Entrepreneurial Co-creation: Societal Impact through Open Innovation

Dr Muthu De Silva

Lecturer in Entrepreneurship and Innovation

Department of Management, Birkbeck, University of London, Malet Street, Bloomsbury, London WC1E 7HX

m.desilva@bbk.ac.uk

and

Professor Mike Wright

Professor of Entrepreneurship

Imperial College Business School, Imperial College London

London SW7 2AZ

mike.wright@imperial.ac.uk

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New open innovation initiatives such as accelerators, living labs, social innovation labs and open labs, involve for-profit and not-for-profit actors working closely together to co-create both business value and societal impacts. However, there is a lack of theoretical underpinning to understand how and why co-creation by actors generate different types of social value in the concurrent pursuit of business and social value. Adopting an inductive case study approach, we find that different types of entrepreneurs who co-exploit co-identified opportunities for co-creation, enables them to generate potentially competing social and business values. We develop four propositions relating to how and why profit orientation and key resource contributions of entrepreneurs co-identifying an opportunity to co-create decide the nature of social value generated. We discuss avenues for future research and practical implications, underlying the importance of developing entrepreneurialism as ways to generate different social impacts through open innovation approaches such as co-creation.

1. Introduction

The open innovation literature paves the way to understanding how companies use inflows and outflows of knowledge, technologies and resources for innovation (Chesbrough 2006). Open innovation practices range from outside-in and inside-out to coupled processes that involve "co-creation with (mainly) complementary partners" (Enkel, Gassmann, and Chesbrough 2009, p. 313). Open innovation literature focusing on co-creation has so far emphasized how it generates business value in the contexts of firm-firm and firm-user co-creations (Dahlander and Piezunka 2014; Lakhani and von Hippel 2003; von Hippel and von Krogh, 2006). However, emerging co-creation initiatives go beyond the interaction between two parties and span to collaborations with many external actors (West et al 2014), not only to generate business value (Kaplan and Haenlein 2006) but also simultaneously to create social value (Grimaldi and Grandi 2005; Domingue 2011). Mainstream open innovation literature has given scant attention to the generation of social value (West et al 2014), other than a handful of studies that have explored the generation of social value in the voluntary or charitable sector (Holmes and Smart 2009). Although social and business values may potentially be competing (Battilana and Lee 2014), their simultaneous creation has been made possible through the adoption of innovative approaches to combine social and business missions with social and market mechanisms (Pache and Santos 2012; Santos 2012; Ebrahim, Battilana and Mair 2014). However, we lack understanding of how open innovation involving co-creation influences the nature of societal impacts arising from the simultaneous generation of social and business value (West et al 2014; Watson et al 2018). This is an important

omission of both theoretical and practical significance as understanding dynamics of mechanisms through which open innovation generates social and business value is crucial for successful engagement (West and Bogers, 2014). This paper sheds light on this knowledge gap.

In addressing this gap, we look closely at the role of individual actors. This is because emerging co-creation initiatives that generate both business and social value – such as joint research labs (Gassmann, Enkel, and Chesbrough 2010), living labs (Domingue 2011), technology platforms (von Hippel and von Krogh 2006) and accelerators (Grimaldi and Grandi 2005) – involve a wide array of actors affiliated with businesses, universities, government, and intermediaries working together closely (Chesbrough and Di Minin 2014; Gemser and Perks 2015; Watson et al 2018). Teece (2007) highlights the importance of entrepreneurialism of actors for successful open innovation, arguing that it goes beyond start-up formation to the "entrepreneurial management function" (Teece 2007, p. 1347). Entrepreneurialism also plays an essential role in generating business and social values simultaneously (Santos 2012; Ebrahim, Battilana and Mair 2014; Wilson and Post 2013). Yet understanding is lacking of how the entrepreneurialism of different actors involved in co-creation enables the generation of social and business value as well as how actor differences influence the nature of social value creation (West et al 2014).

Therefore, we address the following two specific research questions: How does co-creation by individual actors affiliated with different organizations generate societal impacts in the concurrent pursuit of social and business value? How and why do the characteristics of these different types of individual actors involved in co-creation influence the nature of social value generated? Adopting an inductive case study approach, we address the first research question by highlighting that it is the entrepreneurialism of actors involved in co-creation – comprising corporate, academic, public, start-up, intermediary, to citizen, entrepreneurs – that enables the generation of both social and business value by harnessing their different entrepreneurial characteristics. We address the second research question by developing four propositions showing how and why the nature of societal impacts generated is contingent on the profit-orientation and resource contributions of entrepreneurs who co-identify co-creation opportunities.

We contribute to the open innovation and co-creation literature by first discussing how co-creation simultaneously generates both social and business value and by explaining

how and why co-creation mechanisms adopt a particular form, through which we highlight the dynamics of mechanisms by which societal goals can be achieved. Third, we also contribute by extending emerging insights in the open innovation literature on the role of the characteristics of entrepreneurs in co-creating different types of social impact. Finally, from a practical and policy perspective we provide systematic understanding of different co-creation mechanisms which can guide actors of an open innovation generating different forms of societal impacts.

2. Background literature

2.1. Co-creation and the nature of social value generated

Co-creation, a coupled process of open innovation, was applied initially to corporate innovation (Enkel, Gassmann, and Chesbrough 2009). As a result, the co-creation literature has placed special emphasis on investigating how it generates business value predominantly in the contexts of user-centric innovation, open source projects (Payne, Storbacka, and Frow 2007; Lakhani and von Hippel 2003), virtual communities/platforms (Fuller, Hutter, and Faullant 2011), and multi-disciplinary projects (Ahn, Minshall, and Mortara 2015). Although the main emphasis has been on the generation of business value, emerging co-creation initiatives also generate an array of social value (Gemser and Perks 2015), which has received scant attention in the literature (West et al 2014; Watson et al 2018).

Social impacts are multidimensional. First, they may take the form of technological development or capability development. For instance, Murray, Caulier-Grice, and Mulgan (2010) argue that technical innovation drives the generation of societal impacts by inducing social changes and supporting the achievement of social goals through the adoption of open innovation practices. While this might be applicable to open labs aimed at technical innovation, some co-creation initiatives such as accelerators or social innovation labs generate social value by way of capability development without necessarily involving technical innovation (Gassmann, Enkel and Chesbrough 2010). Hence, the social value generated could be either ‘technology’ development or ‘capability’ development.

Second, the social value could reach either a ‘broader’ or more ‘focused’ group of recipients. For example, a corporate accelerator or an open lab would adopt strict criteria to select start-ups and researchers, respectively, to collaborate with, thus generating social value

to a selected focused group of individuals (Pauwels, Clarysse, Wright, & Van Hove 2016). On the other hand, a social innovation lab would be open for many actors to join, thus generating broader social value for parties involved (Pollitt and Hupe 2011). Broader or focused reach of social value could be a result of the breadth of the openness of the initiative. Breadth of openness is defined by Laursen and Salter (2006) in relation to the search behavior of organizations as "the number of external sources or search channels that firms rely upon in their innovative activities" (p. 134). Building on this, we argue when a co-creation initiative has a low breadth of openness (i.e. actors work with a selected group of few), the initiative may generate a 'focused' social value, whereas when it has a greater breadth (i.e. open to many individuals), the social value generated will have a 'broader' reach.

Third, co-creation initiatives may generate social value either directly or indirectly. While some co-creation initiatives are purely formed with social goals (Pollitt and Hupe 2011) such as developing a dementia friendly community or improving the quality of life of disable people, some other formations have greater commercial goals (Payne, Storbacka, and Frow 2007) such as developing new products and services. While those with main social value generate 'direct' social value, those predominantly interested in generating business value still generate social value 'indirectly' (Edvardsson, Tronvoll and Gruber 2011). For instance, the co-creation of Kent dementia friendly community, which is a social innovation lab, generates social value 'directly'. On the other hand, Barclays accelerator, which is mainly aimed at generating business value by improving the profitability of financial services sector, generates 'indirect' social value in the form of fulfilling capability/ skills gaps in the financial technology sector (i.e. technologies used to improve financial services, for example, cryptocurrency, mobile banking and blockchain etc).

2.2. Co-creation and actor motives and resources

In these co-creation initiatives, multiple individuals from businesses, universities, government bodies, intermediaries and citizens, may work closely together to generate innovations (Dahlander and Frederiksen, 2012; Kristensson, Gustafsson, and Archer, 2004; von Hippel, 1988). Individuals from these different organizations may have different profit oriented motives (Müller-Seitz and Sydow, 2012) and have access to different resources

(Agarwal and Shah 2014). The motives and resources of individuals jointly influence innovation outcomes (Laursen and Foss 2003) and value creation (Lee et al 2011).

In recent years we have observed fundamental shifts in the dichotomy between for-profit and not-for-profit organizations and the motives of individuals associated with them. For-profit organizations generate social value as part of their corporate social responsibility (Frederick 2008) and not-for-profit organizations identify and exploit business opportunities that generate both social and business value (Pache and Santos 2012; Santos 2012; Ebrahim, Battilana and Mair 2014; Austin, Stevenson, and Wei-Skillern 2006). These shifts provide a platform for actors with for-profit or not-for profit motives to simultaneously co-create social and business value (Müller-Seitz and Sydow, 2012).

In relation to individuals, the entrepreneurship literature has traditionally distinguished how the for-profit or not-for-profit motives of entrepreneurs lead to the generation of business or social value, respectively (Austin, Stevenson, and Wei-Skillern 2006). Recent studies, however, highlight how individuals entrepreneurially generate both social and business values simultaneously (Pache and Santos 2012; Battilana and Lee 2014; Santos 2012; Ebrahim, Battilana and Mair 2014). Understanding is lacking of how actors use open innovation to co-create different types of social and business value, and how the nature of social value generated may vary depending on whether or not actors are for-profit oriented.

