Essays on the Contingencies of Collaborative Innovation: Appropriability, Openness, and Collaborative Spaces

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I dedicate this work to my mom and dad who have been a relentless source of support, encouragement, and inspiration on this journey.

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ABSTRACT

This doctoral dissertation seeks to explore the drivers and contingent factors of openness and open innovation outcomes. Using both quantitative and qualitative methods in three empirical standalone papers format, this dissertation explored three main research questions covering the "what", "how", and "when" in relation to the management and emergence of collaborative innovation at the firm level.

The first study (Chapter 2) analyses the interplay between external collaboration, appropriability regimes, and innovative performance and examines the differential effects of formal and informal appropriability in manufacturing and service firms. Through a quantitative analysis of a large UK dataset, we found that the effectiveness of both formal and informal appropriation is contingent on the degree of openness. Also, the mechanism of appropriation is contingent on the nature of the firm.

The second study (Chapter 3) digs further to better understand the contingencies of openness and explores 'how' start-ups configure their appropriability regimes and manage the paradox of openness in their various growth stages. Through an inductive study of Fintech start-ups, we argue for a more dynamic approach to appropriability, building on the two theoretical views in the literature, and posit that the relationship between openness and appropriability is contingent upon the start-up growth stage and the type of external collaboration. Results uncover four patterns of appropriability profiles besides a pattern of openness for start-ups.

The third study (Chapter 4) investigates how collaborative practices emerge in collaborative spaces, when they do. Based on a qualitative case study and borrowing from interstitial spaces literature, we develop a theoretical framework for understanding how collaborative practices emerge in a collaborative space. Our findings suggest the enabling and/or inhibiting role of interstitial spaces (e.g. informality and spatiality) and catalysts in the emergence of

collaborative practices in a collaborative space. This study provides important insights in better delineating the conditionality of openness and its associated contingent factors of what precedes collaboration and (open) innovation.

The dissertation's main contribution is to the literature on innovation management. The dissertation aimed to stipulate an empirical testimony to the value of research on collaborative innovation in better understanding its contingencies/drivers and linking the debate to the literature on appropriability (strategy), start-ups (entrepreneurship), and service innovation. The three empirical papers generated insights on topics relevant to scholars and practitioners such as the appropriation of innovation performance, the configuration and management of the paradox of openness in start-ups, and the emergence of collaborative practices in collaborative spaces. As such, this dissertation, by employing both quantitative and qualitative methods, aimed at adding to these important academic debates and further shedding light on the management of collaborative innovation.

Academic Advisor: Professor Stefan Haefliger

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CHAPTER 1

Introduction

Innovation is considered as a main source of welfare, growth, increased productivity, and the basis of competitiveness for societal and economic development (World Bank, 2010) accounting for more than one third of GDP growth of numerous OECD countries (OECD, 2015). Innovation, often defined as the creation of new combinations (Schumpeter, 1934), also refers to the "successful exploitation of new ideas and is the process of translating ideas into useful and used new products, processes, and services" (Bessant & Tidd, 2007).

In academia, innovation has also been has been identified by the extant literature as one of the main drivers for companies to grow and sustain a high profitability (Teece, 1986; Thomke, 2001). This implies that the questions that are asked in research today no longer revolve around why innovation is important but rather lies around on how to innovate and how innovation processes can be optimally organised and managed in order to develop something new and useful (Wallin & Von Krogh, 2010).

1.1 Open Innovation Paradigm

1.1.1 Origins of the Idea

The idea of open innovation stemmed from prior literature in the 20th century in innovation research that can be traced back to three historical antecedents that helped shape and conceptualise the idea of open innovation as we know it today. First, innovation researchers have outlined four decades ago that the external environment outside the boundary of the firm can constitute a source of innovation ideas (Freeman, 1982; Gibbons & Johnston, 1974; Rothwell et al., 1974). In fact, the term "open system" has been used for the first time by Allen (1977) in order to designate R&D labs which collaborated with the external environment to maximise their idea generation. Along these lines was the seminal contribution of the idea of

"user innovation" and the "open source software" (OSS) community (Von Hippel, 1976, 1978, 1986) by referring to external players outside the boundary of the firm and their role in driving innovation. The research on open source has developed into a sizable group of scholars with numerous articles on user innovation and communities (e.g. Lakhani & Von Hippel, 2003; Von Krogh, Haefliger, Spaeth, & Wallin, 2012; West & Lakhani, 2008).

Second, the topic of the appropriation of the returns and the difficulties arising from innovative activity developed by Teece (1986) constituted another academic antecedent for the idea of open innovation regarding the focus on technology. According to Teece (1986), appropriability means the extent to which the innovator can capture the profits generated by the innovation. The degree of capture is impacted by characteristics of the technology and the legal environment, and by the ownership of complementary assets that are needed to bring the innovation to market. Before the introduction of appropriability regimes and complementary assets by Teece, the field of strategy was disconnected from the field of innovation. Teece triggered a deeper exploration of the connection between firms' strategies, innovation, and appropriability. Strategy and organization mattered to innovation. And, appropriability regimes mattered to strategy. In bringing these issues to the same table of debate, Teece introduced to the innovation and strategy fields new theoretical perspectives.

Third, the rapid evolution of technology and the boom of the Internet in the 1990s boosted scholars' interest in business models with unconventional revenue streams and value chains (Afuah & Tucci, 2001; Timmers, 1998). This trend was more clearly corroborated by the work of Chesbrough & Rosenbloom (2002) which further elucidated the mediating role of a business model "between the technical inputs and economic benefits of a technology" in order to appropriate the returns and capture the value from the market.

Fourth, there are so-called "erosion factors" which has also contributed to the materialisation of the open innovation paradigm in modern economies (Chesbrough, 2003). These factors include an "increased mobility of workers, more capable universities, declining US hegemony, and growing access of start-up firms to venture capital" besides the recent surge of the Internet and social media which has given a wider knowledge base, capabilities, and access for small scale ICT firms and networks to the web (Chesbrough, 2003). Thus, these so-called erosion factors can explain "why open innovation reflects a paradigm shift as they challenge the basic assumptions, problems, solutions and methods for the research and practice of 21st century industrial innovation" (Chesbrough, 2003).

1.1.2 Overview of Open Innovation

In the last decade, research on open innovation has grown exponentially resulting in a panoply of scholarly articles (for a review, see Bogers et al., 2016; Randhawa, Wilden, & Hohberger, 2016; West, Salter, Vanhaverbeke, & Chesbrough, 2014). With the innovation process becoming increasingly open towards external partners, collaborative innovation is increasingly becoming a central part of a company's strategy (Chesbrough, 2003; Von Hippel, 2005). In fact, open innovation has also an important impact on practice. More than 50% of Fortune 500 companies have adopted open innovation in new products development such as Pepsi's Mountain Dew, McDonald's 'Just Stevinho Burger', Nivea's Black and White Deodorant, Daimler, Lego, P&G, 3M, and Starbucks Coffee to mention a few.

Having said that, what is exactly open innovation? Scholars have updated and extended their definition and conceptualisation of open innovation more than once since its inception in 2003. Chesbrough (2003) describes open innovation as a paradigm that assumes that organizations can and should combine internal ideas with external ideas as organizations look to advance their technologies. In the 2003 book definition, open innovation means that "valuable ideas can

come from inside or outside the company and can go to market from inside or outside the company as well. This approach places external ideas and external paths to market on the same level of importance as that reserved for internal ideas and paths" (Chesbrough, 2003).

However, due to the evolving nature of the field including a rising attention on non-pecuniary factors and various levels of analysis (Chesbrough & Di Minin, 2014; Dahlander & Gann, 2010), an updated definition of open innovation was presented by Chesbrough and Bogers (2014): "We define open innovation as a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model".

In light of this, the extant literature identifies three types of open innovation along with their respective mechanisms: (a) inbound, (b) outbound, and (c) coupled. Inbound refers to the acquisition and inflow of knowledge from external sources; a stream that has attracted most of the research on open innovation (West & Bogers, 2014a). Outbound denotes the outflow and commercialization of knowledge such as out-licensing IP and technology. Coupled open innovation combines both inbound and outbound processes in managing mutual knowledge flows across firms' boundaries.

Thus far, the era of collaborative innovation has redefined the boundary between companies and its adjacent environment in the extensive use of external knowledge sourcing and external pathways to the market, complementing or even substituting in-house R&D as per the closed model (Chesbrough, Vanhaverbeke, & West, 2006; Dahlander & Gann, 2010; Laursen & Salter, 2006). When managing these open innovation processes and activities, companies create, explore, and exploit a large amount of knowledge that they need to adequately manage (Cassiman & Valentini, 2016; West & Bogers, 2014).

However, the management of collaborative innovation comes with important challenges that needs further exploration by the extant literature (van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009) especially in relation to the contingencies and factors that lead to (open) innovation (Randhawa et al., 2016; West et al., 2014) where many questions are still unanswered (Bogers et al., 2016).

1.2 Dissertation: Research Questions

Building on this academic discourse, this doctoral dissertation seeks to explore the drivers and contingent factors of openness in better understanding the "what, how, and when" related to the management and emergence of collaborative innovation. Specifically, the thesis is structured into three standalone papers that covers different, yet complementary, empirical studies. Each empirical study is presented independently in the dissertation as a unique chapter with the (subsequent) aim to submit for an academic journal. Each chapter can be read individually and attempts to answer different research questions related to the management of collaborative innovation phenomenon.

These three papers are concerned with the contingencies and drivers of collaborative innovation in relation to: (1) the *what* in the interplay between openness, appropriability and innovation performance, (2) the *how* in the configuration of appropriability and management of openness in start-ups, and (3) the *when* on the emergence of collaborative practices. In the following paragraphs, I will briefly outline the main chapters of the thesis that constitute three standalone empirical papers.

Chapter 2 examines the paradox of openness in the context of manufacturing and services firms. In other terms, this paradox manifests itself when companies face the dilemma between an increasing orientation for openness while at the same time dealing with the protection of intellectual property rights (or appropriability regimes) in order to capture value from their

innovation activities. Using a large dataset from UK firms, this study explores the interplay between openness (here defined as external collaboration), appropriability regimes, and innovation performance in a comparison between manufacturing and services firms. This paper contributes to the extant academic discussion and extends our understanding of the benefits/limits of appropriability regimes by exploring the differential effects in manufacturing and service firms and the impact of collaboration in relation to appropriability and innovation performance. First, both formal and informal appropriability are associated with higher degrees of radical innovation. However, it would be incorrect to suggest that all firms should invest equally in formal and informal appropriability. This suggests that the mechanism of appropriation is contingent on the nature of the firm. For service firms, which have distinct characteristics and tend to rely heavily on tacit knowledge, the impact of informal appropriability mechanisms was significantly greater than that of formal appropriability mechanisms. The opposite was not proven. Whilst manufacturing firms appear to benefit more from formal appropriability mechanisms, the difference was not significant. Second, firms are increasingly confronted with the paradox of openness when configuring their appropriability regimes because value creation is partly external, while value appropriation remains within the boundaries of the firm. The results suggest that the effectiveness of both formal and informal appropriation is contingent on the degree of openness. Firms benefit more from deploying appropriability regimes at lower levels of external collaboration. Alternatively, to achieve a given level of innovation, a firm needs fewer appropriation mechanisms if they pursue open innovation practices. The results show that the openness-appropriability relationship is not merely a mutually exclusive one and should be better understood to adequately manage the dynamics of openness and the appropriation of the returns because innovation and value creation occur on both sides of the boundary of the firm. Third, our study provides important implications for research on service innovation and appropriability regimes for service firms

in an open collaborative context, given the emerging but scant literature on the topic (Chesbrough, 2011). For services, although the degree of collaboration moderates the benefits of appropriation, both are needed to drive innovation performance. However, for manufacturing firms, our findings suggest that for formal appropriation, high levels of external collaboration act as a substitute for appropriability. In manufacturing firms, IP and other formal appropriation methods can enhance radical new product development more than the benefits of collaboration.

Chapter 3, through a qualitative case study, is concerned with the contingencies of openness in looking at 'how' start-ups configure their appropriability regimes and manage the paradox of openness in their various growth stages. This paper, firstly, examines the interplay between appropriability and openness beyond the extant one-size fits-all approach to appropriability, and, secondly, uncovers the pattern of openness in start-ups. The extant literature has been polarised around two distinct views on the interplay between openness and appropriability. On the one hand, there is the view that a strong protection regime reduces knowledge spillover (Cassiman & Veugelers, 2002) and facilitates openness. We call this the "protection shield" theory. On the other hand, a deliberate reduction of some appropriability regimes may actually facilitate collaborative innovation (Chesbrough, 2003; Von Hippel & Von Krogh, 2006) in selectively revealing some information (Alexy, Criscuolo, & Salter, 2009; Alexy, George, & Salter, 2013; Henkel, Schöberl, & Alexy, 2014). We name this the "openness protection" theory. Building on these existing views on the appropriability-openness relationship, we, firstly, argue for a more dynamic approach and posit that the relationship between openness and appropriability is contingent upon the start-up growth stage and the type of external collaboration. In other words, we found an orchestration of formal and informal appropriability, acting as inhibitor and facilitator of openness, which is contingent upon the start-up growth stage. Results uncover four patterns of appropriability profiles that are driven by the degree of

openness and the start-up stage of development: the independent, the collaborator, the protector, and the selector. Second, we uncover a more granular pattern of openness in start-ups. The degree of openness is nuanced by the type of external collaboration, either market or institutional, along the various growth stages. For start-ups that collaborate with market oriented partners, openness and informal appropriability move in opposite directions at the early stage with the role of informal gradually shifting from facilitator to inhibitor of openness the more the firm grows. As for stat-ups that collaborate with institutional based partners such as universities, the degree of openness is higher in the growth stage versus the early stage and it is the formal appropriability that is driving higher organisational openness.

Chapter 4 continues in exploring the contingencies and conditionality of openness in examining how collaborative practices emerge in collaborative spaces in a qualitative case study method. A recent scholarly debate points to an emergent empirical phenomenon where collaboration is materialised and shaped in a collaborative space (Binz, Truffer, & Coenen, 2014; Garrett, Spreitzer, & Bacevice, 2017; Toker & Gray, 2008) resulting from firms and communities liaising with a breadth of partners outside firms' boundaries. As innovation is increasingly building on collaboration and openness as per extant studies, a better understanding on how collaborative practices emerge in a collaborative setting can only advance the innovation scholarly agenda. In order to address this question, we borrow from the literature on interstitial spaces and the genesis of new practices (Furnari, 2014) in order to explore the emergence and dynamics of collaborative practices in collaborative spaces. The informal, occasional, and temporally bounded interactions of interstitial spaces that occur between different organisations in collaborative spaces can further enhance our understanding on how and what precedes the outcomes of collaboration and innovation. Building on evidence from our study, we develop a theoretical framework for understanding how collaborative practices emerge in a collaborative space. Our findings suggest the enabling and/or inhibiting role of interstitial

spaces (e.g. informality and spatiality) and catalysts in the emergence of collaborative practices in a coworking space. When there are collaborative practices, innovation is more likely to occur as innovation builds on collaboration (Chesbrough et al., 2006; Dahlander & Gann, 2010; West & Bogers, 2014). This paper, by uncovering how and when these collaborative practices emerge (if they do), contributes to the idea of conditionality of openness in better understanding the underlying mechanisms and contingencies that can lead to collaboration and subsequently to (open) innovation.

The empirical studies that comprise this dissertation aim to advance the academic debate on the dynamics of collaborative innovation in exploring, through an array of research approaches using both qualitative and quantitative methods, the contingencies of openness and the mechanisms that can lead to (open) innovation. By answering a variety of research questions including the what, how, and when, this dissertation provides novel contributions to not only the wider innovation management literature but also aim to bridge the discussion with entrepreneurship, organisational spaces, and service innovation. As such, the dissertation's findings aspire to shed light, propel and stimulate future research on the dynamics and contingencies of collaborative innovation.

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CHAPTER 2

On the Limits of Appropriability in Manufacturing and Service Innovation

ABSTRACT

The appropriability of innovation performance continues to challenge open innovation scholars and practitioners alike. This research aims to determine whether the one-size-fits-all approach to appropriation is appropriate when companies differ in their knowledge bases and strategies of external collaboration. This study first unravels the differential effects of formal and informal appropriability in manufacturing and service firms and analyses the interplay between external collaboration, appropriability mechanisms, and innovative performance. Analysing the data from a large-scale U.K. innovation survey, our results shed light on how boundary conditions in an open innovation context can best be managed to appropriate returns from innovative activities. First, we find that firms based on tacit knowledge, i.e., service firms, have better returns from informal appropriability mechanisms than from formal mechanisms. Manufacturing firms benefit the most from formal appropriability mechanisms. Second, we find that high levels of external collaboration substitute for appropriability. We discuss the implications for open innovation research and practice.

Keywords: Appropriability, open innovation, collaboration, innovation performance

2.1 INTRODUCTION

Capturing the value and appropriating the returns from innovation are essential components of a firm's strategy because innovation constitutes a main driver for companies to prosper, grow, and sustain a competitive advantage (Teece, 1986). Without the ability to generate profit from the commercialisation of innovations, firms have little incentive to engage in innovative activities. One way to capture the benefits of innovation for companies is to use a suitable appropriability regime that helps protect knowledge that is generated internally and exploited externally and helps the innovator capture the respective profits (Teece, 1986). However, the limits of appropriability are not well understood.

Although appropriability mechanisms in manufacturing firms have been well researched, their use in service firms is somewhat limited. The extant literature on both innovation and appropriability inadequately address the nascent field of service innovation even though service firms account for 75% of the OECD GDP (Chesbrough, 2011; Ettlie and Rosenthal, 2011; World Bank, 2014). Aside from services' central role in modern economies, prior research has found that services, such as manufacturing, benefit from external collaboration, investment in R&D in addition to using appropriability regimes and creating and transferring (tacit) knowledge (Amara, Landry and Traore, 2008; Leiponen, 2012; Miozzo, Desyllas, Lee, and Miles, 2016). However, the research on innovation success factors suggests that service innovation is markedly different from product innovation (Storey, Cankurtaran, Papasthopoulou, and Hultink, 2015). Services have distinctive features (e.g., intangibility, co-production with customers, simultaneity, heterogeneity and perishability); thus, it is difficult to derive theories and concepts directly from manufacturing (Coombs and Miles, 2000; Tether, 2005). We posit that the characteristics of service firms and strategies of openness present limits to the usefulness of protection strategies for innovation performance that have been found to be appropriate in manufacturing firms.

The innovation literature differentiates between two types of appropriability regimes: formal (e.g., patent, registration of industrial design, trademark, and copyright) and informal (e.g., secrecy, lead time, and complexity of design) (Hall, Helmers, Rogers, and Sena, 2014; Huang, Rice, Galvin, and Martin, 2014). Formal appropriability regimes are codified, institutionally based mechanisms, whereas informal appropriability regimes work with tacit knowledge (Amara et al, 2008; Henttonen, Hurmelinna-Laukkanen, and Ritala, 2016). Given the intangible nature of services, where the knowledge base is less explicit, the effectiveness of formal versus informal appropriability regimes for innovation performance is expected to be different.

Furthermore, both service and manufacturing firms are pursuing more open innovation strategies and involving more external partners in their development projects, resulting in greater amounts of knowledge crossing the boundaries of the firm (Chesbrough, West, and Vanhaverbeke, 2006). Indeed, more than 50% of Fortune 500 companies have adopted open innovation strategies in new product or service development, such as Pepsi's Mountain Dew, Apple's iOS apps, and McDonald's Just Stevinho Burger. This creates a dilemma for firms, resulting in the paradox of openness (Laursen and Salter, 2014), where firms must manage spillover prevention and organisational openness (Arora, Athreye, and Huang, 2016). Open innovation requires externalising knowledge while also maximising the appropriation of the returns from innovation activities and necessitates deploying protective strategies (Cassiman and Veugelers, 2002).

However, little is known about the effectiveness of appropriability regimes in the open innovation context, and there has been a call for more research on value capture in the dynamics between openness, appropriability, and innovation performance (Laursen and Salter, 2014; West and Bogers, 2014). Previous research has found a concave relationship between external collaboration and innovation performance (Laursen and Salter, 2006) and between

appropriability and external collaboration (Huang et al, 2014; Laursen and Salter, 2014). However, we know little about the "implications of appropriability with regard to innovation performance among different collaboration partners" (Henttonen et al, 2016). The research has not addressed the interaction effects of using appropriability and collaboration strategies for firms' innovation performance, or the specific use of formal versus informal appropriability mechanisms in open innovation contexts. This is particularly important for service firms as these firms have been found to utilise more knowledge sources and engage in more collaboration with their customers and suppliers than manufacturing firms (Tether, 2005).

To address these gaps in the appropriation and open innovation literatures, this study examines between the level of external collaboration, appropriability regimes (formal versus informal), and innovation performance among U.K. manufacturing and service firms. We analyse whether the usage of formal or informal appropriability regimes has a greater impact on innovation performance when firms engage in external collaboration. We adopt a quantitative approach in using the dataset from the UK Community Innovation Survey (CIS7) for the years 2008-2010. We provide a more precise measure by looking at innovation performance instead of relying upon perceived managers' preferences for specific appropriability regimes as much of the extant literature has done.

This empirical study helps us to extend our knowledge about how manufacturing and service firms' appropriability choices should be managed for firms to capture and appropriate the returns from collaborating with external partners. This is important because navigating the degree of openness (Balka, Raasch, and Herstatt, 2014; West, Salter, Vanhaverbeke, & Chesbrough, 2014) is as challenging as managing the appropriation of returns (Gans and Stern, 2003; Hall and Sena, 2017). Thus, we aim to construct a more integrative and holistic understanding of the contingencies of openness with an appropriability angle for services and manufacturing firms.

This paper is structured as follows: First, we explain the conceptual background from which we develop our hypotheses. Next, we outline data and methods, followed by the empirical analysis. Finally, we discuss the results and conclude the paper, presenting the limitations and future research.

2.2 CONCEPTUAL BACKGROUND

2.2.1 Appropriability Regimes for Manufacturing and Services

Appropriability refers to the firm's ability to capture the value (e.g., rents or profits) from the commercialisation of its innovations (Teece, 1986). As such, the importance of managing the appropriability regimes lies in its key role of mitigating uncertainty and knowledge expropriation (Arora and Ceccagnoli, 2006; Gans et al., 2003) because these regimes are essential in formulating an innovative strategy and experiencing performance heterogeneity (Teece, 2002).

A multitude of appropriability choices is available where the extant literature distinguishes between two types of appropriability regimes — formal (e.g., patent, registration of industrial design, trademark, and copyright) and informal (e.g., secrecy, lead time, and complexity of design) — which constitute the firm's appropriability regime as labelled by Cohen, Nelson, and Walsh (2000). Gallié and Legros (2012) found that although formal and informal mechanisms are complements within their own category, they are not complements between categories. This supports the conceptual split between formal and informal.

In practice, companies use both formal and informal appropriability regimes (Cohen et al, 2000; Leiponen and Byma, 2009; Thomä and Bizer, 2013). The literature to date has mainly focused on appropriability regimes in isolation (Hussinger, 2006; Kultti et al, 2007), the extent to which different appropriability mechanisms are observed as substitutes (Kultti et al, 2007;

Somaya, 2012) or complements (Fischer and Henkel, 2013; Hall et al, 2014). However, the extant research relates mainly to manufacturing firms.

The academic debate thus far has mainly examined the usage or managers' preferences for specific appropriability regimes using ratings or descriptive survey results. Patents are rated as more effective by managers of product innovation versus process innovation in sectors that generate "discrete" products (Cohen et al, 2000; Levin et al, 1987). Nonetheless, secrecy and lead-time over competitors are mostly preferred, generally speaking, versus patents. These results are further corroborated in other studies highlighting the relatively higher ratings for informal regimes such as secrecy and lead-time (Arundel, 2001), although patents are used for strategic reasons (Cohen et al, 2000).

In a limited number of studies, appropriability has been associated either with positive innovation performance (Hurmelinna-Laukkanen, Sainio, and Jauhiainen, 2008) or a concave relationship (Laursen and Salter, 2005). However, less attention has been given to the effect of formal and informal appropriability regimes on innovation performance beyond managers' preferences or descriptive ratings. Looking from a performance angle, patents are positively associated with innovation performance (Hall, Helmers, Rogers, and Sena, 2013), and firms engaging in radical innovations rely more on patents than secrecy (Hanel, 2008).

The existing research on appropriability regimes in service firms is more limited despite the fact that service firms are no less innovative than manufacturing firms (Coombs and Miles, 2000; Tether, 2003, 2005). Services have specific characteristics such as intangibility, simultaneity, heterogeneity and perishability (de Brentani, 1991). The intangible tacit nature of services means that the nature of knowledge in service firms will be different to that in manufacturing firms, which suggests that the results of research into appropriability manufacturing firms may not be directly transferable to service firms.

