting the significance of fostering trust between actors. Charlotte already had a good relationship with RadioX, having worked there for many years in a senior editorial role. She had strong ties with the editor of RadioX, Piers. Sarah noted how these established relationships were critical to the project. "*…the reason we were able to take a brand which we didn't have much to do with…RadioX, and say we're going to build content around this, was that Charlotte was able to establish [the ground rules for the innovation] with Piers and say 'these guys are interested in using your brand to do this Red-Go-Digital thing, what do you think*?'." Sarah, Red-Children's Producer, CodingGame. Due to the trust Charlotte already had with the RadioX team, they listened to her from the outset. There was mutual understanding. "*…we're in partnership with good faith*". Matthew, CEO, Liquorice. The trust developed to support the wider business relationship.

10.1.16 Consolidating description (barriers)

Second order themes (level two codes)		First order concepts (level one codes)
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Low_trust	Innovation networks experiencing low trust between actors exhibited weak management, bureaucracy and destructive politics. In these firms', protocols, titles, deferential behaviour, status issues, jealousy, office politics and egos interfered with communicating important information. In the innovation networks experiencing low trust, actors' neither enjoyed their work nor worked well. Suspicion and mismanagement poison trust, consequently the atmosphere is not conducive to collaboration and support to get things done.	*Low_interpersonal_trust:* This theme concerns the weak interpersonal trust that existed in specific innovation networks during the innovation process. Regarding the quotation for Demonland's original music composition, Gavin commented that Nathan believed the initial quote for the music was expensive: *"…initially he thought that would be expensive. But it wasn't, and he knows that now..."* Gavin, Managing Director, Gold-Demonland. To begin with there was weak interpersonal trust between the two company directors. Lack of experience and expertise fuelled Nathan's concern. Gavin pointed out that it was perception that caused the biggest problem. There were frustrations in the innovation network collaborating on Audiolizer, Red-Femteam were polarised from the actors at Morph in addition to Jack and Andy. Jane commented: *"I think that we were a little bit exasperated… because of some of the compromises we were… less invested in it."* Jane, Designer, Red-Femteam Audiolizer.

10.1.17 Coordinating description (drivers)

Second order themes (level two codes)		**First order concepts (level one codes)**
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Project management_actors	Organising and managing resources required to complete a project. The actors that carry out this work are skilled in project management. A project is a piece of work which is not a process or an operation; including goals, a start and end date plus phases, modules and plans. A kick-off meeting using the Agile approach has specific meaning. It is used when a team is starting a major, new, initiative, when a significant number of team members are new. Agenda items include: introductions, scope & deliverables, core & desired capabilities, collaboration and communications, risks, wrap up.	*Project_management_implementation_(skills, phases, modules, planning and kick off meetings):* Adam discussed the phases of project management work involved in the ARVR-Staging innovation. *"… first there was a time of around a month for initial planning, emails…we discussed the greenscreen, hardware, paint, studios, tracking solution, size of the studio, different options, different colours…"* Adam, Director of Technology, Flame, ARVR-Staging. Directly after this the content creation started. Sunteam, the development team producing Metbot planned a series of discrete modules that could be created by individual actors. Brooke described how the work was managed: *"…we split it up between, beyond Stanley taking care of most of the architecture of it, we then split up the different modules."* Brooke, Developer, Red R&D, Metbot.
Project_management_tasks	The activities (tasks) involved in the organisation and management of resources that	*Planning_and_engagement:*

	are necessary to complete a project.	Demonland was commissioned by Sapphire, who had knowledge of monetising and commercialising games. Tyler commented on the metrics gathered from Demonland's soft launch: "…*you start learning about your audiences and what they want*." Tyler, Executive Producer, Sapphire-Demonland. Tyler had years of industry knowledge about target audience(s) and their specific gaming needs. Platinum gained new insights from Tyler that would assist with the formal launch of Demonland and accelerate likely sales. Daniel referred to working through the project management phases quickly: "*… that early engagement we (Amber) had with Liquorice and Blue in 2014… through to September 2015*…" Daniel, Account Manager, Amber-Mediaworks. There were discussions about planning and engagement in 2014, Daniel discussed the phases: "…*support… certified… testing and then registered for the Innovation Award*…" Daniel, Account Manager, Amber-Mediaworks. The process was fast.
Roles	Roles are the positions actors in the innovation network assume or are assigned. The responsibilities are the specific tasks or duties that actors carry out in relation to their role. Hub firms orchestrate network activities. Orchestrator roles were observed in all the innovations (both innovation types); carefully organising and planning innovation development.	*Orchestrator_role:* Sarah said that she saw herself as the: "…*point in the middle bringing all the various parties together*…" Sarah, Red-Children's Producer, CodingGame. She was an effective orchestrator. Jack referred to his orchestrator role for Audiolizer: *"… in terms of driving it… it was mainly me..."* Jack, Executive Producer, Red-Go-Digital Audiolizer.

