THE ROLE OF INCUMBENTS IN OPEN INNOVATION:

Supporting or Suppressing Disruption?

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Abstract

Extant research on open and collaborative innovation has assumed aligned strategic interests and incentives in studying the benefits for firms' innovativeness from searching for knowledge outside the traditional firm boundaries. This disregards the threat of disruption from high innovativeness in competing technologies and leaves unexplored whether the firms facing this threat may strategically use collaborations to avoid disruption and thereby influence open innovation projects and partners. This paper explores the consequences of misaligned incentives and strategic interests by analyzing the influence of incumbents on projects related to complementary and disruptive technologies respectively. The findings show that underlying incentives and strategic interests cause incumbents to increase or suppress innovativeness according to the disruptive or complementary nature of the technology in relation to their existing business models, competences and profits. Strategic motives rather than inability are concluded to cause the suppression as incumbents are found to increase innovativeness in disruptive technologies when their strategic commitment is shown by initiation and leadership of the projects. The findings provide nuanced insights to the strategic management literature regarding the benefits of openness by showing that misalignment of underlying strategic interests causes negative effects on the goal of increasing innovativeness through external collaborations. Furthermore, the findings contribute to extant research on incumbent advantages from collaboration by concluding that strategic interests can cause disadvantages for their partners.

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1. Introduction

R&D alliances and collaborative efforts are widely promoted as a positive influence on firms' innovativeness and performance (Laursen and Salter 2006; Lavie 2006b; Rosenkopf and Almeida 2003; Rothaermel and Boeker 2008). The positive outcomes of these efforts is the development of new products, services or technologies, the innovativeness of which will influence the success rate of innovations and performance of firms (Kleinschmidt and Cooper 1991). Indeed, Chesbrough and co-authors argue that *"cooperation with externals is core to increase innovativeness"* (Enkel et al. 2009, pp. 312). As such, a firm's benefit of external collaboration is increased innovativeness, which in turn positively influences performance. Such benefits from R&D alliances, external knowledge search and collaborative innovation have been particularly well documented for industry incumbents, the large, established firms that have dominated their industry for decades through the use of the established business model and existing technologies, and the capabilities and assets related thereto (Chandy and Tellis 2000; Chesbrough 2003; Rothaermel 2001a; Rothaermel 2001b; Rothaermel and Hill 2005). Extant research has documented the value of this approach in order to escape "the incumbent curse", arising from a lack of innovativeness and a path dependent focus on innovations that complement the status quo, which may ultimately lead to the demise of these large dominant firms (Chandy and Tellis 2000). Through collaborating with firms that are free from the incumbent's narrow perspective, logic of an industry and its opportunities, the incumbents can overcome this curse, increase innovativeness and thereby sustain growth and dominance (Chandy and Tellis 2000; Hill and Rothaermel 2003; Rothaermel 2001b). However, while these incumbent benefits are well documented, the other side of these collaborative efforts remains relatively underexplored.

While access to the incumbents' assets is argued to benefit non-incumbents in these collaborations (Dyer and Singh 1998; Teece 1986) there is a lack of exploration of any potential drawbacks. This is surprising given the argument that non-incumbents are often the source of high innovativeness and disruptive innovations (Henderson 1993; Henderson and Clark 1990; Rosenbloom and Christensen 1994), which have the potential to undermine the position and profitability of incumbents (Christensen 1997; Tushman and Anderson 1986). The author argues that a dilemmatic situation of conflicting strategic interests arises as a result: Incumbents have a strategic interest in and incentive to avoid disruptive innovations in order to sustain their dominance, profitability and the value of their assets and capabilities within existing technologies. Conversely, for the non-incumbents, typically new entrants in the industry, technology developers, entrepreneurs or similar with no vested interest in the status quo and existing technologies, success is defined by high innovativeness and development of the same innovations that disrupt incumbents. Understanding whether such conflicting strategic interests may cause a negative effect from incumbent-collaborations for the non-incumbents will provide nuance to the R&D alliance and collaborative innovation literatures' focus on incumbents and their benefits from collaboration.

The potential disruption of capabilities, assets, power and profitability from highly innovative products or technologies, which may alter the technological or industry base and composition (Henderson and Clark 1990; Lavie 2006a; Tushman and Anderson 1986) creates strong incentives for these actors to avoid radical changes beyond their control (Christensen 1997). Indeed, incumbents have previously been found to focus mostly on incremental innovation with a level of innovativeness that would serve to support and enhance their competences and industry positions, either due to the inability or unwillingness to disrupt themselves (Christensen and Bower 1996; Tushman and Anderson 1986). However, more recent findings suggest that this may have exceptions depending on the willingness of incumbents to self-cannibalize through the development of disruptive innovations (Chandy and Tellis 1998; Hill and Rothaermel 2003; Rothaermel and Hill 2005). This contradiction suggests that depending on the circumstances, incumbents may seek to either avoid or embrace disruption from high levels of innovativeness. This uncertainty about incumbents' approach to disruptive innovations, and the question of whether ability or willingness causes their approach, creates an inherent dilemma for non-incumbent innovators. Due to the position, power and complementary assets of incumbents, non-incumbent innovators often have to engage in collaborative efforts to develop and commercialize innovations (Teece 1986). However, at the same time it is uncertain whether incumbents are willing and able to contribute to the innovativeness, which is essential to the performance of innovations. This is particularly questionable in the context of technologies in which high innovativeness will cause industry disruption and discontinuity (Christensen 1997; Garcia and Calantone 2002; Tushman and Anderson 1986).

The dilemma described above is well illustrated in the empirical setting chosen to explore whether incumbent collaboration reduces innovativeness. While many sectors are characterized by a few large incumbent actors, which possess key complementary assets (Teece 1986), this is particularly true for the electricity sector. Incumbent electricity producers and distributors possess the facilities and assets needed to generate and supply electricity, capital for the investment in new technologies and facilities, direct contact with customers (both in the shape of communication and physical cables supplying the end product), industry knowledge, competences and expertise, as well as powerful, central industry positions to influence regulation and developments (Allen et al. 2008; Geels 2004; Kim 2013; Smink et al. 2013; Stenzel and Frenzel 2008; Unruh 2000). However, increased attractiveness of decentralized electricity generation threatens all these incumbent competences, assets and capabilities, as well as their core business model of producing and supplying electricity (Watson 2004). As a result, high innovativeness within the technologies facilitating increased decentralization is likely to disrupt and threaten the industry incumbents. However, the non-incumbents' likelihood of successfully developing these disruptive technologies is highly dependent on incumbent collaboration due to the capabilities and more listed above, as is argued to be the case in many sectors (Dyer and Singh 1998; Rothaermel 2001a; Rothaermel 2001b; Teece 1986; Tripsas 1997).

This paper explores the influence of incumbent collaboration on the innovativeness of efforts to develop disruptive and complementing technologies, and seeks to disentangle whether lacking abilities or strategic considerations cause potential suppression of innovativeness. The empirical data consists of 1,608 collaborative innovation projects within complementing or disruptive technologies. 3,878 non-incumbent firms participate in projects with or without incumbent participation, and independent expert evaluations capture the incumbents' effects on innovativeness. The results provide evidence that incumbents have a suppressive effect on the innovativeness of disruptive innovation, while supporting the innovativeness of projects related to complementary innovations. However, suppression turns to support when incumbents are strategically committed to the development of a disruptive technology. This is concluded from a supportive effect of incumbent leadership in disruptive technologies, interpreted as indicating strategic commitment. These findings have theoretical implications for the strategic management and collaborative innovation literature, as well as practical implications for innovators considering incumbent collaboration. The following section reviews extant literature and builds hypotheses, before section 3 presents the empirical setting, data and the methodology. Section 4 then presents the results and section 5 discusses these and presents conclusions. Finally section 6 presents limitations and potential avenues for future research.