Nevertheless, service firms have been found to use both formal and informal appropriability regimes (Amara et al, 2008; Mina, Bascavusoglu-Moreau, and Hughes, 2014; Leiponen, 2012). In terms of managers' preferences, service companies generally rely on informal appropriability mechanisms (e.g., lead time, complexity of design, or secrecy). They may indeed use formal appropriability regimes, such as patents (Amara et al, 2008), although most companies rely on copyrights when they are able to do so (Miles, Andersen, Boden, & Howells, 2000). However, with regard to the impact on innovation performance, a very limited number of studies have found a positive association between informal regimes and innovation performance (Elche-Hotelano, 2011). Thus, a better understanding of the dynamics of service firms' appropriability regimes would not only shed light on a sector that represents three-quarters of advanced economies' GDP but would more importantly extend our understanding of the wider appropriability and innovation literature.

2.2.2 Openness and Appropriability

External collaboration is becoming an integral part of a company and managerial strategies; as a result, the innovation process is now more open and distributed (Chesbrough et al., 2006). The era of open innovation has redefined the boundaries of firms, placing firms as entrenched in a network of various actors, ranging from customers, competitors, and suppliers to universities with the aim of commercialising new knowledge (Chesbrough, 2003). This is particularly relevant for service firms because the research has shown that service firms utilise more knowledge sources (Hipp, 2010) and engage in more collaboration with their customers and suppliers than manufacturing firms (Tether, 2005).

The extent of the knowledge search and collaboration breadth have been found to significantly impact innovation performance for both manufacturing (Grimpe and Sofka, 2009; Katila and Ahuja, 2002; Laursen and Salter, 2006) and service firms (Leiponen, 2005; Mansury and Love,

2008). However, previous research has also shown that, at the same time, companies want to protect themselves when they engage in external collaboration outside their boundaries (Cassiman and Veugelers, 2002). This leads to the "paradox of openness": innovation often entails openness, but the appropriation of the returns necessitates protection (Laursen and Salter, 2014).

Managers can respond to this paradox by using appropriability regimes and protecting their intellectual property rights (Gans and Stern, 2003). Companies must carefully plan methods of deploying their appropriability regimes vis-à-vis their involvement with external collaboration for innovation activities. In fact, companies that signal the usage of appropriability mechanisms are perceived to hold important information and, as a consequence, can attract more external partners (Alexy, Criscuolo, and Salter, 2009). However, at the same time, the extant literature on open innovation shows that an excessively strong focus on appropriability regimes can have adverse effects on external searching and collaboration (Miozzo et al, 2016; Laursen and Salter, 2014).

Furthermore, the extant literature on the interplay between appropriability and openness has broadly been addressed for manufacturing companies. The literature is limited on appropriability mechanisms and external collaboration with regard to open innovation, especially those related to service firms. For instance, the role of appropriability has not been explored in either manufactured goods or services despite its implications for firms' innovation strategy.

Given the potential differences in the innovation process for both manufacturing and service firms and the above discussion on openness and appropriability, there appears to be a gap in which to explore the respective role of alternative appropriability regimes when manufacturing and service firms engage in external collaboration.

2.3 HYPOTHESES

Companies use both formal and informal appropriability (Cohen et al, 2000). However, the effectiveness of formal versus informal regimes will be contingent on the nature of the knowledge that is being protected. Relatively speaking, manufacturing firms are built strongly on codified explicit knowledge, whereas service firms tend to rely more on tacit knowledge in the form of the experience of service personnel (Hitt, Bierman, Katsuhiko and Rahul, 2001).

2.3.1 Formal versus Informal Appropriability in Manufacturing Firms

There is evidence to suggest that innovative manufacturing firms consider informal protection mechanisms more effective than formal mechanisms and thus tend to use slightly more informal appropriability (Arundel, 2001). However, patents have been shown to be the most important tool used to capture the returns from innovation where knowledge is codified in "discrete products" (Cohen et al, 2000). A formal appropriability regime through patenting is positively associated with innovation performance (Hall et al, 2013) and the greater reliance of firms on patents than secrecy with regard to radical innovations (Granstrand, 1999; Hanel, 2008). Hussinger (2006) found a positive association between the use of patents and innovation performance; however, no relationship was found between secrecy and the sales of new products. This suggests that while manufacturing firms consider informal regimes more important for protecting their IP, innovative companies still deploy formal mechanisms, such as patents and trademarks, much more effectively (Huang et al, 2014; Miozzo et al, 2016). Because the usage of appropriability regimes in manufacturing firms has been associated with positive innovation performance (Hall et al, 2013; Hurmelinna-Laukkanen et al, 2008; Laursen and Salter, 2005), we suggest that this is associated with higher innovation performance for formal regimes versus informal regimes.

Therefore, we hypothesise the following:

H1: In manufacturing firms, the impact on innovation performance of the usage of formal appropriability mechanisms will be greater than the impact of informal mechanisms.

2.3.2 Informal versus Formal Appropriability in Service Firms

The literature related to service firms and appropriability is not well developed. Like manufacturing firms, services also use a number of appropriability regimes to protect their innovations with both formal and informal methods (Amara et al, 2008). They still use formal appropriability mechanisms such as patents (Mina et al, 2014) and copyrights (Miles et al, 2000) but deploy fewer IP rights than manufacturing firms (Tether and Massini, 2007). However, most service companies use informal mechanisms such as lead time and secrecy (Miles et al, 2000; Tether and Massini, 2007).

Given the intangible nature of services, the effectiveness of formal versus informal appropriation regimes for innovation performance are expected to be different. The value chain for services constitutes a differentiating factor for services versus manufactured goods because it consists of the iterative process of a customer experience that connects the customer to the desired outcome, unlike Porter's linear process value chain for goods where the service comes only at the end (Chesbrough, 2011). Tacit knowledge is produced in the process of engagement and co-creation moving both to and from the customer, making the element of tacit knowledge a core and differentiating factor in the uniqueness of services (Chesbrough, 2011; Storey and Khan 2010). Tether (2005) shows that innovation in services is less formally organised, more incremental and less technologically based.

Whilst knowledge-intensive business services (e.g., KIBS such as software, communications and technical services) appear to engage in the use of formal appropriability regimes more often and have greater levels of new product and service development than other service sectors (Hipp and Grupp, 2005), informal regimes are usually used to protect service and process

innovation (Cohen et al, 2000; Levin et al, 1987). The innovation literature has linked the service sector with the use of more informal appropriability and practices when developing a new service because such informal practices are usually conducted by informal teams rather than regular R&D units (Miles, 2007). Tether (2003) shows that R&D is of lesser importance in services compared to manufacturers, while intangible assets, such as human and organisational features, appear to be more important. Morikawa (2014) shows that service firms display a high level of innovation productivity, which is associated with their preference for informal regimes such as trade secrets.

Hence, even though services may deploy fewer appropriability regimes than manufacturing, we expect that the impact of informal mechanisms will be greater than the impact of formal mechanisms on innovation performance. Therefore, we hypothesise the following:

> *H2: In service firms, the impact on innovation performance of the usage of informal appropriability mechanisms will be greater than the impact of formal mechanisms.*

2.3.3 The Moderating Effect of Collaboration

The extant literature has shown that the use of appropriability regimes can facilitate openness, protect knowledge assets, and enable a smoother transfer of (tacit) knowledge (Alexy et al, 2009; Foray, 2004; Ordover, 1991; Penin and Wack, 2008; Pisano and Teece, 2007). It is then crucial for manufacturing and service companies to use and configure an adequate appropriability strategy to facilitate a stronger association with higher profits when engaging with external partners.

Appropriation mechanisms offer a higher degree of protection to innovation, and a strong appropriability regime is directly associated with more open innovation and promotes vertical specialisation (Chesbrough et al, 2006). Companies that signal the usage of appropriability mechanisms are perceived to generate and retain significant knowledge and, as a consequence,

can attract more external partners (Alexy et al, 2009; Hagedoorn and Ridder, 2012). These companies use appropriation strategies to govern their open innovation relationships to protect their innovative capabilities (Chesbrough et al, 2006; Hagedoorn and Zobel, 2015).

These arguments suggests that a strong appropriability regime is an enabler for external collaboration and that there is a complementarity between collaboration and the use of appropriability regimes because a strong regime may facilitate the exchange of knowledge assets. However, at the same time, it has been found that an excessively strong usage of formal appropriability regimes can have adverse effects on collaboration with external partners (Huang et al, 2014; Laursen and Salter, 2014).

With regard to informal regimes, companies consider lead time and secrecy more important methods of protecting their IP than patents (Arundel, 2001). Informal appropriability mechanisms can also lead firms to limit their interactions with external actors to protect their ideas from imitators and competitors. The risks of knowledge leakage in using secrecy are higher when companies are collaborative (Gans and Stern, 2003; Liebeskind, 1997). This suggests that the use of highly informal appropriability regimes hinders firms from further collaboration with external parties because of the danger of the loss of control over knowledge and, as a result, diminishes the positive effects of external collaboration on innovation performance.

Following this line of reasoning, we expect that when there is a high level of openness (collaboration with external partners), both manufacturing and service firms will benefit less from deploying strong appropriability regimes. As per these arguments and the H1 and H2 discussion, we suggest that the use of strong appropriability regimes will hinder firms from further collaborating with external parties because of the danger of loss of control over

knowledge and, as a result, will weaken the positive effects of external collaboration on innovation performance. Therefore, we hypothesise the following:

> *H3: The greater the collaboration breadth is, the less effective the usage of (a) formal and (b) informal appropriability mechanisms will be on innovation performance (for both manufacturing and service firms).*

2.4 DATA AND METHOD

2.4.1 Data

The data set is drawn from the 7th U.K. CIS data that covers the years between 2008 and 2010[1]. The questions used in the surveys are described in the OECD Oslo Manual (OECD, 2005). This data set has been used by previous studies (e.g., Laursen and Salter, 2006, 2014), and its validity and reliability were confirmed.

The 7th U.K. CIS was administered in 2011 by the Office for National Statistics (ONS), the U.K. government's official division for statistics. The survey was sent to 28,079 firms, of which 14,342 responded; this represents a solid 51% response, which helps prevent a non-response bias (Armstrong and Overton, 1977). The sample of manufacturing and service firms comprised 5,624 and 22,276 firms, of which we used 1,618 and 5,560 companies with non-missing values, respectively. To circumvent any common method bias issues, we ran Harman's one-factor test on the designated items in our study. The results suggest that the primary factor was less than fifty percent of the variance (30% for manufacturing and 26% for services); hence, we can exclude any potential issues related to the common method bias (Podsakoff and Organ, 1986). Additionally, the survey questionnaire administered by ONS

[1] The 8th U.K. CIS survey data (2010-2012) are available; however, they are not used due to the small sample size.

comprised various questions types, including Likert scales, percentage estimation / calculation, and absolute numbers, which were answered by the companies' managers.

2.4.2 Measures

Dependent Variable. We use radical innovation to reflect firms' innovation performance. Radical innovation is the percentage of companies' total turnover in relation to goods or services that are new to the market. We then computed logarithmic transformations for the variable to enhance the normality of the distributions.

In this setting, we capture the radical innovation by using a single-item dependent variable that has already been applied in previous innovation research (e.g., Laursen and Salter 2006). This method yields valid results because it measures "an object that in the minds of respondents refers to a concrete object" (Bergkvist and Rossiter, 2007) and thus is robust.

Independent Variables. To measure *appropriability regimes*, we used a question in the UK CIS survey asking whether the "business uses/registers: (i) patents (ii) industrial designs (iii) trademarks (iv) copyrights (v) secrecy (vi) complex designs (vii) lead times." Each of the seven sources is coded as a binary variable where 1 denotes that the firms used the respective protection regime or 0 if not. We categorise these seven sources of appropriability regimes into two categories: formal (patents, industrial design, trademarks, and copyrights) and informal (secrecy, complex design, and lead time) (Amara et al, 2008; Huang et al, 2014). We then add the scores for the formal and informal regimes such that the maximum is 4 for formal regimes and 3 for informal regimes if firms use all appropriability regimes, while the minimum is 0 for both formal and informal regimes if firms do not deploy any protection mechanisms.

Moderating variable. For *collaboration breadth*, firms were asked to report whether they had collaborated on innovation activities with any of the following six external partners: (i) suppliers, (ii) customers, (iii) competitors, (iv) consultants, (v) universities, and (vi)

government or public research institutes. Each of these six sources is re-coded as a binary variable, with 0 representing no or minimal collaboration and 1 indicating medium or high collaboration breadth. Following Laursen and Salter (2014), we then add these six sources such that the range is from 0 to 6, where 6 denotes that the firms collaborates with all external actors and 0 if the firms do not engage in any external collaboration on innovation activities.

Control Variables. To increase the validity and robustness of the quantitative study, we add several control variables that were used and validated in previous innovation studies on the determinants of innovation performance. *R&D intensity* measured firm R&D expenditure divided by turnover to control for absorptive capacity (Cohen and Levinthal, 1990). We calculated this variable by taking the data from the UK CIS for the R&D expenditure, while total turnover was provided by the ONS register data. We control for the *number of employees*, which has been transformed into a logarithmic expression. The data for firm size are drawn from the ONS register data, which were provided with the survey.

We account for the *start-up* factor where we incorporate a measure on whether the company was founded after 2008, although the survey does not provide information on companies with less than ten employees. *Market size* is included to control for companies' involvement in various markets such as the U.K. local, U.K. regional, U.K. national, or international markets. Finally, we include 12 *geographical dummies* as well as 9 *industries dummies* for both manufacturing and services to control for potential differences across industries and geographies when firms engage in openness.

There may be some concerns that a self-selection bias exists in the interplay between external collaboration and appropriability mechanisms by "high quality" firms. To address this issue, we added two proxies that would help account for these "high quality" firms because finding an instrumental variable has proven to be quite difficult in this context. We included a variable

for *human capital,* which is calculated as a percentage of employees who hold a degree or a higher qualification in the company, and another variable for *labour productivity,* which is the ratio of revenue over the number of employees.[2]

2.5 FINDINGS

Table 1 and Table 2 present descriptive statistics and correlations for the abovementioned variables for both manufacturing and service firms. Although none of the correlations are above 0.5, we have tested for multi-collinearity and found that no single VIF was greater than 3, which satisfies the rule of thumb of a maximum of 10. From these tables, we can see that manufacturing firms appear, on average, to collaborate relatively more often with external partners (1.238) than services (0.715), although the standard deviation is higher in manufacturing. Additionally, manufacturing firms deploy, approximately and on average, two times more formal (0.421) and informal (0.464) regimes than service firms with formal (0.183) and informal (0.186) regimes, respectively. The usage of informal appropriability regimes also appears to be slightly higher than formal regimes in both sectors.

INSERT TABLE 1 AND TABLE 2

Table 3 and Table 4 display average values for the strength of collaboration breadth, formal appropriability, informal appropriability, and percentage of radical innovations by industry. High R&D-intensity manufacturing firms (e.g., chemicals, electronics) and knowledge-intensive service firms (information and communications, professional and scientific activities) engage in higher external collaboration, use more formal and informal regimes, and have a higher proportion of sales resulting from radical innovations..

[2] As a robustness check, we ran the analysis without these two variables. The regression results are unchanged compared to the original case and are still highly significant with very similar magnitudes. This confirms the validity and strength of the relationship between external collaboration, appropriability, and innovation performance.

INSERT TABLE 3 AND TABLE 4

In terms of statistical methodology, our dependent variable for innovation performance is measured as a percentage of the total turnover, which, by definition, has values between 0 and 100. As such, tobit regression analyses are most suitable (Wooldridge, 2002) for testing the various hypotheses and respective moderation effects for the role of collaboration breadth on the relationship between appropriability regimes and innovation performance. However, the data should have a normal distribution under the tobit model. This is not the case for innovation performance because our data are skewed and concentrated towards zero and, hence, not satisfying the standard tobit requirements. As such, an alternative way to solve this problem is to apply a logarithmic transformation (Wooldridge, 2002). Thus, we include a latent variable, Y*, which is a log-transformation of the dependent variable of innovation performance: $Y^* = \ln(1 + Y)$. This latent variable of innovation performance will then serve as a function of the various explanatory variables.

Table 5 shows the result of the tobit regressions on the impact of the collaboration breadth on the relationship between appropriability regimes and innovation performance. Looking at Model 1, we find support for Hypothesis 1 where, in manufacturing firms, the impact of the usage of formal appropriability (0.475; p=0.001) will be greater than the impact of informal appropriability (0.308; p=0.001) on innovation performance. The same applies to Hypothesis 2, where we found that, in service firms, the impact of the usage of informal appropriability (0.625; p=0.001) will be greater than the impact of formal appropriability (0.200; p=0.001) on innovation performance. A simple slope significance test (Cohen, Cohen, West, and Aiken, 2003) was used to assess whether the differences between formal and informal appropriability regimes are significant in each of the manufacturing and services cases as predicted. In manufacturing firms, the impact of the usage of formal appropriability is not statistically significant compared to the impact of informal appropriability on innovation performance

(t=1.14; p=0.26). However, for service firms, the slope test is significant (t=4.88; p<0.00), confirming H2. In service firms, the impact of the usage of informal appropriability is greater than the impact of formal appropriability on innovation performance.

INSERT TABLE 5

We also find support for Hypothesis 3. Looking at Model 2, we found a significant negative moderation coefficient for both manufacturing (-0.272; p=0.001) and services (-0.091; p=0.001). The higher the collaboration breadth is, the less effective the usage of formal appropriability regimes will be on innovation performance, with the effect being stronger for manufacturing firms (Figure 1). Additionally, a similar pattern is applicable to informal appropriability regimes in Models 3 and 4. The higher the collaboration breadth is, the less effective the usage of informal appropriability regimes will be on innovation performance (Figure 2). The moderation coefficient of collaboration is negatively significant for both manufacturing (-0.266; p=0.001) and service firms (-0.145; p=0.001). Thus, we can conclude that the higher the collaboration breadth is, the less effective the usage of formal/informal appropriability regimes will be on innovation performance for both manufacturing and service firms.

INSERT FIGURES 1 AND 2

2.6 Robustness Checks and Post-hoc Analysis

We performed additional analyses to check for the robustness of our results and exclude alternative explanations. We ran the same analyses with a fractional logit regression (Papke and Wooldridge, 1996): the results, significance, and variable magnitudes are extremely similar to the tobit regressions, which confirms the robustness of our models. We also ran quadratic regression analyses with squared terms for collaboration breadth (e.g., Laursen and Salter 2006, 2014) throughout all models for both manufacturing and service firms. Again, the results hold

and the coefficients are significant with the same trends in all cases. We also performed the same analysis for manufacturing and service firms that had innovated by excluding non-innovative firms. The results hold and are significant despite variations in the size of the appropriability and collaboration parameters.

Innovation in services is often incremental in nature (Hipp and Grupp, 2005); therefore, we ran the same analysis as per Table 5 with the dependent variable of incremental innovation (measured as a percentage of companies' total turnover in relation to goods or services that are new to the firm). The results hold for H2 and H3, although no support was found for H1. For manufacturing firms that are pursuing more incremental innovations, the benefits of formal appropriation regimes are not greater than those of informal regimes.

2.7 DISCUSSION AND CONCLUSION

This paper contributes to the extant academic discussion and extends our understanding of the benefits/limits of appropriability regimes by exploring the differential effects in manufacturing and service firms and the impact of collaboration in relation to appropriability and innovation performance. This study points to firm level and organisational challenges that companies must address when formulating and deploying their appropriability regimes in openness practices. These challenges in managing adequate appropriability regimes are often underestimated by managers (Liebeskind, 1997).

Our study contributes to the literature in various ways. First, our paper provides some important implications for the appropriability literature. The academic debate on the effect of formal and informal appropriability regimes on innovation performance has not moved much beyond perceived effectiveness or descriptive ratings (Cohen et al, 2000; Hall et al, 2014). Research on appropriability has somewhat overlooked the different types of appropriability mechanisms and rather focusing more on industry-level measures (Pisano, 2006), implying that managers

have limited scope to revisit their firm-level appropriability mechanisms (Cassiman and Veugelers, 2002). Rather, this paper adds to the wider appropriability literature by providing empirical evidence on the effects of appropriability on innovation performance as well as its limits. This study provides an additional lens on firm level appropriability choices and how these choices are associated with the level of openness and innovation performance.

Both formal and informal appropriability are associated with higher degrees of radical innovation. However, it would be incorrect to suggest that all firms should invest equally in formal and informal appropriability. This suggests that the mechanism of appropriation is contingent on the nature of the firm. For service firms, which have distinct characteristics and tend to rely heavily on tacit knowledge, the impact of informal appropriability mechanisms was significantly greater than that of formal appropriability mechanisms. The opposite was not proven. Whilst manufacturing firms appear to benefit more from formal appropriability mechanisms, the difference was not significant. Nevertheless, for firms that are dependent on tacit knowledge as opposed to those relying on codified knowledge, the use of informal mechanisms should take precedence over the use of formal mechanisms. The previous research has not yet uncovered this.

Second, as innovation increasingly entails the collaboration with external partners, firms are increasingly confronted with the paradox of openness when configuring their appropriability regimes because value creation is partly external, while value appropriation remains within the boundaries of the firm. The results suggest that the effectiveness of both formal and informal appropriation is contingent on the degree of openness. The more firms collaborate with external partners, the less effective the use of appropriability mechanisms will be on innovation performance. In contrast, firms benefit more from deploying appropriability regimes at lower levels of external collaboration. Alternatively, to achieve a given level of innovation, a firm needs fewer appropriation mechanisms if they pursue open innovation practices. This may also

suggest that the use of strong appropriability regimes will hinder firms' from further collaborating with external parties because of the danger of the loss of control over knowledge and, as a result, will diminish the positive effects of external collaboration on innovation performance.

The results show that the openness-appropriability relationship is not merely a mutually exclusive one and should be better understood to adequately manage the dynamics of openness and the appropriation of the returns because innovation and value creation occur on both sides of the boundary of the firm. We responded to the call for more empirical evidence on the implications of appropriability regimes in relation to external collaboration and innovation performance (Henttonen et al, 2016; Laursen and Salter, 2014, West and Bogers, 2014). This study provides empirical evidence to further delineate the way in which managers' appropriability choices, coupled with the level of external collaboration, can affect innovation performance in both manufacturing and service firms, although there are subtle differences between the two.

For services, although the degree of collaboration moderates the benefits of appropriation, both are needed to drive innovation performance. However, for manufacturing firms, our findings suggest that for formal appropriation, high levels of external collaboration act as a substitute for appropriability. In manufacturing firms, IP and other formal appropriation methods can enhance radical new product development more than the benefits of collaboration.

Third, our study provides important implications for research on service innovation and appropriability regimes for service firms in an open collaborative context, given the emerging but scant literature on the topic (Chesbrough, 2011). This study extends our understanding of how service firms are different from manufacturing firms when engaging in innovative activities (Ettlie and Rosenthal, 2011; Miozzo et al, 2016) and seeking knowledge beyond the

boundary of the firm (Mina et al, 2014), hence advancing the research agenda of an improved conceptualisation of open service innovation (Randhawa et al, 2016). We also shed more light on the way services companies utilise various appropriability regimes to protect their innovations (Amara et al, 2008) and the way these choices are associated with openness and innovation performance in a service context (Henttonen et al, 2016). The research extends the understanding of the paradox of openness to service firms (Arora et al, 2016; Laursen and Salter, 2014) and teases out the nuances between formal and informal appropriability regimes in the firm's quest for openness.

2.7.1 Limitations and Future Research

This study has some limitations that we would like to address, as well as some thoughts on future avenues for research. First, the UK Innovation Survey involves cross-sectional data, and as such, it is difficult to draw causality between appropriability, collaboration breadth, and innovation performance. We are aware that this constitutes a main limitation to our study because regression analyses do not prove any form of causality here. Second, this study is limited by the variables in the questionnaire. A more refined measure of informal and formal appropriability would add validity to the findings. It may be useful in future studies to complement the data set (ideally panel data) with additional information on companies' IP stocks, such as patents, trademarks, registration of industrial design, and copyrights, amongst others. Furthermore, the dependent measure of innovations that are new to the market may not cover the full range of innovations that add value to customers but has been recognised as a key indicator of innovation performance (Laursen and Salter 2006).