Tools	The resources required for project management. Agile software development refers to a group of software development methodologies based on iterative development. This is where requirements and solutions evolve through collaboration in the innovation network.	*Project_management_tools_(including_Agile):* The use of Agile project management tools was used consistently in all the studied innovations. Sarah discussed how Pine worked with 'DesignTeam', once the funding was secured, using the Agile approach for CodingGame's development: "…*they basically developed the game with their coders, developers, put a designer on it to develop the whole look and feel of it and they bounced that back to us, we would give them rounds of feedback on that, it was fairly agile*…" Sarah, Red-Children's Producer, CodingGame. Agile principles ensured that CodingGame was developed flexibly. Agile and Stage-gate principles helped to maintain Mediaworks' project management schedule. Peter discussed the approach that was used to build Mediaworks: "…*in terms of what we think is successful, it's all sorts of agile development, putting in functionality and running test scripts*." Peter, CTO, Blue-Mediaworks.

10.1.18 Coordinating description (barriers)

Second order themes (level two codes)		**First order concepts (level one codes)**
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Project_management_tasks	The activities (tasks) involved in the organisation and management of resources that are necessary to complete a project.	*Heavy_workload:* Red-Sport's workload was heavy. Discussions about the innovation occurred in a World Cup year; creating a barrier. Red-Sport covered the event, in 2018, in Russia: "*…a lot of technicians are very busy preparing for that…*" Lloyd, Account Manager, Moss, ARVR-Staging. After the World Cup there were two weeks before the new football season commenced. Red-Sport's flagship programme, 'The Match' is broadcast throughout the season. This means that Red-Sport had very little time outside day to day television programming commitments to factor in the R&D requirements. Jack noted his heavy workload, contributing to the completion of Audiolizer: *"I did put a lot of time in…. As the exec… I was doing a lot of the day work and the sign offs and the legals...*" Jack, Executive Producer, Red-Go-Digital Audiolizer.
Reprioritisation	Innovation development activities that contributed to slow progress and provoked actors to reprioritise. This also included roles which were important resources in the innovation development and were	*Slow_sign_off:* The executive producer was going on maternity leave and was keen to ensure the project plan was signed off before she left. The speed of sign off was slow: "*…I remember saying, I want to get this to a point where you're (maternity leave cover) not coming in, having to still sort out, be talking to Patrick about the logistics of actually getting this rolling…*" Charlotte, Executive Producer, Red-Go-Digital, CodingGame. The outcome of the Red-Innovation-Hub process was slow from Stanley's point of view:

	reprioritised elsewhere; poorly defined; or yet to be defined resulting, on occasion, in actor confusion.	"*…we were kind of thinking, is this opportunity going to land? When are they going to let us know*?". Stanley, Head of Applied Technology, President-Metbot. He had to persuade his finance director that the innovation would be signed off, but he remembered, "*…people doubting me,"* within President. *Role_reprioritisation:* Aiden described the process of defining new roles for the ARVR-Staging solution: "*…this is all quite new tech so it's connecting quite a lot of dots…one thing that is quite apparent is, some jobs don't even have a definition yet*." Aiden, VFX Supervisor, Blue, ARVR-Staging. It was difficult to define the new roles. Role confusion: "*…most of our role was sort of just feeding back on the project as it was coming through*." "*…we'd assumed we'd be more involved with it…*" Jane, Designer, Red-Femteam Audiolizer.
Constraints_resources	Resource constraints to innovation development including sales and marketing effort required, widespread geographical location and resource requirements.	*Sales_and_Marketing_effort_required:* "…it's not a trivial exercise; you need thousands of hours and discussions with customers…" Matthew, CEO, Liquorice-Mediaworks.