Actors in innovation as much as entrepreneurs are resource integrators, who co-create value in actor-to-actor (A2A) networks (Barett, Davidson, Prabhu and Vargo, 2015). Resources are anything an actor can draw on for support (Vargo and Lusch 2004), which include tangible and intangible resources. Tangible resources are "resources that an actor acts on to obtain support" whereas intangible resources are those "that act on other resources to produce effects" (Lusch and Nambisan 2015, p. 159). The former includes equipment, plants, physical resources, lands, buildings, machines and raw material whereas the latter includes knowledge and skills, data, networks and experience (Lush and Nambisan 2015; Paradkar, Knight, and Hansen 2015; Greco, Grimaldi and Cricelli 2015). There is scant emphasis in the open innovation literature on understanding the differential effects of the tangible or intangible resource contribution to the innovation outcome of collaborating partners. However, specifically in relation to co-creation, this is expected to play a significant role where partners are likely to contribute to the initiatives with different types of resources (Müller-Seitz and Sydow, 2012).

2.3. Typology of co-creation

Building on this literature, we argue that, in co-creation, the configuration of the two variables, *initiating* actors' profit orientation and resource contribution, may determine the generation of different types of social value (in the context of concurrent generation of social and business values).We focus on *initiating* actors as their identification of opportunities drives subsequent opportunity exploitation and business and social value creation (Shane and Venkataraman 2000; Santos 2012; Doherty, Haugh, and Lyon 2014).

By combining the extreme cases when the two dimensions of 'profit orientation' and 'resource contribution' are at the extreme ends of the spectrum identified above (i.e. we exclude hybrid organisation and organisation that contribute both tangible and intangible resources), we identify four types of co-creation mechanisms as shown in Figure 1. We utilize this framework to address the gap in the understanding of how and why the four extreme categories influence the generation of different types of social values alongside business value. We acknowledge that there could be multiple other configurations depending on the degree of profit orientation and combination of tangible and intangible resource contributions by initiating actors and discuss this issue in the future research section.

INSERT FIGURE 1 HERE

3. Methodology

We employed an inductive, multiple case study approach which is suitable due to the lack of theoretical underpinning on the micro-level interactions co-creating societal impacts besides business value and the associated heterogeneity of the co-creation mechanisms (Bryman and Bell, 2007). This approach provides a good platform to answer how and why questions (Yin, 2003) as our study does.

Consistent with our typology in Figure 1, twenty cases of co-creation initiatives that concurrently generate both social and business value were selected purposively, each represented by five cases. As suggested by Fig. 1, these are relating to those initiated (a) by for-profit actors contributing intangible assets (Type 1- ID1-ID5), (b) by for-profit actors contributing tangible assets (Type 2- ID6- ID10), (c) by not-for-profit actors contributing intangible assets (Type 3- ID11-ID15) and (d) by not-for-profit actors contributing tangible assets (Type 4- ID16-ID20). Although there could be actors who contribute both tangible and intangible resources and others who are hybrid organisations (i.e. organisations with equal for-profit and not-for-profit objectives), we excluded cases initiated by hybrid organizations

and initiators contributing equal tangible and intangible resources. This is because our main objective is to focus on the effects on the type of social value created by the two individual variables used for typology development at their extremes. When identifying representative cases, the distinction was made on the basis of the motivation and resource contribution of actors *initiating* co-creation even if each case includes multiple other actors with different motives and resources working together closely with these initiating actors (see Table 1 for sample description). To check whether cases fulfil the above mentioned criteria, we used information available online and derived through an email exchange or a brief telephone conversations with representatives of initiatives. Within the inductive approach, cases were treated as a series of independent experiments (Brown and Eisenhardt, 1997), in which theoretical replication is achieved through continuous comparison among the case data, emerging theory, and extant literature (Van Maanen, Sorensen, and Mitchell, 2007). This iterative process was followed both during data collection and analysis (Yin, 2003).

We collected data from various sources but primarily using in-depth face-to-face or telephone interviews with the director/CEO of each selected initiative, which lasted for 60 to 90 minutes. Table 1 provides information on each case together with titles of interviewees. Directors/CEOs, due to their specific role in the initiative, were assumed to have a comprehensive understanding of the initiative (Dexter, 1970). Since co-creation initiatives involve a combination of for-profit and not-for profit actors, centre directors/CEOs oversee the full operation and are aware of the engagement of all actors and value created, thus making them suitable to provide the data required for this study. Also, the focus of our study on the individual level factors of initiating actors further justifies the suitability of interviewing the centre directors/CEOs, who, in all the selected cases, were involved the initiation. A semi-structured questionnaire was used. The questionnaire comprised themes covering three main areas: value generated, individual level engagement and the process involved in generating value (see Appendix 1 for more details). We also used several secondary data sources, including company reports, websites, publicly available case material, and email exchanges with actors (Miles and Huberman 1994). These multiple sources supported the iterative process of theory building.

Within and cross case analyses were conducted to identify similarities, patterns and differences (Yin, 2003). Data analysis was driven by our two research questions, in which value generated and the engagement by actors in the co-creation activity were considered as two main variables of interest, linked by the co-creation process. The coding procedure

adopted is discussed in Appendix 1. We follow the convention of writing the paper in a sequential manner, although the data collection and analysis involved an iterative and simultaneous process of going back and forth between the data and the literatures on individual types of entrepreneurs and co-creation of social and business value to yield theoretical replication (Suddaby 2006).

INSERT TABLE 1 HERE

4. Results

4.1. Different types of entrepreneurs co-creating value

Our first research question focused on how the co-creation by individual actors affiliated with different organizations generates societal impacts in the concurrent pursuit of social and business value. Our findings, presented in Table 2, revealed that the actors involved in co-creation found innovative ways to combine and integrate resources, leading to new resource and knowledge combinations and subsequent value creation for all parties involved. These characteristics are identified in the literature as "entrepreneurial behavior" to generate both business and social value (Zahra, Gedajlovic, Neubaum, and Shulman 2009).

Coming from different organizations, these entrepreneurial actors worked closely together in innovative and creative ways, bringing together different social values. As they were affiliated with different organizations, they had access to different resources, held different knowledge and skills, and different experience and entrepreneurial characteristics. They utilized these differences entrepreneurially to integrate social and market mechanisms to generate both social and business values. Using illustrative quotes, Table 2 presents unique characteristics of each type of entrepreneur involved in co-creation. As discussed below, we found that entrepreneurialism of a diverse set of actors – comprising corporate, academic, public, start-up, intermediary, to citizen, entrepreneurs – enabled them to harness their differences and interdependences to the concurrent pursuit of social and business values through open innovation. Here, what is interesting is that different contributors with different perspectives, expertise and resources, use their different entrepreneurial skills to co-create both social and business value. This is a stark difference with the entrepreneurship literature that has often discussed entrepreneurial “teams” or “collaborators” as involving the same type of entrepreneurs whereas here we see collaboration of different types of entrepreneurs, which seems to be pertinent for co-creation. Also, even though the open innovation literature has

highlighted the importance of entrepreneurialism, it has hitherto not discussed the involvement of different types of entrepreneurs. Therefore, a key characteristic of the simultaneous generation of social and business value through co-creation seems to be the close interaction between different types of entrepreneurs.

INSERT TABLE 2 HERE

In fact, our evidence suggests that in the co-creation process, actors from universities represented entrepreneurial behavior by engaging in 'innovative', 'open' and 'collaborative' interactions with multiple other actors, enabling the co-creation initiative to benefit from the advanced and up-to-date knowledge and skills. The literature defines such individuals as *academic entrepreneurs* (Perkmann and Walsh 2007; De Silva and Rossi 2018) and our study found the importance of entrepreneurial behavior of academics to co-create competing social and business value. When actors from large and medium sized organizations were involved in co-creation to solve business challenges and/or engage in innovation that may be impossible to address independently, they seemed to exemplify *corporate entrepreneurship*. They brought to the co-creation initiatives specific industry scale resources, commercial networks and market knowledge (Porter and Kramer 2011) and used innovative methods of working to co-create innovation with other actors to optimize both corporate performance and social conditions. When *start-up entrepreneurs* were involved in the co-creation process, their unique characteristics of being small (Minshall, Mortara, Elia, and Probert 2008), flexible and innovative put them in a stronger position to solve specific challenges, particularly in emerging industries, creating interdependence between start-up entrepreneurs and other types of entrepreneurs. It was also evident that entrepreneurialism of public sector employees, in terms of being creative, engaging and futuristic that goes beyond creating the right infrastructure and setting rules, was important for co-creation. Their unique characteristics including power, access to funding, and extensive economic knowledge generated interdependence between them and other entrepreneurs in the concurrent pursuit of social and business value. Users/citizens also worked with other entrepreneurs to produce products or services or to address wider socio-economic challenges (von Hippel 2007). It was apparent that the citizens involved in co-creation were innovative, creative, challenge seeking, and enjoy generating innovation and social value. We introduce the term '*citizen entrepreneurship'* to define the role played by entrepreneurial citizens in the co-creation process. Finally, as co-creation with parties from different organizations was challenging,

intermediaries acted innovatively and creatively (i.e. exemplifying entrepreneurial behavior) in facilitating actors to achieve competing goals, which we define as '*interpreneurship*'.

Therefore, our findings highlight the importance of developing entrepreneurial skills and harnessing the differences and interdependence between entrepreneurs as a pathway for the simultaneous generation of social and business value through co-creation. Hence, in the rest of the paper, we identify co-creating actors as entrepreneurs. Note that all these entrepreneurs were not involved in a single co-creation, but each initiative comprised entrepreneurs with for-profit and not-for-profit motives, which we discuss in detail below.