This research explores the difference between manufacturing and service firms. However, it is recognised that the heterogeneity between types of services may be as significant as that between services and products (Storey et al, 2015). Further research could explore the impact

of different appropriability regimes when the innovation involves an elevated level of knowledge codification and output tangibility (e.g., software, communications and technical services) compared to other service sectors (Hipp and Grupp, 2005; Miles, 2007),

This paper raises the important issue of the openness-appropriability duality and its implications for innovation performance in a comparison between U.K. manufacturing and service firms. Manufacturing and service companies face considerable challenges when configuring and establishing their appropriability regimes when collaborating with external partners while also ensuring that they exploit the knowledge and capture the rents from innovation collaboration and activities. In this context, more research is needed on how companies and managers can configure the elements of this tension and subsequently react to this duality. It would also be useful to examine the intensity of the collaboration with external partners and further observe the point at which these agreements occur in the innovation process and the cooperation agreements that are the most influential. Although this paper responds to the call for further research on open service innovation (Mina et al, 2014; Randhawa et al, 2016), little is currently known on whether openness in the service sector translates to higher performance and, if so, the circumstances in which this is the case.

Table 1: Manufacturing Descriptive Statistics

	Variable	Mean	s.d.	Min	Max	1	2	3	4	5	6	7	8	9
1	Radical Innovation (log)	0.572	1.080	0.00	- [a]									
2	Collaboration Breadth	1.238	1.647	0.00	6.00	0.39**								
3	Formal Appropriability	0.421	0.890	0.00	4.00	0.32**	0.42**							
4	Informal Appropriability	0.464	0.793	0.00	3.00	0.31**	0.47**	0.47**						
5	R&D Intensity	0.011	0.043	0.00	- [a]	0.21**	0.25**	0.25**	0.31**					
6	Number of Employees (log)	4.186	1.330	0.00	- [a]	0.10**	0.25**	0.26**	0.15**	0.05*				
7	Startup	0.052	0.223	0.00	1.00	0.04†	0.01	-0.04	-0.05*	-0.01	-0.08**			
8	Market Size	2.995	1.064	1.00	4.00	0.20**	0.26**	0.27**	0.27**	0.16**	0.34**	-0.05*		
9	Labor Productivity	176.8	1598.8	- [a]	- [a]	0.04†	0.07**	0.06*	0.02	0.01	-0.03	-0.02	0.10	
10	Human Capital	10.3	15.565	0.00	100.00	0.23**	0.28**	0.21**	0.24**	0.24**	0.15**	0.03	0.24**	0.14**

***p ≤ 0.01; *p ≤ 0.05; †p ≤ 0.10; a: numbers suppressed in compliance with ONS rules on data disclosure*

Table 2: Services Descriptive Statistics

	Variable	Mean	s.d.	Min	Max	1	2	3	4	5	6	7	8	9
1	Radical Innovation (log)	0.124	0.416	0.00	4.62									
2	Collaboration Breadth	0.715	1.373	0.00	6.00	0.34**								
3	Formal Appropriability	0.183	0.568	0.00	4.00	0.24**	0.28**							
4	Informal Appropriability	0.186	0.520	0.00	3.00	0.34**	0.37**	0.47**						
5	R&D Intensity	0.009	0.057	0.00	- [a]	0.20**	0.18**	0.20**	0.24**					
6	Number of Employees (log)	4.061	1.527	0.00	- [a]	-0.02	0.10**	0.07**	0.02†	-0.01				
7	Startup	0.066	0.249	0.00	1.00	0.05**	0.02	0.00	0.00	-0.01	-0.09**			
8	Market Size	2.017	1.087	1.00	4.00	0.15**	0.18**	0.27**	0.30**	0.15**	0.14**	-0.05**		
9	Labor Productivity	235.7	2632.8	- [a]	- [a]	0.00	0.00	0.00	0.01	-0.01	-0.03**	-0.01	0.04**	
10	Human Capital	18.3	27.408	0.00	100.00	0.18**	0.21**	0.25**	0.29**	0.22**	-0.01	0.00	0.38**	0.04**

***p ≤ 0.01; *p ≤ 0.05; †p ≤ 0.10; a: numbers suppressed in compliance with ONS rules on data disclosure*

Table 3: Manufacturing Industry Averages

Industry	Collaboration Breadth (x6)	Formal Appropriability (x4)	Informal Appropriability (x3)	% Radical Innovation
Food, beverage, and tobacco	1.22	0.30	0.25	3.33
Textiles, wearing apparel, and leather	1..07	0.40	0.22	2.79
Wood, paper, printing, and publising	0.71	0.23	0.25	2.17
Petroleum, chemicals, rubber, and plastic	1.42	0.56	0.60	3.19
Metals, metallic, and non-metallic mineral	0.93	0.31	0.35	2.83
Computer, electric, and elecronic equipment	1.74	0.76	0.79	6.98
Machinery and equipment	1.47	0.52	0.64	5.22
Transport	1.50	0.38	0.58	4.49
Other Manufacturing	1.01	0.37	0.39	3.72

Table 4: Services Industry Averages

Industry	Collaboration Breadth (x6)	Formal Appropriability (x4)	Informal Appropriability (x3)	% Radical Innovation
Electricity, Gas, and Water Supply	0.84	0.13	0.21	2.40
Construction	0.56	0.05	0.10	1.16
Wholesale and Retail Trade	0.61	0.22	0.14	1.99
Transportation	0.59	0.07	0.11	1.11
Accommodation and Food Services	0.57	0.10	0.07	1.87
Information and Communication	1.29	0.48	0.58	4.87
Financial, Insurance, and Real Estate	0.79	0.15	0.13	1.36
Professional, Technical, and Scientific	0.98	0.33	0.33	4.52
Administration and Support	0.52	0.07	0.12	1.74

Table 5: Tobit Regressions

	Manufacturing Firms								**Services Firms**							
	Radical Innovation								Radical Innovation							
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
Variables	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err
Collaboration Breadth	0.557***	0.063	0.740***	0.072	0.741***	0.076	0.804***	0.077	0.405***	0.029	0.442***	0.031	0.475***	0.033	0.479***	0.034
Formal Appropriability	0.475***	0.104	1.224***	0.167	0.491***	0.103	1.075***	0.177	0.200**	0.063	0.421***	0.091	0.217***	0.063	0.303**	0.097
Informal Appropriability	0.308*	0.125	0.295*	0.123	0.969***	0.187	0.665	0.199	0.625***	0.073	0.631***	0.073	0.953***	0.103	0.907***	0.110
Collaboration x Formal			-0.272***	0.047			-0.215***	0.053			-0.091***	0.027			-0.037	0.032
Collaboration x Informal					-0.266***	0.056	-0.147*	0.062					-0.145***	0.032	-0.124**	0.037
R&D Intensity	1.745	1.833	2.988†	1.811	2.210	1.813	2.983†	1.806	1.542**	0.550	1.596**	0.549	1.589**	0.547	1.602***	0.547
Nb of Employees (log)	-0.104	0.079	-0.092	0.078	-0.085	0.079	-0.083	0.078	-0.072*	0.030	-0.072*	0.030	-0.065*	0.030	-0.066*	0.030
Startup	0.317	0.408	0.361	0.404	0.280	0.408	0.333	0.405	0.414**	0.157	0.395*	0.157	0.420**	0.157	0.412**	0.157
Market Size	0.408***	0.109	0.358*	0.108	0.375*	0.109	0.350*	0.109	0.156***	0.045	0.147***	0.045	0.145***	0.045	0.143**	0.045
Labor Productivity	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Human Capital	0.010†	0.006	0.013*	0.006	0.012*	0.006	0.014*	0.006	0.006***	0.002	0.006***	0.002	0.006***	0.002	0.006***	0.002
Constant	-5.049***	0.762	-5.164***	0.759	-5.268***	0.765	-5.270***	0.762	-3.521	0.340	-3.551***	0.341	-3.603***	0.344	-3.603***	0.344
Geography Dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Industry Dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Chi-Square	358.4		392.5		381.1		398.1		842.9		854.1		864.4		865.7	
Left Censored	1216		1216		1216		1216		4977		4977		4977		4977	
N	1618		1618		1618		1618		5560		5560		5560		5560	
Log likelihood	-1411.2		-1394.1		-1399.8		-1391.3		-2082.4		-2076.8		-2071.7		-2071.0	
R2	0.113		0.123		0.120		0.125		0.168		0.171		0.173		0.173	

****p ≤ 0.001; **p ≤ 0.01; *p < 0.05; †p ≤ 0.10;*

MANUFACTURING **SERVICES**

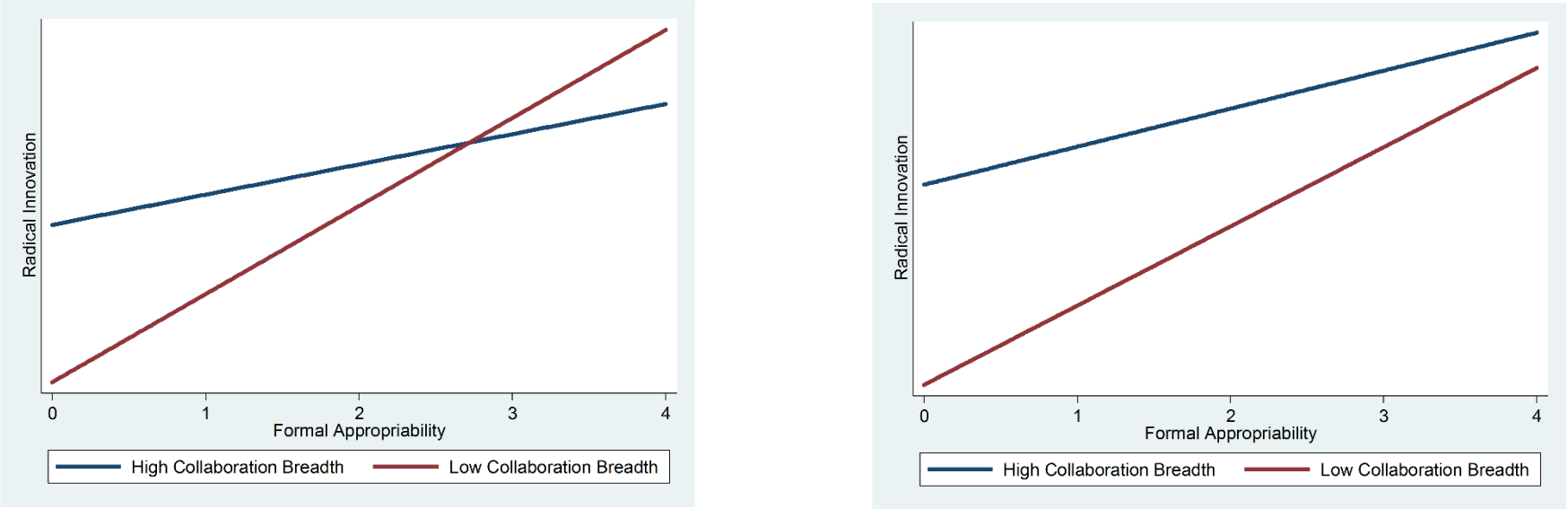

Figure 1. Effect of Formal Appropriability Mechanisms on Innovation Performance

MANUFACTURING **SERVICES**

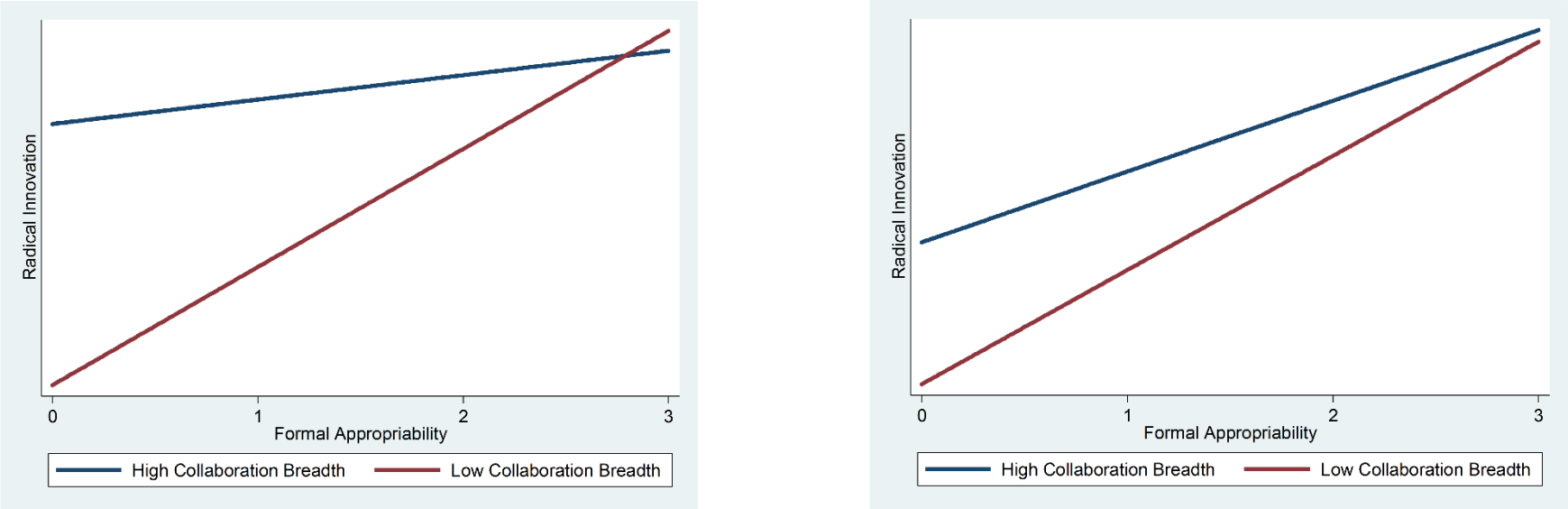

Figure 2. Effect of Informal Appropriability Mechanisms on Innovation Performance

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CHAPTER 3

The Dynamics of Openness and Appropriability in Start-ups: Evidence from the FinTech Sector

ABSTRACT

Appropriability is about knowledge protection and openness is about being open with knowledge, resulting in a dilemma known as the paradox of openness. Through an inductive study of FinTech start-ups, we unravel how these firms manage this paradox in exploring contingencies and drivers of openness. We posit that the relationship between openness and appropriability is contingent upon the start-up growth stage, the type of open innovation, and the type of external collaboration. Firstly, we go beyond the extant one-size fits-all approach to appropriability and found an orchestration of formal and informal appropriability, acting as inhibitor and/or facilitator of openness, which is contingent upon the start-up growth stage. Secondly, we uncover a more granular pattern of openness in start-ups. The degree of openness is nuanced by the type of external collaboration, either market or institutional, along the various growth stages. We discuss implications for theory and practice.

Keywords: Open Innovation; Start-ups; Appropriability

3.1 INTRODUCTION

Collaborative innovation has been increasingly recognised, by academics and practitioners alike, as an important part of a firm's strategy in its quest for growth and profitability (Chesbrough, 2003). But in order to capture the returns from their innovations, firms need to protect their intellectual property and deploy suitable appropriability regimes (Teece, 1986). This interplay between openness and appropriability, also known as the paradox of openness, has recently started to be addressed in the innovation management literature (Laursen & Salter, 2014). Besides, previous research on open innovation and appropriability has mainly focused on large firms while research on SMEs and start-ups has received little attention (Brunswicker & van de Vrande, 2014; Zobel, Balsmeier, & Chesbrough, 2016).

Open innovation is of particular importance for start-ups which diverge from large firms in their implementation of open innovation (Brunswicker & Vanhaverbeke, 2015; Lee, Park, Yoon, & Park, 2010; van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009). As much as start-ups have contributed to numerous breakthrough innovations (Acs & Audretsch, 1988; Reynolds & White, 1997), these firms have to navigate through various challenges due to their liability of newness and smallness (Freeman, Carroll, & Hannan, 1983; Hannan & Freeman, 1989). Due to these constraints, start-ups are bound by their limited internal resources to efficiently advance and commercialise their innovations when compared to larger firms.

As such, external collaboration becomes an important pathway to access new knowledge and inputs for their product or service innovations (Brunswicker & Vanhaverbeke, 2015; van de Vrande et al., 2009). But at the same time, companies have to protect themselves in order to appropriate the returns from their innovation activities (Teece, 1986). Despite the importance of both external collaboration and appropriability regimes for start-ups, "the interplay of IP management and open innovation is hardly addressed in existing work" (Brunswicker & van

de Vrande, 2014). Despite the need to explore contingencies of openness (Bogers, Zobel, Afuah, & Almirall, 2017; West et al., 2014), only few studies so far have started to look at contingencies of appropriability and openness (Arora, Athreye, & Huang, 2016; Laursen & Salter, 2014; Zobel et al., 2016).

There are two distinct views on the interplay between openness and appropriability. On the one hand, there is the view that a strong protection regime reduces knowledge spillover (Cassiman & Veugelers, 2002) and facilitates openness. In other words, the stronger the firm's appropriability regime, the more likely that the firm will seek external partners for collaborative innovation given that they are guarded against knowledge spillovers (Pisano & Teece, 2007). Alternatively, the lack of adequate protection mechanisms can prevent firms from engaging in open innovation (Drechsler & Natter, 2012). We call this the "protection shield" theory. On the other hand, another group of scholars argues that a deliberate reduction of some appropriability regimes may actually facilitate collaborative innovation (Chesbrough, 2003; Von Hippel & Von Krogh, 2006) in selectively revealing some information (Alexy, Criscuolo, & Salter, 2009; Alexy, George, & Salter, 2013; Henkel, Schöberl, & Alexy, 2014). We name this the "openness protection" theory. In this context, only few recent studies began to look at contingencies of openness and appropriability, beyond the one-size fits-all approach above, such as the contingency of technological intensity (Zobel et al., 2016) and innovation leadership (Arora, Athreye, et al., 2016).

This study then aims to contribute to this debate and sheds light on how contingencies and boundary conditions of the paradox of openness can be best managed when start-ups engage in collaborative innovation. First, this paper examines the interplay between appropriability and openness beyond the extant one-size fits-all approach to appropriability by providing granularity and contingencies such as the start-up growth stage and open innovation type. Open innovation necessitates effective appropriability management where distinct strategies may

prevail in different contexts. Given small firms' preference for informal appropriability even though they employ formal means of protection (Arundel, 2001; Leiponen & Byma, 2009), we examined what role do these regimes have in relation to the degree of openness. Second, this paper unravels the pattern of openness in start-ups in their various growth stages given its important contingency (Love, Roper, & Bryson, 2011; Manzini & Lazzarotti, 2016) in relation to openness. We explore how the growth stage, either early stage or high growth phase, influences start-ups' orientation and pattern of openness.

To investigate these questions, we conducted an inductive study consisting of multiple case studies of FinTech start-ups (defined as firms that generate technological products or services for the financial services sector) at various stages of their growth in London, United Kingdom. This method is particularly suitable in our case to search for common patterns across heterogeneous cases where little is known about the phenomenon which can serve to build theory (Eisenhardt & Graebner, 2007; Yin, 2013). The FinTech sector is particularly suited to study innovation in start-ups as it is generating numerous innovations that have redefined the way consumers and companies save, borrow, invest, transfer, spend, and protect money with more than $50 billion invested in the last five years (Accenture, 2016). London, comprising almost half of all emergent European FinTech start-ups, represents an ideal research setting for innovation and potential collaboration with various external partners. Furthermore, our research setting is based in one of Europe's largest technology accelerator start-up space for FinTech/Tech under one collaborative open space with various stages of growth. We believe that this artificial setup constitutes an ideal setting to test the prospect for collaboration and protection given the potential shared knowledge and proximity.

In this paper, we argue for a more dynamic approach to appropriability based on the two distinct views mentioned above and posit that the relationship between openness and appropriability is contingent upon the start-up growth stage and the type of external collaboration. Firstly, we

found an orchestration of formal and informal appropriability, acting as inhibitor and facilitator of openness, which is contingent upon the start-up growth stage. In other words, the role of the informal regime can oscillate between facilitator and inhibitor of openness depending on the growth stage and the type of open innovation exchange beyond the definite choices of either "openness protection" or "protection shield" theories. Results uncover four patterns of appropriability profiles that are driven by the degree of openness and the stage of development of the start-up. Secondly, we uncover a more granular pattern of openness in start-ups. The degree of openness is nuanced by the type of external collaboration, either market or institutional, along the various start-up growth stages. For start-ups that collaborate with market oriented partners such as customers or suppliers, openness and informal appropriability move in opposite directions at the early stage with the role of informal gradually shifting from facilitator to inhibitor of openness the more the firm grows. As for stat-ups that collaborate with institutional based partners such as universities, it is the formal appropriability that drives higher organisational openness in the growth stage.

This paper contributes to the literature in several ways. First, this study contributes to the discussion about the contingencies and paradox of openness. In this paper, we contribute to this discussion about exploring contingencies and determinants of openness (Arora, Athreye, et al., 2016; Bogers et al., 2016; Zobel et al., 2016) for start-ups and young small firms (Brunswicker & van de Vrande, 2014; Laursen & Salter, 2014). We try to extend our understanding beyond the one-size fits-all approach to appropriability that has polarised the debate in two specific views and provide boundary conditions and contingencies. Second, this study can provide important implications for the integration of the open innovation literature with entrepreneurship (Bogers et al., 2016; Eftekhari & Bogers, 2015) and SMEs/start-ups (Brunswicker & van de Vrande, 2014; Brunswicker & Vanhaverbeke, 2015). This paper extends our understanding on the dynamics of openness and protection from the perspective of

start-ups and founders where the extant literature is still in its early stage (Bogers et al., 2016). Third, our paper can also add to the emerging literature on open service innovation (Chesbrough, 2011; Randhawa et al., 2016) in shedding light on how, in this case, FinTech services firms can engage in service innovation (Ettlie & Rosenthal, 2011; Storey, Cankurtaran, Papastathopoulou, & Hultink, 2016) and manage their appropriability regimes (Miozzo, Desyllas, Lee, & Miles, 2016) when collaborating with external partners (Mina, Bascavusoglu-Moreau, & Hughes, 2014).

The paper is structured as follows. First, we will outline the conceptual background about open innovation, appropriability, and start-ups. Second, we will explain the methodology. Third, we will explore the findings. Finally, we will discuss the results and contributions.

3.2 CONCEPTUAL BACKGROUND

3.2.1 Open Innovation and Start-ups

Despite the surge of the open innovation literature in the last decade, research on start-ups has only recently started to emerge and is still in early stage. Start-ups are an important source of innovation and have helped to generate several radical innovations (Acs & Audretsch, 1988; Chesbrough et al., 2006; Lee et al., 2010). The extant literature has mainly focused on multinational and large companies with more recent studies covering SMEs which diverge from large firms in their management and implementation of open innovation (Brunswicker & van de Vrande, 2014; Brunswicker & Vanhaverbeke, 2015; Colombo, Piva, & Rossi-Lamastra, 2014; Criscuolo, Nicolaou, & Salter, 2012; Lee et al., 2010; Spithoven, Vanhaverbeke, & Roijakkers, 2013; van de Vrande et al., 2009b). Yet, very few recent studies have tackled collaborative innovation in new firms and start-ups (Eftekhari & Bogers, 2015; West & Kuk, 2016; Zobel et al., 2016).

The dynamics of openness in large and small firms diverges quite significantly in their collaboration patterns. Previous research has demonstrated that collaboration with external partners can help small firms overcome the lack of resources (Gassmann, Enkel, & Chesbrough, 2010), given their liability of smallness and newness (Freeman et al., 1983), and engage in innovation activities with other firms (Lee et al., 2010). External collaboration in small firms has a positive impact on firms' propensity to launch a new product or service (Spithoven et al., 2013) while vertical collaboration is positively related to radical innovation (Parida, Westerberg, & Frishammar, 2012). Although the literature on inter-organisational linkages and networks has demonstrated the importance of ties in innovation (Birley, 1985; Edwards, Delbridge, & Munday, 2005; Macpherson & Holt, 2007), examining the unique challenges in managing open innovation in SMEs and start-ups merit further studies (Brunswicker & van de Vrande, 2014).

Firm size appears to be another determinant of openness with some studies outlining a positive association with size (Drechsler & Natter, 2012) while others argue for a curvilinear relationship between size and search breadth (Barge-Gil, 2010). Even though large firms display generally a higher degree of openness (Teirlinck & Spithoven, 2013; van de Vrande et al., 2009b), small firms appear to show greater intensity and concentration vis-a-vis their open innovation activities (Spithoven et al., 2013).

The stages of innovation and process in SMEs firms are distinct from large firms (Edwards et al., 2005). Some studies have argued that collaboration for innovation for SMEs is more beneficial at the commercialisation stage rather than in the early phases of innovation (van de Vrande et al., 2009b; van Hemert, Nijkamp, & Masurel, 2013). In terms of the type of collaboration and the various stages of the innovation process, (Love et al., 2011) found that client collaboration is important at the knowledge sourcing stage, research institutions at the

knowledge transformation stage, and collaboration with professional associations at the knowledge exploration phase.

3.22 Appropriability and Openness

In order to capture the returns from their innovations, firms need to protect their intellectual property and deploy suitable appropriability regimes (Teece, 1986). But concurrently, firms are becoming more open in their innovation activities in collaborating with various external partners (Chesbrough et al., 2006). Thus, this duality between collaborative innovation and protection, dubbed as the "paradox of openness" (Laursen & Salter, 2014) has polarised the academic debate into contrasting views.