10.1.19 Controlling description (drivers)

Second order themes (level two codes)		**First order concepts (level one codes)**
Driver	**Description/ key elements**	**Illustrative quotations from the interviews**
Roles	Roles are the positions actors in the innovation network assume or are assigned. The responsibilities are the specific tasks or duties that actors carry out in relation to their role. This code presents the importance of the orchestrator role (it also emerged in coordinating).	*Orchestrator_role:* *"…I'm a connector…I have a technical understanding…I find the right people and put them in touch with each other…my role is similar to that of a director…"* Robin, Head of 360 Production, Blue, ARVR-Staging. Blue were the orchestrator firm in the development of Mediaworks: "*…we brought the network together for our innovation…we funded the development…*" Peter, CTO, Blue, Mediaworks.
Power/dependence	During the innovation cycle it was important that specific rules and roles were established as specific actor skills were required in different phases. Roles within the innovation network were established early in the development cycle to ensure that actors understand what is expected of them, and how their role	*Rules_and_roles_were_established:* Sarah expressed how the DesignTeam was originally created and rules and roles were established for CodingGame in the first innovation phase: "*…my manager at the time had said 'can we put together a team for this? Why don't you join up with CodeClub and do that?' So that's essentially how we ended up, I think two or three of us from the Red-Children's department and two or three from CodeClub, going to that initial day and scoping up ideas and coming up with what would then become CodingGame. Which was essentially how do we take an event (RadioX Summer event) and do some kind of experience around that, that involves computer science but does it in a way that's more engaging than a tutorial video or a workshop or something like that...*" Sarah, Red-Children's Producer, CodingGame.

	fits into the wider innovation development. This code also included actor commitment noted in both formal and informal roles and merging sectors required for innovation development.	Intra-organisational collaboration between actors in Audiolizer's development was noted for Air and Red-Femteam. A contributing factor to creating the rules and roles for collaborating in both groups was the shared culture. For Air this was expressed directly by the CEO. Phoebe noted that rules and roles were established: "…*everybody was full time on it; everyone worked their hearts out on it*…" Phoebe, CEO, Air, Audiolizer.
Commitment	Controlling management activities guide innovation development. Control was tailored to: plans, the involved actors and the needs for efficiency and effectiveness. An open approach is the ability of any actor in the innovation network to get access to and share information and resources. Teamwork and collaboration denote a mix of interpersonal, problem solving, and communication skills required from actors in the innovation network to work towards common goals.	*Teamwork_and_collaboration:* The DJs had a competition amongst themselves, to try to achieve the best score possible for their on-screen/ game character DJ. One DJ enjoyed playing it so much; he was late for his radio show. "…*he was too busy playing the game, he wouldn't put it down and we thought, 'this could work, this could be a fun game*…'. Charlie, Developer, CodeClub, CodingGame. "…*it remains one of the most efficient development teams I've ever been part of...*" Brooke, Developer, Red R&D, Metbot.

10.1.20 Controlling description (barriers)

Second order themes (level two codes)		First order concepts (level one codes)
Barrier	**Description/ key elements**	**Illustrative quotations from the interviews**
Power/dependence	On occasion the atmosphere prevented ease of the innovation development and controlling factors prevailed including: conflicting innovation goals, accountability, lack of power delegation, constraints of the established user interface (UI) design, start-up firm (financial stability) and limited experience (in some areas) as a new firm.	*Conflicting_innovation_goals:* Tyler noted the complicated tutorial dialogue in the second phase of Demonland's development. The enthusiasm of the Platinum team crept into the tutorial dialogue, resulting in complex and confusing gameplay for an international audience. Feedback from testing illustrated this: "*…when you put it in front of an American player… the recordings of them playing it… they're going, 'this is good' and then they'll read a big spiel of quite funny dialogue, but not get the meaning initially…*". Tyler, Executive Producer, Sapphire. Therefore, lines of dialogue used in the game needed to be reduced and refined. Tyler's role was to encourage the Platinum developers to check that the tutorial was meaningful before adding more features. He needed to ensure that the developers spent their time developing functionality in the correct areas of the game. Jack commented on the development of Audiolizer: *"So, typically, the people who had the idea would make the idea, but in this case, I don't think Rebecca and the team would have had time … to do it because it was an internal team…"* Jack, Executive Producer, Red-Go-Digital Audiolizer. Jack was part of the Red-Go-Digital judging panel at the Build and Development Studio events. He saw Red-Femteam's pitch which aligned well with the Digital Maker Kits (DMK) he had already created. He saw the opportunity to collaborate with Red-Femteam for their ideas. However, Jack and Andy exploited the chance to develop their existing innovation idea at the expense of Red-Femteam's. Jack used the fact that Red-Femteam were an internal team as an excuse to progress his own innovation. Jack knew the line managers of the actors in Red-Femteam and their existing work commitments. In previous scenarios, winners were given time away from their day-to-day roles to

