Lead users, suppliers, and experts: The exploration and exploitation trade-off in product development.

Abstract

We develop a theoretical framework that explains how lead users, key suppliers, and product experts play into the exploration and exploitation trade-off, and how their changing roles supports the development of their ideas into marketable solutions. We explain that close collaboration with product experts, suppliers and lead users supports exploitation, as it tends to support the development and improvement of existing products. Irregular or non-systematic collaboration with lead users, on the other hand, supports exploration by providing ideas for entirely new products. Furthermore, our theoretical framework argues that the changing role of the external agents increases their understanding of the products they help to develop, supporting a process of exploration and exploitation. This learning process supports the technical abilities of the lead user group in particular, who can then use their newly acquired knowledge to further modify existing products and introduce new ones to meet their needs. At the same time, this process educates internal staff, suppliers, and product experts about the use of the product, which then enhances their ability to develop new and marketable ideas.

Our proposed theoretical model has several implications for lead user theory and for product development managers seeking to enhance the development of new products and solutions, which we discuss at the end of the paper.

Introduction

Expensive and novel technologies and the rapidly changing nature of consumer needs have resulted in a constant demand for new ideas. Organisations typically aim to improve performance in this area by focussing on two dimensions of product development. The first (exploration) relates to the development of entirely new product lines, whereas the second (exploitation) pertains to the improvement of existing ones. Given the limited resources with which organisations have to operate, organisations and product development teams must find the right balance between these two dimensions. These seemingly contradictory trends have driven the development of several theoretical models and practical approaches, which aim to address the trade-off as efficiently as possible.

One approach that has been explored by both product development practitioners and academics relates to the systematic pursuit of ideas that originate outside an organisation's boundaries (Kotler et al. 2009). The literature increasingly acknowledges the role of external sources or "agents", as we will refer to them in this paper, in the development of new products. Such agents can include customers, suppliers, product experts, lead users (von Hippel and Katz 2002; von Hippel 2005) and even competitors. External agents can expand the pool of new ideas thereby increasing the possibility of developing products and services to meet market needs. At the same time, these agents can act as innovators providing the organisation with already developed and often marketable ideas.

The basic premise of this approach is that as internal development teams are entrenched in the management, and are invested in the improvement of existing procedures, their ability to produce a large number of new ideas is relatively limited (Benner and Tushman 2003). They tend to focus on improving existing product lines, often at the expense of the introduction of riskier new products. At its extreme focusing entirely on the existing procedures and existing

markets can lead to loss of performance and business failure (Christensen 1997). Sources external to the organisation, on the other hand, can potentially provide a pool of useful and relevant ideas (Rindfleisch and Moorman 2001; Salter and Gann 2003). Some of these ideas can provide improvements to existing products and product lines, whereas others can generate entirely new products and even new business (Shenhar et al. 1995). External sources of ideas could therefore support one or both dimensions of product development. That is, external agents can contribute not only to incremental innovation, which may be seen as a relatively safe way of improving existing offerings and gradually improving financial performance (Adams 2009), but also to more radical innovation in which entirely new products are introduced (McCarthy et al. 2006). Managing this trade-off and achieving the right balance between introducing entirely new products and the improvement of existing ones can provide the organisation with a more sustainable competitive advantage. Famously, Apple has been able to continuously and successfully improve the performance of its iPod product series while introducing entirely new products such as the iPhone (Economist 2007) and later the iPad. Despite the intuitive appeal of this argument, and the potential practical implications of knowing the parties and mechanisms that can best support each dimension of product development innovation, there has been little empirical and theoretical work in this area.

A similar discussion about the trade-off between new alternatives and the refinement of existing products and procedures can be found in the organisational learning literature (Benner and Tushman 2003; Gilsing and Nooteboom 2006). In his seminal paper, March (1991) defined *exploration* as relating to those things that are captured by *search, variation, risk taking, experimentation, play, flexibility, discovery, innovation* (March, 1991, p.71). On the other hand, he defined *exploitation* as relating to terms such as *refinement, choice, production, efficiency, selection, implementation, and execution* (March, 1991, p.71). Within

the context of product development, therefore, exploration would relate to the introduction of an entirely new product, whereas exploitation would relate to the continuous improvement of an existing line or process (Benner and Tushman 2003). March (1991) further argued that refining exploitation would lead to benefits in the short run but be destructive in the longer run. Follow-up articles have largely confirmed and further investigated this hypothesis (McCarthy and Gordon 2011).