The extant literature distinguishes between two types of appropriability regimes: formal (patent, industrial design, trademark, and copyright) and informal (secrecy, lead time, and complexity of design) (Hall, Helmers, Rogers, & Sena, 2014). In the real world, firms can use a combination of formal and informal appropriability regimes (Cohen, Nelson, & Walsh, 2000; Leiponen & Byma, 2009; Thomä & Bizer, 2013). Small firms tend to prefer informal means of protection such as secrecy and lead time (Arundel, 2001; Leiponen & Byma, 2009). Although patents represent an important signal of innovation potential for interested venture capital firms (Gans & Stern, 2003) and may facilitate the transfer of knowledge (Alexy et al., 2009), the associated costs with patents render it less attractive for small firms (Penin, 2005). Free or selective revealing can also be used by small firms to overcome the liability of smallness (Gruber & Henkel, 2006) and engage in collaborative innovation (Alexy et al., 2013).

The literature differentiates between two theoretical views on the interplay between openness and appropriability. On the one hand, there is the view that there is a positive association between openness and appropriability. First, scholars have argued that a strong protection regime reduces knowledge spillover (Cassiman & Veugelers, 2002) or the lack of adequate

protection can prevent firms from engaging in open innovation (Drechsler & Natter, 2012). Companies that are more open towards external partners find it harder to protect their innovation developed via collaboration (Giarratana & Mariani, 2014) and are prone to imitation (Noordhoff, Kyriakopoulos, Moorman, Pauwels, & Dellaert, 2011). In other words, the stronger the firm's appropriability regime, the more likely that firms will seek external partners for collaborative innovation (Graham & Mowery, 2006; Hagedoorn & Zobel, 2015; Laursen & Salter, 2014; Pisano & Teece, 2007). Second, firms have to deal with the knowledge aspect: appropriability is about knowledge protection and collaboration is about being open with knowledge. As such, open firms need to protect the knowledge that is involved in the innovation activities. Scholars have argued a strong protection regime is advantageous for firms engaged in open innovation (Arora & Gambardella, 1994; Chesbrough, 2003) as it can create a "platform for the transfer of knowledge assets" (Graham & Mowery, 2006). Third, companies may deploy various appropriability regimes which act as a signalling and strategic tool of their innovative capabilities to other players in the market (Alexy et al., 2009; Hagedoorn & Ridder, 2012). We called this the "protection shield" theory.

On the other hand, a second view in this debate is that there is a negative relationship between openness and appropriability. Some scholars posit that a deliberate reduction of some appropriability regimes may actually facilitate collaborative innovation (Von Hippel & Von Krogh, 2006) in selectively or freely revealing information or technologies to external partners (Alexy et al., 2013; Henkel et al., 2014) which help to attract more partners into the focal firm's ecosystem. In this view, the usage of appropriability regimes can make the firm less attractive to other partners and hence result in less incentive to deploy strong protection regimes as it deters collaboration for innovation. We named this the "openness protection" theory.

More recent studies have emerged to extend our understanding on the paradox of openness in further delineating boundary conditions and contingent factors of this relationship. (Arora,

Athreye, et al., 2016)) argues that the relationship between patenting and openness is contingent upon the technological superiority of the firm vis-à-vis their rivals, i.e. leader or follower. In this sense, leaders display higher patterns of patenting in line with more openness versus followers. (Miozzo et al., 2016)) focuses on knowledge intensive business services and points out to a paradox of formal appropriability in finding a positive association between formal appropriability and external collaboration for innovation with the relationship varying depending on the type of partners (i.e. clients or others). In a study studying start-ups, (Zobel et al., 2016) argue beyond the one size fits all approach to inter-organisational relationships in discussing the contingent effect of technological intensity on the generally positive relationship between openness and patenting.

In sum, the literature to date on openness and appropriability has discussed these differing views of the trade-off when firms are confronted with the paradox of openness. Nevertheless, the current debate can greatly benefit from a less static and more dynamic approach on appropriability and openness beyond the one size fits all studies. Exploring determinants or contingent factors of the paradox of openness can further extend our understanding of this important scholarly and managerial topic. This is even more needed for young and small firms (Laursen & Salter, 2014) given the challenges they face when engaging in collaborative innovation activities.

3.3 METHOD

3.3.1 General Context and Sample

This study consists of a comparative case study where the cases are considered multiple experiments in which each case tries to approve or disapprove the findings from others (Yin, 1984). This method is particularly suitable in our case to search for common patterns across heterogeneous cases where little is known about the phenomenon which can serve to build

theory (Eisenhardt & Graebner, 2007; Yin, 2013), allowing us to derive robust theory and generalizable results. Based on the methodology of comparative case study (Eisenhardt, 1989), we chose the cases based on a theory driven approach, collected data, and inductively analysed the results.

We carried this research in FinTech start-ups in London (United Kingdom) in 2015-16 for several reasons. First, the FinTech industry is particularly suited to study innovation in start-ups as the latter has produced numerous innovations that redefined the way consumers and companies save, borrow, invest, transfer, spend, and protect money. The sector has witnessed a 60% cumulative annual growth between 2011 and 2015 with more than $50 billion invested in 2,500 start-ups since 2010 (Accenture, 2016). Even more relevant, the UK FinTech market, which generated £20 billion in 2015, comprises half of all emergent FinTech start-ups in Europe and London is considered as the leading global FinTech hub (UKTI, 2016); an ideal research setting to study innovation in start-ups. The sector resembles others that rely on knowledge, human capital, processes, technology, and innovation and can therefore be generalised to several other industries.

Second, our sampling approach was theory driven in order to suit our research focus (Eisenhardt, 1989). Given our interest in the dynamics of openness in the start-up context, we selected distinct cases which also have similar features. Following on the liability of newness and smallness that start-ups face (Freeman et al., 1983; Hannan & Freeman, 1989), we have defined some criteria for selecting the cases. The selection of the cases is based on: (i) the company is an independent start-up that develops FinTech products or services (e.g. payments, software, data and analytics, platforms, and cyber-security) for the financial services sector (ii) the company is still in activity and has been founded in the last five years (iii) the number of employees is less than fifty people with the aim to scale up the business (iv) the company is still run by at least one of its founders at the time of selection and interview (v) the classification

of the growth stage (e.g. early stage, growth) is based on company's monthly customer growth rate, employee numbers, and revenue growth whenever applicable. *Table 1* presents an overview of the cases used in this study.

Third, we made sure to look for companies that display commonalities for replication purposes, yet at the same time heterogeneous enough in order to have potential generalisability. The selected firms offer products or services within the FinTech sector but also display some variety in different specialisations such as payments, compliance, artificial intelligence, data and analytics, and risk management. At the selection stage, these cases were still based in one of Europe's largest space for FinTech and Technology start-ups located under one collaborative open space. This setting is comprised of three different floors, with each floor dedicated to start-ups' various stages of development. We selected firms with various ages, sizes, and growth stages. We believe that this artificial setup constitutes an ideal setting to test the prospect for collaboration and protection given the potential shared knowledge and proximity under one setting.

INSERT TABLE 1

3.3.2 Data Collection

Our data collection took place over the course of two years, between 2015 and 2016. We have used several data sources, primarily semi-structured interviews with founders and managers, which is also complemented by archival materials, conferences, and observations; secondary data which is aimed at strengthening or rebutting our findings (Forster, 1994). *Table 2* displays the various data sources with both primary and secondary data that will be used in the analysis as part of the triangulation process.

INSERT TABLE 2

Semi-Structured Interviews. We conducted interviews with founders and managers of seven FinTech start-ups who are directly involved in strategy, innovation process, and business development and partnerships. The interviews were conducted in person or by phone, with each interview lasting at least an hour. The sample consists of start-ups that are categorised in either early stage or growth stage according to the criteria mentioned above. Almost all interviews were recorded and transcribed verbatim in order to account for reliability (Eisenhardt & Bourgeois, 1988). In order to make sure that our sample had the most relevant informants, we adopted a "snowball technique" where initial informants recommended us others within their companies who can provide additional insights. Based on the 24 hour rule (Eisenhardt, 1989; Miles & Huberman, 1994), we drafted case notes within a day following each interview.

Archival Data. We also gathered secondary data from articles and archival materials. These include press releases, marketing materials, and articles about each company and founders via a search on Factiva database engine resulting in over 175 articles. Following the interviews, we utilised these materials for triangulation purposes and further validate the data or detect additional avenues. We also looked at the UK Intellectual Property Office for Trademark and Copyrights (UK Intellectual Property Office, 2016) in order to cross-check firms' appropriability regimes.

Observations. We attended events and conferences and took notes of the dynamics in all our case studies. As such, informal and nonparticipant observations were done during these visits and conferences. We also observed the collaborative space and working environment in order to better understand and triangulate the interview data.

3.3.3 Data Analysis

In analysing the data, we disentangled raw data from various sources that helped us identify the dynamics between openness and appropriability in start-ups. We based our analysis on systematic, thematic, and iterative comparisons of data backed by the extant literature and theoretical lens of appropriability and open innovation.

Stage 1. The first stage consisted in proceeding to an iterative comparison of the various data sources in order to identify relevant themes and categories so that patterns can emerge (Boyatzis, 1998). Even though interviews were the primary source of information, we made sure to triangulate our data with archival materials and field notes from conferences and events. The first codes constituted of participants quotes that referred to themes such as collaboration, innovation, and openness.

Stage 2. The second stage included constructing the case studies from the collected materials that contain descriptive information on the foundation and growth of the start-up, innovation and external collaboration related dynamics, and choices about appropriability regimes. Based on this and prior literature, we have followed a thematic approach and tried to unpack two main themes: external collaboration and appropriability regimes. After consultation with researchers involved, the codes were defined around the dynamics and orchestration of collaboration and appropriability choices by the firms.

INSERT TABLE 3

Stage 3. We looked for cross-case patterns in comparing and contrasting the cases (Eisenhardt, 1989) which let us spot differences in the mechanisms and dynamics related to openness, appropriability, and start-up growth stage. This allowed us in turn to build tables aided by existing studies of open innovation and appropriability to revisit our labels and understandings. *Table 3* displays the cross comparison of cases.

3.4 FINDINGS

Exploring the paradox of openness in start-ups, we have identified two overarching patterns. First, we found a dynamic orchestration of formal and informal appropriability, acting as inhibitor and/or facilitator of openness, which is contingent upon the start-up growth stage. Second, informants were actually aware of the duality between protection and openness as the company grows and engage in collaborative innovation. But the degree of external collaboration or openness is nuanced by the type of external collaboration, the type of open innovation, and the start-up growth stage. *Table 4* displays four patterns of appropriability profiles that are driven by the degree of openness and the start-up growth stage while *Table 5* presents the respective quotes for the constructs.

INSERT TABLE 4

INSERT TABLE 5

INSERT FIGURE 1

Orchestration of Appropriability and Pattern of Openness

Findings uncover four patterns of appropriability profiles that are driven by the degree of openness, the stage of development of the start-up, and the type of open innovation.

The Independent. The independent start-up is in its early stage of its development characterised by a low level of openness with limited interaction with external partners for collaborative innovation.

> It's hard for one start up to collaborate with another start up. It is not possible. To collaborate at early stage between two companies is really dangerous. It's a huge exercise in itself [to collaborate]. It doesn't help anyone. It's probably better when you have grown to a certain extent, and both companies are clear about their product market fit. Before

> their product market fit happens, it's not wise to collaborate for selling to customers. [Firm 2]

Although these firms interact with customers in order to get feedback and test the technology of the product or service, their primary external collaboration resides with targeted institutional partners especially research based partners such as universities, public or private research or non-profit organisations where they feel they can benefit the most.

> "Advisors do play a role. We have advisors, Professor [X] in [University] e-Research Centre, he advised on individual analytics. Some of their [University] researchers, and we had, through [University] we had a pretty senior design consultant working with us for many months. It is better to focus in a place like university, you are doing the early stage research, building the product, and your focus on customer development is lesser. [Firm 2]

> I'd just highlight [non-profit organisation] and I guess UKTI as the two that have been most helpful to us. We are also a member of this non-profit in Boston FinTech that gives Fintech stats [Firm 1]

This orientation for a relatively closed model for collaborative model has mainly been driven by either a previous failure when engaging in open innovation or lack of previous exposure in dealing with partnerships with various partners.

> There has been an incident where we have been involved in a program where there was a lot of openness between the start-ups and one of the start-ups pivoted and they basically took a fair amount of our ideas and what we proposed and that's now their product [Firm 1]

> I don't think I have handled a lot of partnerships in my previous business [Firm 2]

> We constantly ask people to look and have feedback. Initially, we had friendly advice from people we know as it was like trial and feedback stage and still the case…but one has be careful, we can't talk and share with anyone, only when we need. [Firm 4]

As such, in terms of protection regimes, the independent has a low usage of formal appropriability coupled with a high usage of informal protection regimes. While few firms have a registered trademark, none of the firms use patents as they are seen as ineffective for protection.

> It's a challenge. We could patent, we could trademark, or none of that can deter, discourage the imitators from coming in and trying to do copying and replicating [Firm 2]

Informal appropriability seems to be the most relevant and important means of protection that acts as an inhibitor of openness. Firms seem to use and value mostly secrecy and lead time over competitors but also mention the complexity of the design and technology and the internal processes and culture as a shield.

> This is if you study the business, the best way to do it is to move really fast, to seek, to keep secrecy. The idea gets stolen the day you'll set up a website. You will have no way. Because even if you copy is not the dominant design… That will evolve. That's something that nobody can steal or nobody can copy [Firm 2]

> They basically took a fair amount of our ideas and what we proposed and that's now their product. I was actually pretty pissed off about that but again they didn't sign, there were no NDAs signed between the start-ups. We're not overly explicit in terms of this is how we do it. It's like this is what we do but we are not talking too much about how we do it. [Firm 1]

> The software can be replicated but it will take a lot of time and money. For example, some of ex-colleagues founded a start-up which took 3-4 years to take to market costing more than $30MM. [Firm 4]

The Collaborator. What distinguishes the collaborator start-up from the independent is the high degree of openness in the early stage of development coupled with very low appropriability regimes (Alexy et al, 2013) and a coupled type of open innovation (inbound and outbound). The collaborator is focused on increasing the number of customers and refining the current business model. The firm collaborates extensively with external partners, mainly market oriented players where complementarity exists, resulting in a joint new product innovation with another Fintech company.

> You have to be open to new ideas, new ways of working, new tech. This has helped us… We've gone Company called [XYZ]. We've sold there. We got an activity. We got some software. They got some software. We've come together so the customer gets a wider range of software on delivery... We're going to hopefully try to build a business together with him. That said, we'll work with anybody complimentary. [Firm 5]

Besides, the collaborator has the peculiarity of using a coupled type of innovation in using both inbound and outbound (Dahlander & Gann, 2010), which is relatively uncommon for a SME and start-up.

> We helped guide a few other companies as well. Richard is a mentor here. There's at least 3 companies we helped guide. We try to give back as well. Get some really good, techy ideas. Which is great. Vice versa, we like to give a bit of business and maybe some techy ideas back. That has been very important. [Firm 5]

Despite its open mindset, the collaborator does not use any formal appropriability regimes such as trademarks or patents in order to protect their innovations. Formal regimes are not seen as important for protection given that it will be hard for other people to effectively copy.

> Everybody asked what they do. They said, "I do [this software]. That wasn't the case a few weeks ago. There's a bit of that [copying]. To be honest, I think that's understandable. Second, nobody cares. People think, they copied. They don't see it… they pivot a little bit but they don't really pivot remarkably. [Firm 5]

Even for the informal appropriability which is more often used by small firms, the collaborator uses only a low degree of appropriability which acts as a facilitator of openness. Besides the usage of the complexity of design and technology as a tool for protection, the firm uses internal processes and culture in order to shield itself from intellectual property threats. For an open and collaborative firm, it is not only the technology that matters but also the processes and culture taking the shape of an informal appropriability and acting as facilitator of collaborative innovation; helping the firm to manage the paradox of openness.

> We've been really very cutting edge even compared to the people here. We're very cutting edge on technology. We started three years ago with this concept called data virtualization. It's only 4 or 5 vendors in data virtualization. Big companies like Informatica. [Firm 5]

> As long as you've got confidence in what you're doing and how you're going about it. The processes. Your culture. What we're trying to put in place here. A vision as well. As long as you've got confidence in those three things in particular, I think... It's very difficult to replicate. [Firm 5]

The Protector. This type of start-up is oriented towards a rather closed approach to collaborative innovation with a moderately low and targeted interaction with external partners, mainly with research based universities (Perkmann et al., 2013) in order to advance their innovations on specific projects. The founders do not see tangible advantages in external collaboration stressing that they have prior experience in founding and managing companies.

> It's always good to know your enemy. That's great. This is an advantage. Now whether we interact, answer is no, we don't really need anything. We have experience in place. We've

> done it before. I, myself, built a company in Moscow and that's a company that has forty employees. All major Russian banks are its clients. I did it before. [Firm 7]

The focus is also on getting a reputable and a high standard scientific product or service as well as maintain high growth momentum to further scale up the business. The informants found that possible in cooperating and collaborating with renowned university departments that have specific expertise in the start-up's field and technology.

> Another reason was that [this University] is a part of [this Dr. X initiative]. You can look it up. The reputation of why this is just brilliant. They also have one of the best mathematics statistics departments in the world. They were quite a natural choice. [Firm 7]

> Let's start with [University] in [outside UK]. Those guys are world leaders in both processing algorithms, period. You can't find anyone better. [Firm 7]

However, this exclusive and somewhat closed approach to openness is associated with a high usage of appropriability regime, both formal and informal (Cassiman and Veugelers, 2002). Although the company uses patents and trademarks as part of a high formal protection regime, the founders believe that the effectiveness of patents resides in its valuable signal for investors rather than for the purpose of protection on its own.

> We have patents in place, but they don't protect you. The problem with patents is that they work only so much. That's a statement valuable for investors sometimes, but from the perspective of actual protection of your IP it's useless.

> We patented the approach to quantification of relationships. This is an algorithm, and visualization coupled with that. You can patent visualizations. Those we did. We filed the patent quite a long time ago, and to be honest, since then we realized that this is not something we need to focus on. [Firm 7]

The informal appropriability seems to be the most relevant for the protector with a high usage overall. The complexity of the technology is considered as the most important for protection followed by secrecy with non-disclosure arguments for instance. The high usage of these informal mechanisms acts as a protection shield and lets the start-up engage or not in collaborative innovation on specific projects with well-defined objective and timeline.

> It's impossible to replicate this software for two reasons…our code base is huge. We're talking about probably a million lines of code already. [Firm 7]

> Because there is an exchange of confidential information. We want to be protected. It's a very simple thing [NDA]. It's very formal thing. Usually the way it works you sign the MOU or NDA irrespective, and then you start discussing specific of such agreement. We usually work so it's temporary. It's on a project basis. [Firm 7]

The Selector. The selector is a type of start-up in the growth stage that is characterised by an above average and selective openness coupled with a moderate usage of appropriability regimes. The start-up collaborates mainly with market based partners but only selectively revealing or sharing information with other players (Alexy et al, 2013). The focus is on maintaining fast growth of customers and gradual monetisation along with scaling up and expanding the platform. Even though the selector is not as collaborative and open as the collaborator type, it nevertheless keeps an open approach to collaborative innovation with the protection mechanism acting as a facilitator of openness.

> Yes we interact with customers, we do change and update small processes here and then, it might be very minor from a technical point of view but it is something that can affect the user's experience quite a lot. [Firm 6]

> My role is to take feedback from clients and assess the requirements and make a decision on what new features are needed and how we can improve our existing features. [Firm 6]

However, informants find that a too high external collaboration can have some decreasing returns given the effort, time, and coordination costs with all the parties.

> Unfortunately we collaborate with too many of them. It is very difficult to deal with all parties, that was the most painful part when we first started when you have to agree terms and everything with other financial institutions [Firm 3]

Hence, the selector utilises not only selective revealing in order to drive forward their collaborative innovation but also uses coupled open innovation (inbound and outbound) in giving and exchanging solutions with other start-ups for free.

> You know if you want to get some basic information, it makes sense to collaborate. We talk for sure, not only competitors but general start-ups in the industry, to get feedback, be up-to-date. In a way we have the same problems and we also exchange solutions. [Firm 3]

This selective openness approach goes hand in hand with a proportionally moderate appropriability regime. As the legal way of protection, there is an emphasis on trademarks as patents are either seen as not effective or merely as a signal to other players.

> We filed a patent application in the US for multi-currency algorithm that we developed. It sends a message. [Firm 3]

> At the moment we don't have any patent but all of our technology is proprietary and is developed in house. [Firm 6]

The selector, nevertheless, uses a combination of moderately strong informal protection regimes. Both the complexity of design and secrecy are considered as the most relevant for protection while lead time and the regulatory environment can also provide some additional layer of protection.

> The technology is quite complex to replicate now, it is not just a simple software build...There is a reason why no one has attempted to do that before us. [Firm 3] Then the

ability to build the technology that is built in house with our own data centres. It is all done in-house. [Firm 6]

Obviously we don't share things that are really critical for our business, which give us unique advantage. [Firm 3] All of our technology is proprietary and is developed in house. We do sign NDAs. [Firm 6]

Our business has particular high barriers to entry than just imitating a website. We are kind of in a regulated environment. It is not easy to get to that level, we managed to survive it. You imagine another company where there is an 18 month long sale cycle, they ran out of cash. [Firm 6]

3.5 DISCUSSION

Previous studies have acknowledged the benefits of openness to start-ups as a way to compensate for their liability of newness and smallness. However, start-ups are faced with the core issue of protecting their innovation and knowledge bases, thus creating a dilemma for firms and managers involved in open innovation. Through this comparative case study, we explore how start-ups configure their appropriability and manage the paradox of openness in shedding light on boundary conditions and contingencies when they engage in collaborative innovation. First, this paper examines the interplay between appropriability and openness beyond the extant one-size fits-all approach to appropriability by providing granularity and contingencies such as the start-up growth stage. Given small firms' preference for informal appropriability even though they employ formal means of protection (Arundel, 2001; Leiponen & Byma, 2009), we examined what role do these regimes have in relation to the degree of openness. Second, this paper unravels the pattern of openness in start-ups in its various growth stages that seem to be contingent on the type of external collaboration. We explored how each growth stage, either early stage or high growth stage influence start-ups' orientation for openness.

This paper contributes to the literature in several ways. This study contributes to the appropriability and openness discussion. Associated with the paradox of openness debate, there are two contrasting theoretical views. On one hand, there is the view that the stronger the firm's appropriability regime, the more likely that they will collaborate with external partners for collaborative innovation (Graham & Mowery, 2006; Hagedoorn & Zobel, 2015; Laursen & Salter, 2014; Pisano & Teece, 2007) as a strong protection regime reduces knowledge spillover (Cassiman & Veugelers, 2002). We called this theory "protection shield". On the other hand, a deliberate reduction of appropriability regimes may actually facilitate collaborative innovation (Von Hippel & Von Krogh, 2006) in selectively or freely revealing information or technologies to external partners (Alexy et al., 2013; Henkel et al., 2014). We dubbed this "openness protection" where there is negative relationship between openness and appropriability.

In this context, a recent stream of research has started to look at contingencies of openness and appropriability such as technological intensity (Zobel et al., 2016), innovation and technological leadership (Arora, Athreye, et al., 2016). In this paper, we contribute to this discussion about contingencies and determinants of the paradox of openness (Laursen & Salter, 2014) in the start-up context. We go beyond the one-size fits-all approach to appropriability that has dominated the debate so far in either adopting the theory of "protection shield" or "openness protection" when engaging in collaborative innovation.

Instead, we argue for a more dynamic approach and posit that the relationship between openness and appropriability is contingent upon the start-up growth stage, the type of open innovation flow, and the type of external collaboration. Firstly, we found an orchestration of formal and informal appropriability, acting as inhibitor and facilitator of openness, which is contingent upon the start-up growth stage. In other words, the role of the informal regime can oscillate between facilitator and inhibitor of openness depending on the growth stage and the

type of open innovation exchange beyond the definite choices of either "openness protection" or "protection shield" theory. Results uncover four patterns of appropriability profiles that are driven by the degree of openness and the start-up stage of development: the independent, the collaborator, the protector, and the selector. In terms of the type of the open innovation (Enkel, Gassmann, & Chesbrough, 2009; West & Bogers, 2014b), open start-ups display a tendency to use more coupled innovation flow like the collaborator at early stage (coupled) or the selector at the growth stage (mostly inbound with selected coupled). This raises an important point on the contingent factor of the type of collaborative innovation flow in the start-up context; hence contributing to the openness-appropriability academic debate (Cassiman & Valentini, 2016; Dahlander & Gann, 2010).