		progress their innovation ideas, this happened in Metbot and CodingGame. Jack used his influence to guide the project for his own means.
Roles	Actors in an innovation network may adopt informal roles that depend more on their character than: specific knowledge, position or because they have not been clearly defined and the actors assume the role. These roles often resulted in tension between the involved actors. Additional tensions arose between actors resulting from lack of resources.	*Tensions:* Due to his governance role, Patrick wanted to ensure that there was at least one actor representing each firm, in the innovation network creating CodingGame. The intention was to capture any issues as they arose. He agreed a protocol for the weekly call. There were tensions between himself and actors at Pine: "*…Sarah represented Pine in the meetings.*" Patrick, Project Manager, Red-Innovation-Hub, CodingGame. Sarah was close enough to the project to be aware of the fine detail. However, someone from Pine should have attended; these changes contravened the project governance and caused Patrick concern. "*…with him being one of the most highly paid presenters at the moment, he's got a lot of power… it must be quite daunting… to work on a green screen*." Lloyd, Account Manager, Amber, ARVR-Staging. The lead presenter was not a trained actor. He was a footballer with personality and knowledge to comment on football clips, including advice from popular football pundits. Working on the ARVR-Staging innovation would be very different to a physical television set, requiring acting skills to interact with graphics information and a set design that can only been seen by the presenter on a television screen. The lead presenter needed to be persuaded of the benefits of the ARVR-Staging innovation. He thought the innovation was a great idea but would need support to use it (and act with it) well.
Expectations_actors	Expectations from specific actors including: misaligned decision making, risks, lack of compliance to rules and	*Misaligned_decision_making:* Flame had given Moss a version of their Reality software which they used to demonstrate their Startracker camera tracking solution:

	roles, an overprotective nature towards actors in the innovation network and taking responsibility for team decision making.	"…*they gave us their system… we had it in our showroom… when Robin and Austin came… I had it working for them and they could see it*…" Lloyd, Account Manager, Moss, ARVR-Staging. Flame had offered their Reality software to Moss for free, but Magnus asked Flame to buy Startracker. Lloyd was concerned that despite the close working relationship Magnus did not appreciate that offering Reality for free could be advantageous: "*Magus sold them a tracking system… when I found out I was very upset, I was confused that he didn't give it to them*…" Lloyd, Account Manager, Moss, ARVR-Staging. The rapport between the firms was undermined, this impacted on day-to-day relationships. There was misaligned decision making between Red-Go-Digital and Air regarding launching Audiolizer on a bespoke website rather than Red's main website. "*I wouldn't say the wrong decision made for the right reasons, but kind of in that realm…I think if things had gone slightly differently it could have been one of those decisions that was lauded around Red…and the industry… but it just made everything harder and unfortunately it slowed us down*…" Phoebe, CEO, Air. This demonstrates Phoebe's frustrations. If Red and Air had agreed which website Audiolizer was launched from at the outset, development would have been smoother.

10.2 Appendix 2: Interview protocol guide

Date: xx/xx/xx

An invitation to participate in a research study on innovation networks within MCD&MS.

Thank you for your consideration and support to participate in the study. Your decision to participate is greatly appreciated.

The study seeks to understand how innovations evolve in the innovation networks found within MCD&MS. It is anticipated that these networks are helping to move the industry from its current base to a thriving and growing industry.