2. Theory and Hypotheses

Innovativeness is essential for firms' to survive and prosper in the increasingly competitive global business environment as this is the foundation of continuously introducing new products, services and technologies (Christensen 1997). The strength of innovativeness in terms of creating and sustaining competitiveness is clear from its potential to shift the structure of an industry and influence firms' existing technological resources, skills, knowledge, capabilities and strategy (Garcia and Calantone 2002). This captures the value of innovativeness for firms' competitive advantage while also supporting established knowledge that high innovativeness in disruptive technologies can undermine the business model and profitability of industry incumbents (Christensen 1997; Lavie 2006a; Tushman and Anderson 1986). The disruption of industry structures, firm assets, capabilities and business models caused by high levels of innovativeness will be particularly damaging to incumbents who have built their profitability and dominant positions around investments in and have tied their capabilities to existing technologies and business models. In complementary technologies however, high innovativeness will reinforce industry structures and business models, and increase the value of assets related to the particular technology (Christensen 1997; Henderson and Clark 1990). Following this, high innovativeness on complementary technologies will benefit and strengthen incumbents through increased used of their core competences and resources. Conversely, non-incumbents may benefit from high levels of innovativeness in disruptive technologies as they seek to displace the established industry structure and capture market shares (Christensen

1997). High innovativeness and the resulting novelty create superior benefits to customers and users (Kleinschmidt and Cooper 1991) and the likelihood of incumbent disruption increases with the level of innovativeness since preference for the disruptive technology compared to the established technology will lead to competitive advantages for the firms active in the new disruptive technology and destruction of those active in the now existing technology (Anderson and Tushman 1990).

It is increasingly well established that important sources of innovativeness are located outside the traditional firm boundaries and that external collaborations positively impact firms' innovativeness (Chesbrough et al. 2006; Katila and Ahuja 2002; Laursen and Salter 2006; Rosenkopf and Almeida 2003; Sofka and Grimpe 2010). Innovativeness and the successful development of new products or technologies require collaborative efforts in order to drawn on and combine different sources and areas of expertise, which can raise innovativeness (Miotti and Sachwald 2003; Rosenkopf and Nerkar 2001) and in order to access knowledge and complementary assets, which are essential to developing and capturing value from innovations (Chesbrough 2003; Teece 1986). However, inherent in the perspective on disruption of incumbents is the fact that high innovativeness within certain technologies has dissimilar consequences for different firms. Firms therefore have dissimilar incentives related to development of certain technologies (Anderson and Tushman 1990) and consequently for increasing the innovativeness related to these technologies depending on the consequences they face as a result. However, despite increasing research on R&D alliances, collaborative innovation and the use of external knowledge, the risks and drawbacks remain underexplored relative to the benefits (West and Bogers 2013). One resulting research gap is the question of whether misaligned incentives and strategic interests between collaborators may potentially cause negative effects from collaboration.

2.1. Incumbents and Collaboration

The rise and demise of large, successful firms and the question of why and how this occurs has persistently captured the attention of researchers. The majority of research has focused on how prosperous firms move from excellence and domination, to decline and obliteration in the face of disruptive change, and mainly cite the lack of innovativeness and adaptability (Abernathy and Utterback 1978; Christensen 1997; Henderson and Clark 1990; Tushman and Anderson 1986; Utterback 1994). Studies of this phenomena has naturally led to an interest in whether and how some incumbent firms nevertheless manage to escape this detrimental path and survive disruptions through innovativeness and adaption (Hill and Rothaermel 2003; Rosenbloom 2000). Indeed, studies show that a fruitful strategy for incumbents to maneuver disruption is to engage in strategic R&D alliances and collaborations with innovative external partners (Rothaermel and Hill 2005; Rothaermel and Boeker 2008; Rothaermel 2001b). As such, the research into these dynamics has mainly been concerned with the failure of incumbents, and how collaboration from their perspective improves their chances of continued survival. This dominant incumbent perspective has neglected the non-incumbents firms that attempt to develop the disruptive technologies. While findings show that incumbents may benefit from collaborating with these firms, the question remains whether the same is necessarily true the other way around. Indeed, incumbent survival through collaboration may be caused by increasing their innovativeness and embracing disruption, or by decreasing the innovativeness of their collaborators and preventing disruption.

In addition to analyzing the role of suppliers, customers, competitors and universities, extant research shows the benefits for non-incumbents of collaborating with incumbents in order to gain access to a number of complementary assets, which are key to the successful development and commercialization of innovations (Lee et al. 2010; Spithoven et al. 2013; Teece 1986; Van de Vrande et al. 2009). However, the implicit assumption in extant research on open innovation (Chesbrough et al. 2006; Chesbrough 2003; Laursen and Salter 2006; Van de Vrande et al. 2009) and collaboration and alliances (Eisenhardt and Schoonhoven 1996; Lavie 2006b; Mowery 1996; Rosenkopf and Almeida 2003; Rothaermel 2001a; Vanhaverbeke et al. 2002) is that incentives are aligned and that collaborators have shared motivation for high innovativeness. However, this assumption disregards the knowledge that high innovativeness in disruptive technologies may lead to the demise of incumbents (Christensen 1997; Henderson and Clark 1990; Tushman and Anderson 1986; Utterback 1994) and that this may incentivize incumbents against innovativeness. Although the importance of alignment in business models is discussed by Chesbrough in the early work on open innovation (Chesbrough 2003; Chesbrough and Crowther 2006a), this has since been neglected in the further development of the paradigm (West and Bogers 2013) and the fundamental aspect of aligned incentives has remained largely unexplored in extant literature.

2.2. Incumbent Collaboration in Complementary Technologies

The paper defines complementary technologies from the point of view of the incumbent actors. As such, complementary technologies are defined as those where high levels of innovativeness would contribute to maintain or reinforce the power, position and profitability of the incumbents. Innovations of this sort are generally of an incremental character (Henderson and Clark 1990) with minor improvements to the existing technologies, products or services, which do not significantly impact the industry structure or business model (Christensen 1997). Extant research has studied how different external sources may serve the purpose of this type of innovation. Köhler et. al. find that searching for knowledge from competitors is beneficial for the development of innovations that successfully imitate existing products or services that are currently offered in the market (Köhler et al. 2012). These types of innovations would carry little disruptive consequences as they are based on products, services or technologies that are already in the market and thus would likely have had their disruptive consequences at this point. Furthermore, the use of suppliers is show to have a positive influence on the successful development of process innovations (Reichstein and Salter 2006) and other types of complementary and incremental innovations (Laursen and Salter 2006). The use of suppliers allows the opportunity for accessing expert and detailed knowledge about the specific and well-defined challenges needed to be solved for small improvements in existing and industry prevalent technologies.