Secondly, we uncover a more granular pattern of openness in start-ups. The degree of openness is nuanced by the type of external collaboration (market or institutional) along the various start-up growth stages. For start-ups that collaborate with market oriented partners, openness and informal appropriability move in opposite directions at the early stage with the role of informal gradually shifting from facilitator to inhibitor of openness the more the firm grows. While the role of the formal regime is not relevant in the early stage, it becomes more relevant in the later growth stage. There is a dynamic orchestration of appropriability regimes in moving from an openness protection (negative association) to a protection shield theory (positive association) along the growth stage. As for the pattern of openness, the degree of openness is high in the early stage and then becomes lower with the growth of the firm, transforming into a selective openness pattern. At the early stage, the high willingness to collaborate with market oriented partners (customers, suppliers, and even competitors in some cases) may be due to the important role of downstream knowledge as basis of entrepreneurship (Adams, Fontana, & Malerba, 2017) and the need for start-ups to commercialise the innovation (Arora, Cohen, & Walsh, 2016). External collaboration with customers and suppliers, for instance, has a positive

impact on radical innovation (Parida et al., 2012), enhances process innovation (Tsai, 2009), shares market insights beyond existing products (Brunswicker & Vanhaverbeke, 2015), and minimises product design failure (Tsai, 2009; Tsai & Hsieh, 2009).

As for stat-ups that collaborate with institutional based partners such as universities, the degree of openness is higher in the growth stage than at the early stage. While formal appropriability is not deployed in the early stage, the role of formal becomes relevant in the growth stage where it acts to prevent knowledge leakage and subsequently partially facilitates external collaboration. As such, while the role of the informal remains inhibitory and negatively related to openness as to prevent spillover, it is the formal appropriability that delivers higher organisational openness in the growth stage. For these start-ups that collaborate with institutional partners like universities (Cassiman, Di Guardo, & Valentini, 2010), this relatively closed pattern of openness can be explained by the dynamics of university-industry collaboration. As firms need to liaise with providers of scientific knowledge in order to generate an invention (Gittelman & Kogut, 2003) advancing these entrepreneurial firms (Gans & Stern, 2003), collaboration with universities will enhance start-ups' scientific and inventive knowledge and more likely result in radical invention (Perkmann et al., 2013; Tsai, 2009) with higher invention quality (Walsh, Lee, & Nagaoka, 2016). For instance, some of these firms in our study engage in collaborative contract research with reputable universities' department at an early stage in order to advance their product innovation (Arora & Gambardella, 1990). However, they remain closed to other external partners outside of these defined university collaborations, especially at the early stage. This may be due to the transfer of tacit knowledge with universities that start-ups deem sufficient to commercialise their product or service, the risk of knowledge spillover, the lack of trust in external collaboration with non-institutional partners, the lack of prior collaboration experience, or failed open innovation activities as some start-ups show (Bruneel, d'Este, & Salter, 2010; Perkmann et al., 2013).

As such, our study also provides important implications for the open innovation literature in the context of entrepreneurship (Bogers et al., 2016; Eftekhari & Bogers, 2015) and SMEs/start-ups (Brunswicker & van de Vrande, 2014; Brunswicker & Vanhaverbeke, 2015). This paper extends our understanding on the dynamics of openness and protection from the perspective of start-ups and founders where the extant literature is still in its early stage (Bogers et al., 2016; Randhawa et al., 2016). We provided important insights on the orchestration of collaboration and appropriability regimes in the different growth stages of start-ups, from its early stage to growth.

In our study of FinTech services start-ups, our paper can also add to the emerging literature on open service innovation (Chesbrough, 2011) in shedding light on how services firms can be different from manufacturing (Ettlie & Rosenthal, 2011; Storey et al., 2016) when collaborating with external partners (Mina et al., 2014). We also provide more granular findings on the interplay between collaboration and appropriability regimes for services firms (Miozzo et al., 2016).

Future Directions

In this study we presented an exploratory case study related to the interplay between openness and appropriability in U.K. based FinTech start-ups. This is an opportunity for future research to examine start-ups in different contexts, geographies, or industries (e.g. low-tech, creative industries). Besides, it would be interesting to look for future studies that tackle further contingencies or dive in more processes when start-ups engage in collaborative innovation. This results in a call for more integration between the entrepreneurship literature and the open innovation literature in start-ups given the early stage of the extant research on the topic (Bogers et al., 2016; Eftekhari & Bogers, 2015). Further research can also draw from

longitudinal studies and explore how openness and appropriability change over a longer period of time with different external patterns.

Implications for Practitioners

The key decision makers of a start-up's engagement in collaborative innovation are either founders of the business who stir the strategic direction of the firm or senior managers who decide on the R&D and innovation activities of the start-up. Regardless of the decision makers, they can influence quite significantly the direction, growth, and possibly the survival of their new ventures given also the limited resources at their disposal. This study gives managers and founders (i) much needed granularity on how openness can be managed whilst protecting their intellectual property from a start-up angle in various growth stages and OI flow involved and (ii) how the type of external partners that they seek can affect the pattern of openness. We believe that these are extremely important for a start-up to be aware and understand how the paradox of openness can be managed in the real world in order to further drive breakthrough innovations.

Table 1: Overview of Cases

FIRM	Year Founded	Number of Employees	Number of Offices	Start-up Growth Stage	Fintech Focus
FIRM 1	2014	4 in London	1	Early Stage	Data analytics - Uses big data technologies to enable analysis and visualization of insights for financial portfolios
FIRM 2	2014	5 in London	2	Early Stage	Automated predictive analytics and machine learning applications for financial sector, retail, and e-commerce
FIRM 3	2015	15	1	Growth	Foreign exchange and money transfer platform via personal money cloud and applications
FIRM 4	2014	7 in London	1	Early Stage	Risk management in capital markets and regulatory compliance software tools
FIRM 5	2014	5 in London 8 in India (IT)	1	Early Stage	Data analytics and payments focused on Fintech and energy sector for sustainability and efficiency
FIRM 6	2012	7 in London 13 in Paris	2	Growth	Payment solutions for financial companies via a single multi-channel platform
FIRM 7	2014	7 in London 13 in Russia (IT)	2	Growth	Risk and compliance focused software aimed at identifying potential rogue activity in the financial sector
Collaborative Space	2014	16	1	- Pantry space for young start-ups - Two high growth floor spaces	One of Europe's largest co-working space with over 200 members, of which two thirds focused in Tech and Fintech

Table 2: Data Sources

Data Sources	FIRM 1	FIRM 2	FIRM 3	FIRM 4	FIRM 5	FIRM 6	FIRM 7
Semi-Structured Interviews	CEO and Co-Founder (1) COO and Co-Founder (2)	CEO and Co-Founder (1)	CEO and Co-Founder (1) Business Development Manager (1)	CEO and Co-Founder (1) CIO and Co-Founder (1) CTO and Co-Founder (1)	Director and Co-Founder (2)	Head of Product Strategy & Commercialisation (1) Marketing and Communications Manager (1	COO and Co-Founder (1)
Archival Material	Articles (22) Website (1)	Article (1) Website (1)	Articles (9) Website (1) Blog (10) Marketing Materials	Press Releases (12) Website (1)	Articles (2) Website (1) Blog (23) Marketing Materials	Articles and Press Releases (46) Website (1) Marketing Materials	Articles (6) Website (1) Blog and White Papers (14) Press Releases (6)
Other Sources	Conference: Innovate Finance Global FinTech Summit 2016 – London (UK) 9 hours observation and discussions with start-ups 2 workshops 5 panel events Over 10 presentations UK Intellectual Property Office for Trademark and Copyrights Database						

Table 3: Comparisons of Case Studies

Stage of Development	**Early Stage**				**Growth**		
Name	**FIRM 1**	**FIRM 2**	**FIRM 4**	**FIRM 5**	**FIRM 3**	**FIRM 6**	**FIRM 7**
Label		The Independent		The Collaborator	The Selector		The Protector
Collaboration Orientation	Market and Institutional	Market and Institutional	Market and Institutional	Market and Institutional	**Market**	Mostly **Market**	Institutional
OI Type	Inbound	Inbound	Inbound	Coupled	Inbound and Outbound	Inbound and Outbound	Inbound
Formal	**Low**	**None**	**Low**	**None**	**High**	**Low**	**High**
Role	Not relevant	Not relevant	Not relevant	Facilitates openness	Facilitates openness	Facilitates openness	Selectively Inhibits openness
Informal	**High**	**High**	**High**	**Low**	**Moderate High**	**Moderate High**	**High**
Role	(Selectively) Inhibits openness	Inhibits openness	(Selectively) Inhibits openness	Facilitates openness	Selectively facilitates openness	Facilitates openness	Selectively Inhibits openness
External Collaboration	**Low** (Selective)	**Low** (Exclusive)	**Low** (Selective)	**High**	**Mid-High** (Selective)	**Mid-High** (Selective)	**Lower Average/ Moderate** (Exclusive)

Note:
Market Orientation: customers, suppliers, competitors, consultants
Institutional Orientation: universities, public and private research organisations

Table 4: Orchestration of Appropriability in Start-ups

Openness	Early Stage	Growth
Open	**The Collaborator** **Formal Appropriability:** - None - Usage: Not Relevant **Informal Appropriability:** - Low - Usage: Complexity of Design (Technology); *Processes and Culture* **Collaboration:** - High - *Market* and Institutional **OI Type:** Coupled (Inbound and Outbound)	**The Selector** **Formal Appropriability:** - Moderate - Usage: *Trademark*; Patent **Informal Appropriability:** - Moderate to High - Usage: *Secrecy*; *Complexity of Design* (Technology); Lead Time **Collaboration:** - Moderate/Average High - *Market* and Institutional **OI Type:** Mostly Inbound
Closed	**The Independent** **Formal Appropriability:** - None to low - Usage: *Trademark* - Not Effective for Protection **Informal Appropriability:** - High - Usage: *Secrecy*; *Lead Time;* Complexity of Design; Internal Processes and Culture **External Collaboration:** - Low - Market and *Institutional* **OI Type:** Inbound	**The Protector** **Formal Appropriability:** - High - Usage: *Patent*; Trademark **Informal Appropriability:** - High - Usage: *Complexity of Design* (Technology); Secrecy **External Collaboration:** - Moderate/Average Low - Mostly Institutional **OI Type:** Inbound

Start-up Stage

Note: words in italic refers to stronger usage or emphasis

Table 5: Representative Quotes on the Dynamics of Openness and Appropriability

Growth Stage	Early Stage				Growth		
Company	**FIRM 1**	**FIRM 2**	**FIRM 4**	**FIRM 5**	**FIRM 3**	**Firm 6**	**Firm 7**
Collaboration Orientation	Market and Institutional	Market and Institutional	Market and Institutional	Market and Institutional	Market	Mostly Market	Institutional
OI Type	Inbound	Inbound	Inbound	Coupled	Inbound and Outbound	Inbound and Outbound	Inbound
Formal Appropriability	Usage: **Low** - No patent - Registered trademark	Usage: **None** - No patent - No trademark "It's a challenge. We could patent, we could trademark, or none of that can deter, discourage the imitators from coming in and trying to do copying and replicating" (CEO)	Usage: **Low** - No patent - Registered trademark	Usage: **None** - No patent - No trademark "Everybody asked what they do. They said, "I do [this software]. That wasn't the case a few weeks ago. There's a bit of that [copying]. To be honest, I think that's understandable. "Second, nobody cares. People think, They copied. They don't see it… They pivot a little bit but they	Usage: **High** - Usage of patent - Registered trademark "We just filed a patent application in the US for multi-currency algorithm that we developed. It sends a message"	Usage: **Low** - No patent - Registered trademark "At the moment we don't have any patent but all of our technology is proprietary and is developed in house"	Usage: **High** - Usage of patent - Registered trademark "We have patents in place, but they don't protect you. The problem with patents is that they work only so much" "That's a statement valuable for investors sometimes, but from the perspective of actual protection of your IP it's useless"

				don't really pivot remarkably"			
Informal Appropriability	Usage: **High** - Secrecy - Complexity of design - Lead time - Internal processes and culture "There has been an incident where we have been involved in a program where there was a lot of openness between the start-ups and one of the start-ups pivoted and they basically took a fair amount of our ideas and what we proposed and that's now their product. I was actually pretty pissed off about that but again	Usage: **High** - Secrecy - Complexity of design - Lead time "This is if you study the business, the best way to do it is to move really fast, to seek, to keep secrecy. The idea gets stolen the day you'll set up a website. You will have no way" "Because even if you copy is not the dominant design… That will evolve. That's something that nobody can steal	Usage: **High** - Complexity of Design - Lead time "The software can be replicated but it will take a lot of time and money. For example, some of ex-colleagues founded a start-up which took 3-4 years to take to market costing more than $30MM" "Our technology is not that easy, it is quite complex and has been done over the years in-house with lots of experience	Usage: **Low** - Complexity of design - Internal processes and culture "We've been really very cutting edge even compared to the people here. We're very cutting edge on technology. We started three years ago with this concept called data virtualization. It's only 4 or 5 vendors in data virtualization. Big companies like Informatica" "As long as you've got	Usage: **Moderate High** - Secrecy - Complexity of design "The technology is quite complex to replicate now, it is not just a simple software build...There is a reason why no one has attempted to do that before us" "Obviously we don't share things that are really critical for our business, which give us unique advantage"	Usage: **Moderate High** - Secrecy - Complexity of design - Lead time "Our business has particular high barriers to entry than just imitating a website. We are kind of in a regulated environment" "Then the ability to build the technology that is built in house with our own data centres. It is all done in-house" "All of our technology is proprietary and	Usage: **High** - Secrecy - Complexity of design - Internal processes and culture "It's impossible to replicate this software for two reasons…our code base is huge. We're talking about probably a million lines of code already" "Because there is an exchange of confidential information. We want to be protected. It's a very simple thing [NDA]. It's very formal thing"

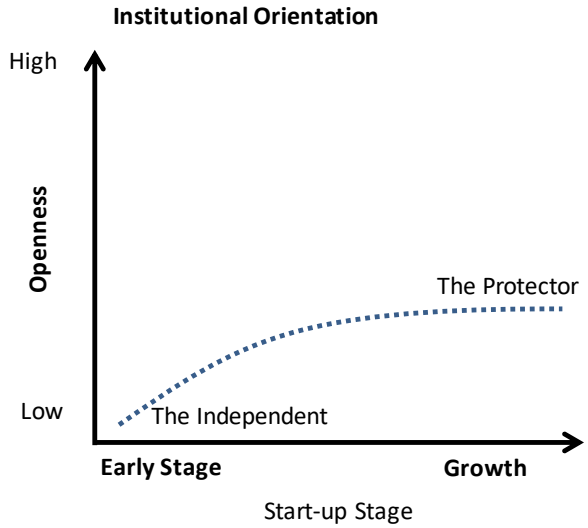
	they didn't sign, there were no NDAs signed between the start-ups" "We're not overly explicit in terms of this is how we do it. It's like this is what we do but we are not talking too much about how we do it"	or nobody can copy". "Some companies have tried to do it, that they would absolutely not launch it unless they have built the product to a certain…one should not worry too much about it"	from people involved"	confidence in what you're doing and how you're going about it. The processes. Your culture. What we're trying to put in place here. A vision as well. As long as you've got confidence in those three things in particular, I think ... It's very difficult to replicate"		is developed in house. We do sign NDAs" "It is not easy to get to that level, we managed to survive it. You imagine another company where there is a 18 month long sale cycle, they ran out of cash"	"Usually the way it works you sign the MOU or NDA irrespective, and then you start discussing specific of such agreement. We usually work so it's temporary. It's on a project basis"
External Collaboration	**Low (Selective)**	**Low (Exclusive)**	**Low (Selective)**	**High**	**Moderate High (Selective)**	**Mid-High (Selective)**	**Lower Average / Moderate (Exclusive)**
	"We talked to people we knew in asset management,…to help confirm our understanding of what the pain points are in each of these three areas. Also, get a sanity check in	"It's hard for one start up to collaborate with another start up. It is not possible" "To collaborate at early stage between two	"We constantly ask people to look and have feedback. Initially, we had friendly advice from people we know as it was like trial and feedback stage	"You have to be open to new ideas, new ways of working, new tech. This has helped us…" "We've gone Company called [X]. We've sold there. We got an	"Unfortunately we collaborate with too many of them. We are dependent on our issuing banks and other financial institutions"	"Yes we interact with customers, we do change and update small processes here and then, it might be very minor from a technical point of view but it is	"It's always good to know your enemy. That's great. This is an advantage. Now whether we interact, answer is no, we don't really need anything. We

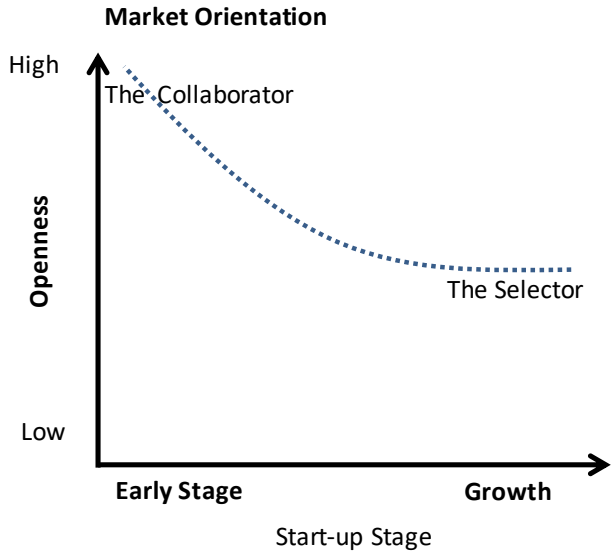
	terms of how to actually develop a product suite” “I did what you'd think of as market research first of all with what might become potential customers. That was very helpful” “I'd just highlight [non-profit organisation] and I guess UKTI as the two that have been most helpful to us” “We are a member of this non-profit in Boston FinTech that gives Fintech stats”	companies is really dangerous” “Advisors do play a role. We have advisors, Professor [X] in [University] e-Research Centre, he advised on individual analytics” “Some of their [University] researchers, and we had, through [University] we had a pretty senior design consultant working with us for many months” “It is better to focus in a place like university, you are doing the early stage research, building the product, and	and still the case” “…but one has be careful, we can't talk and share with anyone, only when we need”	activity. We got some software. They got some software. We've come together so the customer gets a wider range of software on delivery... We're going to hopefully try to build a business together with him” “That said, we'll work with anybody complimentary” “We helped guide a few other companies as well. Richard is a mentor here. There's at least 3 companies we helped guide. We try to give back as well. Get some really good, techy ideas. Which is great. Vice	“It is very difficult to deal with all parties, that was the most painful part when we first started when you have to agree terms and everything with other financial institutions” “You know if you want to get some basic information, it makes sense to collaborate. We talk for sure, not only competitors but general start-ups in the industry, to get feedback, be up-to-date. In a way we have the same problems and we also exchange solutions” “We have a partnership with	something that can affect the user’s experience quite a lot” “My role is to take feedback from clients and assess the requirements and make a decision on what new features are needed and how we can improve our existing features” “Essentially, it is just about talking to each other as often as possible and overall what is good with us is that everyone is very approachable all the way up to our CEO”	have experience in place. We've done it before. I, myself, built a company in Moscow and that's a company that has forty employees. All major Russian banks are its clients. I did it before, and I'm the youngest one” “Another reason was that [University] is a part of [Dr. X Initiative]. You can look it up. The reputation of why this is just brilliant. They also have one of the best mathematics statistics departments in the world. They were quite a natural choice”

	your focus on customer development is lesser”		versa, we like to give a bit of business and maybe some techy ideas back. That has been very important”	Money Saving Expert”	“Let's start with [University] in [outside UK]. Those guys are world leaders in both processing algorithms, period. You can't find anyone better”

Note: underlined words refer to prevailing orientation

Figure 1: Pattern of Openness





Note: Dashed lines refer to untested longitudinal projection

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CHAPTER 4

How do Collaborative Practices Emerge in Coworking Spaces?

ABSTRACT

Innovation is more likely to materialise when there are collaborative practices as innovation builds on openness and collaboration. Yet, we somewhat don't fully grasp how and when these collaborative practices, when they occur, can indeed act as a precursor of innovation. Based on a qualitative case study, this study aims to explore when collaborative spaces lead to collaborative practices, when they do. Our findings suggest the enabling and/or inhibiting role of interstitial spaces (e.g. informality and spatiality) and catalysts in the emergence of collaborative practices in a coworking space. We develop a theoretical framework for understanding how collaborative practices emerge in a collaborative space. This study, by disentangling how and when these collaborative practices emerge, contributes to the idea of conditionality of openness in better understanding the underlying mechanisms and contingencies that can lead to collaboration and subsequently to (open) innovation outcomes.

Keywords: Open Innovation; Collaborative Space; Interstitial Spaces; Co-working Space

4.1 INTRODUCTION

How do collaborative spaces lead to collaborative practices, when they do? A recent scholarly debate points to an emergent empirical phenomenon where collaboration is materialised and shaped in a collaborative space (Binz, Truffer, & Coenen, 2014; Garrett, Spreitzer, & Bacevice, 2017; Toker & Gray, 2008) resulting from firms and communities liaising with a breadth of partners outside firms' boundaries (Fabbri & Charue-Duboc, 2013; von Krogh, Spaeth, & Lakhani, 2003; West et al., 2014).

Although the extant literature has well documented the benefits of openness and external collaboration on innovation outcomes and performance (Dahlander & Gann, 2010; Laursen & Salter, 2006; West & Bogers, 2014b), little is still relatively known about the emergence of collaborative practices. In fact, innovation is more likely to materialise when there are collaborative practices as innovation builds on openness and collaboration (Chesbrough, 2003). Yet, we somewhat don't fully grasp how and when these collaborative practices, when they do occur, can indeed act as a precursor of innovation. We refer here to collaborative practices as a formal or informal collaborative activity involving more than one organisational entity in the aim of creating an innovation outcome. As such, both researchers and practitioners are interested in understanding the conditionality and contingencies that can lead to collaboration and hence result in (open) innovation.

At the same time, organizational spaces, by defining what people make and do at work, can have important implications on interaction between individuals and innovation (Allen, 1977; Fayard & Weeks, 2007, 2011; Moultrie et al., 2007). While research on organisational spaces has mainly focused on the physical design, efficiency, and processes (Clegg & Kornberger, 2006; Elsbach & Pratt, 2007; Gieryn, 2000; Taylor & Spicer, 2007), the scope of research has

broadened to embrace more recent transformations in the workplace and work practices that increasingly encompass collaborative practices such as coworking spaces.

The study of collaborative practices in collaborative spaces (e.g. coworking) warrants special importance for innovation research for two reasons. First, these spaces are at the centre of collective activity entrenched with communities that can generate significant and radical innovations (von Hippel and von Krogh, 2003) on the micro (Furnari, 2014; Toker & Gray, 2008), meso (Cohendet, Grandadam, & Simon, 2010) and macro levels (Binz et al., 2014). Second, these inter-organisational spaces and the emergence of coworking spaces have reshaped the typical physical and temporal boundaries of organisations' work and practices beyond the "third place" concept (Oldenburg, 1989). Studies suggest that there is an associated rise in productivity and belonging to a community resulting from these spaces (Deskmag, 2017; Garrett et al., 2017; Waber, Magnolfi, & Lindsay, 2014). Firms like Google and SAP have converged toward this space model in an attempt to broaden their innovation projects and collaboration (Spreitzer, Garrett, & Bacevice, 2015).

In this paper, we qualitatively explore when do collaborative spaces, if they do, lead to collaborative practices for Fintech start-ups. As innovation is increasingly building on collaboration and openness, a better understanding on how collaborative practices emerge in a collaborative setting can only advance the innovation scholarly agenda. In order to address this question, the literature on interstitial spaces and the genesis of new practices (Furnari, 2014; Kellogg, 2009) provides a useful theoretical lens to explore the emergence and dynamics of collaborative practices in collaborative spaces for two reasons. First, external collaboration implies engaging in liminal spaces – physical or virtual – that is discerned between various external actors (Turner, 1975). In this context, the informal, occasional, and temporally bounded interactions of interstitial spaces that occur between different organisations in collaborative spaces can further enhance our understanding on how and what precedes the

outcomes of collaboration and innovation. This angle of interstitial spaces can further complement the literature on spaces which has so far focused on collaboration (Capdevila, 2015; Fabbri & Charue-Duboc, 2016; Fayard & Weeks, 2011; Moultrie et al., 2007). Second, while the extant literature has mainly emphasised on the diffusion and institutionalisation of existing practices (Tolbert & Zucker, 1999) in relational spaces (Kellogg, 2009; Smets, Morris, & Greenwood, 2012), interstitial spaces can explicate when and how new practices – collaborative practices in this case – can emerge as well as the interactions that happen within the space.