Prompt questions	Response
1. *Why does this innovation exist? What is its purpose?*	
2. Focus on one innovation: *a) Brief history and background within the network (supplier, manufacturer, distributor, customer? Business setting – industry, company / corporation, business unit department, individual?)* b) *How, when and where, were the relationships established?* *c) Which other businesses are involved in creating the innovation? Why? How? What are the relationships between the businesses?* *d) What are the links between the firms in relation to resources?* *e) Which firms are responsible for delivering particular phases of activity to complete the innovation?*	

f) How purposefully did you seek these relationships? *g) Are you using existing connections or seeking new connections to progress the innovation?* *h) What is the purpose of the innovation?* *i) Which company goals and objectives does the innovation relate to?* *j) Depending on what development phase the innovation is at… what was achieved in the past 6 months, what will it achieve in the next 6 months? And the next 12 months?* *k) Who do you expect to be involved in the innovation in the next 6 months? Next 12 months?* l) *What are your hopes and aspirations for the innovation? Future gains opportunities? Value creation?*	
3. How is the innovation managed? *Why?* *What is the structure?*	
4. Does the design of the network reflect how it achieves its goals?	
5. How does the network innovate?	
6. Are there any other important people or organisations that are considered important?	
7. Which individuals influence or affect the management of the innovation?	
8. What problems do you encounter? *9. Can you tell me more?*	

10. What happened then? *11. Why do you think it occurred?* *12. How did it occur?* *13. When did it occur?*	

10.3 Appendix 3: Summary of Interviews Conducted

No.	Innovation	Company Name (Anonymised)	Interview Date	Interviewee Position	Interview Type	Interview Location	Existing relationship with the researcher	Documentation collected	Observations carried out
1	Mediaworks	Liquorice	29.7.16	CEO	Skype		No	Yes	No
2	Mediaworks	Blue	13.7.16	CTO	Face to face	Manchester	Yes	Yes	Yes
3	Mediaworks	Blue	15.8.16	Senior Technologist	Face to face	Manchester	No	Yes	Yes
4	Mediaworks	Amber	2.8.16	Sales Director	Skype		No	Yes	No
5	Mediaworks	Freelance	14.9.16	Freelance Cameraman	Face to face	Manchester	Yes	No	Yes
6	Demonland	Platinum	29.11.16	CEO	Face to face	Manchester	No	Yes	Yes
7	Demonland	Gold	1.11.16	CEO	Face to face	Manchester	No	Yes	Yes
8	Demonland	Sapphire	23.11.16	Senior Executive	Face to face	Manchester	No	Yes	Yes
9	CodingGame	Red-Go-Digital	22.11.16	Executive Producer	Skype		No	Yes	No
10	CodingGame	CodeClub	10.11.16	Lead Developer	Skype		No	No	No
11	CodingGame	CodeClub	25.11.16	Developer	Skype		No	No	No
12	CodingGame	Red-Innovation-Hub	5.12.16	Project Manager	Telephone		No	Yes	No
13	CodingGame	Red-Children's	9.12.16	Producer	Telephone		No	No	No
14	CodingGame	Pine	10.12.16	CEO	Face to face	Manchester	No	Yes	Yes
15	Metbot	President/Freelance	22.11.16	Developer	Face to face	Manchester	No	No	Yes

16	Metbot	Red R&D	6.12.16	R&D Engineer	Telephone		No	Yes	No
17	Metbot	Red R&D	5.12.16	Developer	Telephone		No	Yes	No
18	Metbot	President	30.11.16	Head of Applied Technology	Skype		No	No	No
19	Metbot	Scarlett	13.1.17	Developer	Telephone		No	Yes	No
20	Metbot	Red-Innovation-Hub	5.12.16	Project Manager	Telephone		No	Yes	No
21	Metbot	Red-News & Weather	7.12.18	Editor	Skype		No	No	No
22	Audiolizer	Red-Femteam	8.11.16	Technologist	Face to face	Manchester	No	Yes	Yes
23	Audiolizer	Red-Femteam	18.11.16	Designer	Skype		No	Yes	No
24	Audiolizer	Red-Go-Digital	16.11.16	Executive Producer	Telephone		No	Yes	No
25	Audiolizer	Red-Go-Digital	23.11.16	Project Manager	Face to face	Manchester	No	No	Yes
26	Audiolizer	Morph	30.11.18	Producer	Skype		No	No	No
27	Audiolizer	Air	20.12.18	CEO	Skype		No	Yes	No
28	ARVR-Staging	Flame	15.1.18	Director of Technology	Skype		No	Yes	No
29	ARVR-Staging	Moss	20.1.18	Account Manager	Skype		No	Yes	No
30	ARVR-Staging	Moss	17.1.18	Managing Director	Telephone		No	No	No
31	ARVR-Staging	Red-Sport	29.1.18	Creative Director	Face to face	Manchester	No	No	Yes
32	ARVR-Staging	Blue	30.1.18	VFX Supervisor	Face to face	Manchester	No	Yes	Yes
33	ARVR-Staging	Blue	10.1.18	Head of Studios	Face to face	Manchester	Yes	Yes	Yes
34	ARVR-Staging	Blue	12.1.18	Head of 360 Production	Face to face	Manchester	No	Yes	Yes