High innovativeness in these technologies is unlikely to be disruptive to incumbents, as the resulting improvements would ultimately complement and enhance the foundation on which their position has been built. Rather, improvements in these technologies through high innovativeness would sustain or even improve the profitability of these actors. Improvements to manufacturing processes most often have the advantage of reducing cost or time of production, or even both, benefitting the profitability of incumbents. Alternatively, innovativeness in these technologies might provide opportunities to integrate related technology, components or similar into the existing product or business model. This is confirmed by findings that incumbents tend to focus on and favor incremental and complementary innovations since they do not threaten their existing capabilities, assets, value chains and position (Henderson and Clark 1990; Tushman and Anderson 1986). In the context of the electricity sector high innovativeness in complementary technologies may enable integration of biomass or clean coal into existing production facilities, or result in advances in technologies such as wind energy. Wind and similar large-scale technologies is currently or can be integrated into the production capacity of an incumbent with low risk of disruption since the large scale and centrality is complementary to their capabilities and business model. Innovativeness in these technologies thus serves to sustain rather than disrupt the incumbent. The benefits of economies of scale further encourages the focus on complementary innovations, which will help better utilize and increase the capacity of existing production facilities, to the economic benefit of the incumbents (Panzar and Willig 1977).

It would be expected that incumbents have an influence similar to that of suppliers in terms of adding value to the development of incremental innovations. Although the knowledge afforded might be different than that of small-medium sized suppliers, the insights into the workings of the technology and the applicability and value of innovations would expectedly be beneficial. Furthermore, in the context of this paper the incentive and motivation to contribute to the innovativeness of improvements in products or technology the benefits are clear for the incumbent. Higher innovativeness would expectedly yield higher cost or time savings, or allow for the integration of technology that complements, benefits and sustains the incumbent position and profitability, rather than disrupting it. Considering the value for incumbents from these technologies, we expect that their participation will increase the level of innovativeness. Incumbents should be willing to contribute positively in terms of offering knowledge, expertise and capabilities to the non-incumbents when high innovativeness would sustain rather than disrupt them. Based on this, the first hypothesis expects that incumbents want to sustain their position and profitability and will therefore have a supportive effect on the innovativeness of their non-incumbent collaborators within technologies that complement their existing technological foundation and business model.

H1: *Incumbent collaboration increases non-incumbents' innovativeness in complementary technologies*

2.3. Incumbent Collaboration in Disruptive Technologies

Technologies with disruptive potential are often radically new technologies, products that offer new and superior customer benefits or dramatically alter established industry structures or business models (Adner 2002; Christensen 1997; Christensen and Rosenbloom 1995). High levels of innovativeness in these technologies therefore have the potential to radically overturn the foundation on which incumbents have built their dominant position and undermine their profitability and business model (Christensen 1997; Tushman and Anderson 1986). As existing technologies or business models are outcompeted, the sunk costs incurred during decades of establishing a dominant position based on these technologies are lost. In addition to this financial loss, the incumbents loose future profitability since they are subordinately positioned to compete in the new reality, their capabilities that have been tied to the now inferior technology or business model have lost substantial if not all value, and their competences and knowledge have little application (Christensen 1997; Ron Adner and Zemsky 2005; Tushman and Anderson 1986). The *"disastrous effects on industry incumbents"* (Henderson and Clark 1990, pp.1), which often occur due to the emergence of technologies that lie beyond the incumbents' competences and capabilities have often been argued to be both caused by and the breeding ground for entrepreneurial activity. As such, just as the incumbents may seek to avoid these developments, other actors come into existence because of and build their future rise to incumbency based on disruption. The central question in this paper is whether these non-incumbents benefit from incumbent collaboration.

Just as different actors stand to benefit from disruptive innovations, different actors are found to be able to contribute to these innovations in the context of open innovation. The arguably most significant contributor to these innovations has been widely found to be universities (Cohen et al. 2002; Köhler et al. 2012; Link and Scott 2005). Indeed, findings in the open innovation literature have shown that openness towards and access to knowledge from universities has a positive influence on firms' ability to develop disruptive technologies or products with high levels of innovativeness (Köhler et al. 2012; Laursen and Salter 2006). The high level of novelty and innovativeness of university knowledge (Cohen et al. 2002) has the potential to result in radically new technologies or products, which may disrupt and undermine the incumbents (Christensen 1997). Collaborating with universities on disruptive technologies would therefore ne expected to contribute with high levels of innovativeness and indeed be a logical choice for innovators focused on such technology. Furthermore, the non-commercial nature of universities makes them a mostly neutral collaborator in terms of motives to support or suppress innovativeness. In fact, the typical motivation of researchers in universities is the publication of their work, and since the likelihood of publishing scientific work is increased by the newness of the work and knowledge generated, universities could generally be expected to seek the highest possible level of innovativeness. Furthermore their lack of commercial incentives increase their value as collaborator, since the likelihood that they will seek to appropriate the commercial value of innovations resulting from the collaboration is relatively low to that of private actors (Link and Scott 2005).

While universities are a valuable contributor to raised innovativeness in disruptive technologies without obvious commercial concerns and incentives, this paper argues the opposite for incumbents. The incentive for universities is to promote innovativeness since this sustains or promotes them, while incumbents have built their position and profitability based on the established dominant design in an industry, and so disruption to this is critical. Their practices, procedures, problem-solving strategies, investments and more have centered around and developed based on the established technologies (Geels 2002; Henderson and Clark 1990). As these actors survive and grow through the maturing of the industry, these competences and commitments increase, forming a competitive advantage but also having the reinforcing effect of a path-dependency (Arthur 1989). This path-dependency makes disruptive changes to the established industry increasingly undesirable for incumbents as this undermines their core competences, their value chains, assets, profitability, business model etc. (Dosi 1982; Tushman and Anderson 1986). The economies of scale and price advantages created through their investments would also suffer if disruptive technologies steal market share and reduce the need to utilize the full capacity of existing investments in production facilities (Panzar and Willig 1977). This contributes to the incumbent's motivation for intensifying the use of complementary technologies rather than promoting the innovativeness of alternative, disruptive technologies.

The successfully suppress the innovativeness of disruptive technologies by incumbents may reduce the threat to their position as the benefits and advantages of these new technologies compared to the existing technologies are reduced. Non-incumbents may then be expected to avoid incumbent collaboration in the efforts to increase innovativeness on disruptive technologies. However, as previously described, collaboration with incumbent actors is often a necessity for innovators in most industries as these possess numerous essential complementary assets (Rothaermel 2001b; Teece 1986). This dilemmatic situation may force a potentially suppressive collaboration on the non-incumbent, which this paper expects to result in reduced innovativeness. Based on this, the second hypothesis expects that the incentives for incumbents to avoid disruption of their business model and profitability will lead to a suppressive effect on the innovativeness of the non-incumbents collaborating with them on disruptive technologies.