We conducted a qualitative exploratory case study in a leading coworking space in London (United Kingdom) focused on the Tech and Financial Technology (Fintech) sector, thereafter named as *FinWork* (pseudonym). Our empirical setting constituted of Fintech start-ups provides a unique opportunity to answer our research question. First, with external collaboration and collaborative innovation becoming a more common practice among companies (Chesbrough et al., 2006), the study of collaborative practices in a synthetic and confined spatial environment constitutes an appropriate setting to explore our research question. Second, the rise of Fintech with its different sub-fields and radical innovations have indeed reshaped how we think about money and is thus well suited to examine the emergence of new practices that can result in innovation. London being the global leading hub for Fintech (Ernest and Young, 2016), allows us to be immersed in the Fintech revolution. The UK Fintech sector, which encompasses fifty percent of European Fintech companies, generated more than GBP20 billion in revenues (UKTI, 2016).

Building on evidence from our study, we develop a theoretical framework for understanding how collaborative practices emerge in a collaborative space. Our findings suggest the enabling and/or inhibiting role of interstitial spaces (e.g. informality and spatiality) and catalysts in the emergence of collaborative practices in a coworking space. Our paper has three contributions

for the literature. First, this study has important implications for the (open) innovation literature. When there are collaborative practices, innovation is more likely to occur as innovation builds on collaboration (Chesbrough et al., 2006; Dahlander & Gann, 2010; West & Bogers, 2014b). This paper, by uncovering how and when these collaborative practices emerge (if they do), contributes to the idea of conditionality of openness in better understanding the underlying mechanisms and contingencies that can lead to collaboration and subsequently to (open) innovation. Second, the study complements the literature on organisational spaces which has so far focused on collaboration in relation to innovation (Capdevila, 2015; Fabbri & Charue-Duboc, 2016; Fayard & Weeks, 2011; Moultrie et al., 2007) by providing a more nuanced understanding of the role and conditionality of physical spaces and collaborative dynamics where innovation practices can occur. Third, this research supports and empirically extends on Furnari's (2014) work on the role of interstitial spaces in the genesis of new practices. It sheds light on the interactions that happen in interstitial spaces, adding to the literature that has rather focused on relational spaces (Kellogg, 2009; Smets et al., 2012)..

Next, we outline the theoretical background in relation to interstitial spaces and organisational and collaborative spaces. Then we go over the methodology and sample. Then we explore the findings of our case study. Following that, we discuss the results, suggest respective propositions, and present our conceptual model on how collaborative practices emerge in coworking spaces. We also discuss implications for the literature and practitioners.

4.2 THEORETICAL BACKGROUND

4.2.1 Organisational Spaces and the Emergence of Coworking Spaces

Management studies on organisational spaces – the concrete spaces organizations use like office floors – has mainly focused on institutional issues of space with a special interest on physical design, efficiency, and processes (Clegg & Kornberger, 2006; Elsbach & Pratt, 2007;

Gieryn, 2000; Taylor & Spicer, 2007). Organizational places do not only personify organizations from their stakeholders' standpoint (Dale & Burrell, 2008; Wasserman, 2011) but also are places where actual work takes place. They have an impact on organizational processes such as communication (Allen, 1977), productivity (Olson, Teasley, Covi, & Olson, 2002), concentration (Banbury & Berry, 1998), and interaction between various individuals (Kabo, Cotton-Nessler, Hwang, Levenstein, & Owen-Smith, 2014). As such, organizational spaces, by delineating what people make and do at work, can facilitate or hinder interaction, collaboration, and innovation (Allen, 1977; Fayard & Weeks, 2007, 2011; Moultrie et al., 2007).

Looking at spaces from the angle of interaction and innovation, the extant literature has mainly focused on the features of communication and the physical characteristics of spaces that may spur collaboration and innovation. Allen (1977) showed that R&D employees have higher probability of interaction and communications between themselves the closer their offices are to each other. More recently, studies have shown that colocation increased the productivity of workers by two fold (Olson et al., 2002) and the probability of collaboration increases when people are within immediate proximity such as the same division or floor (Kabo et al., 2014). In fact, the physical and social features of workspaces play a role in fostering interaction between individuals with an adequate balance of discretion, consent, and proximity (Fayard & Weeks, 2011). Spaces that are dedicated to back firms' innovation like innovation labs can support firms' strategy, symbolism, efficiency, capabilities, teamwork, and customer involvement in the innovation process (Moultrie et al., 2007). As such, these studies have not only overemphasized the physical aspect of space design (Lewis & Moultrie, 2005) but also did not fully capture the evolution of workspaces and the emergence of new practices in coworking spaces outside the regular office space or the third place (Garrett et al., 2017; Johns & Gratton, 2013; Oldenburg, 1989).

In this context and more recently, the transformation of work practices is happening and responding to various technological and social change. The emergence of coworking spaces have redefined the typical physical and temporal boundaries of organisations' work and practices beyond the "third place" (Oldenburg, 1989). Given the multitude of practitioners' definition and lack of a unified academic definition, we hereby define in this paper coworking as an open, shared, and diverse workspace with flexible structures gathering knowledge workers from different backgrounds and objectives. Initially established in 2005 in San Francisco, there are currently over 1.2 million people working in over 13,800 coworking spaces worldwide which grew at rates as high as 250 per cent in the last five years (Deskmag, 2017). Given the resulting increased productivity, business network, and sense of community derived from these coworking spaces (Deskmag, 2017; Waber et al., 2014), firms like Google, Zappos, and SAP have adopted the coworking space model to their employees in an attempt to broaden their innovation projects and collaboration (Spreitzer et al., 2015).

However, despite this emerging organisational phenomenon, the literature to date is scant and further research is needed in order to better understand the dynamics of coworking spaces (Fabbri & Charue-Duboc, 2016; Garrett et al., 2017; Johns & Gratton, 2013; Moultrie et al., 2007; Spinuzzi, 2012) especially in relation to collaborative practices and innovation (Capdevila, 2015; Fabbri & Charue-Duboc, 2016; Moultrie et al., 2007). Nowadays, as more and more organisations are either embedded in a coworking space or designing their own, it becomes crucial to explore the dynamics and emergence of collaborative practices in coworking spaces; where the next paragraph will explain the analytical lens used in the study.

4.2.2 Interstitial Dimensions in Space and Emerging Collaborative Practices

The literature on interstitial spaces and the genesis of new practices (Furnari, 2014; Kellogg, 2009) can provide a useful theoretical lens in order to better grasp the emergence and dynamics

of collaborative practices in coworking spaces. Interstitial spaces are defined as "small-scale settings where individuals positioned in different fields interact occasionally and informally around common activities to which they devote limited time" (Furnari, 2014). While previous studies have focused on exploring relational spaces in situated interactions in different fields and within organisations (Kellogg, 2009), interstitial spaces constitute inter-field spaces where new practices could emerge from "meet-ups, informal gatherings, small-scale workshops, and hangouts" (Furnari, 2014). Such spaces usually happen at the intersection of fields but can also be created on purpose at the interface of various fields (Furnari, 2016).

The interplay between institutional change and practice is increasingly attracting scholarly attention (Furnari, 2014; Kellogg, 2009; Lounsbury & Crumley, 2007; Smets et al., 2012). Practices correspond to regular patterns of repeated activities that are "infused with broader meaning and provide tools for ordering social life and activity" (Jarzabkowski, 2005). Thus practices form activities that are both "meaningful and recurring" from the eyes of certain people or group (Zietsma & Lawrence, 2010) by being "material interactions or behaviours that are made understandable and durable by their interpretation with wider cultural rules" (Lounsbury & Crumley, 2007).

The extant literature has mainly focused on the diffusion and institutionalisation of existing practices (Tolbert & Zucker, 1999) rather than on the emergence of practices that can be institutionalised in a later period (Lawrence, Hardy, & Phillips, 2002; Padgett & Powell, 2012). Recently, there has been an increase in exploring when and how new practices emerge and better understand how actors are involved in the genesis of new practices. Even tough past studies have pointed to the role of experimentation and progressive approval of new ways of doing things in fostering practice change, recent work highlights the importance of space in enabling or hindering change and emerging practices with a particular interest in interstitial spaces (Furnari, 2014).

As such, collaborative spaces (e.g. coworking spaces) provide an ideal setting to empirically test the concept of interstitial spaces and the emergence of new practices, or rather in this case the emergence of collaborative practices in coworking spaces. Given the open, diverse, and shared nature of coworking spaces, such spaces trigger collaboration between individuals coming from different fields (Spinuzzi, 2012; Spreitzer et al., 2015; Waber et al., 2014), act as intermediary for open innovation (Fabbri & Charue-Duboc, 2016), and create a sense of community (Garrett et al., 2017). The informal, occasional, and temporally bounded interactions that occur between different organisations in coworking spaces fulfil the defining features of interstitial spaces (Furnari, 2014) which contribute in developing new collaborative practices.

So far, this research aims at exploring how these collaborative practices emerge in coworking spaces by using the theoretical foundations of interstitial spaces, organisational spaces, and open innovation. Give the latest workspace transformations and the increased interest in collaborative innovation in (coworking) spaces, this topic becomes an important one given the interrelatedness of space, practices, and collaboration in further contributing to the genesis of new collaborative practices.

4.3 METHOD

4.3.1 Case Setting and Context

The setting for our study consists of a coworking space based in London (United Kingdom), hereafter named as “FinWork” (pseudonym). The latter is one of Europe’s largest coworking spaces mainly dedicated to the Financial Technology sector or known as Fintech but also to tech, security, and retail. Opened in 2013, FinWork is located in the financial district of London and has grown to over 200 members in three years as of March 2016 out of over 1,500 applications received. FinWork does not only provide a mere shared space for companies to

work in but also is the base for various events, workshops and seminars, conferences, informal meet-ups, mentoring, investor meetings, and launch events. FinWork hosts a diverse and international community of more than 800 individuals, of which more than one third originates from outside the United Kingdom (U.K.).

The coworking space has a membership based system where a financial rent is paid on a monthly basis and depending on the size and growth stage of the start-up or team in place. There are four types of membership schemes: hot desk, fixed desk, internal space, and high growth space; which accommodate a variety of actors between freelancers, remote workers, but mostly Fintech and tech start-ups. FinWork is composed of three distinct floors spanning over 80,000 square foot of space. Floor 1 and Floor 3 are high growth spaces where member companies are at an accelerated growth stage and with employees ranging between eight and fifty people. Floor 2, which has a considerable open space layout, includes desk members and young companies that are between four and twelve employees. All of the floors have a common area to work, talk, or take a break, a shared kitchen, a lounge bar, and an open space layout except in certain high growth spaces where larger start-ups have their own internal offices within the space.

FinWork is a coworking space that is primarily focused on the Fintech (and tech) sectors, representing about 70% of all member companies in 2015. Having said that, there is ample heterogeneity in the Fintech sector given the numerous sub-fields which can be categorised into six broad categories: data and analytics, payments, banking solutions, trading, foreign exchange (FX), and crowdfunding. Also, there are other fields and technology involved such as machine learning, artificial intelligence, blockchain, and cyber security that even differentiate more the various sub-field mentioned above.

A Fintech oriented coworking space offers a unique case setting opportunity to study the emergence of collaborative practices in a collaborative environment for the following reasons. First, the spatial and social characteristics of FinWork provide a suitable setting to examine the interplay between practices, collaboration, and (interstitial) spaces. The likelihood of informal and temporal interactions resulting from the coworking spatial and social configurations can shed light on the role of interstitial spaces in the genesis of new practices. Second, with external collaboration and the innovation process becoming more open (Chesbrough et al., 2006), exploring collaborative patterns and practices in a synthetic environment constitutes an appropriate setting to test the prospect of the emergence of collaboration practices in a collaborative space like FinWork. This is also the opportunity to empirically investigate the impact of interstitial spaces on collaboration and emerging practices in start-ups. Third, the recent rise of the Fintech industry, its different sub-fields, and the numerous innovations that have redefined how individuals and companies think about money are well suited to examine the emergence of new practices. In fact, London being the global leading hub for Fintech (Ernest and Young, 2016), allows to be immersed in the Fintech revolution. The UK Fintech sector, which encompasses fifty percent of European Fintech companies, generated more than £20 billion in revenues in 2015 (UKTI, 2016). This sector, being heterogeneous with numerous sub-sectors, provides an ideal research context for an exploratory study into collaborative practices in a collaborative space. This industry is thus similar to other sectors that are reliant on technology, knowledge workers, and innovation and can hence be applicable beyond this study to several industries.

4.3.2 Data Collection

In this paper, we explored the emergence of collaborative practices in Fintech start-ups that are located in a coworking space that took place between 2015 and 2016. We got access to the coworking space including seven start-ups. We have used an exploratory case study approach

which is suited in a situation where little is known about the phenomenon with the aim to build theory (Eisenhardt & Graebner, 2007). We have used three main types of data sources: semi-structured interviews, archival material, and participant and non-participant observations. Table 1 and Table 2 present an overview of the case studies and data sources.

INSERT TABLE 1

INSERT TABLE 2

Semi-structured interviews. Interviews were a primary data source for our study. To date, we conducted 15 interviews with members of FinWork, ranging from start-ups to the management team of the coworking space. All of the interviewees participated in the coworking space. We identified and contacted founders, CEOs, decision makers in the start-ups, and other stakeholders that play a part in the coworking ecosystem. Within our sample, we have interviewed founders and senior managers of seven Fintech start-ups that operate at FinWork. These selected firms display enough heterogeneity in their sub-fields within Fintech (e.g. payments, data analytics, risk and compliance, machine learning), growth stage (various floor levels within the coworking space), number of employees, and diversity. Almost all interviews were done in person (or by phone), lasting at least half hour, and were professionally transcribed for reliability purposes (Eisenhardt & Bourgeois, 1988). Informants were asked general questions about the organisation, their innovation and collaboration patterns, and their experiences and practices being part of the coworking space.

Archival Data. We have also gathered secondary data from articles, marketing materials, press releases, space layout, photos, and websites. Besides looking at press releases and marketing materials of member companies in our sample, we performed a search in Factiva database for any additional news coverage or articles that can give us further insight on collaborative practices and the space setting. Besides, pictures can capture personal perspectives of social

and spatial dynamics that took place at the collaborative space (Knoblauch, Baer, Laurier, Petschke, & Schnettler, 2008). We then use these materials for triangulation purposes so we can either confirm or spot new directions in our study.

Observations. The lead researcher participated in numerous events and conferences in relation to FinWork. First, we attended two major conferences in Fintech, the Global Fintech Summit in London in 2016 and 2017, with about 24 hours of non-participant observation, two workshops, and five panel events. Second, we attended five panel events involving the selected member companies where we observed patterns of collaboration and practices in interstitial spaces that may arise in these events. Besides, we had five hours of non-participant observation in the coworking space in just being part of the lounge and open floor setting across the three floors at FinWork. All of this helped us develop a deeper understanding of the coworking space in place.

4.3.3 Data Analysis

As per the traditions of an inductive case study research (Eisenhardt & Graebner, 2007; Yin, 2013), there is an overlap between data collection and data analysis stages that involves several iterations. We scanned the interview notes supported by our observations and archival materials looking for emerging themes. This process involved going back and forth to the literature on drivers of collaborative practices such as interstitial spaces, coworking spaces, and collaboration. The emerging themes of informality, spatiality, and catalysts were observed and coded accordingly in Table 3. First, informality denotes informal and occasional interactions such as in events and workshops, which was rated as low, moderate, or high. Second, spatiality refers to the spatial dimension and proximity of the coworking space drawn from informants' response and archival materials. We added a note on the status of spatiality for each case which outlines the spatial position of the member company in the coworking space (e.g. Floor 2, then

Floor 3) or whether they exited the space during the course of the study. We have noticed either a facilitator or inhibitor role when reading through informality and spatiality quotes, which we then coded accordingly. Third, catalysts designate "actors who sustain others' interactions over time and assist the construction of shared meanings" in helping to generate new practices (Furnari, 2014). In this case, catalysts include stakeholders like the management company of the coworking space, NGOs, and policy players in relation to FinWork. We rated the importance and relevance of catalysts from each case's standpoint as low, moderate, or high. Besides, following the above iterations and checks with the corresponding literature, we then uncovered two themes related to the development of practices in a coworking space: collective exploration and the emergence of collaborative practices in the process. We identified the respective quotes and materials for each case where we again rated these as either low, moderate, or high. These patterns across different cases with representative quotes were then presented in tables and ultimately built a framework model that we will discuss in the next sections of the paper.

We will discuss our findings in the next section which include quotes from our interviews with member companies of FinWork as well as excerpts from archival materials or observations during our study. For the purpose of confidentiality, all identifiable companies or individuals' names have been anonymised without compromising on the content.

4.4 FINDINGS

We begin by presenting the building blocks of collaborative practices including interstitial spaces (informality and spatiality) and catalysts before crafting a model on the emergence of collaborative practices in coworking spaces for Fintech start-ups. The data advocated for a conceptual model, presented in Figure 1, and connecting the concepts and their relationships. Following on (Pratt, 2009) propositions on depicting qualitative research, we aim to show our

results using a combination of “power quotes in the body text as well as “proof quotes” in comparative tables.

INSERT FIGURE 1

4.4.1 Interstitial Spaces as Facilitator and Inhibitor of Collaborative Practices

While evaluating our cross-case comparisons, we noticed an alternating role of interstitial spaces – informality and spatiality – in first facilitating collective exploration then hindering the development of collaborative practices within the coworking space. We offer respective explanations for each emerging construct underneath with related quotes. Table 3 presents data on the dimensions of interstitial spaces in relation to collaborative practices.

INSERT TABLE 3

Informality. This term refers to informal and occasional interactions between various actors in the coworking space. In conducting our analysis, we noticed that informality had an enabling role on collective exploration but an inhibitor effect on collaborative practices. We will first outline the facilitating impact followed by the inhibitor one.

Facilitator. Informal interactions like informal mentoring and occasional meet-ups during workshops or event sessions led to the development of collective exploration at FinWork. Informal mentoring sessions have been mentioned as one instance of informality:

> “There's a mentoring program here. You have options to ... If you're quick enough to get a face-to-face meeting with certain individuals who do mentoring. Just like Richard does mentoring. We've had similar backgrounds. CEO, chairman, investor. That mentoring is ... It doesn't have to be formal but the ability to talk to people who've been through it before or have got a view. Or got a big company view. Or our investor or etc. it's very helpful.” (Director and Co-Founder - Firm F)

> "Yes, I have met a number of companies. You take some time before some … One of them becomes a customer, but definitely potential customers, you can access from here." (CEO and Co-Founder - Firm E)

Besides, the various events and workshops that happen at the coworking floor constitute a stimulus for possible collaboration and collective exploration

> "FinWork organises monthly events where we're all able to get together and work with each other on our projects." "They have weekly investors meeting. They do different EC, different angels. They also organized some educational events." (COO and Co-Founder - Firm C)

> "All the time we go through events and I actually work very closely with people from FinWork and [Fintech membership organisation]. The community in general itself in order to put ourselves out there with the Fintech space in front of banks and financial institutions". (Head of Product Strategy & Commercialisation - Firm D)

Thus, the informality aspect of interstitial spaces within the coworking space has facilitated interaction between member companies and individuals and has hence enhanced the prospect of collaboration via exploration which becomes more accessible for members:

> "Once a week FinWork sends out an email newsletter where they offer seminars on particular topics and mentorship or discounted tickets to events and what have you." (CEO and Co-Founder - Firm B)

> "Plus it's much easier for you to access academic research, people, resources, interns, when you're building the product, sitting there." (CEO and Co-Founder - Firm E)

This has also been corroborated by our non-participant observations at FinWork where people from different fields informally met during one of these workshops or casual events that occur on the floor.

Inhibitor. Informality has also its shortcomings as it inhibits the move from collective exploration to the development of a collaborative practice in the collaborative space. There are indeed decreasing returns from repeated activities of informality such as events, workshops, and informal networking. With the coworking space growing and first interactions completed, informality becomes harder to help in the formation of a collaborative practice.

> "When it was a smaller group of people and a smaller group of company there was a fair amount of comradery and people exchanged information. I think, particularly early on when it was a smaller group of people, that was actually very beneficial and there was this sense of comradery." (COO and Co-Founder - Firm B)

> "I think FinWork is growing very rapidly. When it was slightly smaller, it felt more intimate; we knew exactly what our neighbours are doing. But now because it is growing, we still have the same number of events. So I think little more intimate events where we can discuss solutions, something like speed networking." (Marketing and Communications Manager - Firm D)

Although informality through informal mentoring and where limited time was devoted produced a positive impact on collective exploration, these same repeated activities proved to be inhibitory for the development into collaborative practices.

> "The mentoring program at [FinWork], it's like 30 minute speed dating. You read a person's file, you speak to them for 30 minutes, and then it either turns out that they can be helpful or they can't. It's very hard to judge from a bio." (Co-Founder - Firm B)

> "The kind of events we are talking about is a one-to-one meeting with investors, they always have limited timeslots like 5 times, so now you have like 500 people trying to get these 5 timeslots which is quite difficult." (Head of Product Strategy & Commercialisation - Firm D)

The informal factor seems to fade with time as informality hinders the transition from exploration to a new practice. Given the transitional aspect of interstitial spaces, if these interactions are not sustained and catalysed, the emergence of collaborative practices will be harder to materialise.

Thus, based on our results on informality, we suggest that:

> ***Proposition 1****: Informality has an enabling effect on collective exploration and an inhibiting effect on the emergence of collaborative practices*

Spatiality. This term refers to the spatial dimension, space layout, and actors' proximity in the coworking space. As previously mentioned, FinWork has three floors: Floor 1 and Floor 3 for high growth spaces and Floor 2 for desk members and young companies. All of the floors have a common area to work, talk, or take a break, a shared kitchen, a lounge bar, and an open space layout except in certain high growth spaces where larger start-ups have their own internal offices. In Table 3, we noted the spatial position of each case and its movements within FinWork as three organisations have exited the coworking space during our study. As we will discuss later, these counter cases will further validate our theoretical framework. Similar to informality, this emerging dimension is another important element of interstitial spaces that has both an enabling and inhibitory role for collective exploration and collaborative practices respectively.

Facilitator. Like informality, spatiality has a facilitating effect on collective exploration within the coworking space. The space itself enables experimentation such as in interacting in the pantry area, kitchen, lounge, and breakout areas within the open space layout. These interstitial spaces within the space create occasional and informal opportunities that can enable exploration in a collaborative space.

> "Some of the guys there reach out to us and ask us things about our experience so the pantry area is actually very nice. People hangout there, you come across them they ask you a question, you ask. I think, actually the social space is very important to get people to hangout. People have their lunch there and so you come across them". (COO and Co-Founder - Firm B)

> "There is a breakout area, people meet around lunch time, walking around you usually bump into people and talk to them" (Marketing and Communications Manager - Firm D)

The space layout itself can ignite the likelihood of collaboration between actors from different fields. FinWork has a spacious and brand new floor layout with breath-taking views of London, which further enhances the spatial experience. Based on our observations, pictures, and being physically there, we can say that the spatial layout, breakout area, its legacy in the Fintech field and the city of London, and location of FinWork can definitely have an enabling effect on interaction and experimentation.

> I choose [FinWork] because it is kind of a legacy based corporate space in London and it really helps people to set up their start-up, there are different synergies created, it is not that you are sitting on your own like in a 2 meter office on your own. A lot can happen when you are close to people working on related businesses." (Firm G)

> FinWork has a good branding, so a lot of people come to meet you here, meeting customers, meeting investors, meeting mentors. To scale up after [previous university incubator] has been pretty useful by being here in [FinWork]." (CEO and Co-Founder - Firm E)

At FinWork, the event space allows for numerous opportunities to have occasional and informal interactions for a certain time, either from meet-ups, workshops, or mentoring to name a few. Hence the potential facilitating effect of interstitial spaces in fostering

collective exploration through the actual spatial component of a collaborative space likes FinWork.

> "There is also an event space, so a lot of times are hosted by [FinWork] which is quite beneficial. Besides the events, now there are a lot of banks and financial institutions are using this space to host events. So when they do that, a lot of times [FinWork] members get tickets. So of course being there to network helps as we are at the centre of the ecosystem." (Marketing and Communications Manager - Firm D)

> "9 out of 10 people that we bring to our office upstairs, the first thing is that they walk and see around. People say "oh can I take a picture? pretty nice view they say…You kind of build a personal and graphical relationship with the client just because being at [FinWork]" (Head of Product Strategy & Commercialisation - Firm D)

Inhibitor. Similarly to informality, spatiality has also a hindering effect on the emergence of collaborative practices in coworking spaces. Out of seven start-ups cases, three firms (Firm A, B, and C) have actually left the FinWork space as the benefits of a collaborative space did not endure and they were rather spatial drawbacks in relation to interaction. It seems that the (interstitial) space's positive effect on first hand collective exploration does not necessarily last and make it harder to morph into an institutionalised collaborative practice.