10.4 Appendix 4: Glossary

Agile software development	An approach to software development under which requirements and solutions evolve through the collaborative effort of self-organising cross-functional teams and their customers or end users. Using Agile, requirements and solutions evolved from the collaborative effort of network actors. Agile encourages adaptive planning, evolutionary development, early delivery and continuous improvement. It also promotes fast and flexible response to change. Important Agile terms used include: Scrum, Sprint and Kick-off. • The collaborative *Agile development* framework, that breaks large processes down into small items to streamline efficiency, is known as Scrum. • A Sprint (or iteration) is the basic unit of development in Scrum. The sprint is restricted to a specific duration. The duration is fixed in advance for each sprint and is normally between one week and one month, with two weeks being the most common. The main agenda items of the kick-off meeting include: • Project Vision: why does the project exist? • Success Criteria: How will you know when the project is complete, and the vision is realised? • Project Scope: What is in scope and out of scope for this project? • Stakeholders: Who is involved and/or affected by this project? • Project Risks: What are the top risks of this project? • Responsibilities: Who is doing what?

Augmented Reality (AR)	A live direct or indirect view of a physical, real-world environment whose elements are "augmented" by computer-generated perceptual information, ideally across multiple sensory modalities, including visual, auditory, haptic, somatosensory, and olfactory. The overlaid sensory information can be constructive or destructive and is spatially registered with the physical world such that it is perceived as an immersive aspect of the real environment. In this way, AR alters one’s current perception of a real-world environment, whereas VR replaces the real-world environment with a simulated one.
Automated workflow	The design, execution, and automation of processes. This is based on workflow rules where human tasks, data or files are routed between people or systems based on pre-defined business rules.
BAFTA	The British Academy Film Awards (BAFTA) are presented in an annual award show hosted by the British Academy of Film and Television Arts to honour the best British and international contributions to film.
BIMA	The longest standing and most prestigious digital awards in the UK. They honour organisations as one of an elite few, moving the digital economy forward.
Chroma key	A special effects / post-production technique for compositing (layering) two images or video streams together based on color hues (chroma range). The technique has been used heavily in many fields to remove a background from the subject of a photo or video – particularly the newscasting, motion picture and videogame industries. A colour range in the foreground footage is made transparent, allowing separately filmed background footage or a static image to be inserted into the scene. The chroma keying technique is commonly used in video production and post-production. This technique is also referred to as colour keying, colour-separation overlay, or by various terms for

	specific colour-related variants such as green screen, and blue screen – chroma keying can be done with backgrounds of any colour that are uniform and distinct. Green and blue backgrounds are more commonly used because they differ most distinctly in hue from most human skin colours. No part of the subject being filmed or photographed may duplicate the colour used as the backing.
Content delivery network	A geographically distributed group of servers which work together to provide fast delivery of file-based content. The aim is to deliver content quickly, cost-effectively and securely.
Encoding	Using, or mounting, optical encoders or sensors on manual or automated equipment to very accurately measure and record their motion. The measurements can be saved for use in post-production or output in real-time for on set pre-visualisation or virtual set use.
Green screen	Many people use the terms chromakeying and green screen interchangeably, but the principle that powers chrominance keying is not limited to the green parts of the spectrum. In the visual effects world of Hollywood, blue screens are far more common than green. In fact, you can key out any colour; red, yellow, purple or pink, blue and green. Why is green chosen for television and video? The biggest factor is contrast. In order to isolate one area from the rest, the background colour must be distinctly different. Bright green beats blue partially because it is not a colour commonly worn by actors and presenters. Any clothing that matches the background too closely will also key out, punching a hole in your subject’s body, or making him invisible altogether.