As with product development, managing the trade-off between exploration and exploitation is likely to depend on the nature of ideas that are being developed by the product development team. Ideas that seek to improve existing products are more likely to support exploitation, whereas ideas for entirely new products would support exploration. Understanding the mechanisms through which ideas are developed into new products would, therefore, also help understand and balance the trade-off between exploration and exploitation.

In this paper, we aim to advance the literature by addressing the above gaps. More specifically, we aim to explain (a) how agents external to an organisation's product development interact with each other to develop their ideas into marketable solutions, and (b) how such agents support the trade-off between exploration and exploitation. To do so, we propose a theoretical model, which aims to explain how learning and open information sharing in communities external to the organisation feed into the product development process. Our main premise is that information is being shared in communities outside an organisation through an iterative learning process, which centres on the changing roles of agents.

We define such *agents* as any individuals or organisations external to the focal organisation's product development process who have an interest in developing its products. We explain this model by focusing on the interaction between three groups; product experts, key suppliers, and lead users. *Product experts* are external product development partners who

have a commercial interest in the development of a new product (Tsinopoulos and Al Zu'bi 2012). *Key suppliers* are suppliers with similar or superior technical capabilities whose interests do not conflict with those of the buyer firm (Littler et al. 1995; Sako and Helper 1998). Finally, *lead users* are a subset of product users with three distinct characteristics. First, they experience needs unknown to the average customer. Second, they benefit greatly if they obtain a solution to these needs (von Hippel 1986). Third, lead users have technical expertise which they utilise creatively to find solutions to those needs (von Hippel 1988; Luthje et al. 2002). Lead users are therefore *creative consumers* who will use their own innovative approach to provide new solutions, often unknown to the manufacturer (Morrison et al. 2000; Luthje and Herstatt 2004). As we explain later in the paper in more detail, this is not an exhaustive list of agents as there are several additional ones external to an organisation and could include competitors, legislators, customers, *etc.*

We have chosen to study these three groups for two primary reasons. The first relates to the similarities between the three groups. As we explain in more detail in the next section, the three groups share some common characteristics, such as technical expertise, which makes them ideal for the development of new products. The second relates to the immediate impact that these groups of users have on product development. Previous research has indicated that collaborating with these groups is likely to have a significant impact on an organisation's ability to innovate (Petersen et al. 2003; Koufteros et al. 2005).

User innovation

Recent work on user innovation, creative consumers (Berthon et al. 2007), and open innovation more generally (Chesbrough 2003) has explored the impact that it may have on an organisation's ability to create successful products. In the last two decades several seminal articles have explained how users can provide sources of new marketable ideas (von Hippel 2005). Such articles have introduced the concept of lead users as a group of customers and

have introduced the concept of *lead users* as a distinct group of users with characteristics different to those of leading or most important customers (Franke et al. 2006). Such ideas have been developed in several industrial contexts and have more recently included services (Oliveira and von Hippel 2011). Comparative work has also identified that the impact of such users on the product development performance is likely to be superior to that of other external agents including suppliers (Al-Zu'bi and Tsinopoulos 2012) and product experts (Tsinopoulos and Al Zu'bi 2012). There is therefore a consensus emerging in the literature about the innovative characteristics of users and the potential impact on product development success.

From a practical point of view, regardless of what the source of innovation is, the responsibility of finding ways of capturing any ideas and to make decisions about their potential success in the market remains with the product development and marketing teams. As with other sources of innovation, lead users' ideas still have to be evaluated for their feasibility, risk, and potential return on investment (Berthon, Pitt et al. 2007). Exploring how lead users interact with other external innovation sources and how they support exploration and exploitation can therefore help product development and marketing teams appreciate the value of integrating them into their idea generation processes.