> "The diminishing returns as you add more companies, Dorothee's just voted yes. I would tend to vote yes as well. The challenge we've got is in November we left the main floor of [FinWork] and moved up to [Floor 3] into permanent office space and then because they had some heating and cooling issues, about two months ago we moved down to [Floor 1]. Our view is that that doesn't work as well as it did, but I think you have to take that a little bit with a grain of salt in that we're not there every day like we used to be, being down [Floor 1]". (CEO and Co-Founder - Firm B)

> Perhaps it is becoming too big for everybody to benefit equally." (Head of Product Strategy & Commercialisation - Firm D)

Besides, different actors may have different expectations and objectives vis-à-vis the collaborative space itself as they do not appear to have fully benefited from exploration as a first step. These actors have a less open approach to interaction and collaborative innovation and display a more closed approach.

> "We want to be part of the ecosystem but not physically there. You know, if your clients are based in [financial centre], then maybe it makes more sense. You know [another coworking space in London] is close to our clients and affordable" (CEO - Firm A)

> It's also expensive. They charge £[X] per desk. It has a great location, great infrastructure, but I guess we're just a little bit different and we cannot benefit from a lot of things they can offer to us (COO and Co-Founder - Firm C)

In view of our findings on spatiality in relation to collective exploration and collaborative practices in coworking spaces, we posit:

> ***Proposition 2****: Spatiality has an enabling effect on collective exploration and an inhibiting effect on the emergence of collaborative practices*

4.4.2 Catalysts as Enabler of Collaborative Practices

Our findings also suggest the enabling effect of catalysts in forming new collaborative practices in the coworking space. Catalysts refer to actors who facilitate and encourage activities that sustain other' interactions and induce cooperation. For example, catalysts can be moderators, hosts or organisers within the coworking space who provide continuity and ultimately assist in the construction and institutionalisation of collaborative practices. In this case, catalysts include stakeholders like the management company of the coworking space, NGOs, a Fintech member organisation and policy

players in relation to FinWork. We also rated the importance in Table 3 and relevance of catalysts from each case's standpoint as low, moderate, or high.

One non-profit Fintech membership organisation, which is associated with U.K. policy makers and based at FinWork, has been a significant catalyst in fostering collaboration and facilitating the development of collaborative practices.

> [Fintech NGO membership organisation], I think have been very helpful to us. We also, I think, got a fair amount of benefits out of UKTI and their focus on FinTech. [Fintech NGO organisation] make connections between different members so for example, I think it's [IT multinational] like the systems integrator. They are now a member of [Fintech NGO membership organisation]. They have a 500 million fund where they want to invest in startups. Obviously we want to be introduced to the right people at [IT multinational] and then because we are both members [Fintech NGO membership organisation] does that" (COO and Co-Founder - Firm B)

> They now understand really well what we are doing. I have a personal relationship and most of the people in the office and if I need anything, I have any ideas they come across something is very active dialogue" (COO and Co-Founder - Firm B)

> "We are a founding member of [Fintech NGO membership organisation] where we participate" (CEO - Firm A)

The host or the management team at FinWork has also been an important contributor to the collaborative space environment and has contributed in making numerous introductions and follow-up meetings. The collegial and open environment at FinWork further sustain these relationships and help them transition into new practices.

> "It creates a really good environment. The staff here is really top notch. They're better than... very good. Very high quality reception and everything. I think here beats it. That

for me is quite high accolade. The politeness and curtness of everybody here is great. It's got that environment." (Director and Co-Founder - Firm F)

I don't know how she [FinWork Ecosystem Manager] knows all those people, but it is quite impressive. For example, the few available introductions they made for us, it wasn't that important because we already had all the necessary contacts, but she introduced us to [X], one of the largest venture capital firms in the world. She made the introduction to very significant people at Morgan Stanley" (COO & Co-Founder - Firm C)

"Within 4 or 5 months of joining here we did a product launch. We spoke to [FinWork CEO] and he said, "I'll give you mates rates for a product launching. We did a product launch at [FinWork] which is fantastic. They really helped us. We started getting part of this ecosystem here. [Fintech NGO membership organisation] as well as [FinWork]. A very memorable lead. That got us a lead with [leading firm]." (Co-Founder - Firm F)

"FinWork definitely helped in advancing my business." (CEO and Co-Founder - Firm G)

The uniqueness of FinWork as the specialised Fintech coworking space coupled with a rigorous application process for start-ups to be based there (more than 1,500 applications received) have propelled FinWork into being a catalyst in itself for the member companies or individuals. The seasoned team backed by influential business groups and policy makers enhance the legitimacy of the space. As such, it acts as a catalyst by further sustaining the relationships and ensuring continuity of its members who can benefit from interaction with a multitude of partners and actors.

"It's obviously also been a certain cliché related to being a [FinWork] member company. It helps you differentiate yourself and at least initially when I'd say the selection of the companies was fairly rigid in terms of who they accepted and who not. It was like an additional stamp of approval." (Co-Founder - Firm B)

> "So of course being there to network helps as we are at the centre of the ecosystem. So whenever we go to meetings or talk to some people about us, as soon as we say that we are based out of [FinWork], there is already a trust. Because they already feel like you already ticked some boxes. There is kind of an implied due diligence by being at [FinWork]". (Marketing and Communications Manager - Firm D)

As such, catalysts (e.g. facilitator, hosts, and moderators) play an important role in providing continuity, order, and a suitable environment for interaction which can eventually be more institutionalised into a new collaborative practice. We hence posit:

> ***Proposition 3:*** *Catalysts facilitate the emergence of collaborative practices from the collective exploration stage.*

4.4.3 Toward the Emergence of Collaborative Practices via Collective exploration

Following the presentation of the building blocks and the three respective propositions, the conceptual model in Figure 1 depicts the role of the identified concepts (spatiality, informality, and catalysts) on the likelihood of collective exploration and eventually the emergence of collaborative practices in the coworking space. Table 4 presents the comparative data on collective exploration and collaborative practices.

INSERT TABLE 4

Collective exploration. As per our findings, we have seen that interstitial spaces - informality and spatiality – facilitate collective exploration while at the same time hindering the transition into a collaborative practice from the exploration stage. We will outline below respective quotes that illustrate collective exploration in the Fintech coworking space.

The occasional and informal nature of forming initial interactions at FinWork facilitates the prospect of experimentation from the start-up perspective that occurs within the coworking and in a limited time.

> "If you talk to a lot of people that are also talking to a lot of other people and the better they understand what you're doing, the more likely they'll come back and be like hey, I just spoke to so and so. Then, as a result of winning a [FinTech Challenge] where people in the audience approached us afterwards, made an introduction, and that person then made an introduction for a systems integrator, who then got us into a large investment bank" (Co-Founder - Firm B)

> "If we hadn't attended this event, we wouldn't have found this job. That was great. He was a FinTech guy. When we told him the story he said, "I'm going to put you in touch with my energy and carbon manager director." (Director and Co-Founder - Firm F)

> "All those introductions naturally led to introduction meetings, formal demo, and something else." (COO and Co-Founder - Firm C)

The spatial aspect also enables the likelihood to experiment with other actors from different fields on the same floor.

> "To be putting everyone in the same ecosystem really helps especially for start-ups like us". You can come here every day and benefit from the network here - that is the kind of idea - grab a seat anywhere." (Marketing and Communications Manager - Firm D)

> "There are a number of businesses on our floor so it's natural that a degree of collaboration and idea-sharing happens." (CEO and Co-Founder - Firm G)

> "Both Charles and I helped one guy ... I guess, I helped with the marketing material, Charles helped with input on a contract negotiation. The guy we sat next to at [FinWork] was thinking of which Russian banks he could introduce us to" (CIO - Firm B)

Collaborative Practices. The emergence of collaborative practices is contingent upon a successful transition via collective exploration and reinforced or weakened by the impact of informality, spatiality, and catalysts. As illustrated in Figure 1, the conceptual model outlines the process in order to develop exploration into a more institutionalised practice in the coworking space. The following cases corroborate that.

> "You have to be open to new ideas, new ways of working, new tech. This has helped us from a technical entrepreneurial standpoint being in this environment. Sharing ideas. We have taken advantage to exchange ideas and cross-check our thinking and logic. If there are opportunities to share ideas or failures or successes with people who are interested, we're really happy to do that." (Director and Co-Founder - Firm F)

> "At least half the people here in [FinWork] are clients. Since we're all based on the same floor we work together more frequently." (CEO and Co-Founder - Firm G)

In fact, some start-ups have developed collaborative practices and in actually institutionalising it in ongoing projects and external collaboration with other actors in the coworking space. Start-ups have developed joint products with other actors resulting in a new and open collaboration practice beyond the occasional interaction.

> Well our neighbours upstairs are our client actually. For example, I was talking about our expense platform and so we were just talking, they were like we need something like that (Head of Product Strategy & Commercialisation - Firm D)

> "We've gone Company called [X]. We've sold there. We got an activity. We got some software. They got some software. We've come together so the customer gets a wider range of software on delivery…We integrated the project into one interface with the customer. A new interface. It is using a chunk of [X]'s new search engine. We had the domain and they had the tech capabilities. We combined that to create a product." (Director and Co-Founder – Firm F)

> For example, Firm G works with nearby [coworking space company]s market data to help track prices, reports and fundamentals in real time. “This insight into the financial market is crucial in our industry and something that would have taken much longer to develop ourselves. In turn, it uses us for payments.” (CEO and Co-Founder - Firm G)

However, in our case study, three Fintech start-ups out of seven have left FinWork and did not witness the emergence of collaborative spaces before reaching a collaborative practice. Besides, there are also start-ups that are still based at FinWork but did not fully develop collaborative practices and move from just occasional and informal interactions. As per our model, this is due to the strength and importance of each construct’s enabling or inhibiting effect (e.g. informality, spatiality, and catalysts) that will ultimately moderate the relationship between collective exploration and collaborative practices.

> My view is the benefit of collaborations with other companies there is still there, but due to the almost exponential increase in the population of companies there I think it's actually become harder, almost an impediment to building those relationships of trust. We're not right in the centre of the interactions so our perspective, which is yes I think there are too many companies there and the main lounge area is overpopulated with drop-in members rather than as a casual place for the permanent companies there to get together and talk and get to know each other” (COO and Co-Founder - Firm B)

> It’s a huge exercise in itself. It doesn’t help anyone. It’s probably better when you have grown to a certain extent, and both companies are clear about their product market fit. Before their product market fit happens, it’s not wise to collaborate for selling to customers.” (CEO and Co-Founder - Firm E)

> “Our formal competitors are based here as well. A company called [X] for example. It's always good to know your enemy. That's great. This is an advantage. Now whether we interact, answer is no, we don't really need anything.” (COO and Co-Founder - Firm C)

The presence of both successful and less successful cases in the coworking space further validates and strengthens our findings as the counterfactual also holds in the conceptual model that we developed in Figure 1.

4.5 DISCUSSION

We explored how collaborative practices emerge in collaborative spaces such coworking spaces for Fintech start-ups, addressing a knowledge gap in (open) innovation research. Our results suggest the role of interstitial spaces and catalysts in playing an enabling and/or inhibiting roles in the genesis of new collaborative practices in a coworking space. Building on evidence from our study, we develop a theoretical framework for understanding how collaborative practices emerge in a collaborative space (see Figure 1). We now present three contributions to the literature which has implications for scholars interested in open innovation, collaborative spaces, and interstitial spaces.

First, the emergence of collaborative practices warrants special importance for innovation scholars. When there are collaborative practices, innovation is more likely to materialise as innovation builds on collaboration (Chesbrough et al., 2006; Dahlander & Gann, 2010; West & Bogers, 2014b). Although the extant literature has well documented the benefits of openness and external collaboration on innovation outcomes (Dahlander & Gann, 2010; Laursen & Salter, 2006; West & Bogers, 2014b), little is still relatively known about what precedes the emergence of collaborative practices. This study, by disentangling how and when these collaborative practices emerge (if they do), contributes to the idea of conditionality of openness in better understanding the underlying mechanisms and contingencies that can lead to collaboration and subsequently to (open) innovation outcomes. Besides, we also contribute to the open innovation literature in further revealing contingencies of openness (Bogers et al., 2016)

with a particular focus on start-ups where even more research is needed (Brunswicker & Vanhaverbeke, 2015; Eftekhari & Bogers, 2015; Zobel et al., 2016) which diverge from large firms in their innovation activities (van de Vrande et al., 2009b).

Second, the study complements the literature on organisational spaces which has so far focused on collaboration in relation to innovation (Capdevila, 2015; Fabbri & Charue-Duboc, 2016; Fayard & Weeks, 2011; Moultrie et al., 2007) by providing a more nuanced understanding of the role and conditionality of physical spaces and collaborative dynamics where innovation practices can occur. The extant literature on organisational space has mainly focused on physical design and efficiency (Clegg & Kornberger, 2006; Elsbach & Pratt, 2007; Gieryn, 2000; Taylor & Spicer, 2007). Given the recent transformation of work practices associated with various technological and social change, this research captures the evolution of workspaces and the emergence of new practices in collaborative spaces (such as coworking spaces) beyond the regular office space (Garrett et al., 2017; Johns & Gratton, 2013; Oldenburg, 1989). As more and more organisations are either embedded in a coworking space or designing their own, it becomes crucial to explore the dynamics and emergence of collaborative practices in these spaces. This study therefore contributes to this academic discussion and uncovers how new collaborative practices can emerge in a collaborative space. We also explicate the role of space, such as breakout area, common kitchen, and open space, in facilitating the development of collective exploration but at the same time hampering the emergence of new collaborative practices in the coworking space. As such, this article adds to the extant literature and provides novel insights into the organisational dynamics of coworking spaces in shaping new collaborative practices.

Third, our study adds to the recent academic discussion on the role of interstitial spaces and the micro-interactions that occur within that space. First, this research supports and

extends on Furnari's (2014) work on the role of interstitial spaces in the genesis of new practices, where more scholarly research is needed on the topic. To the best of our knowledge, our study provides one of the first empirical examples on the role of interstitial spaces in originating new collaborative practices in a collaborative setting. The extant literature has mainly focused on the diffusion and institutionalisation of existing practices (Tolbert & Zucker, 1999) rather than on the emergence of practices that can be institutionalised in a later period (Lawrence et al., 2002; Padgett & Powell, 2012). Instead, we add to the debate and explore when and how new practices emerge in better understanding how actors are involved in collective exploration and later in the genesis of new practices. Even tough past studies have pointed to the role of experimentation and progressive approval of new ways of doing things in fostering practice change, our work highlights the importance of interstitial spaces in enabling or hindering change and emerging practices (Furnari, 2014). Besides, our study sheds light on the micro-interactions that happen in interstitial spaces, adding to the literature that has rather focused on relational spaces (Kellogg, 2009; Smets et al., 2012). Our results show that elements of interstitial spaces, such as informality and spatiality, have both a facilitating and inhibiting effect on the emergence of new practices. We also highlight the micro-interaction of catalysts - actors who facilitate and encourage activities that sustain other' interactions and induce cooperation – who has an important enabling role in the emergence of collaborative practices from the stage of collective exploration. It is indeed the micro-interactions of informality, spatiality, and catalysts that shape or not the emergence of new practices in the collaborative space. As such, this study, in using the analytical lens of interstitial spaces, provides important implications for the literature on the emergence of new collaborative practices and the interactions in the space in responding to a young and emerging research stream on this important academic debate.

Implications for Practitioners

The emergence of collaborative practices in coworking spaces is contingent upon the level of informality, spatiality, and catalysts. Given the characteristics of the theoretical model, practitioners can have their say in the direction of their collaborative experience in the coworking space. For start-ups and entrepreneurs, the ability to adequately benefit from the informal and spatial elements of interstitial spaces as well as capture the enabling effect of catalysts is crucial to generate new collaborative practices. For other stakeholders of the coworking space such as moderators, membership organisations, and hosts, it is vital to create that "catalyst" effect on the actors of the space in order to ensure continuity and sustainability of the interactions and experimentations in the aim that they become new collaborative practices.

Figure 1: Conceptual Model on How Collaborative Practices Emerge in Collaborative Spaces

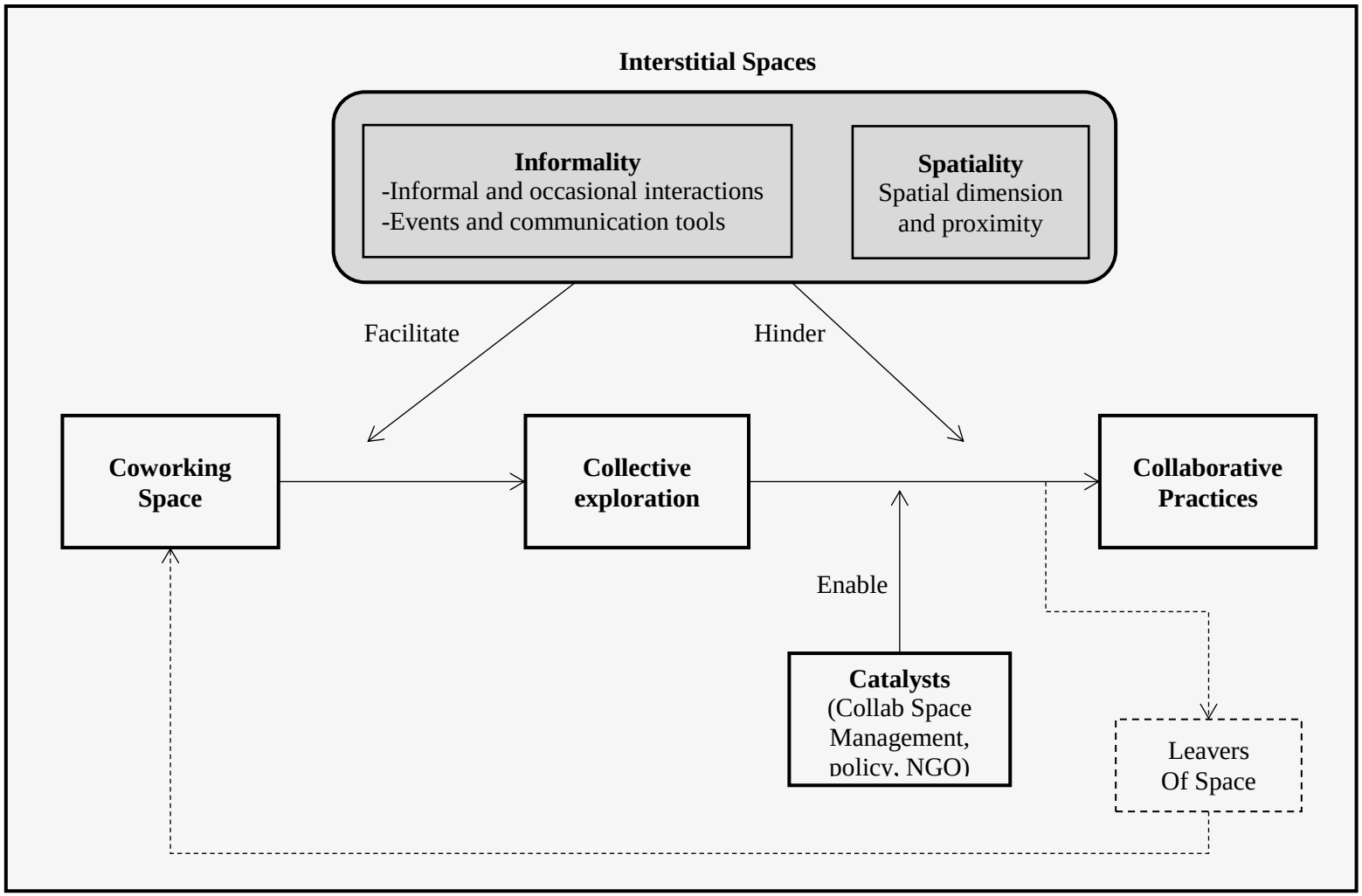

Table 1: Overview of Fintech Case Firms

FIRM	Year Founded	Number of Employees	Number of Offices	Collab Floor Level / Stage	Fintech Focus
FIRM A	2014	7 in London	1	Floor 2, then exited the space	Risk management in capital markets and regulatory compliance software tools
FIRM B	2014	4 in London	1	Floor 2 then Floor 1 then exited the space	Data analytics - Uses big data technologies to enable analysis and visualization of insights for financial portfolios
FIRM C	2014	7 in London 13 in Russia (IT)	2	Floor 3 (High Growth) then exited the space	Risk and compliance focused software aimed at identifying potential rogue activity in the financial sector
FIRM D	2012	7 in London 13 in Paris	2	Floor 3	Payment solutions for financial companies via a single multi-channel platform
FIRM E	2014	5 in London and Oxford	2	Floor 2	Automated predictive analytics and machine learning applications for financial sector, retail, and e-commerce
FIRM F	2014	5 in London 8 in India (IT)	1	Floor 2	Data analytics and payments focused on Fintech and energy sector for sustainability and efficiency
FIRM G	2015	15	1	Floor 3	Foreign exchange and money transfer platform via personal money cloud and applications
Co-Working Space	2014	16	1	3 floors: - Pantry space for young start-ups - Two high growth spaces	One of Europe's largest co-working space with over 200 members, of which two thirds focused in Fintech

Table 2: Data Sources

Data Sources	FIRM A	FIRM B	FIRM C	FIRM D	FIRM E	FIRM F	FIRM G	Collab Space Stakeholders
Semi-Structured Interviews	CEO and Co-Founder (1) CIO and Co-Founder (1) CTO and Co-Founder (1)	CEO and Co-Founder (1) COO and Co-Founder (2)	COO and Co-Founder (1)	Head of Product Strategy & Commercialisation (1) Marketing and Communications Manager (1)	CEO and Co-Founder (1)	Director and Co-Founder (1)	CEO and Co-Founder (1)	Ecosystem Development Manager (1) Policy and Research Manager in Membership Organisation (1)
Archival Material	Press Releases (6) News (5) Website	Articles (22) Website	Articles (24) Website Blog and White Papers (19) Press Releases (14)	Articles and Press Releases (77) Website	Articles (6) Website	Articles (45) Website Marketing Materials	Articles (9) Website Blog Marketing Materials	Marketing Materials Space Layout Articles Website Pictures
Conferences, Events, and Observation	(i) FinTech Conferences: - [Fintech membership organisation] Global FinTech Summit 2017 – London (UK) - [Fintech membership organisation] Global FinTech Summit 2016 – London (UK) 24 hours of non-participant observation 2 workshops 5 panel events Over 10 presentations (ii) FinTech Events in the Collaborative Space - 5 attended (panel) events involving the above case studies 5 hours of non-participant observation							Non-Participant Observation of the collaborative space (6 hours)

Table 3: Drivers of Collaborative Practices

	Informality	Spatiality	Catalysts
FIRM A	**Usage: Low to Moderate** *Facilitator* "We participate in some exhibitions and events like the FinTech Summit." *Inhibitor* "The company has been selected by the UK's Department for International Trade (DIT) to be part of the first UK RegTech mission to [City in USA]" Newsletter participation: Low	**Status: Initially on Floor 2, exited space now** *Inhibitor* "We want to be part of the ecosystem but not physically there." "You know, if your clients are based in Canary Wharf, then maybe it makes more sense. You know Bathtub is close to our clients and affordable"	**Importance: Moderate** "We are a founding member of [Fintech membership organisation] where we participate" "Also, we were selected to be part of the UKTI trip to Switzerland as [FinWork] members"
FIRM B	**Usage: Moderate to High** *Facilitator* "In terms of content provided by [FinWork], I think the seminars that they've started to set up were really beneficial. In terms of just helping people understand topics like intellectual property, PR etc" "Once a week [FinWork] sends out an email newsletter where they offer seminars on particular topics and mentorship or discounted tickets to events and what have you."	**Status: Initially Floor 2, then Floor 1, then exited space** *Facilitator* "The location and the proximity to what we consider potential clients with the banks within Canary Wharf." "Some of the guys there reach out to us and ask us things about our experience so the pantry area is actually very nice. People hangout there, you come across them they ask you a question, you ask. I think, actually the social space is very important to get people to hangout.	**Importance: Moderate to High** "It's obviously also been a certain cliché related to being a [FinWork] member company. It helps you differentiate yourself and at least initially when I'd say the selection of the companies was fairly rigid in terms of who they accepted and who not. It was like an additional stamp of approval." "[Fintech membership organisation], I think have been very helpful to us. We also, I think, got a fair amount of benefits out of UKTI and their focus on FinTech"

	Informality	Spatiality	Catalysts
	Inhibitor "The mentoring program at [FinWork], it's like 30 minute speed dating. You read a person's file, you speak to them for 30 minutes, and then it either turns out that they can be helpful or they can't. It's very hard to judge from a bio." "When it was a smaller group of people and a smaller group of company there was a fair amount of comradery and people exchanged information. I think, particularly early on when it was a smaller group of people, that was actually very beneficial and there was this sense of comradery." Newsletter participation in collaborative space: none	People have their lunch there and so you come across them". *Inhibitor* "The diminishing returns as you add more companies, [My co-founder] just voted yes. I would tend to vote yes as well. The challenge we've got is in November we left the main floor of [FinWork] and moved up to another floor into permanent office space and then because they had some heating and cooling issues, about two months ago we moved down to the [Floor 1]. Our view is that that doesn't work as well as it did, but I think you have to take that a little bit with a grain of salt in that we're not there every day like we used to be, being down on [Floor 1]. "So it's interesting because this floor actually doesn't have that many companies so I personally think makes it easier if they're not that many different people around."	"[Fintech membership organisation] make connections between different members so for example, I think it's Infosys like the systems integrator. They are now a member of [Fintech membership organisation]. They have a 500 million fund where they want to invest in startups. Obviously we want to be introduced to the right people at Infosys and then because it's both members [Fintech membership organisation] does that" "They now understand really well what we are doing. I have a personal relationship and most of the people in the office and if I need anything, I have any ideas they come across something is very active dialogue."
FIRM C	**Usage: Moderate** *Facilitator* "They have weekly investors meeting. They do different EC, different angels.	**Status: Initially on Floor 3, exited space now** *Facilitator*	**Importance: Moderate to High** "I don't know how she [FinWork Ecosystem Manager] knows all those people, but it is quite impressive.