4.2. Entrepreneurial co-creation generating different social values

More interestingly, we observed the process used by the actors to generate the social value. In our cases, firstly the entrepreneurs together identified an opportunity to initiate a co-creation in a phase we call '*co-identification'*. Then, a diverse range of entrepreneurs were working together closely to exploit co-identified opportunities. We call this phase '*co-exploitation'* of opportunities. The illustrative case examples are provided in Table 3 where we highlight these two phases of a co- creation process (co-identification and co-exploitation) and their difference in terms of the involvement of entrepreneurs.

The co-identification of opportunities entailed parties identifying a challenge, a gap or the potential for new technological or service capability development, the addressing of which required the simultaneous generation of business and social value through close interaction between different entrepreneurs. The co-identified opportunities were then co-exploited by diverse entrepreneurs together to reach new outcomes by combining complementary physical resources, people, knowledge and skills, capabilities, technologies, finance, markets and networks. During this phase, entrepreneurs together selected and adopted appropriate strategies – on integration mechanisms, managing intellectual property rights, distributing gains and mitigating risks – they deemed especially suited for co-creation. For example, in relation to ID2, when the entrepreneurs co-identified the need to develop the financial technology industry, they then integrated their resources and expertise (e.g. 1. Four corporate entrepreneurs: Barclays – Financial knowhow and funding; Techstars – Providing seed funding, mentorship, and networking opportunities for start-ups, Innovation Loft – Organizing events for start-ups, and Central Working- Designing co-working spaces; 2. Start-up entrepreneurs – Expertise in financial technology sector; and 3. Academic entrepreneurs –

knowledge and skills) to co-exploit the opportunity. Co-creation hence involved the co-exploitation of co-identified opportunities.

Interestingly, while all the entrepreneurs in a specific co-creation activity were involved in co-exploitation, only those who had co-identified opportunities were involved in initiating co-creation.

INSERT TABLE 3 HERE

In fact, as well as co-exploiting the opportunity, the entrepreneurs not involved in the co-identification and in the initiation of co-creation were instead involved in shaping the specific objectives of the projects that they were involved in. Such shaping was important for co-creation to generate both social and business value. For instance, in case ID2, four corporate entrepreneurs co-identified the opportunity to initiate an accelerator to work with start-up entrepreneurs and academic entrepreneurs, to develop financial technology sector. While the start-up and academic entrepreneurs were not involved in the initial co-identification of the opportunity to establish the accelerator, they shaped the objectives of the specific projects with corporate partners. Similarly, in ID14, a group of public (i.e. entrepreneurial employees of Kent council) and citizen entrepreneurs (e.g. entrepreneurial volunteers and students) co-identified the opportunity to initiate a Dementia Action Alliance in their local geographical area. Other for-profit-entrepreneurs (e.g. local businesses that offer caring and other related services, and local radio stations), who were not involved in the initial opportunity co-identification phase, shaped the direction of specific activities carried out by the initiative. Their involvement was important to provide user perspective (e.g. local business entrepreneurs who provided caring services to Dementia patients), improve service provisions for dementia patients (e.g. local business entrepreneurs who provided special training for their staff to cater Dementia patients), and increase awareness (i.e. the role of entrepreneurs from local radio stations). This involvement by for-profit entrepreneurs on the other hand improved their business provisions and reputation, thus generating business value.

As such, when entrepreneurs with predominantly not-for-profit motives co-identified a co-creation opportunity, those with for-profit motives shaped the objectives of specific projects, and vice versa.

This analysis suggests that the characteristics of entrepreneurs who initially co-identify an opportunity end up influencing the type of social value generated. Hence, focusing on co-identifying entrepreneurs, we further analyzed the data to understand *how*

their characteristics influence the type of social value generated. We used the three dimensions of social value identified in earlier literature, i.e. prominence (direct or indirect social value), innovation (technology development or capability development) and reach (benefiting a focused or a broader group), and looked how these vary depending on the profit orientation and the key resources of co-identifying entrepreneurs. Further, our analysis of *why* characteristics of the starting co-identifying entrepreneurs influence the nature of social value generated identified three factors underpinning the relationship; namely, the nature of the opportunity, the breadth of the openness and the framework conditions.

The particular framework conditions are specific to each co-creation type (Figure 2). (i.e., the ability of entrepreneurs to develop internal capabilities – Type 1, effectiveness of IP strategies – Type 2, social commitment of entrepreneurs – Type 3 and availability of public funding – Type 4). Below we discuss in detail how and why the four co-creation types deliver different forms of societal impacts besides business value and develop four propositions to encapsulate these relationships.

INSERT FIGURE 2 HERE

Type 1: Co-creation initiated by for-profit entrepreneurs contributing intangible assets

As presented in Figure 3 and reflected in the illustrative quotes in Table 4, when for-profit entrepreneurs such as corporate and start-up entrepreneurs co-identified an opportunity for co-creation, they pursued a commercial opportunity that would enable them to increase profit, lower costs, or improve business operations/delivery. Nevertheless, they decided to co-create since the type of challenges addressed could not be solved in isolation. For instance, in case ID1, two corporate entrepreneurs – one in the delivery industry and the other in the healthcare service sector– co-identified an opportunity to setup efficient healthcare services. These ventures would help to diversify the market of the former and to improve the efficiency of the latter. Yet, these business objectives could not be achieved without collaborating with public and academic entrepreneurs, who provided user perspective, policy support, advanced and up-to-date knowledge and skills and resources. Therefore, while the initiative generated business value for for-profit entrepreneurs, it also resulted in improved healthcare services, one of the goals of public entrepreneurs, and opened up opportunities to generate impact for academic entrepreneurs. The initiative was funded by corporate entrepreneurs since this engagement generated valuable outcomes for their businesses.

Nevertheless, since it was not possible for them to achieve their objectives independently they collaborated with public and academic entrepreneurs (i.e. not-for-profit entrepreneurs in this case), who, although not involved in the identification of the co-creation opportunity, shaped the direction of specific projects. These partners were predominantly involved in the co-exploitation process in the form of innovating ways to improve the efficiency of healthcare services. The value generated in this group of cases was mainly that of capability development of the entrepreneurs involved. Hence, the ability of actors to improve their internal capabilities and organizational routines was crucial for the co-exploitation.

As the main opportunity was commercial, initiating for-profit entrepreneurs seemed to be very selective in only choosing entrepreneurs with complementary objectives and resources to join the co-creation project. This filtering activity to select entrepreneurs meant that the initiative was not open to any entrepreneur to join, indicating a low breadth of the openness. The capability development of a selected group of entrepreneurs thus resulted in a type of social value which mainly benefited those directly involved in the collaboration. In summary, the social value generated by Type 1 is indirect, of focused reach and in the form of capability development.

INSERT FIGURE 3 HERE

INSERT TABLE 4 HERE

Type 2: Co-creation initiated by for-profit entrepreneurs contributing tangible resources

When the for-profit entrepreneurs who co-identified a co-creation opportunity, contributed mostly tangible resources and pursued a commercial opportunity (Figure 4 and Table 5), wanted to address a specific challenge for which they needed to rely on other actors. For example, in case ID10, corporate entrepreneurs in the pharmaceutical industry saw the opportunity to address neglected diseases in the developing world and worked with academic entrepreneurs (i.e. entrepreneurial researchers from universities and public research organizations) who have advanced expertise to develop specific drugs. The academic entrepreneurs relied on the industrial scale R&D facilities of the corporate entrepreneurs to develop the drugs. Whilst initially corporate entrepreneurs co-identified the opportunity, it was the academic entrepreneurs who shaped the objectives in relation to discovering specific drugs to address particular diseases. This interdependence means that indirect social value can be generated even when co-identifying entrepreneurs have for-profit motives. In our

cases the provision of tangible resources from the initiation partners led mainly to social value in the form of technology development. In these cases, having an appropriate IP strategy was crucial for the co-exploitation process. Some cases (e.g. ID9) designed an IP strategy ex-ante, by considering the objectives of all the co-creating partners, which fostered trust and reduced conflicts. Some (e.g. ID7, ID10) had an open IP strategy where anyone could commercialize the resulting technology. Others (e.g. ID8) decided how to appropriate IP at later stages of technology development rather than at the beginning (i.e. when there is less clarity on the final output at the beginning).

Co-exploiting a commercial opportunity means that for-profit entrepreneurs who co-identified the opportunity, used strict selection criteria to choose their collaborators. Hence, this type, similarly to type 1, is not open for anyone to join, indicating a low breadth of the openness. However, products and services generated through co-creation (e.g. drugs discovered in the case of ID 10) benefited consumers even though they were not actively engaged in the co-creation. Therefore, this group of cases represented a broader reach of the social value (i.e. the benefit went to consumers, who could use newly developed products and services, which would not have been possible without the co-creation). In conclusion, the social value generated by Type 2 is indirect, of broad reach, and in the form of technology development.

INSERT FIGURE 4 HERE

INSERT TABLE 5 HERE

Type 3: Co-creation initiated by not-for-profit entrepreneurs contributing intangible assets

When not-for-profit entrepreneurs such as public, citizen, or academic entrepreneurs co-identified a co-creation opportunity, they mainly directly addressed social challenges, and thus generated direct social value (Figure 5 and Table 6). Some examples were poverty reduction or helping deprived communities through skill development, and developing dementia-friendly communities. Nevertheless, the involvement of for-profit entrepreneurs in shaping the objectives of specific projects and co-exploitation process meant that the opportunities indirectly generated also business value. For instance, in case ID 13, not-for profit entrepreneurs (i.e. entrepreneurs in a social intermediary) co-identified the opportunity to improve the welfare of deprived communities in Africa by working with young people to develop their digital and entrepreneurial skills. A well-known multinational corporate entrepreneur, involved itself in the co-exploitation process by providing both matched-

funding and relevant skills. The corporate entrepreneur helped shape the specific projects run by the initiative but were not involved in the initial co-identification phase. The initiative focused on deprived communities and considered the welfare of youngsters over the initiative's potential to generate financial value (this is in contrast to the importance of generating financial value by accelerators initiated by for-profit entrepreneurs). Yet, the initiative generated business value through the establishment of new ventures by young entrepreneurs, plus it contributed to the reputation and to add new market knowledge for the corporate entrepreneur.