H2: *Incumbent collaboration suppresses non-incumbents' innovativeness in disruptive technologies*

2.4. Disentangling Strategic Intent and Lack of Ability

A central question in the literature on incumbents and in relation to the hypothesis above is whether lack of ability or willingness is the driver behind the relationship between incumbents and disruptive innovations, and the above expected influence on their collaborative partners. Furthermore, some extant studies have found that incumbents and disruptive technologies are not necessarily opposites, as some incumbents successfully develop and benefit from disruptive innovations and technologies (Chandy and Tellis 1998; Chandy and Tellis 2000; Lavie 2006a; Rothaermel 2001a; Rothaermel 2001b). In the context of these findings as well as this paper it is therefore relevant to explore whether incumbents make the strategic choice of suppressing the innovativeness of disruptive technologies due to their incentives, or if they are incapable of contributing to the innovativeness even if they so desire. If the former is the case, then the choice of suppressing innovativeness may seem surprising since history has clearly shown that change occurs and the slow, conservative incumbent will suffer and eventually fail if not embracing these changes. It would however be less surprising if we expect incumbents to have learned from the failings of their predecessors and act strategically to avoid their own failure. Such strategic action might well involve the incumbent carefully considering when it would be preferable to suppress the innovativeness of a disruptive technology and when it might be beneficial to support it. Accepting the incumbents as strategic in this respect, and thereby their suppression as a matter of willingness rather than inability, would indeed explain why extant research has found some incumbents to promote disruptive innovations (Chandy and Tellis 1998; Chandy and Tellis 2000; Lavie 2006a; Rothaermel 2001a; Rothaermel 2001b).

This paper seeks to explore whether in fact incumbents strategically choose when to support or suppress the innovativeness of disruptive technology projects to the good or harm of their collaborators. This will contribute to understanding whether lack of willingness or ability is the cause of the traditionally observed opposition between incumbents and disruptive innovation. It would also strengthen the argument in this paper that the incentives and motivations of actors should be considered as central in the open innovation literature if in fact willingness is the driver of suppression. To explore this it is necessary to identify situations when incumbents show willingness and strategic intent towards the support of the innovativeness in projects related to disruptive technologies. This is done by separating projects on which incumbents assume the role of project leaders and project on which they are only participants. The reasoning is that assuming the role of project leader indicates high commitment to the development of a technology. While participation allows the opportunity to influence a project just as well, the choice of the incumbent to be project leader shows a higher degree of commitment and strategic intent. As the strategic incumbent identifies an attractive opportunity in or an unavoidable development from a disruptive technology, the incentive to position itself in this technology would motivate its use of power and position to assume project leadership. This situation of opportunity or necessity related to the technology would motivate the incumbent to increase the innovativeness of this technology, thereby optimizing its advantage from the outcome in retaining its position in the post-disruption situation. Based on this the final hypothesis of the paper expects that incumbents' strategic commitment to disruptive technology in the shape of leadership will positively influence innovativeness.

H3: *Incumbent leadership increases innovativeness in disruptive technology projects*

3. Data and Method

3.1. Empirical Setting

The empirical setting chosen to explore the effects of incumbents on open innovation is the energy industry. This is an industry in which the hypothesized influences from incumbents on supportive and disruptive projects are likely to be present for a number of reasons, thereby making it a suitable setting to study an unexplored phenomenon. The first reason is that the industry is characterized by very large sunk costs incurred by incumbents related to investments in assets for both production and distribution of energy. These assets are all but exclusively tied to traditional fossil based technologies such as coal, gas and oil based fuels, and to complementary and established renewable technologies such as biomass, hydro and wind power (Eurostat 2013). As a consequence the financial loss incurred by incumbents from displacement of these assets due to disruptive innovations would be significant.

Second, the technologies of these production facilities are incompatible with other technologies, thereby increasing the destructive effect of disruptive technologies as they would substitute the existing in providing a homogenous good: electricity. Similarly, the distribution infrastructure is geared towards centralized, stable production from the existing large-scale facilities and technologies (Eltawil and Zhao 2010). Significant investments are required to accommodate disruptive technologies resulting in decentralized production. Furthermore, the sunk costs in the centrally oriented infrastructure would to some degree be lost and often incumbents are required by authorities to provide and pay for the further necessary development of infrastructure to accommodate integration of new technology, thereby increasing both the disruption and its costs. Adding to the disruptive impacts on the incumbents is the fact that decentralized production is incompatible with their business model since decentralized facilities are often owned by private individuals or investor groups (Watson 2004). Due to the substitutional and homogenous nature of energy, this has large negative impacts on the profitability of incumbents. As an example the rise in installation of decentralized photovoltaic solar has provided substantial challenges and costs for incumbents (Borenstein 2008; Eltawil and Zhao 2010; Ipakchi and Albuyeh 2009), resulting in their well-documented resistance towards this technology (Jacobsson et al. 2004)

Third, the energy producers and distributors have enjoyed monopoly power for years, and effectively continue to do so to a large extend, even after liberalization measures across several countries (Joskow 2008). As such, these actors are both in a good position to protect themselves from destructive events via disruptive innovations, and stand to gain significantly from doing so in terms of maintaining current assets, market power and large profits when possible. Furthermore, this monopolistic situation allows a very tight control over important complementary assets (Teece 1986) such as customer access, the distribution system – the power grid, and enabling access for facilities using new technologies to this grid.

The data used for analysis is drawn from the EU database of the 7th Framework Program's energy area and consists of 1,880 projects proposals and their 15,304 respective participants. The project proposals are submitted in application for co-funding from the European Union in the period 2007 to 2013. Firm level data is available for each participant, while data on each project provides identification of the technological area and the participants. The unit of analysis for is the individual participant on each project and how the innovativeness is influenced for that participant.

3.2. The Energy Incumbents

In the context of this paper incumbents are defined as large actors with large sunk costs in and capabilities and competences tied to, the existing industry technologies, structures and business models (Christensen 1997), and who possess a position and power that makes them central to the development and commercialization of innovations (Teece 1986). This results in strong interests in and incentives to retain the status quo rather than face the consequences of disruptive technologies, which relates directly to the motivation of the paper. In the empirical setting of this paper these incumbents are the electricity producers, distributors and transmission companies, who during the course of several decades have incurred sunk costs into large, centralized facilities to generate, transmit and distribute electricity using established technologies; sunk costs which would ultimately be lost if high innovativeness in disruptive technologies would cause displacement of these facilities and the related business model and profits. Non-incumbents are defined as private firms developing technologies, entering the industry or otherwise falling outside the incumbent categorization and incentive.

The following provides exemplification of the strategic interests of incumbents in the energy sector. The independent German consultancy Ecoprog analyzes 100 coal-fired power plants in Europe with total capacity of more than 70GW, an approximate average capacity of 0.7GW (Siebertz 2012). The US Energy Information Agency estimates the average capital cost of coal fired power plants to be in the range of approximately $3,000 to $5,000 per kW capacity excluding financing costs, interests and similar (Beamon and Leff 2013). These figures amount to an approximate average price of coal power plants for the energy producers beyond the $2bn-$3.5bn range. To exemplify the incumbents' vested interests in the status quo of the industry, Danish energy company Dong Energy's sunk costs in five coal plants in Denmark is thus beyond $10bn. While the largest energy company in Denmark, Dong is a relatively small actor among the large European energy companies who thereby have significantly higher investments in coal power and thus the status quo, even disregarding investments in other technologies and infrastructure. While these are rough figures they provide perspective on the intensity of the investments made by energy incumbents into existing technologies such as coal power and on the lock-in and path dependency which occurs. In further support of this Ecogrog reports that the 80 new coal power plants planned for construction between 2012 and 2020 in Europe amounts to a doubling compared to the previous 8 year period (Siebertz 2012). As such, the incumbents' commitment to the status-quo seems to be increasing rather than decreasing. On this background this paper defines the incumbent actors in our data as producers and distributors electricity. These are identified using the NACE code 40.1 in the dataset "Production and distribution of electricity". Following this identification the author carried out a review to check for any identified incumbents, which only or mainly utilize technologies defined as disruptive, which provided a number of false identifications, which were cleaned in the data and redefined as non-incumbents.