Product experts, lead users, suppliers and exploitation

In this section we explore how the three agents of interest can support the development and exploitation of ideas, which in turn support the improvement of existing products. We argue that close collaboration with these three agents will lead to the incremental improvement of existing products and thus support exploitation.

One characteristic shared by all three agents relates to their technical expertise. As we explain in this section, encouraging forms of collaboration between the three agents that focus on harnessing this expertise is likely to result mainly in the improvement of existing products. The suppliers' technical expertise can provide a forum for the evaluation and improvement of

ideas and products during both the early and late stages of the product development process (Millson, Raj, and Wilemon, 1992). Similarly, product experts possess specific knowledge about relevant technologies (Haeussler et al. 2012) as well as the market and competitive dimensions of a product (Moorman et al. 1992). Product experts support product development teams by advancing existing products and ideas, addressing questions and providing information that would otherwise take the internal staff much longer to solve (Haeussler, Patzelt et al. 2012). Because product experts profit from an in-depth understanding of the market, collaboration with such experts can reduce the time a firm spends on marketing research (Harhoff et al. 2003).

Both product experts and suppliers are likely to participate in distinct stages of the product development process, with specific and measurable contributions, i.e. they will need to meet specific requirements within preagreed timescales and budgets. As has also been explained by McCarthy and Gordon (2011), imposing such measurable targets provides a feedback control orientation that generates or enhances exploitation. Product experts' and suppliers' contribution will thus focus on aspects of the product under development rather than on the introduction of an entirely new one. Their contribution is therefore likely to refine an existing idea or product and thus support exploitation.

Close collaboration may also give suppliers the technical autonomy to invest in and develop subsystems that can then be used by a buyer during the final assembly (Kamath and Liker 1994). Modularity enables standard and common parts to be combined in various ways that can then form the basis for a product family (Sawhney 1998; Ramdas and Sawhney 2001)**.** Increased modularity should lead to a higher number of products in a product family (Alford et al. 2000; Halman et al. 2003)**,** and thus help improve an organization's existing products.

From the above discussion we can conclude that the external agents' characteristics support the incremental improvement of existing products. First, they have technical expertise

relevant to the focal company's products. In all three cases, the agents use this expertise to modify existing products. Second, they are able to contribute to the development of products as they can provide ideas for their improvement, addressing new and existing needs. Supported with their technical expertise the contribution of all three agents in the development of new products relates to change and continuous improvement. This leads us to our first proposition:

Proposition 1: When agents act as product experts or key suppliers in product development they encourage exploitation. Close collaboration with these agents will help improve existing product lines.

Lead users' technical expertise is also likely to be used in a similar way when they are closely integrated in the product development process. In such a situation, lead users' ideas are likely to be based on improvement and modifications to existing products. A formal integration process, such as the one explained my Lilien *et al.* (2002), is more likely to guide lead users towards improvement of products, which are already available. For instance, the steps of goal generation and team formation could encourage the development of specific boundaries within which new ideas will be developed. Such boundaries and predetermined processes are known to limit the participants creative abilities (Bonner et al. 2002) and hence limit the potential for generating entirely new products.

In-house product development teams aim to integrate relevant expertise from across an organization in order to improve decision-making and generate new products (Cooper and Kleinschmidt 1993). The process of doing so is typically characterised by a specific set of decision making points or "gates" at the end of each developmental stage, allowing staff to evaluate progress and ensure that the firm's objectives are being met (Cooper 2001). Such decision-making requires market data and information regarding technical specifications, product performance, and rates of customer approval. Highly integrated in-house product

development teams can efficiently utilise such information and streamline the development process, helping to avoid costly mistakes and thus reducing overall costs (Al-Zu'bi and Tsinopoulos 2012; Tsinopoulos and Al Zu'bi 2012).