Since key resources brought by the entrepreneurs who co-identified the co-creation opportunity are intangible resources, the social value generated during co-exploitation took the form of capability development of co-creating entrepreneurs.

In alignment with their social aim, the co-creating actors were open to anyone to work with them for co-exploitation. Therefore, this group of cases has a high breadth of openness. Since the co-exploitation process of this type involved in capability development of a large number of co-creating entrepreneurs, the social value generated had a broad reach. Since the co-creation was driven by a social motive, the social commitment of co-creating entrepreneurs was essential for value creation. In sum, the social value generated by Type 3 is direct, of broad reach, and in the form of capability development.

INSERT FIGURE 5 HERE

INSERT TABLE 6 HERE

Type 4: Co-creation initiated by not-for-profit entrepreneurs contributing tangible resources

When co-identifying entrepreneurs had not-for-profit motives and contributed tangible resources, they aimed to address a social problem/issue and developed technology as a mean to tackle it (Figure 6 and Table 7). Some examples included developing sustainable technologies to reduce environmental pollution (ID16), improving the safety of nuclear sector (ID20), aiding the mobility of handicapped people (ID19), and improving public space (ID18). Yet, the type of social challenges they addressed required the involvement of for-profit entrepreneurs, which resulted in the co-creation indirectly opening up new business opportunities. For instance, in case ID17, public entrepreneurs, in collaboration with citizen

and academic entrepreneurs co-identified an opportunity to develop new technologies to strengthen the partnership between residents and government. Public entrepreneurs funded the initiative and worked as co-players, academic entrepreneurs brought in knowledge and skills and citizen entrepreneurs contributed their user experience. All three types of entrepreneurs broadly had the social goal of improving the public space. Yet, the initiative could not achieve the objectives without the involvement of local for-profit start-up entrepreneurs, who contributed market knowledge and relevant technical skills on new urban mechanics. While the not-for-profit entrepreneurs co-identified the opportunity, the for-profit entrepreneurs shaped the decisions on the types of technologies to be developed and involved in the co-exploitation phase, allowing the specific opportunities to generate not only social value but also business value.

Availability of public funding was essential, particularly due to the not-for-profit nature of co-identifying entrepreneurs. These technologies involved comparatively greater risks than those we observed in the Type 2 cases. They aimed to develop a technology to address a direct social need, which corporate entrepreneurs are generally reluctant to finance. Entrepreneurs with profit motives, engaged in the co-exploitation process, mainly as a member of a publicly funded consortium.

Since this type pursued a social challenge, when selecting entrepreneurs to co-exploit the opportunity, they were not as restrictive as those in Type 2. Due to their relatively high breadth of openness and the ability of the developed technologies to be used for the benefit of wider society beyond those who are involved in co-creation, the social value generated has broad reach. Accordingly, the social value generated by Type 4 is direct, of broad reach and in the form of technology development.

INSERT FIGURE 6 HERE

INSERT TABLE 7 HERE

5. Discussion and conclusions

5.1. Theoretical implications

Our study investigated: (a) how co-creation by individual actors generates societal impacts (in the concurrent pursuit of social and business value) and (b) how and why the characteristics of individual actors involved in co-creation influence the nature of social value generated.

With respect to the first research question, we have shown that it is the entrepreneurialism of a diverse set of actors – comprising corporate, academic, public, start-up, intermediary, to citizen, entrepreneurs – who co-exploit co-identified opportunities for co-creation that enable them to generate potentially competing social and business values. These diverse entrepreneurs closely worked together, by harnessing their differences and interdependence, to co-create value. This finding aligns with the literature on hybrid social enterprises that has highlighted the importance of entrepreneurialism to the concurrent generation of social and business value (Thompson and Doherty, 2006; Pache and Santos 2012; Battilana and Lee 2014; Santos 2012; Ebrahim, Battilana and Mair 2014). Yet, this literature has mainly focused on the achievement of social and business values, predominantly within the boundary of a single organization, and has placed little emphasis on studying the generation of these competing goals through open innovation. In contrast, we extend emerging insights in the open innovation literature on the role of entrepreneurialism (Teece 2007) by specifically highlighting the significance of harnessing the differences and interdependence between different types of entrepreneurs as a pathway for the simultaneous generation of social and business value through co-creation.

In relation to the second research question, we developed a typology that explicitly recognize how and why the heterogeneity of entrepreneurs who co-identify a co-creation opportunity determines the nature of societal impacts. Our findings highlight that the prominence (direct or indirect social value), innovation (technology development or capability development) and reach (benefiting a focused or a broader group) of social value vary depending on the profit orientation and the key resource contributions of co-identifying entrepreneurs. As a result, we respond to recent calls to further our understanding of social value creation through, and the involvement of individuals in, open innovation (West et al 2014; Watson et al 2018). Further, our typology led to the development of propositions (see below) which highlight multiple ways to use open innovation to support social value. A proposition is developed for each type of co-creation initiative discussed in the results section.

Type 1 leads to the first proposition:

P1: When for-profit entrepreneurial actors contributing intangible resources co-identify a co-creation opportunity, the social value generated is more likely to be indirect, of focused reach, and in the form of capability development.

Type 2 leads to the second proposition:

P2: When for-profit entrepreneurs contributing tangible resources co-identify a co-creation opportunity, the social value generated is more likely to be indirect, of broad reach, and in the form of technology development.

Type 3 leads to the third proposition:

P3: When not-for-profit entrepreneurs contributing intangible assets co-identify a co-creation opportunity, the social value generated is more likely to be direct, of broad reach, and in the form of capability development.

Type 4 leads to the fourth proposition:

P4: When not-for-profit entrepreneurs contributing tangible resources co-identify a co-creation opportunity, the social value generated is more likely to be direct, of broad reach and in the form of technology development.

Specifically, when investigating why such causality exists, we contribute to the open innovation literature by identifying factors that explain the relationship between the characteristics of entrepreneurs co-identifying co-creation opportunities and the nature of the social value created. The nature of opportunities and breadth of the openness of co-creation explain why there is a relationship between the motives of co-identifying entrepreneurs and the nature of the co-created social value. Also, the conditions specific to each type of co-creation such as the ability of entrepreneurs to develop internal capabilities (for Type 1), the effectiveness of IP strategies (for Type 2), the social commitment of entrepreneurs (for Type 3) and the availability of public funding (for Type 4) further explain the conducive conditions for each type. For instance, when co-creating social value through capability development, the entrepreneurs' ability to develop internal capabilities and their social commitment are crucial. Past research has discussed the key role played by capability development in some co-creation initiatives such as accelerators (Keil, Autio and George 2008) and social commitment of actors in social enterprises (Ramus and Vaccaro 2017). We extend this line of argument by highlighting in which type of co-creation these factors are more likely to moderate the relationship between the characteristics of co-identifying entrepreneurs and nature of social value co-created. We also suggest that when the social value is co-created through technology development, having an effective IP strategy and the availability of

public funding are essential. Recent literature has highlighted the greater likelihood of businesses co-patenting with non-competitive actors such as universities (Belderbos et al 2013), and the need for public funding for social innovation (Fougère, Segercrantz, and Seeck 2017). Yet, the originality of our findings is in highlighting the types of co-creation for which these factors are more important.

Our findings suggest that having different entrepreneurs co-creating value together, by tightly linking their social and business missions, could be a solution to the financial challenges associated with social value creation, the generation of which traditionally relies on less effective sources such as philanthropy, internal reserves, donations or loans (Brandsen and Karré 2011). We highlight that when a co-creation initiative is started by for-profit entrepreneurs, the generation of social value alongside business value is resourced and financed by for-profit entrepreneurs. Here, what is interesting is that for-profit entrepreneurs are likely to co-create value with not-for-profit entrepreneurs when they co-identify opportunities that cannot be exploited independently by themselves. On the other hand, when co-creation is initiated by not-for-profit entrepreneurs to generate direct social value and they involve for-profit entrepreneurs enabling them to generate indirect business value, the chances of securing finance from public entrepreneurs or public grants increase. Also, in these instances, the involvement of the funding entrepreneurs extends beyond financial contribution to direct active engagement in the co-creation initiative to shape the direction in a way that meets their own specific goals besides those of other actors.

Considering co-creation as a coupled process of open innovation, we suggest that achievement of societal goals should not be perceived as a separate activity from achieving business goals. When the achievement of societal goals is linked with business goals, co-creation between for-profit and not-for-profit actors is more likely, enabling to address challenges that cannot be addressed by any stakeholder independently. As the achievement of potentially competing social and business goals is challenging, the entrepreneurialism of actors in adopting open innovation plays a major role. Different co-creation mechanisms generate different social values and involve different entrepreneurs, thus a ‘one size fits all’ model will not be effective.

5.2. Implications for policy and practice

Our analysis has implications for policy and practice towards co-creation as a form of open innovation. Our study shows that co-creation is emerging as an important platform to

generate societal impact through open innovation, addressing the both business and social interests. Further, the entrepreneurialism of actors involved in co-creation is shown to be essential to generate competing social and business values. Hence, fostering the development of entrepreneurialism – comprising corporate, academic, public, start-up, intermediary, to citizen, entrepreneurship – would pave the way for successful co-creation.