3.3 Variables

3.3.1. Complementary and Disruptive Technologies

The data provides information on which of the EU's thematic areas a specific project applies for funding within. As these areas are defined by technological areas, this is used split projects into complementary and disruptive. For the purpose of studying the effects of incumbent collaboration on innovativeness, this categorization is made from the perspective of the incumbents. As incumbents are expected to be motivated by the perseverance of their existing profitability, business model, assets and capabilities, disruptive technologies are defined as those which undermine these (Christensen 1997). Conversely, technologies that would sustain or improve the incumbents' existence are defined as complementary and high innovativeness in these technologies would thus serve to preserve the incumbents' profitability and position. The variable *disruptive* is reflects if the project relates to disruptive technologies. This variable covers the definition "*future technologies and novel materials*" in the dataset, and projects related to fuel cells and hydrogen, electro-chemical storage as well as photovoltaic solar energy. These technology areas are either radically different from existing technologies or can significantly disrupt the industry structures and business models as high innovativeness in the technologies will increasingly enable profitable decentralized production and storage of electricity. Increased feasibility of this would remove the largest constraints on renewable and decentralized energy production, the requirement to use it at the time of production. Such developments would be highly disruptive to the incumbents' position and profitability by threatening the advantages and profitability of the existing production and distribution facilities based on established technologies. This would undermine the incumbents' business model, profitability, assets, power and competences. Finally, the disruptive definition covers projects related to *energy savings*. Significant reductions in the electricity usage of consumers would be disruptive to the incumbents' core business of selling kilowatt-hours of electricity, for which reason we consider this as a disruptive technology from the perspective of the incumbents.

The variable *complementary* captures the projects involving established technologies that are integrated into or complement the incumbents' position, profitability and business model. These are technologies in which the incumbents have either made significant investments, or which can be integrated into the existing technologies or traditional business model of large-scale centralized production and distribution. More specifically, the technologies included are: wind, biomass, geothermal, concentrated solar power, ocean power, hydro power, biofuels, smart energy networks, co2 capture and storage technology, and clean coal technologies.

3.3.2. Incumbent Participation and Leadership

To test the hypotheses of the paper the author constructs two explanatory variables: *inc_part* and *inc_leader*, which each represent that the observed participant is part of a project with an incumbent participant or leader respectively.

3.3.2. Dependent Variable: Innovativeness

Innovativeness is defined as the degree of newness in and the potential for a paradigm shift in an industry caused by a technology or product (Garcia and Calantone 2002). This relates well to the research agenda of exploring how potential disruption drives incumbents to exert supportive or suppressive influence on the innovativeness of projects related to either complementary or disruptive technologies, with consequences for their collaborators. As such, supporting innovativeness and potential industry change towards increasing use of complementary technologies would be expected to appear attractive to the incumbent. The opposite is the case for disruptive technologies where support for innovativeness and thereby increased use or likelihood of use of these technologies would undermine the incumbent's position and profitability. In line with extant research on innovativeness of ideas, products and projects the go/no-go decision of rejecting or accepting a project proposal for co-funding is used as a dependent variable measuring innovativeness (Garcia and Calantone 2002). The binary outcome variable thereby measures the likelihood that a participant on a particular project receives approval based on the innovativeness of the project. Acceptance or rejection is based on the evaluation of each project, conducted by three to five of Europe's leading experts in the relevant area. This evaluation is focused on the project's technological excellence, the move beyond current state-of-the-art and the commercial potential, which matches the definition of innovativeness used in extant literature well as outlined in Garcia and Calatone's review of the field and terminology (Garcia and Calantone 2002).

With regards to the ability of experts to evaluate innovativeness and the use of this as an outcome measure, extant research has established this as a valid for data where no ex-post realization information is available. Indeed the evaluation criteria in the empirical data align well with previous research's established measures of evaluating the quality or innovativeness of ideas or projects ex-ante potential realization (Amabile et al. 2005; Garcia and Calantone 2002; Moreau and Dahl 2005). For the purpose of evaluating the novelty and potential of proposed projects, Salge et. al. use the evaluation of internal experts (Salge et al. 2013). Similarly, Poetz and Schreier analyze the value and innovativeness of ideas generated by different problem solves based on the evaluations of executives (Poetz and Schreier 2012). In fact, the use of expert evaluations as a measure of innovativeness or potential is shown by Anderson et. al. to be predominant and widespread in much of the research on team and project levels (Anderson et al. 2014). In addition to being well-established in extant research, the use of expert evaluations of projects hold noteworthy advantages to other measures in innovation studies on firm level. Firstly, evaluations are based on the innovativeness of the specific project, regardless of the many unobservable factors, which would influence the ex-post performance of a project or a participating firm. Secondly, both approved and rejected projects are included. In a study of the ex-post performance of granted projects and participating firms only, the characteristics of rejected projects would be unavailable. Finally, the evaluation criteria fit well to the definition of innovativeness in the literature, while the expert evaluators are still required to be sensitive to the feasibility of the proposed projects. The process of evaluation consists of individual evaluations by each expert before a joint meeting in which an additional expert and EU representative ensures that the reflections of all experts are heard and incorporated in the final evaluation.

The experts' decision to grant funding for an application rests on a number of criteria designed to evaluate the soundness of the proposed innovation project, whether the team is competence to execute the project, impact of the project results and the degree to which the technological focus progresses beyond state-of-the-art (European Commission 2007). In the context of this paper, the latter two criteria of moving beyond the current state of the technology and high impact results capture innovativeness. To isolate soundness and competence from the decision to grant funding we drop project proposals that do not meet the evaluation minimum threshold within each criteria. This results in a sample of applications which are found to meet the requirements of competence, leave innovativeness as the main differentiator in approval of applications. Furthermore, the analysis includes control variables for number of participants, inclusion of universities and research organizations that provide important competences in addition to private firms.

3.3.3. Control Variables

For the sample with available Orbis data the following controls are included. *To_2007usd* captures the firms turnover at the start of the sample in million US dollars and *assets_2007_usd* capturing the same amount in terms of firm assets (again, aimed at addressing Magali's point, although I would need to change this to also be an “incumbent assets” which captures the assets held by the incumbent which the observed firm is collaborating with!..coming up). The variable *empl_2007* captures the number of employees in each firm, while *pat_interv* captures whether the observed firm has a number of patents in the intervals 0-9, 10-19, 20-49, 50-99, 100-999, or above 1,000. Finally, the variable *bvd_idep* captures whether the observed firm is a subsidiary of a parent company, with different variations of connectedness to a parent company available.