	Informality	Spatiality	Catalysts
	"They also organized some educational events." *Inhibitor* For us it's usually not interesting because we have very high standards of who we consider to be interesting. If this is a second tier VC, we're not interested at all." Releases its own press releases, minimal participation in the space newsletter or activities	"Just to give you an example, when we started the company our first office in London was based at Oval and it was ... You know Big Yellow, the storage business? They also have offices. We were renting one of those. Shit hole, complete shit hole, but this is how you start it off." "You cannot bring a head of research of Deutsche Bank, or you cannot bring a very senior guy from a bank to this kind of office. That's going to be embarrassing. It's all about reputation." "The problem, I would say, also is that if you're a part of an accelerator this works only to a certain extent because if you're in an accelerator you're a start up." *Inhibitor* "It's also expensive. They charge £650 per desk "It has a great location, great infrastructure, but I guess we're just a little bit different and we cannot benefit from a lot of things they can offer to us."	"For example, the few available introductions they made for us, it wasn't that important because we already had all the necessary contacts, but she introduced us to [X], one of the largest venture capital firms in the world. She made the introduction to very significant people at Morgan Stanley."

	Informality	Spatiality	Catalysts
FIRM D	**Usage: Moderate to High** *Facilitator* "All the time we go through events and I actually work very closely with people from [FinWork] and [Fintech membership organisation]. The community in general itself in order to put ourselves out there with the FinTech space in front of banks and financial institutions". Newsletter participation moderate but also continuously publishes its own press releases. Active participation in the collaborative space activities *Inhibitor* "I think [FinWork] is growing very rapidly. When it was slightly smaller, it felt more intimate; we knew exactly what our neighbours are doing. But now because it is growing, we still have the same number of events. So I think little more intimate events where we can discuss solutions, something like speed networking." "The kind of events we are talking about is a one-to-one meeting with investors, they always have limited timeslots like 5	**Status: Initially on Floor 2, currently in Floor 3** *Facilitator* "There is a breakout area, people meet around lunch time, walking around you usually bump into people and talk to them" "There is also an event space, so a lot of times are hosted by [FinWork] which is quite beneficial. Besides the events, now there are a lot of banks and financial institutions are using this space to host events. So when they do that, a lot of times [FinWork] members get tickets. So of course being there to network helps as we are at the centre of the ecosystem." "9 out of 10 people that we bring to our office upstairs, the first thing is that they walk and see around. People say "oh can I take a picture? pretty nice view they say." "There was once we had a meeting with a high profile client, we had a touch screen to run the meeting. So they said "oh wow there is a touch screen". You kind of build a personal and graphical	**Importance: High** "So of course being there to network helps as we are at the centre of the ecosystem. So whenever we go to meetings or talk to some people about us, as soon as we say that we are based out of [FinWork], there is already a trust. Because they already feel like you already ticked some boxes. There is kind of an implied due diligence by being at [FinWork]". "[FinWork] has kind of become synonymous with Fintech in Europe now, so the moment you say you are based at [FinWork], you are automatically given some level of credibility because if you are already in a space that everybody else is trying to get in to, then you might be doing something right".

	Informality	Spatiality	Catalysts
	times, so now you have like 500 people trying to get these 5 timeslots which is quite difficult."	relationship with the client just because being at [FinWork]" *Inhibitor* "Perhaps it is becoming too big for everybody to benefit equally."	
FIRM E	**Usage: Moderate** *Facilitator* "They have the whole ecosystem like any incubator has. They are people who can advise you on a number of things, there are accelerator sessions. It's a typical incubator, the only thing is that [university incubator] has a different framework into everything, plus it's much easier for you to access academic research, people, resources, interns, when you're building the product, sitting there." "Yes, I have met a number of companies. You take some time before some … One of them becomes a customer, but definitely potential customers, you can access from here." *Inhibitor* Newsletter participation and active involvement in activities and events are low	**Status: Currently in Floor 2** *Facilitator* "Several things: it's central to customers in the London area, basically banking and finance. [FinWork] has a good branding, so a lot of people come to meet you here, meeting customers, meeting investors, meeting mentors. To scale up after [university incubator] has been pretty useful by being here in [FinWork]." *Inhibitor* "No, I have not worked with other [FinWork] companies, but I work very closely with a number of mentors who have also become advisors to my company, and they have contributed too."	**Importance: Moderate to High** "[FinWork] has been a great contributor to business."

	Informality	Spatiality	Catalysts
FIRM F	**Usage: Moderate to High** *Facilitator* "There's a mentoring program here. You have options to ... If you're quick enough to get a face-to-face meeting with certain individuals who do mentoring. Just like Richard does mentoring. We've had similar backgrounds. CEO, chairman, investor." "That mentoring is ... It doesn't have to be formal but the ability to talk to people who've been through it before or have got a view. Or got a big company view. Or our investor or etc. it's very helpful." *Inhibitor* Newsletter participation and active involvement in activities and events are low	**Status: Currently in Floor 2** *Facilitator* "The environment's got to fit the culture. We're very virtual company. We've got some half time staff as well as full time staff. That ability and that flexibility is quite important to our organisation." "Mike suggested that we go to the "[FinWork] Club Lounge", which is a more corporate and exclusive dining/bar within [FinWork] designed for business meetings." *Inhibitor* "There is a lot of people. Huge ship. Critical about certain things. Aspects. Etc. They're not doing that they should be doing themselves."	**Importance: High** "It creates a really good environment. The staff here are really top notch. They're better than... very good. Very high quality reception and everything. I think here beats it. That for me is quite high accolade. The politeness and curtness of everybody here is great. It's got that environment." "Within 4 or 5 months of joining here we did a product launch. We spoke to [[FinWork] CEO] and he said, "I'll give you mates rates for a product launching." "We did a product launch [FinWork] which is fantastic. They really helped us. We started getting part of this ecosystem here. [Fintech membership organisation] as well as [FinWork]. A very memorable lead. That got us a lead with [leading company] in October."
FIRM G	**Usage: Moderate to High** *Facilitator* "[FinWork] organises monthly events where we're all able to get together and work with each other on our projects." *Inhibitor*	**Status: Initially in Floor 2, currently Floor 3** *Facilitator* "I started here at [FinWork], on my own first, then I brought the CTO and the rest of the team and grew."	**Importance: High** "[FinWork] definitely helped in advancing my business."

Informality	Spatiality	Catalysts
Newsletter participation and active involvement in activities and events are low to moderate. Informal interaction is focused on organic growth rather than ecosystem development	"I choose [FinWork] because it is kind of a legacy based corporate space in London and it really helps people to set up their start-up, there are different synergies created, it is not that you are sitting on your own like in a 2 meter office on your own" "A lot can happen when you are close to people working on related businesses." *Inhibitor* "We share information which could initially be beneficial for both parties. But obviously we don't share things that are really critical for our business, which give us unique advantage."	

Table 4: Collaborative Spaces: Exploration and Collaborative Practices

Collective Exploration	Collaborative Practices
FIRM A **Moderate to High** "We constantly ask people to look and have feedback. Initially, we had friendly advice from people we know as it was like trial and feedback stage and still the case"	***FIRM A*** ***Low*** "We don't see the point in being there as all our clients are based either in the City or Mayfair. Having an office there is a huge expense. So you see it is good to get some introductions and new contacts."
FIRM B **Moderate** "Both Charles and I helped one guy ... I guess, I helped with the marketing material, Charles helped with input on a contract negotiation. The guy we sat next to on [FinWork] was thinking of which Russian banks he could introduce us to "If you talk to a lot of people that are also talking to a lot of other people and the better they understand what you're doing, the more likely they'll come back and be like hey, I just spoke to so and so" "Then, as a result of winning the [Fintech Challenge] where people in the audience approached us afterwards, made an introduction, and that person then made an introduction for a systems integrator, who then got us into a large investment bank"	***FIRM B*** **Low** "My view is the benefit of collaborations with other companies there is still there, but due to the almost exponential increase in the population of companies there I think it's actually become harder, almost an impediment to building those relationships of trust." "We're not right in the centre of the interactions so our perspective, which is yes I think there are too many companies there and the main lounge area is overpopulated with drop-in members rather than as a casual place for the permanent companies there to get together and talk and get to know each other" "There is not frequent interaction with every company on this floor. Some people are doing stuff that's very different but there is a community here and people know each other"
FIRM C **Low** "All those introduction naturally led to introduction meetings, formal demo, and something else." "This [these introductions in the space] is quite valuable, but I guess to a lesser extent to us. We had all the right people already"	***FIRM C*** **Low** "We're talking, and we continue talking to Morgan Stanley for example. We probably will advance to a POC with them for example. With [VC] we haven't raised from venture capital firms yet, but going forward we will have to" "Our formal competitors are based here as well. A company called [X] for example. It's always good to know your enemy. That's great. This is an advantage. Now whether

Collective Exploration	Collaborative Practices
	we interact, answer is no, we don't really need anything."
FIRM D **Moderate to High** "To be putting everyone in the same ecosystem really helps especially for start-ups like us" "A lot of times what happens is that people just exhibit at events and that is great as we want to try and explain our solutions whether we get a 5 minute on stage it really summarises what we do very well in front of people." "You can come here every day and benefit from the network here - that is the kind of idea -, grab a seat anywhere."	***FIRM D*** **Moderate** "Well our neighbours upstairs are our client actually. For example, I was talking about our expense platform and so we were just talking, they were like we need something like that." "So far, there are more leads than actual conversion but the sales side takes long anyways. But in a way or another we managed to get a lot of relevant leads by virtue of being part of [FinWork]." "[FinWork] had about 140 members 3-4 months ago and now it is around 190. So even then the problem is more people competing for more or less same resources and network".
FIRM E **Low to Moderate** "Just two days ago, [Global Consulting Firm], global head of Insight was here at [FinWork] talking to me, sharing with me that they're running a large outreach, a couple of hundred million dollars business. Their customers are asking them about innovation, but they don't know how to do it and they have the best people and they have the best resources. So much money, I said, "It's very hard to build an innovation ecosystem. It's not to do with people alone, it's not to do with money." Start-ups can do it because they start from scratch."	***FIRM E*** **Low** "If both of you are growing, if you can't really help each other, the complementarities of calibration is what? That I have X the other person has Y, X +Y comes together, creates a better value preparation, we can sell to more people and distribute the profits." It's a huge exercise in itself. It doesn't help anyone. It's probably better when you have grown to a certain extent, and both companies are clear about their product market fit. Before their product market fit happens, it's not wise to collaborate for selling to customers.
FIRM F **High** "This helped us with business as well. If we hadn't attended this event, we wouldn't have found this job. That was great. He was a Fintech guy. When we told him the story he	***FIRM F*** **High** "You have to be open to new ideas, new ways of working, new tech. This has helped us from a technical entrepreneurial standpoint being in this environment. Sharing ideas. We have taken advantage to

Collective Exploration	Collaborative Practices
said, "I'm going to put you in touch with my energy and carbon manager director."	exchange ideas and cross-check our thinking and logic."
"Understanding how these things break and what people are doing and losing these ... This is quite good. That's another thing where this ecosystem, a lot of people are graduating to yeah, we need an account system. We say we use this, they say we use that and we have a chat. That conversation's usually good from a tech perspective."	"If there are opportunities to share ideas or failures or successes with people who are interested, we're really happy to do that."
"There was an account. Microsoft. These folk ... Have a really deep business and tech demand. We were reintroduced ... In a roundabout way, it probably came from here."	"We use [another start-up based at FinWork] for our finance and accounting. All these types of new techy trial basis. That's rather helpful, too. Assuming some of this work, somebody did see our good work. Maybe by the enterprise."
"The other thing which we've done is ... We bought a lot of products, meaning we signed up a lot of these things. We keep evolving, finding small packages."	"We've gone Company called [XY]. We've sold there. We got an activity. We got some software. They got some software. We've come together so the customer gets a wider range of software on delivery…We integrated the project into one interface with the customer. A new interface We had the domain and they had the tech capabilities. We combined that to create a product."
FIRM G **Moderate** "When I started, I used to visit and attend some mentor presentations and workshops. But to be honest now, I don't have much time anymore." "There are a number of businesses on our floor so it's natural that a degree of collaboration and idea-sharing happens."	***FIRM G*** **Moderate** "At least half the people here in [FinWork] are clients of [us]. Since we're all based on the same floor we work together more frequently." "For example, [Firm G] works with nearby [XX]'s market data to help track prices, reports and fundamentals in real time. "This insight into the financial market is crucial in our industry and something that would have taken much longer to develop ourselves," CEO says. "In turn, it uses [Firm G] for payments."

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CHAPTER 5

Conclusion

The dissertation aims to explicate the contingencies that can have an impact on openness and (open) innovation outcomes. Using both quantitative and qualitative methods in three standalone papers format, we explored three questions covering the "what, how, and when" related to the management and emergence of collaborative innovation. Table B presents the main dissertation's findings by chapter which are also discussed below.

The first study (Chapter 2) analyses the interplay between external collaboration, appropriability mechanisms, and innovative performance and examines the differential effects of formal and informal appropriability in manufacturing and service firms. We responded to the call for more empirical evidence on the implications of appropriability regimes in relation to external collaboration and innovation performance (Henttonen et al, 2016; Laursen and Salter, 2014, West and Bogers, 2014). Through a quantitative analysis of a large UK dataset, we found that the effectiveness of both formal and informal appropriation is contingent on the degree of openness. The more firms collaborate with external partners, the less effective the use of appropriability regimes will be on innovation performance. Also, the mechanism of appropriation is contingent on the nature of the firm. For service firms, which have distinct characteristics, the impact of informal appropriability mechanisms was significantly greater than that of formal appropriability mechanisms. The opposite was not proven. Whilst manufacturing firms appear to benefit more from formal appropriability mechanisms, the difference was not significant.

The second study (Chapter 3) digs further to better understand the contingencies of openness and explores 'how' start-ups configure their appropriability regimes and manage the paradox of openness in their various growth stages. Through an inductive study of Fintech start-ups, we

argue for a more dynamic approach to appropriability, building on the two theoretical views in the literature, and posit that the relationship between openness and appropriability is contingent upon the start-up growth stage and the type of external collaboration. There is an orchestration of formal and informal appropriability, acting as inhibitor and facilitator of openness, which is contingent upon the start-up growth stage. Results uncover four patterns of appropriability profiles that are driven by the degree of openness and the stage of development of the start-up besides a pattern of openness in the various growth stages. As such, this paper extends our knowledge on the contingencies and determinants of openness (Arora et al., 2016; Bogers et al., 2016; Zobel et al., 2016) for start-ups and young small firms (Brunswicker & van de Vrande, 2014; Laursen & Salter, 2014) and provides a more granular approach beyond the one-size fits-all approach to appropriability that has so far polarised the debate.

The third study (Chapter 4) investigates how collaborative practices, if they do, emerge in collaborative spaces. Based on a qualitative case study, this question was explored in the context of tech and fintech start-ups, adopting disruptive technologies (e.g. payment, artificial intelligence, data analytics), and being part of a collaborative space. Building on evidence from our study and borrowing from interstitial spaces literature (Furnari, 2014), we develop a theoretical framework for understanding how collaborative practices emerge in a collaborative space. Our findings suggest the enabling and/or inhibiting role of interstitial spaces (e.g. informality and spatiality) and catalysts in the emergence of collaborative practices in a coworking space. This study provides important insights in better delineating the conditionality of openness and its associated contingent factors of what precedes innovation (Laursen and Salter, 2014; West et al, 2014, Bogers et al, 2016).

The dissertation's main contribution is to the literature on innovation management. The dissertation aimed to stipulate an empirical testimony to the value of research on collaborative innovation in better understanding its contingencies and also linking the debate to the literature

on appropriability (strategy), start-ups (entrepreneurship), and service innovation. Although the extant literature has well documented the benefits of open innovation (Dahlander & Gann, 2010; Laursen & Salter, 2006; Leiponen and Helfat, 2010; West & Bogers, 2014), little is still relatively known about the contingencies of openness as innovation builds on openness and collaboration (Chesbrough, 2003). The three empirical papers generated insights on topics relevant to management such as the appropriation of innovation performance (Laursen and Salter, 2014; West et al, 2014), the configuration and management of the paradox of openness in start-ups (Brunswicker & van de Vrande, 2014; Laursen & Salter, 2014; Arora et al., 2016; Bogers et al., 2016; Zobel et al., 2016), and the emergence of collaborative practices in collaborative spaces (Moultrie et al., 2007; Garrett et al, 2017) by borrowing attributes from interstitial spaces (Furnari, 2014). As such, this dissertation, by employing both quantitative and qualitative methods, aimed at adding to these important academic debates and further shedding light on the management of collaborative innovation. Appendix A presents the dissertation's overall impact.

The dissertation has also some limitations that we need to mention. For the quantitative study (Chapter 2) using cross-sectional data from the UK Innovation Survey, it is difficult to draw causality between appropriability, openness, and innovation performance. Also, this study is limited by the variables in the questionnaire as a more refined measure of informal and formal appropriability would add validity to the findings. For the qualitative studies (Chapter 3 and Chapter 4), these exploratory empirical papers lack a large sample testing which make generalisation of the results somewhat problematic. Also, the use of a single industry (tech and Fintech), although heterogeneous, can further question generalisability of the findings. Besides, the qualitative analysis (e.g. interviews, coding), although consistent and thorough in the approach and steps, was primarily performed by the author and then discussed with the academic advisor as it was not possible to have field experts to validate the results.

5.1 Towards a Future Research Agenda

Building on this dissertation and the author's research interests, future research can tackle a series of interconnected, yet different, topics on the management, boundary conditions, and contingencies of (collaborative) innovation on various levels of analysis. My agenda for the next few years is to explore openness and participation in innovation, strategic, and entrepreneurial processes within, outside, and between organisations. Table A below presents selected key research questions that can be considered for future research.

Even though the field of open innovation has generated a panoply of scholarly attention, there are still important gaps and issues that needs to be addressed at various levels of analysis (e.g. for a review see West and Bogers, 2014; Randhawa et al, 2016; Bogers et al, 2016). Following on this dissertation's questions and the author's research agenda, selected questions are presented in the table below that covers three main themes: (a) (inter)-organisational, (b) intra-organisational, and (c) collaborative and innovation spaces. We propose some research questions associated to each topic along with some key references that can act as a starting point to tackle the question.

It would be interesting for innovation scholars to explore questions that bridge other fields such as linking the discussion to entrepreneurship or strategy for instance, which can complement our understanding on the management, the contingencies, and boundary conditions of collaborative innovation. Besides, the inclusion of a multi-level analysis in future research questions can further shed light on the overall innovation process and activities given the multi-nature of open innovation that is entrenched in (inter)-organisational, intra-organisational, ecosystem, and strategy amongst others.

Table A: Selected Potential Avenues for Future Research

Topic	Key Questions	Starting Points
(Inter)-Organisational	- How firms can choose between various formal and informal choices in formulating their appropriability regime in an open innovation context? - How to find the optimal point of appropriability-openness and under which context, industry, or factors? - Looking at OI and entrepreneurship, what are the contingencies that influence success? How do (start-ups) manage and react to the paradox of openness over time? What are the dark sides of open innovation for start-ups? - Where, where, and under what circumstances does open innovation result in higher performance in the service economy?	Laursen and Salter (2014); Arora et al (2016); Miozzo et al (2016); Zobel et al (2016) Brunswicker & van de Vrande, (2014); Gruber et al (2013); Love et al (2014) Mina et al (2014); Randhawa et al (2016)
Intra-Organisational	- How do intra and inter-organisational networks benefit individuals in order to reap the benefit from openness? - How do people (emotionally) respond to working in an open innovation network and how important are emotions in dealing with openness? What about the dark side of individual openness? - Why do individuals really engage in OI? How important is the context and contingencies? - How do individual-level attributes (e.g. motivation, identity) influence the engagement in open innovation?	Alexy et al (2013); Antons and Piller (2015), Salter et al (2015); Dahlander et al (2016) Du et al (2014); Lopez-Vega et al (2016)
Collaborative Spaces / Communities	- How does space influence different outcomes of collaboration? - How do collaborative communities/spaces develop and implement new intellectual property right systems, new business and governance models as new ways of being entrepreneurial and innovative? - Do collaborative dynamics differ from one collaborative movement/community/space to another? How to enhance these collaborative dynamics? - How do intra-organizational practices and inter-organizational collaborative practices interact?	Dahlander and Wallin (2006); Moultrie et al (2007); de Vaujany and Vaast (2013); Fabbri and Charue-Duboc (2013); Furnari (2014); Garrett et al (2017)

Table B: Dissertation's Main Findings

	CHAPTER 2	CHAPTER 3	CHAPTER 4
Unit of Analysis	- Firm level	- Firm level	- Firm level
Empirical Context	- Manufacturing and services firms	- Tech/Fintech start-ups	- Tech/Fintech start-ups
Methodology	- Quantitative	- Qualitative	- Qualitative
Main Findings	- The effectiveness of both formal and informal appropriation is contingent on the degree of openness - The mechanism of appropriation is contingent on the nature of the firm - For service firms, which have distinct characteristics, the impact of informal appropriability mechanisms was significantly greater than that of formal appropriability mechanisms. The opposite was not proven. - Whilst manufacturing firms appear to benefit more from formal appropriability mechanisms, the difference was not significant.	- The relationship between openness and appropriability is contingent upon the start-up growth stage and the type of external collaboration - We go beyond the extant one-size fits-all approach to appropriability and found an orchestration of formal and informal appropriability, acting as inhibitor and/or facilitator of openness, which is contingent upon the start-up growth stage - We uncover a more granular pattern of openness in start-ups which is nuanced by the type of external collaboration, either market or institutional, along the various growth stages	- We develop a theoretical framework for understanding how collaborative practices emerge in a collaborative space - Findings suggest the enabling and/or inhibiting role of interstitial spaces (e.g. informality and spatiality) and catalysts in the emergence of collaborative practices in a coworking space

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APPENDIX A: ACADEMIC PAPER PRESENTATIONS

Chapter 2: On the limits of appropriability in manufacturing and service innovation

2016 On the Limits of Appropriability in Manufacturing and Service Innovation. Invited seminar presentation at ***Politecnico di Milano School of Management.*** Milan, Italy

2015 Heads or Tails? The Openness-Appropriability Duality and its Implications for Innovation Performance. ***DRUID Academy Proceedings.*** Aalborg, Denmark.

2015 Heads or tails? The openness-appropriability duality and its implications for innovative performance. ***Academy of Management Annual Meeting Proceedings.*** Vancouver, Canada.

Chapter 3: The dynamics of openness and appropriability in fintech start-ups

2017 Collaborative Innovation and Appropriability in Start-ups: Evidence from the FinTech Sector. ***Academy of Management Annual Meeting Proceedings.*** Atlanta, USA

2017 Collaborative Innovation and Appropriability in Start-ups: Evidence from the FinTech Sector. Invited seminar presentation at ***Grenoble Ecole de Management.*** Grenoble, France.

2016 The Dynamics of Openness and Appropriability in Start-ups***. World Open Innovation Conference.*** Barcelona, Spain

Chapter 4: How do collaborative practices emerge in co-working spaces?

2018 How do Collaborative Practices Emerge in Coworking Spaces? ***2nd International Research Group on Collaborative Spaces (RGCS) Symposium***. London, United Kingdom.