Our typology and associated propositions provide insights to develop new policy directions to generate societal impacts through open innovation. A one-size-fits-all policy for heterogeneous co-creation mechanisms seems unlikely to work since these types generate varied societal impacts by adopting different mechanisms. For instance, regarding indirect social value generated by co-creation mechanisms with commercial goals, the government could encourage, work with, and support the corporate entrepreneurs who tend to drive these co-creation mechanisms (i.e. Types 1 and 2: e.g. the discovery of drugs for neglected diseases in developing world or the development of financial technology industry by corporate entrepreneurs). Alternatively, government could initiate and encourage co-creation types with direct social goals (Types 2 and 3: e.g. the development of Kent dementia friendly community initiated by local government). Some co-creation types generate social value through technology development (i.e. Types 2 and 4), which could be supported by the government by establishing research-based tangible infrastructure. Co-creation initiatives generating societal impacts through capability development (i.e. Types 1 and 3) could be supported through the provision of intangible assets such as access to data and training. Also, close relationships between public entrepreneurs with other entrepreneurs help bottom up policy making, an effective mechanism for ecosystem-related policy making (Curley and Salmelin 2013).

The systemic understanding of the heterogeneity of co-creation we have presented here will be of value to any actor co-creating value as they could decide which type they should engage with depending on their goal for co-creation. In sum, our typology is useful to design a specific form of co-creation initiative taking into account the dimensions such as profit orientation and key resource contributions of co-identifying entrepreneurs, the co-creation opportunities, the nature of intended societal and commercial impacts, the breadth of the openness , the nature of the opportunity and the framework conditions such as the ability of entrepreneurs to develop capabilities, effectiveness of IP strategies, social commitment of entrepreneurs and availability of public funding.

5.3. Limitations and further research

Our study has limitations that open up areas for further research. We have considered co-creation as one form of open innovation, but others involve outside-in and inside-out processes. Research is needed to explore the boundaries of these different approaches to open innovation and to identify when co-creation may be an appropriate approach to creating social and/or business value.

In developing our typology, we adopted a dichotomy between for-profit and not-for-profit motives of, and intangible and tangible resource contribution by, entrepreneurs. Nevertheless, since there might be co-creations at the interfaces of the different types, further research effort could be devoted to exploring the variety of organizational forms, strategies and different processes associated with such heterogeneity.

Our study highlighted how and why the profit orientation and key resource contributions of entrepreneurs decide the nature of social value co-created through open innovation. However, our inductive analysis might not have provided an exhaustive list of all possible types of co-creation initiatives. Future research could verify the generalizability of our findings and also identify other heterogeneous forms of co-creation initiatives focusing on the configuration of other dimensions.

We know that once alliances are formed they co-evolve with the partners and environment (Das and Teng 2002). However, in contrast to alliances, co-creation involves a more complex engagement with a variety of actors. Our analysis so far omitted the lifecycle of co-creation processes, concerning how co-creation initiatives are formed and sustained or how they decline.

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Appendix 1:

The questionnaire comprised themes covering three main areas of focus of this study: value generated (i.e. innovation/s by the initiative [if any], benefits generated by the initiative [if any]), individual level engagement (i.e. actors initiating and engaged in the initiative together with their contribution in terms of knowledge and skills, physical resources, networks, and technologies etc., and specific goals of the actors involved) and the process involved in generating value (how it has been started, the process adopted, and the breadth of the openness [i.e. whether any party could join the initiative or selected on the basis of specific criteria]).

The analysis was driven by coding, which is aggregated into themes at different levels. Four major themes used were 'actor characteristics influencing co-creation', 'co-creation process', and 'value created through co-creation'. Under the 'actor characteristics influencing co-creation', the coding used were profit orientation (for profit/not-for profit), key resources (tangible and intangible resources), entrepreneurial characteristics, type of entrepreneur, and their involvement. Codes used for 'co- creation process' were nature of opportunity co-identified and co-exploited, breadth of the openness (low/high) and framework conditions enabling co-creation. The codes used for 'value created through co-creation' were value created (social academic, and business value) and the dimensions of social value; namely, reach (broader or focused), innovation (capability or technology development), and prominence (direct or indirect). Please note that this finalised list of codes and themes was a result of an iterative process involving data analysis and the comparison of emerging findings with the literature, which is often suggested in inductive qualitative research to improve the rigour of the study (Saldana 2009).

Figure 1: Typology of co-creation mechanisms generating societal impacts

		Resource contribution of actors involved in co-creation	
		Intangible resources	**Tangible resources**
Profit orientation of actors involved in co-creation	**For-profit**	**Type 1: For-profit actors contributing intangible resources**	**Type 2: For-profit actors contributing tangible resources**
	Not-for-profit	**Type 3: Not-for-profit actors contributing intangible resources**	**Type 4: Not-for-profit actors contributing tangible resources**

Table 1: Study sample description

Case ID number	Title of the interviewee	Profit orientation of actor initiating co-creation	Resource contribution of initiating actor	Name category	Values generated	The affiliation of actors involved in the initiative
Cases representing Type 1						
ID1	Technology Lead	For-profit	Intangible resources	Collaborative project	***Social*** - Efficient healthcare services ***Business*** - Increased profit through new service development	University, Large- medium business, Government organization, Citizens
ID2	Senior manager	For-profit	Intangible resources	Accelerator	***Social***- Capability/ skills gap fulfilment in financial technology sector ***Business*** – Increased profits through efficient banking services	University, Large- medium business, Start-ups
ID3	CEO	For-profit	Intangible resources	Accelerator	***Social*** - Capability/ skills gap fulfilment in multi sector ***Business*** – Profit gained through accelerator service	University, Large- medium business, Start-ups
ID4	Director	For-profit	Intangible resources	Social innovation labs	***Social*** - Addressing teenage binge drinking ***Business*** – Improved profit through new business model innovation	Large- medium business, Government organization, Citizens
ID5	Accelerator Manager	For-profit	Intangible resources	Accelerator	***Social*** - Capability/ skills gap fulfilment in finance retail and cyber security ***Business*** – Profit gained through accelerator service	University, Large- medium business, Start-ups
Cases representing Type 2						
ID6	Manager of the living lab	For-profit	Tangible resources	Living lab	***Social*** - Innovation in sustainable consumer goods ***Business*** – Profit gained by diversifying into new products and markets ***Academic***- Research impacts	University, Large- medium business, Citizens
ID7	Director - Lab	For-profit	Tangible resources	Living lab	***Social*** - Innovation in sustainable electronic products ***Business*** - Profit gained by diversifying into new products and markets ***Academic***- Research impacts	University, Large- medium business, Citizens
ID8	Business Director	For-profit	Tangible resources	Living lab	***Social*** - Innovation in sustainable products based in biomaterials and biomimicry	University, Large- medium business, Citizens

					Business - Profit gained by diversifying into new products and markets ***Academic***- Research impacts	
ID9	Director	For-profit	Tangible resources	Open lab	***Social*** - Smart homes with energy and infrastructure ***Business*** - Profit gained by diversifying into new products and markets	Large- medium business, Start-ups, Citizens
ID10	Chief Executive Officer	For-profit	Tangible resources	Open lab	***Social***- Developing drugs for neglected diseases in developing world ***Business*** - Profit gained by diversifying into new products and markets ***Academic***- Research impacts	University, Large- medium business
Cases representing Type 3						
ID11	Professor	Not-for-profit	Intangible resources	Accelerator	***Social*** - Poverty reduction through the development of entrepreneurial skills in digital sector ***Business*** – Financial gain through new business development	University, Start-ups
ID12	Lab manager	Not-for-profit	Intangible resources	Social innovation lab	***Social*** – Opportunity enhancement and skill development for cross disciplinary engagement, which doesn't have direct, short run business opportunities but future potential ***Business*** – Financial gain through new business development	Satart-ups, Intermediary
ID13	Manager (Lab)	Not-for-profit	Intangible resources	Social innovation labs	***Social*** - Digital and entrepreneurial skill development of young entrepreneurs in deprived communities ***Business*** - Financial gain through new business development	Large- medium business, Start-ups, Intermediary
ID14	Project Officer	Not-for-profit	Intangible resources	Social innovation labs	***Social*** - Dementia friendly community development ***Business*** – Improved service offering ***Academic*** – Impact generation	University, Large- medium business, Start-ups, Government organization, Citizens, Intermediary
ID15	Head teacher	Not-for-profit	Intangible resources	Collaborative project	***Social***- Innovative sports education for school girls ***Business*** - Financial benefits through improved pool of potential customers ***Academic*** – Impact generation	University, Large- medium business, Citizens

Cases representing Type 4						
ID16	Professor	Not-for-profit	Tangible resources	Living lab	***Social*** - Reducing environmental pollution by developing sustainable building technologies ***Business*** – Income in the form of public grants, New business opportunities ***Academic*** – Research impacts	University, Large- medium business, Government organization
ID17	Co-chair	Not-for-profit	Tangible resources	Social innovation labs	***Social*** - Improved public sector through efficient technology development ***Business*** – Income in the form of public grants, New business opportunities, support to local entrepreneurs ***Academic*** – Research impacts	University, Start-ups, Government organization, Citizens
ID18	Centre Direction and User	Not-for-profit	Tangible resources	Social innovation labs	***Social*** - Improved public space with sustainable technologies ***Business*** – Financial gain through new product development	Large- medium business, Start-ups, Government organization, Citizens
ID19	Centre director	Not-for-profit	Tangible resources	Living lab	***Social*** - Equipment to aid mobility of handicapped people ***Business*** – Income in the form of public grants, New business opportunities ***Academic*** – Research impacts	University, Government organization, Citizens, Intermediary
ID20	Professor/ Centre Director	Not-for-profit	Tangible resources	Open lab	***Social*** - Optimising the current nuclear sector with a special emphasis on safety ***Business*** – Income in the form of public grants, New business opportunities, Cost reduction through new technologies ***Academic*** – Research impacts	University, Large- medium business, Government organization, Intermediary