Firm size is often found to be related to innovative capability, and may also be suspected to influence the ability of participants to increase the innovativeness of a project. Therefore the analysis includes the control variable *size* to control for whether the actor is an SME, a dummy taking the value 1 for SMEs and 0 for large firms. The dummy *turn_over* is included and takes the value 1 for firms with turnover below €50mio annually as high turnover and availability of resource may influence the ability to employ skilled R&D personal and thus increase innovativeness. The variable *balance* takes the value 1 for firms with an annual balance sheet above €43, indicating a large amount of capital for investment in e.g. R&D. The dummy *subsidiary* is included to ensure that the benefits the first two controls are not afforded from a parents company. The variable takes a 0 for firms that are independent of a parent company, and 1 for subsidiaries. *Uni_in_project* controls for whether a university participates on a project since this has previously been found to raise innovativeness (Cohen et al. 2002; Link and Scott 2005; Siegel et al. 2004). Project_*size* is a count to control for the number of participants, with *projectt_size2* being the squared term included to account for previous findings of decreasing returns to increased number of collaborators beyond a certain point (Laursen and Salter 2006). *Project_cost_interv* capture whether the project costs are in the intervals €0-€1mio, €1mio-€20mio, or above €20mio, while *participant_experience* captures the number of other projects each firm participates in to control for experience as the driver of approval as well as limited capacity to engage in multiple projects as a driver of rejection.

3.4. Statistical Method

The unit of analysis is private non-incumbent small and medium-sized firms, which participate in collaborative innovation efforts. For each participant the model estimates the likelihood of approval based on incumbent participation or leadership. As these participants are potentially observed multiple times across the dataset due to their potential participation in several different projects, we employ a Generalized Estimating Equations approach. This accounts for the high correlation in firm-specific error terms that could potentially occur as a result of the repeated observation of one firm across several projects, which in turn would violate the assumption of independent error terms (Liang and Zeger 1986; Wooldridge 2010). The output of the model is interpreted as the likelihood of approval based on the explanatory variables. The dependent variable of approval functions as a proxy of innovativeness, since this is the primary differentiator in the expert evaluation and approval after dropping projects which do not meet minimum requirements for competence.

4. Results

4.1. Descriptive Results

Table 2 shows the distribution of technologies, the number of participants and projects within each technology and the classification of technologies as complementary or disruptive.

Table 2: Participation, projects and technology classification

Technology	Participants	Projects	Classification
PV	630	87	Disruptive
Wind	501	41	Complementary
Biomass	224	21	Complementary
Geothermal	60	4	Complementary
CSP	254	35	Complementary
Ocean	303	29	Complementary
Hydro	103	10	Complementary
Fuel Cells and Hydrog	525	62	Disruptive
Biofuel	1424	161	Complementary
CO2 Capture and Stora	761	68	Complementary
Clean Coal	341	31	Complementary
Future Tech and Novel	440	87	Disruptive
General RES Generatio	278	40	Complementary
Smart Energy Networks	1034	82	Complementary
Energy Efficiency and	1084	84	Disruptive
Complementary	5283	522	
Disruptive	2679	320	
Total	7962	842	

Table 3 shows the representation of different organization types as collaborators for the participants in the sample's projects. Not surprisingly these innovation projects involve a high use of science-based actors in the shape of higher secondary education actors and research organizations. Furthermore, private companies have a strong representation. Public bodies typically include municipalities, energy agencies and regulatory bodies. Table 4 provides descriptive statistics for approval rates for participants in projects related to complementary and disruptive technology respectively. The slightly higher rejection rate for disruptive projects is unsurprising given the higher uncertainty often associated with this type of innovation. The distribution does not however raise concerns regarding bias in the sample.

Table 3: Organization Types and No. of participants

Organization type	Complementary	Disruptive	Total
Science Based	2,648	1,240	3,888
Other	135	92	227
Private commercial	2,276	1,133	3,409
Public body (ex. educ	224	214	438
Total	5,283	2,679	7,962

Table 4: Approval and Technology Type

Tech. Type	Rejected	Approved	Total
Complementary	1,227	4,056	5,283
Disruptive	841	1,838	2,679
Total	2,068	5,894	7,962

Table 5 provides descriptive statistics with means, standard deviations and correlations for the full set of variables in the sample of participants on both complementary and disruptive projects. The table shows low correlations of the key explanatory variables and high correlations for controls for size and turnover, which would be expected as large firms typically have higher turnover. Furthermore the table shows the high use of science-based knowledge, which based on previous studies of the value of science sources, is expected in innovation related projects (Köhler et al. 2012). This value is confirmed in table 7 by an approval rate of approximately 20% for participants without use of science-based knowledge, whereas the approval rate for those collaborating with science-based partners is approximately 39%. The mean number of collaborators for a participant in the sample is 12, although this is influenced by a number of large projects. As such, 62% of the sample's participants collaborate with 12 or less actors, and approximately 50% collaborate with 6-12 partners. Additional descriptive statistics are provided in the appendix.

Table 5: Correlations, Means, Standard Deviations

	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
approved	0.363	0.481	0	1	1.00												
incumbent_in_project	0.451	0.498	0	1	0.12	1.00											
incmb_leader	0.054	0.226	0	1	0.07	0.26	1.00										
uni_in_project	0.871	0.335	0	1	0.05	0.04	-0.02	1.00									
project_size	11.819	5.955	1	40	0.22	0.39	0.10	0.27	1.00								
project_size2	175.135	193.940	1	1600	0.20	0.34	0.12	0.20	0.96	1.00							
project_cost_interv	2.023	0.432	0	3	0.15	0.15	0.08	0.08	0.22	0.22	1.00						
to_2007_usd	27.349	143.296	0	1913	0.04	0.01	0.05	0.02	0.02	0.01	-0.01	1.00					
empl_2007	4.541	24.820	0	386	0.05	0.03	0.04	0.02	0.03	0.02	-0.01	0.81	1.00				
assets_2007_usd	32.563	362.122	0	15041	0.05	0.00	0.05	0.02	0.03	0.02	0.01	0.45	0.48	1.00			
participant_experience	2.854	5.637	1	94	0.05	0.01	0.00	-0.03	-0.02	-0.02	-0.02	0.10	0.05	0.03	1.00		
pat_interv	1.187	1.875	0	6	0.02	-0.01	0.02	-0.01	-0.03	-0.02	0.01	0.36	0.34	0.13	0.10	1.00	
bvd_idep	7.744	2.825	1	10	0.02	0.03	0.01	0.02	0.06	0.05	0.01	-0.14	-0.15	-0.08	0.09	-0.07	1.00

4.2. Regression Results

Tables 6 presents the main regression results from GEE model for each of the split samples with detailed firm-level controls. Table 7 in the appendix provides more elaborate estimation results. In table 8 in the appendix we provide a consistency check of these results using no Orbis controls. This involves using less detailed dummy variables as explained above, but provides the advantage of a larger sample as the observations without available Orbis data are not excluded from the estimation. The consistency of the results in the two models lead us to conclude that no bias is created from the exclusion of certain firms due to a lack of detailed controls and that the main model presented here is valid. The outcome in both models is the likelihood of approval, which captures the project's innovativeness. For both samples the variables captures whether the observed participant is exposed to either participation or leadership of an incumbent. The significance of controls for the count of collaborators and the squared term with positive and negative influence respectively in the complementary sample, confirms the expectation of an inverted u-shape in relation to breadth of openness (Laursen and Salter 2006), although this fails to report significance in the disruptive sample. As the use of collaborators is increased the innovativeness increases as more knowledge is accessed and more input can be utilized for the development of new ideas, technology and products. However, beyond a certain point this will have diminishing returns as the likelihood of a coherent, clear and feasible project decreases due to overwhelming complexity. Similarly, we find the expected significance and positive effect of science-based knowledge on approval in disruptive technologies as innovation in these technologies projects often require basic science insights from universities and research organizations, which are able to offer knowledge of high novelty, found to be associated with high levels of innovativeness (Cohen et al. 2002).