HTML5	HTML5 (hypertext mark-up language) is used for structuring and presenting content on the World Wide Web. It is the fifth and current major version of the HTML standard.
Ingest	The process of capturing, transferring, and storing video files in an organised manner for simple identification and location in the future.
IP network	An IP network is a communication network which uses Internet Protocol (IP) to send and receive messages between one or more computers.
Keying	Keying is the process of isolating a single color or brightness value in an electronic image and using software to make that value transparent, allowing another image to show through the affected areas. Luminance keying, or lumakeying, is the process of keying out a brightness value or range, like black or white.
Post-production	Part of the process of filmmaking, video production, and photography. It includes all stages of production occurring after shooting or recording individual program segments. Traditional (analogue) post-production has mostly been replaced by video editing software that operates on a non-linear editing system (NLE).
Python	An interpreted high-level programming language for general-purpose programming.
Rushes	A film production term used to describe the raw footage from a day's filming/shooting.
Remote broadcast	Broadcasting carried out from a location away from a formal television studio.
Side-scrolling game	A game where the gameplay action is viewed from a side-view camera angle. Side-scrolling games have been succeeded by 3D games; however, they continue to be made, often for handheld devices or for digital-only releases.

Tapeless workflow	A television production operating process which does not use any magnetic re-coding media. Tapes are avoided. From initial camera recording, onto post-production and transmission, audio visual information is managed as a PC file.
Television format	The overall concept and branding of a copyrighted television program. The most common type of formats are those in the television genres of game shows and reality shows, many of which are remade in multiple markets with local contestants.
Unreal Engine	A games engine developed by Epic Games. It was first showcased in 1998. Its code is written in C++. It features a high degree of portability and is widely used by games developers today.
VFX	The process by which imagery is created or manipulated outside the context of a live action shot in film making. Visual effects involve in the integration of live-action footage and generated imagery to create environments which look realistic, but would be dangerous, expensive, impractical, time consuming or impossible to capture on film.
Video on demand	A system where viewers choose their own filmed entertainment, by means of a PC or interactive television system.
Virtual Reality (VR)	A computer-generated scenario that simulates a realistic experience. The immersive environment can be similar to the real world in order to create a lifelike experience grounded in reality or sci-fi. AR systems may also be considered a form of VR that layers virtual information over a live camera feed into a headset, or through a smartphone or tablet device.
Viz Engine	A real-time graphics rendering engine and video server. It renders animated 3D scenes in real-time, producing high-end animations in HD, 4K. Viz Engine functions as a standalone video server as well as the graphics and video compositing platform for Vizrt products.

10.5 Appendix 5: Further information about Red-Go-Digital (relevant to CodingGame and Audiolizer)

The Red-Go-Digital team submitted a brief to Red-Innovation-Hub. The creative brief stated that: “Digital literacy is a highly valuable skill and in future could become as essential to a successful career as reading or writing.” The challenge, therefore, was to create an appealing digital experience with a coding component for teenagers aged 13-16.

When the brief was written, there was a shortage of female talent, only 18% of computing professionals were women (E-Skills 2012) and the number of female computer science graduates was down 13% (HESA 2013). The event brief, therefore, targeted not only teenagers in general, but teenage girls aged 13-16. Given that coding does not interest most 13-16-year olds, Red wanted an idea with coding in it rather than something obviously connected to coding. The intention was that coding was a means to an end rather than the end in itself. The broadcaster wanted to build something valuable and useful that would feed the interests of the target group.

The Red-Go-Digital campaign briefing happened in May 2014. The challenge of creating a product to get teenagers, especially girls, interested in technology was set. All too often, the teams were told, teenage girls are patronised with the ‘pink it and shrink it’ strategy of product design. They heard how teenage girls (a digitally literate, sophisticated group) are attracted to gender-neutral, mature products with ‘edge’, that let them express themselves. The two winning teams progressed from the initial Red-Go-Digital brief through to the pilot phase. They created Audiolizer and CodingGame. Both products were fully developed and disseminated.