Table 2: Different types of entrepreneurs co-creating value

Type of entrepreneur	Characteristics of this type of entrepreneur in the context of co-creation	Illustrative quotations	Case study numbers in which this type of entrepreneur was present
Academic entrepreneur	Academics, who entrepreneurially combining their knowledge with that of other entrepreneurs to generate impactful innovation.	"*combining the knowledge* of academics with industry knowledge was very important to develop these drugs" [ID10] "our researchers work closely with experts and businesses in the field of renewable technologies to for sustainable buildings…in this way we could generate *impacts from our* research" [ID16] "I have always been *innovative, challenge seeking, optimistic and hard working*….working with industry is crucial to make the most out of my research" [ID20]	ID1, ID2, ID3, ID5, ID6, ID7, ID8, ID10, ID11, ID14, ID15, ID16, ID17, ID19, ID20
Corporate entrepreneur	Employees of large or medium sized organizations, who work with other types of entrepreneurs to spur organizational innovation and performance	"in this kind of collaborative initiatives, we achieve our business objectives using new *innovative mechanisms*….we need to think about *new ways* that allow us to develop financial technology sector while helping start-ups to achieve their own objectives" [ID2] "We adopt *new methods of working*, so that, we could meet our sustainability goals and market targets, while also ensuring company A benefits from the collaboration" [ID8] "we have to be *very creative and strategic* at the same rime…yes, it is *high risk but it's worth trying*" [ID1] "we enjoy this close collaboration with customers very much. We are so *passionate* and together we come up with *innovative designs and technologies*" [ID6]	ID1, ID2, ID3, ID4, ID5, ID6, ID7, ID8, ID9, ID10, ID13, ID14, ID15, ID16, ID18, ID20
Start-up entrepreneur	Individuals who establish new ventures, the unique characteristics of which being small, flexible and innovative enable them to work with other entrepreneurs	"I have tried establishing my business for a couple of years by myself. However, after joining the accelerator the growth of my business both in terms of *profit and innovation significantly increased*. We [other entrepreneurs in the accelerator] and collaborate…I work closely with mentors…I am pitching to secure larger investments"[ID3]	ID2, ID3, ID5, ID9, ID11, ID12, ID13, ID14, ID17, ID18
Public entrepreneur	Public sector workers, who are co-players in the co-creation process by actively engaging with other types of entrepreneurs to generate social value.	"Traditionally public sector is perceived as a service or grant providers…but now we understand that it is not sufficient…if we are to solve social challenges, we need to working with people *in innovative ways*…the initiative should start with and from people. We have to be *co-players*" [ID14] "Working with the beneficiaries, motivates us so much. We see direct effects….also, helps with policy making…..I think that we have become more creative, committed and futuristic" [ID17]	ID1, ID4, ID14, ID16, ID17, ID18, ID19, ID20
Citizen/ user entrepreneur	Innovative citizens, who work closely with other types of entrepreneurs to develop new products and services and/or to generate social value	"I always would like to *try new things*. People see me as *innovative*…..I am always concern about the sustainability side…I am *very happy* that I could contribute to company A's effort be more sustainable [ID8] "at the end of the day we as consumers benefit….apart from that I am very proud of myself being able to shape the future technologies. I do it for free…I get such a pleasure through the engagement" [ID18]	ID1, ID4, ID6,ID7, ID8, ID9, ID14, ID15, ID17, ID18, ID19

Interpreneur	Employees of intermediaries, who support the collaboration between a wide array of actors by way of introducing new combinations of knowledge and new practices to manage close working relationship between a wide array of different entrepreneurs	"our core competency is to help parties to collaborate with. However, these new initiatives demands us to introduce whole set of *new practices, new knowledge combinations, negotiating mechanisms, and relationship management techniques*" [ID12] "we have to be *innovative constantly*, as the wide array of different organizations, who have not been used to work, are collaborating in this initiative…together we develop new technologies" [ID19]	ID13, ID12, ID14, ID19, ID20

Table 3: Varied involvement of entrepreneurs in co-identification and co-exploitation of opportunities

Case study No	ID2	ID10	ID14	ID19
Co-identification of opportunities	**Only four corporate entrepreneurs were involved in co-identification phase** Finance industry cannot survive without the development of fin-tech industry. **Corporate entrepreneurs together** have co-identified the opportunity to establish an escalator that cannot be initiated by a single entity.	**Only corporate entrepreneurs were involved in co-identification phase** There are several neglected diseases in developing world, discovering drugs for which is risky and complex and require a wider resource and competency base. **GSK employees as corporate entrepreneurs** have co-identified this opportunity to establish an open lab.	**Only public and citizen entrepreneurs were involved in co-identification phase** **Public entrepreneurs** (i.e. employees of Kent council) in collaboration with **citizen entrepreneurs** have co-identified the opportunity to address an unmet community need to develop dementia friendly community in Kent.	**Only interpreneurs were involved in co-identification phase** **Interpreneurs** (i.e. researchers from FPF) co-identified opportunities to innovate products to improve the mobility of handicapped people.
Co-exploitation of opportunities	**All the entrepreneurs were involved in co-exploitation phase** Established in June 2014 – one in London and the other in Manchester – Escalators: All four corporate entrepreneurs together with other entrepreneurs by combining their resources and competencies very closely work with start-up community to scale	**All the entrepreneurs were involved in co-exploitation phase** Established in 2010 as an independent, not-for-profit organization, Tres Cantos provides a platform for all the entrepreneurs to work together. This is further facilitated by the introduction of mechanisms such as the	**All the entrepreneurs were involved in co-exploitation phase** Established in 2014, Kent Dementia Action Alliance brings together more than 50 stakeholders to create a dementia friendly community. Rather than government providing a service to citizens, whole community becomes an integral part of the social innovation process. For example, at the Greenhithe borough, the	**All the entrepreneurs were involved in co-exploitation phase** Established in 2008, Amazon Living Lab brings users and researchers together during all phases of product development. Rather than involving users at the end of the innovation process for market testing, researchers innovate with users from concept to market, which ensures that

	up their businesses that wouldn't have been possible otherwise. Contribution by each actor for co-exploitation: **1. Corporate entrepreneurs** from ***Barclays*** – Financial knowhow ***Techstars*** – Providing seed funding, mentorship, and networking opportunities for start-ups ***Innovation Loft*** – Organizing events for start-ups ***Central Working***- Designing co-working spaces **2. Start-up entrepreneurs** – Expertise in financial technology sector **3. Academic entrepreneurs** – knowledge and skills	adoption of flexible IP strategies, a wide variety of partnership mechanisms and a broad base of resources. Contribution by each actor for co-exploitation: **1. Corporate entrepreneurs** ***GSK*** - Industrial-scale processes, facilities and infrastructure and expertise **2. Academic Entrepreneurs** ***Nine universities*** – Advanced knowledge and skills ***Two NGOs*** – Expertise in drug discovery **3. Public Entrepreneurs** ***Public research organization*** - Expertise in drug discovery and policy formulation	Council together with ASDA runs workshops to help retail staff to enhance the shopping experience of patients. Council closely works with bus drivers to help them understand how to build a trusting rapport with the older community. It also works with schools and local businesses to organize awareness raising workshops. This initiative has driven structural changes far beyond the scope of what one organization could do on their own. Contribution by each actor for co-exploitation: **1. Public entrepreneurs** ***Government*** – Bring the community together and support activities **2. Corporate entrepreneurs** ***Local businesses*** – Train staff and raise awareness ***Retail business and bus drivers*** – Experience on how to identify and support dementia patients **3. Citizen entrepreneurs** ***Charities, Community groups, Schools*** – Together with the community raise awareness ***Care workers*** – Knowledge on the needs of dementia patients	products are fit for purpose. Contribution by each actor for co-exploitation: **1. Interpreneurs** ***FPF*** - Laboratory and researchers for research and development **2. Corporate entrepreneurs** ***Industrial partners*** – Market based expertise in specific domains. **3. Public entrepreneurs** ***Government*** – Providing the policy perspective ***Hospitals, Handicapped Associations, Rehabilitation centers–*** Providing the perspective of user needs **4. Academic entrepreneurs** ***Universities*** – Academic knowledge and skills