Table 6: Regression Results: Logit Regression. Outcome Approval

Variables	Complementary	Disruptive	Complementary	Disruptive	Complementary	Disruptive
incumbent_in_project			0.08	-0.33**	0.01	-0.39***
			(0.08)	(0.14)	(0.08)	(0.14)
incmb_leader					0.45***	2.63***
					(0.14)	(0.79)
science_in_project	0.22	1.80***	0.21	1.74***	0.20	1.84***
	(0.33)	(0.44)	(0.33)	(0.42)	(0.33)	(0.46)
no_participants	0.26***	0.01	0.25***	0.01	0.26***	0.03
	(0.02)	(0.05)	(0.02)	(0.05)	(0.02)	(0.05)
part_sq	-0.01***	0.00	-0.01***	0.00	-0.01***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
turn_over	-0.15	-0.00	-0.14	0.01	-0.15	0.02
	(0.12)	(0.18)	(0.12)	(0.18)	(0.12)	(0.18)
subsidiary	-0.86***	-1.00***	-0.86***	-1.01***	-0.85***	-1.01***

	(0.08)	(0.12)	(0.08)	(0.12)	(0.08)	(0.12)
size	0.10	0.05	0.11	0.02	0.11	0.03
	(0.13)	(0.19)	(0.13)	(0.19)	(0.13)	(0.19)
nuts	0.00	-0.00***	0.00	-0.00***	0.00	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
otype_1	0.08	-1.21***	0.09	-1.27***	0.09	-1.23***
	(0.17)	(0.27)	(0.17)	(0.27)	(0.17)	(0.27)
otype_2	0.45	-1.05***	0.46*	-1.10***	0.45*	-1.07***
	(0.27)	(0.38)	(0.27)	(0.38)	(0.27)	(0.39)
otype_3	0.18	-0.71***	0.18	-0.75***	0.18	-0.72**
	(0.18)	(0.28)	(0.18)	(0.28)	(0.18)	(0.28)
am_contrib_rq	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
am_part_contrib_rq	0.00	-0.00***	0.00	-0.00***	0.00	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	-1.15***	-1.00*	-1.15***	-0.89	-1.18***	-1.08*
	(0.38)	(0.56)	(0.38)	(0.55)	(0.38)	(0.58)
Observations	5,283	2,679	5,283	2,679	5,283	2,679
Pseudo R2	0.114	0.231	0.114	0.233	0.116	0.236

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The first hypothesis of the paper expected the participation of incumbents on projects related to complementary technologies to have a supportive influence on the innovativeness. There is only partial support for this hypothesis from the insignificant influence of incumbent participation on projects related to complementary technologies. However, as the influence of incumbent leadership does show a positive significant influence, there is confirmation of the notion that incumbents will increase the innovativeness of complementary innovation projects. This is increasingly interesting given the support found for hypothesis two, which expected the opposite to be the case for disruptive technologies. Indeed the significant reduction of likelihood of approval from the variable *incumbent_in_project* provides confirmation of hypothesis two, which expected that incumbent participation on projects focused on disruptive technologies results in a suppression of innovativeness compared to projects without incumbent participation. This is confirmed by a decrease in the odds ratio of likelihood of approval. In comparison then, these results indicate that incumbents provide support for innovativeness when this sustains and benefits them, and suppresses it when it disrupts and damages them. These findings are further supported by the confirmation of the third hypothesis. This expected that incumbents could support innovativeness in disruptive technologies if they had intentions of this and were dedicated to doing so. The significant positive influence on the likelihood of approval from *incmb_leader* in the disruptive technologies supports the third hypothesis, which was expected that incumbent suppression of innovativeness in disruptive technologies is a strategic choice rather than inability. The increase in likelihood of approval by having an incumbent rather than non-incumbent project leader furthermore strengthens the confirmation of hypothesis two, and suggests that strategic intent and misaligned incentives is the cause of incumbent suppression of innovativeness in disruptive technologies.

5. Discussion and Conclusions

With the growing use of external sources to increase innovativeness and thereby performance, research in the area has similarly increased under the popular term open innovation (Chesbrough 2003). Researchers have especially directed their attention towards the effects of collaboration with universities, suppliers and user (Bogers and West 2012; Köhler et al. 2012; Laursen and Salter 2006; Reichstein and Salter 2006; von Hippel 2005). The fruitful results of this have been increasing and valuable understanding of how these actors can play important roles in increasing the innovativeness in firms and thereby raise their performance and innovation output. Extant research has however neglected the exploration of the role of the central incumbent actors. This paper has argued the importance of directing attention towards this omission given that incumbents have central positions and high power in most industries, which makes them an all but unavoidable part of the innovation and commercialization process (Teece 1986). Coupled with well-established knowledge regarding the uncertainty incumbents face from high levels of innovativeness in disruptive technologies (Christensen 1997; Henderson and Clark 1990; Tushman and Anderson 1986), a dilemmatic situation for the non-incumbents arises regarding whether to utilize the incumbent source in their open innovation efforts. This paper contributes to the knowledge in open innovation regarding the influence of different actors on innovativeness by covering the research gap related to the role of incumbents. The results of the analysis shows that incumbents will either support or suppress the innovativeness of projects and thereby their collaborators depending on whether the technology in question sustains or disrupts their position, profitability and business model. The exception is the situation in which the incumbents have seemingly identified an attractive opportunity and made a strategic commitment by acting as project leader. In such instances incumbents will in fact support the innovativeness related to both complementary and disruptive technologies. This exception provides further implications for extant literature through suggesting that incumbent suppression is caused by underlying strategic consideration rather than lack of ability.

The insight that incumbents can in fact contribute with support to the innovativeness in disruptive technologies forms the basis of further contribution to the open innovation literature. A research gap in the extant literature on open innovation is the under-exploration of potentially misaligned incentives and motives. Current work seems to implicitly assume that all parties in open innovation have a shared and equally strong incentive to optimize innovativeness. Given the fundamental acceptance that open innovation is a useful strategic tool for increasing innovativeness and thereby increasing firm performance, it seems reasonable that firms may utilize this to achieve other underlying strategic goals. Building on the argument that collaborators are disproportionally motivated and incentivized towards different degrees of innovativeness and resulting disruption, the paper as argued that the lack of consideration of these underlying interests is a significant research gap in the open innovation literature. A contribution to covering this gap is made by analyzing how incumbent participation and leadership respectively influences the level of innovativeness on open innovation projects as a means of protecting their investments, position and profitability, and thus for the other participants on these projects. Results show that participation suppresses innovativeness while leadership supports it, which suggests that strategic intentions and consideration of own benefits rather than lack of ability are behind the suppression. This suggests that incumbents act in accordance with underlying strategic interests rather than a shared collective goal, which significantly influences their partners who may have other incentives. This finding contributes to the open innovation literature by showing that the underlying interests of collaboration partners should indeed be a central consideration in the choice of who to open towards and collaborate with.