Lead users, by definition, are a unique group of consumers who possess specific needs that are unknown to the wider public, and benefit from helping to find a solution to those needs (von Hippel 1986). They possess technical knowledge relevant to the focal organisation's products (Morrison *et al.*. 2004). They are likely to have gradually acquired this knowledge through iterative attempts to satisfy their own needs. Product development team members, on the other hand, have been employed by the organisation because of the knowledge and experience they have gained. Although their motivations may vary, the technical knowledge relative to the product is likely to be similar between the two groups. Sharing this knowledge could help to improve products with which both product development teams and lead users are familiar.

Our previous work has examined how integrating lead users with in-house product development teams benefits the firm in several ways, including lowering costs, increasing product variety, and increasing the speed with which new products are developed (Al Zu'bi and Tsinopoulos, 2012). The main argument has been that product development teams are able to better understand the lead users' requirements. Furthermore, lead users can provide partially-, and sometimes even fully-developed solutions to these requirements making the development of any new product less risky.

Effective integration of lead users into the product development process would require the acquired knowledge (developed by the lead users) to be similar to internally-developed knowledge (developed by product development teams). Put differently, it would require the absorptive capacity of the focal organisation to be high (Lane and Lubatkin 1998). Taking this argument further would suggest that systematic integration of lead users will lead to

improvement of existing products for which knowledge is already available, at the expense of entirely new products, where entirely new knowledge would need to be developed.

The above leads us to our second proposition:

Proposition 2: When agents systematically act as lead users in product development they support exploitation. Close collaboration with lead users will help improve existing product lines.

Lead users and exploration

Despite the similarities between the agents, there are some significant differences that distinguish the inputs and contributions of each group to the product development process. One such difference relates to the nature of these agents and their closeness to the customers. Lead users also function as customers, and thus they are in a unique position to design products that are closely aligned to consumer needs (Berthon et al. 2007). As they have a genuine interest in creating a product that best suits their needs, they are motivated by factors other than profit (Franke, von Hippel et al. 2006). As a result, the solutions they can provide are generally considered less-risky than those that result from the use of in-house product development teams (Kessler and Bierly 2000). Therefore, firms who are able to identify and utilise lead users will not only reduce the product development costs incurred by marketing departments (Tsinopoulos and Al Zu'bi 2012), but are more likely to avoid investing in products that are unwanted in the marketplace (Swan and Allred 2003).

A second key difference relates to their motivation and the regularity of their involvement in the product development process. Product experts' and suppliers' motivation is likely to be linked with monetary compensation. The role of product experts is to provide expertise – whether technical or consumer-related – during the product development process in return for compensation. Although product experts may have some intrinsic motivation associated with

their job satisfaction, their relationship with the product development team and focal organisation more generally, is likely to be contractual. Product experts are more likely to be concerned with establishing a long-term, measurable (McCarthy and Gordon 2011), and profitable relationship with the firm than with increasing product development speed (Tsinopoulos and Al Zu'bi 2012). Suppliers' relationships with the focal firm are also likely to be contractual, with an added motivation being the business benefits of the relationship. Lead users' actions, on the other hand, by definition, are driven by own needs. Because lead users are customers with an interest in improving or developing a product for their own personal use, they will act to accelerate the product development process so as to benefit from such products as soon as possible. Furthermore, because lead users can express their needs and suggest solutions to product development teams without having to specifically articulate them, their information can be processed more quickly than that of product experts, who must transfer clearly explained knowledge amongst various people throughout different stages of the product development process (von Hippel 1994).

A third difference relates to the nature of involvement with the product development process. Suppliers' and product experts' involvement is likely to be temporary, and be prescribed by a contract which focuses on specific aspects of the new product development process. Lead users' involvement, on the other hand, is likely to be more long-lasting, although still irregular, and is unlikely to be codified by a contract. In fact, as we have previously observed (Tsinopoulos and Al Zu'bi 2012), asking lead users to operate under a contract would probably lead to a longer-term loss of their innovative abilities within the context of the given products. Lead users' motivation and ideas are driven by their own needs, which would be difficult to predetermine and codify into a contract.