Figure 2: Factors underpinning co-creation typology

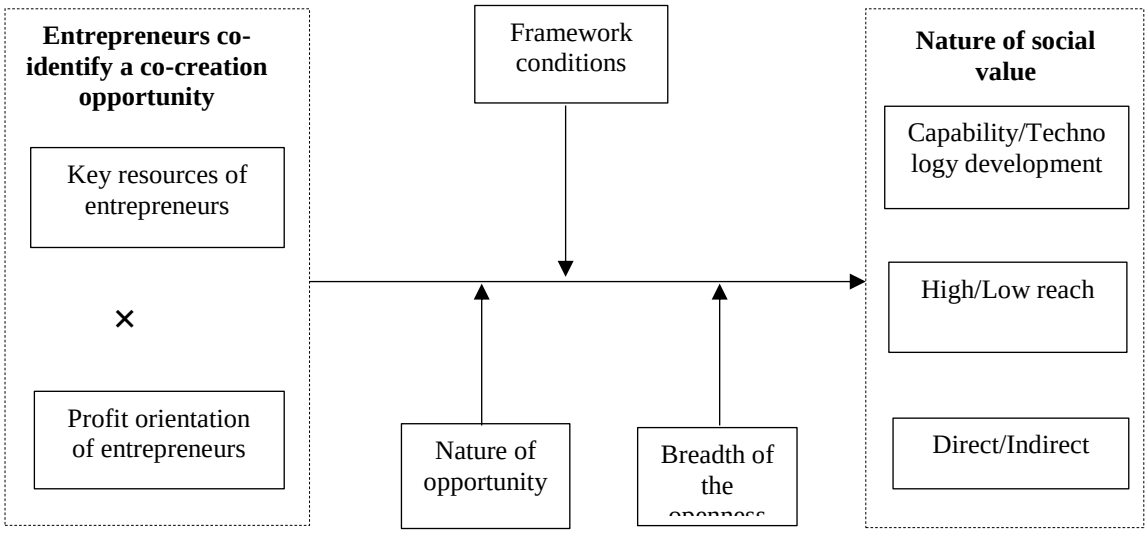
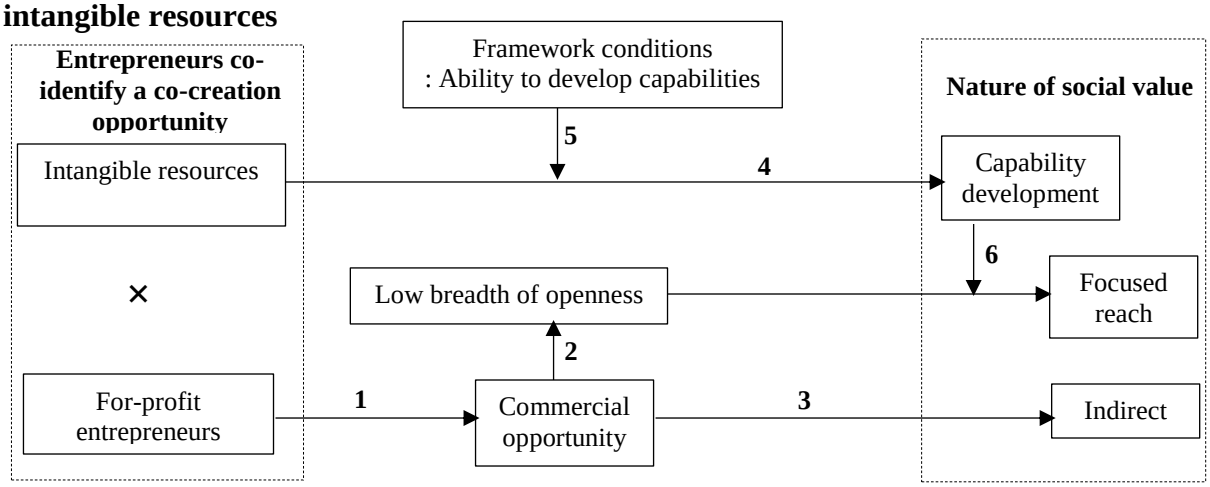


Figure 3: Type 1: Co-creation initiated by for-profit entrepreneurs contributing intangible resources



Note: Numbers in the figure correspond to those in Table 4

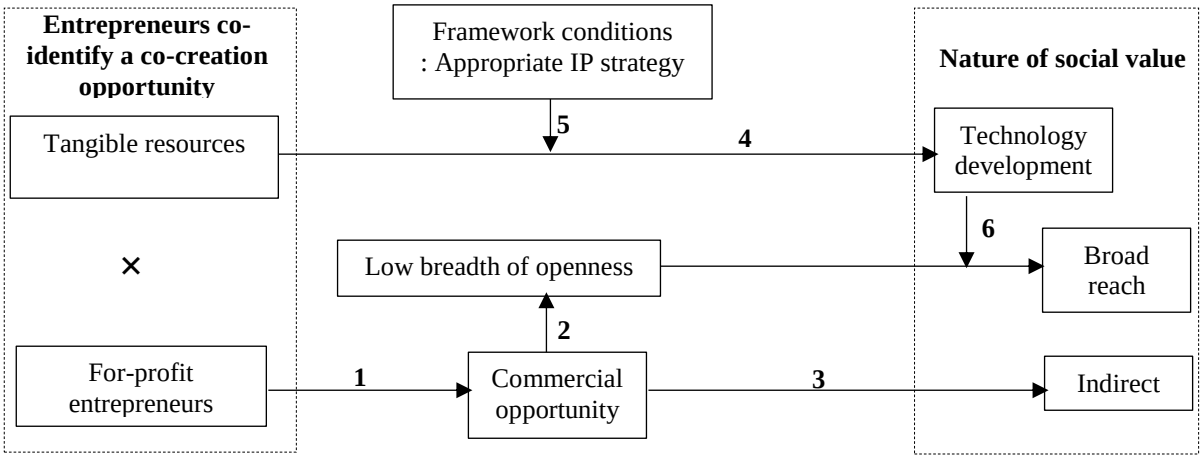
Table 4: Type 1: Co-creation initiated by for-profit entrepreneurs contributing intangible resources

No	Model dimensions	Quotation
1	For-profit entrepreneurs →Commercial opportunity	"without the development of financial technology sector, we are not able to survive in the future. However, it is not our core business….the accelerator helps develop the skills of entrepreneurs in this sector…..in this way we can ensure that we have a platform to thrive'[ID2]
2	Commercial opportunity→Low breadth of openness	"we use strict selection criteria [when selecting entrepreneurs to collaborate]….we need to ensure that we generate greater return on investment" [ID 3]
3	Commercial opportunity →Indirect social value	"this initiative is a component of A's more expansive Open Design Explorations which seeks to innovate around redesigning the nightclub and bar experience. This specific initiative, however, focuses innovation around the point-of-consumption to tackle a pertinent social issue – binge drinking. …..This is a significantly detrimental social issue which affects a large amount of A's global customer base" [ID4]

4	Intangible resources →Capability development	"we leverage our market-leading capabilities to innovate healthcare solutions. By combining the global transportation and logistics capabilities of A [an initiating corporate entrepreneur] with the healthcare expertise and specialized facilities of B [an initiating corporate entrepreneur], we create innovative supply chain solutions for the healthcare industry….we together develop capabilities for innovative healthcare delivery…We also work with local hospitals and university A and B… [ID1]
5	The effect of Entrepreneur's ability to build capabilities on the relationship between Intangible resources and capability development	"our aim is to help skill development of entrepreneurs in finance retail and cyber security industry…..there are a number of businesses on our floor so it's natural that a degree of collaboration and idea-sharing happens. We organize monthly events [e.g. pitching, networking and mentoring event etc.] where we're all able to get together and work with each other…It is crucial that the entrepreneurs are flexible enough to develop new capabilities capabilities…sometimes this involves changing their business practices, adopting new routines, working with new partners or changing the business direction" [ID5]
6	The effect of capability development on the relationship between the breadth of openness and reach	"it is important to have strict criteria for selection [of entrepreneurs], otherwise, it would not be possible to develop capabilities during a programme" [ID3] "we are quite focused….of course, the society benefits since we develop skills of selected entrepreneurs. For this kind of an initiative a focused and selective approach is very important" [ID 3]

Note: Numbers in the table correspond to those in Figure 3

Figure 4: Type 2: Co-creation initiated by for-profit entrepreneurs contributing tangible resources



Note: Numbers in the figure correspond to those in Table 5

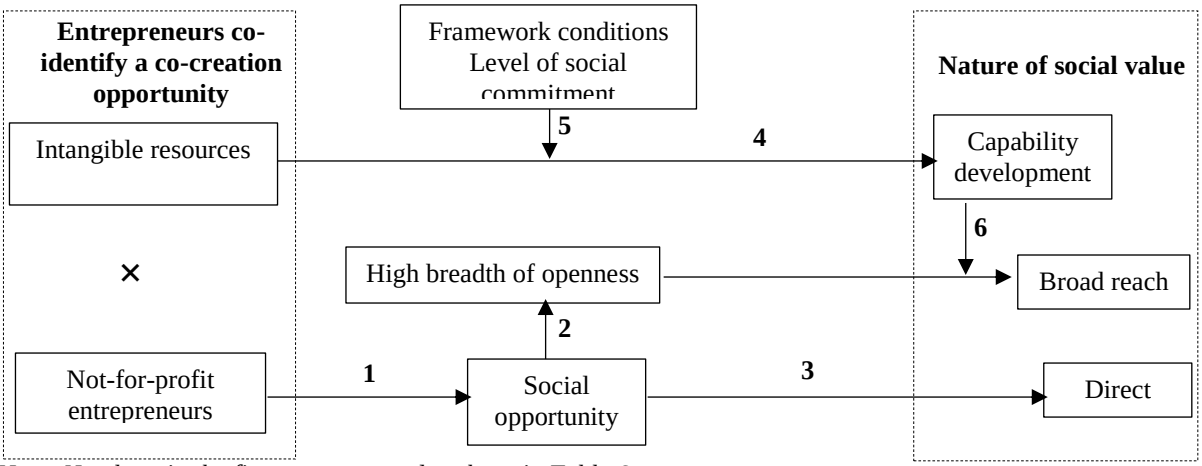
Table 5: Type 2: Co-creation initiated by for-profit entrepreneurs contributing tangible resources