While the role of incumbents has so far remain untouched in open innovation, other areas of research in the strategic management literature have in fact focused on the relationship between incumbents and innovation. This has provided insight into the “incumbent’s curse” and how this results in failure due to the high innovativeness of disruptive technologies and the incumbents’ inability or unwillingness to embrace this, as well as how certain incumbents manage to escape this trap (Chandy and Tellis 1998; Chandy and Tellis 2000; Hill and Rothaermel 2003; Rothaermel 2001b; Rothaermel and Hill 2005). In relation to the open innovation literature there has been findings that strategic alliances and collaboration can be a valuable contribution to avoiding this failure for the incumbents (Rothaermel 2001a; Rothaermel 2001b). However, the shared characteristic of both lines of research has been the point of view of the incumbents. As such, the findings have shown how incumbents may raise innovativeness and avoid failure through collaboration with external parties, but without considering the effects for these parties. While an R&D alliance may benefit the survival of the incumbent it does not automatically imply that the same benefit will befall the non-incumbent collaborator. Indeed, a central contribution of this paper has been the insight that non-incumbents face negative influence in terms of reduced innovativeness when collaborating with incumbents. This reduction in innovativeness may indeed be exactly why incumbents benefit from collaboration, while the opposite is true for non-incumbents. As such, the paper makes a contribution to the line of research that has explored the incumbents’ benefits of collaborations. The insight offered from this paper is that although incumbents may benefit, the opposite is the case for non-incumbents, unless the incumbent has clear strategic commitment and intent to increase innovativeness.

The findings in the paper provide grounds for reflection for practitioners of open innovation regarding the tension between the rewards of collaborating with incumbents and benefitting from their complementary assets, and on the other hand potentially facing suppression of innovativeness. While incumbents' suppression provides grounds for such concerns for non-incumbents focused on disruptive technologies, their supportive influence does however provide the opposite regarding complementary innovations. The results suggest that no tension exists with respect to the strategic intention of the incumbent in terms of complementary technologies. As such, for non-incumbent actors developing innovations related to complementary technologies, incumbent collaboration provides significant benefit in terms of increased innovativeness and access to complementary assets. However, there might still be concerns to address for the non-incumbents. Previous research has pointed to issues of appropriation of the value generated by innovation (Gans and Stern 2003; Teece 1986), something currently attracting increasing attention in the context of open innovation (Laursen and Salter Forthcoming). While incumbents may not suppress the innovativeness in complementary technologies they may instead use aggressive appropriation strategies, which then presents a different concern for non-incumbents regarding intentions and incentives. Specific exploration of the appropriation strategies of incumbents, the consequences for their non-incumbent collaborators and whether differences exist between complementary and disruptive technologies would be an interesting avenue for future research.

6. Limitations and Further Research

While this paper benefits from detailed data on nuances of individual projects and the effects on participants from inclusion of particularly incumbent actors, this also has the drawback of not observing the long-term performance. While linking open innovation strategies or specific projects with long-term performance may suffer from unobservable influence, it may nevertheless add to the insights in this paper regarding the influence of incumbents on innovativeness and through that the performance of firms. It may be particularly fruitful to investigate the influence on new firms' survival and performance as new firms' innovativeness is likely to be strongly influenced the support or suppression from incumbents due to their limited resources and portfolio of products. Furthermore, since many new firms are resource constrained they may be forced to collaborate with incumbents regardless of the contingencies discovered here. While the findings show the suppressive effects of incumbents, this initial suppression may eventually change to become supportive if long-term committed collaborative agreements are entered into. This potential dynamism may be explained through the role of incumbents in the emergence of wind energy. Even in the pioneering Danish marked, which was among the first to embrace and integrate wind energy, incumbents resisted the technology heavily in early stages of the development. Large efforts were made to refute its justification and prevent its development, although eventually the incumbents increasingly embraced the technology and have now fully integrated this into their operations and business model (Garud and Karnøe 2003; Karnøe and Buchhorn 2008). Longitudinal studies of the dynamics of such incumbent suppression or support for disruptive technologies could be a fruitful avenue for future research.

The results of the empirical analysis should also be seen in the light of a dataset consisting of firms choosing to engage in collaborative efforts and in the application for EU funding. A potential limitation might lie in the choice of certain firms to refrain from such application, remain closed, or open in different settings and ways. While this does not devalidate the findings of this paper, it should be acknowledged as a potential limitation to the generalizability. The analysis in this paper is limited to the context of the energy sector. While this is a relevant and valuable empirical setting for an initial exploration of the existence of incumbent suppressive and supportive effects on innovativeness it is relevant to test the findings across a wider range of sectors. This may test these effects in sectors where incumbents have less centrality and less powerful positions. Finally, the author supports the increasing call for understanding the details and nuance of open innovation through a more explicit focus on the project level. Exploring whether firms adapt their open innovation strategies and approaches to the specifics of individual projects, rather than retaining a generic approach across all external collaborations, seems a both relevant and fruitful avenue for future research in the field.

7. Appendix

Table 7: Regression Results: Logistic Regression. Outcome Approval. Odds Ratios

Variables	Complementary	Disruptive	Complementary	Disruptive	Complementary	Disruptive
incumbent_in_project			1.08	0.72**	1.01	0.68***
			(0.09)	(0.10)	(0.08)	(0.09)
incmb_leader					1.57***	13.93***
					(0.22)	(11.01)
science_in_project	1.24	6.05***	1.23	5.70***	1.23	6.30***
	(0.41)	(2.66)	(0.40)	(2.42)	(0.40)	(2.93)
no_participants	1.30***	1.01	1.29***	1.01	1.30***	1.03
	(0.03)	(0.05)	(0.03)	(0.05)	(0.03)	(0.05)
part_sq	0.99***	1.00	0.99***	1.00	0.99***	1.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
turn_over	0.86	1.00	0.87	1.01	0.86	1.02
	(0.11)	(0.18)	(0.11)	(0.18)	(0.11)	(0.19)
subsidiary	0.42***	0.37***	0.42***	0.36***	0.43***	0.36***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
size	1.11	1.05	1.11	1.02	1.11	1.03
	(0.14)	(0.20)	(0.14)	(0.20)	(0.14)	(0.20)
nuts	1.00	1.00***	1.00	1.00***	1.00	1.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
otype_1	1.09	0.30***	1.10	0.28***	1.10	0.29***
	(0.19)	(0.08)	(0.19)	(0.08)	(0.19)	(0.08)
otype_2	1.56	0.35***	1.58*	0.33***	1.58*	0.34***
	(0.43)	(0.13)	(0.43)	(0.13)	(0.43)	(0.13)
otype_3	1.20	0.49***	1.20	0.47***	1.19	0.49**
	(0.21)	(0.14)	(0.21)	(0.13)	(0.21)	(0.14)
am_contrib_rq	1.00***	1.00***	1.00***	1.00***	1.00***	1.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
am_part_contrib_rq	1.00	1.00***	1.00	1.00***	1.00	1.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.32***	0.37*	0.32***	0.41	0.31***	0.34*
	(0.12)	(0.21)	(0.12)	(0.23)	(0.12)	(0.20)
Observations	5,283	2,679	5,283	2,679	5,283	2,679
Pseudo R2	0.114	0.231	0.114	0.233	0.116	0.236

Robust seeform in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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