No	Model dimensions	Quotation
1	For-profit entrepreneurs →Commercial opportunity	"This site is also home to the Open Lab, which is integrated within the facility's Discovery Performance Units [i.e. a core activity the initiating corporate entrepreneur is involved in] focused on Malaria, TB, Kinetoplastids and Shigella" [ID10]
2	Commercial opportunity→Low	"when selecting parties to collaborate with, we carefully look at their expertise, experience, and resources….. innovating sustainable products requires a specific set of broader skills. So we [two corporate entrepreneurs and a selected group of

	breadth of openness	customers] and work together since we bring different expertise and resources required for the collaboration" [ID6]
3	Commercial opportunity →Indirect social value	"Our market is in the area of biomaterials and biomimicry…This is our speciality and we have lab facilities…..Company A brings their expertise in sustainability angle…University X brings expertise…we together work with a selected set of consumers to develop new products that meet both their [i.e. customers'] demand and sustainability targets. Meeting such targets would not have been possible without this collaboration" [ID8]
4	Tangible resources →Technology development	"This initiative, created in 2010, allows independent researchers to access A's [initiative corporate entrepreneur] industrial scale facilities, resources and expertise to help them advance their own research into diseases of the developing world. The initiative is overseen by a Governing Board of leading scientists and provides funding and support to researchers to help them develop and advance ideas that could lead to new medicines to treat diseases of the developing world" [ID10]
5	The effect of an appropriate IP strategy on the relationship between tangibles resources and technology development	"Researchers working in the initiative are encouraged to share their work to ensure their discoveries are also available to other researchers. With over 50 projects in the portfolio, TCOLF activities are starting to bear fruit in terms of publications, validation of novel therapeutic modalities, promising lead optimisation programs and leveraged funding from third party agencies" [ID 10] "since we are dealing with technology development having an appropriate IP strategy is key for success. Most of similar initiatives failed due to this issue. We try to enter into a contract at the beginning or as soon as we have a clear idea of that the end product is" [ID 9]
6	The effect of technology development on the relationship between the breadth of openness and reach	"Once the prototypes [of sustainable electronic products] are developed in the lab, we do further tests and then take to the market. All our customers benefit from these sustainable products. We are proud of ourselves" [ID7] "To enable translation of innovative research to benefit the health of the people in the developing world affected by Neglected Tropical Diseases,….. This goal will be achieved through collaborations where the complementary expertise and capacity, currently residing in the Pharmaceutical industry as a whole, is made accessible to Academic, Biotech and other Pharmaceutical Industry scientists" [ID 10]

Note: Numbers in the table correspond to those in Figure 4

Figure 5: Type 3: Co-creation initiated by not-for-profit entrepreneurs contributing intangible resources



Note: Numbers in the figure correspond to those in Table 6

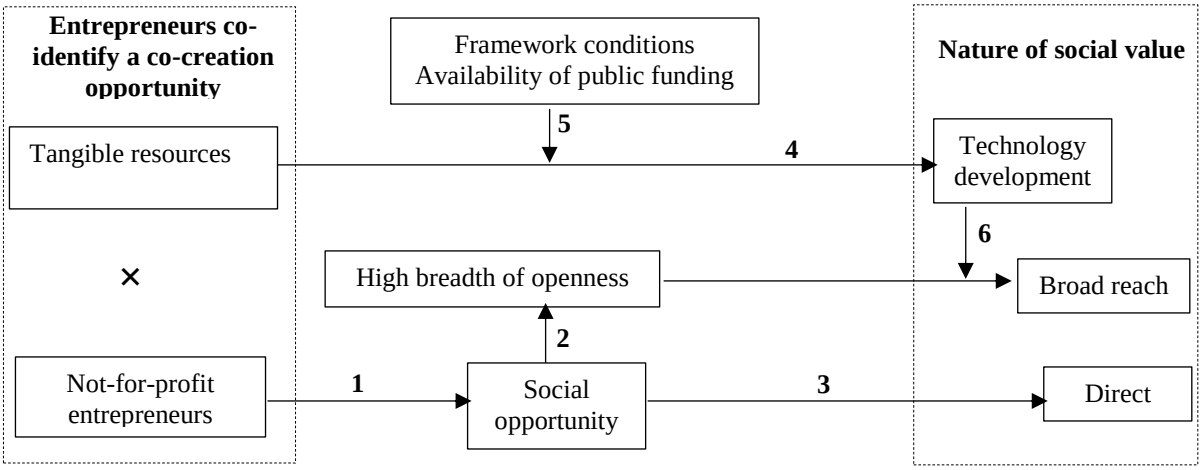
Table 6: Type 3: Co-creation initiated by Not-for-profit entrepreneurs contributing intangible resources

No	Model dimensions	Quotation
1	Not-for-profit entrepreneurs →Social opportunity	"This alliance is a group of local organizations who want to work together to better meet the needs of people with dementia so everyone can live well within their communities. A wide range of partners are now members of the alliance" [ID14]
2	Social opportunity→High breath of openness	"The membership of the alliance is 'open' to all. Organizations, schools, businesses, groups and residents can get involved at the level which best suits them" "Developed using the SILK approach, Starting with people" [ID14]
3	Social opportunity →Direct social value	"A is a not-for-profit organization in Africa that offers hubs for development and innovation for the local deprived communities [especially young entrepreneurs] to improve their digital skills as path way for eradicating poverty. The initiative was implemented in partnership with Company Y, a worldwide known computer and software company, as part of their corporate social responsibility activities….We are different, it is not like we offer a service to young entrepreneurs…we work with them very closely - even when designing programmes, delivering these and taking their ideas to the next level…In this way we could, together, overcome poverty through digital and entrepreneurial skill development. We have achieved so much during past few years" [ID 13]
4	Intangible resources →Capability development	"We run a variety of events and conferences throughout the year, including an annual festival that takes place in the city of Z where our initiative is based. During the festival there are a variety of music events, art galleries and discussion to stimulate the creation of ideas. Developers and coders interact with artists and thinkers to test and share new ideas and aim to combine their skills to develop ideas for the future……we work with them closely, we nurture the collaboration….this collaboration helps them develop relevant skills and explore new opportunities" [ID 12]
5	The effect of the level of social commitment on the relationship between intangible resources and capability development	"To be able to build strong cohesive dementia friendly communities we need to look in greater depth at the communities themselves and understand what assets are available to allow us to strengthen those community links. One of the main assets which we believe will be pivotal in strengthening our communities are our local residents, which is why we are looking for local people who would be interested in volunteering in their local area to promote the various aspects of the Dementia Friendly Kent programme. Volunteers would be encouraged to primarily work in their own local areas with occasional travel to assist at County wide events or attend training sessions. Agreed mileage and/or travel expenses will be reimbursed (including car parking) on production of receipts" [ID14] "as you know, this initiative is purely driven by social needs. We work with several entrepreneurs….we are open to anyone in need….but of course, if we are to generate the best value, there should be a real commitment from entrepreneurs, mentors, and trainers…..unless they are committed to develop their own skills and make use of these skills to go to the next stage of their entrepreneurial journey, this would not work" [ID11]
6	The effect of capability development on the relationship between the breadth of openness and reach	"This is an initiative between high school 'X' and the football club 'Y'. We [X] are a state school located in North London and prides ourselves on sports education and sporting achievements. In regard to women in sport, we felt we could do more… the statistics on females obtaining A*-C in physical education was significantly lower than other schools…..in fact we are not supporting but we work with them

		to introduce and implement innovative physical education….It is key that the girls in this programme are committed, work with us and develop relevant skills… Our collaboration supports any school girl. So we are very proud of this highly impactful initiative" [ID15] "A dementia-friendly community is a city, town or village where people with dementia are understood, respected, supported, and confident they can contribute to community life…We welcome anyone with strong social commitment to work with us…..together, as a community, we develop skills and understanding to deal with this challenge" [ID14]

Note: Numbers in the table correspond to those in Figure 5

Figure 6: Type 4: Co-creation initiated by Not-for-profit entrepreneurs contributing tangible resources



Note: Numbers in the figure correspond to those in Table 7

Table 7: Type 4: Co-creation initiated by Not-for-profit entrepreneurs contributing tangible resources

No	Model dimensions	Quotation
1	Not-profit entrepreneurs →Social opportunity	"university's 'Living Lab', a pioneering project, aimed at developing a centre for sustainable excellence. The Carbon Trust states that buildings constitute 40 per cent of UK carbon emissions. Making existing buildings more energy efficient is a vital factor in helping to reach Government targets for carbon reduction by 2050" [ID16]
2	Social opportunity→High breadth of openness	"the computers versatility and capacity as communication channels makes them a powerful working tool that brought enormous new opportunities to handicapped people. …..In order to ensure that these opportunities become effective products it is very important to develop them along with the participation of Governments, Hospitals, Universities and Handicapped Associations, and Industry partners [in specific expert domains – such as computing and electronics but not in the development of the equipment] so these products can fully fit their real needs" [ID19]
3	Social opportunity →Direct social value	"we explore how new technology, and designs can strengthen the partnership between residents and government and significantly improve opportunity and experiences for all. …..Currently, there are three offices that are part of this initiative. There are Mayor's Offices of New Urban Mechanics in city X and Y. These City-funded offices serve as the in-house research & development group for Mayor A and B, respectively. There is also an Office of New Urban Mechanics housed at Z University, supporting innovation efforts across a range of municipalities in the P

		metropolitan area. Individually, each office builds partnerships between internal agencies and outside entrepreneurs to pilot projects that address the needs of residents. As a network, we share lessons learned from this work so that good practice can scale more quickly" [ID17]
4	Tangible resources →Technology development	"The Zones are temporary installations on Market Street, the City's cultural, civic and economic spine…. We activate public spaces. These zones provide opportunities to test projects, technologies intended to enhance sustainability and improve public experience" [ID18]
5	The effect of the level of the availability of public funding on the relationship between tangible resources and technology development	"as you know, technology development is costly and a long term activity. So having public funding is vital. We try to secure EU funding, government funding and sometimes other international sources of funding" [ID16] "Optimising the current nuclear sector is a key priority. We do have relevant expertise and resources…..we are a EU funded collaborative initiative" [ID20]
6	The effect of technology development on the relationship between the breadth of openness and reach	"We are a member of the international non-profit association called N. We work closely with members, comprising industry players, research organizations, universities and safety authorities to improve the safety, reliability and efficiency of nuclear power plants…..Obviously once the relevant technologies are developed, these benefit several countries across the word" [ID20]

Note: Numbers in the table correspond to those in Figure 6