From the above arguments we can conclude that longer term but irregular collaboration with lead users will improve the ability to introduce entirely new products. Therefore, our third proposition is:

Proposition 3: When agents act as lead users in the product development process but their collaboration is irregular they encourage exploration. Non-systematic collaboration with lead users will support the development of entirely new products.

One important aspect of the preceding discussion relates the ability of organizations to identify the lead users of their products. Advocates of a formal integration of lead users into the product development process argue for a four stage process which comprises goal generation and team formation, trend research, pyramid networking, and workshop and idea generation (Lilien et al. 2002). Although the development and integration of such a formal process with current product development processes is relatively rare (Olson and Bakke 2001), informal processes for identifying and integrating ideas from this group of users are frequently employed, as evidenced by several studies which have explored these groups in various industrial contexts (Herstatt and von Hippel 1992; Luthje, Herstatt et al. 2002; Franke and von Hippel 2003; Morrison et al. 2004; Franke et al. 2006). In the above arguments we therefore consider that such users are formally and informally used during the product development process.

The changing roles of external agents

In the previous sections we have explained the impact the involvement of lead users, suppliers and product experts has on the trade-off between exploration and exploitation. In doing so we have assumed that each of these agents is distinct from the other. In this section, we relax this assumption to explore how changing roles between lead users, suppliers, and product experts can affect the product development process. We argue that by relaxing this

assumption, the trade-off between exploration and exploitation can be better understood and potentially overcome.

In line with our assumption, previous literature has, in general, dealt with external members of product development processes as individuals or organisations with relatively constant roles (Reger and Schultz 2009). A supplier would therefore remain a supplier, whereas a product expert would remain a product expert. Adopting such an approach has several merits. One relates to the relative ease by which the characteristics of these members can be examined. As a result, previous studies have defined very precisely what a supplier or a product expert is and then tried to explore how their contribution affects the product development process (Petersen, Handfield et al. 2003; Koufteros et al. 2007). Another merit associated with assuming that agents are distinct from each other relates to the clarity of roles and contributions. As a result, the motivations of the various individuals for being involved in the product development process are well known. Suppliers are motivated by increased product sales, product experts are involved to sell more of their services and possibly to gain competitor knowledge, and lead users to satisfy their own needs.

Despite these benefits, considering such external parties as constant entities can break down in the longer term. It is very feasible to assume that roles might change as the context in which agents operate also changes. For instance, an engineer who works for a company that is involved in the development of a new product as a supplier or a product expert may also act as a user of that same product. As a supplier, he will contribute to the product development process within the boundaries set by the contractual agreements agreed by his employer. As a user, he will aim to satisfy his own needs. If he chooses to use his skills to modify the product to meet new needs he will become a lead user of that product. Focusing, therefore, on one of the roles that an individual could limit the ability to understand all the avenues through which ideas developed by lead users drive product development processes.

The emergence of powerful computing technology, standardised design languages and low cost communications has enhanced the capabilities of individual designers and support distributed collaborative design projects (Baldwin and von Hippel 2011). External agents are therefore gaining the ability to connect with each other and develop ideas that are not necessarily controlled by an organisation and are certainly not following the waterfall stage gate process. As a consequence, communication boundaries across different agents are becoming less significant. At the same time, suppliers are also likely to make use of lead user innovation or to be lead users themselves. As has previously been reported in several case studies in the sports industry (Schreier and Prügl 2008), new product innovations developed by lead users have then been commercialised by a manufacturer or a supplier to a manufacturer. Such developments, however, are not necessarily being adopted by manufacturers of the existing products in the first instance, but by parts manufacturers. For instance, modifications in wheel design are often first developed by wheel specialist suppliers (such as Germany's BBS) of some of the larger automotive manufacturers (de Saint-Seine 2006) before they are later integrated into the original vehicle design. Similarly, a motorcycle enthusiast who makes a modification to his or her bike may generate a potentially marketable product. As this modification is at its early stage, it may not be significant enough for the motorcycle manufacturer to alter the design of the motorcycle. However, a parts manufacturer could adapt their products to accommodate the new idea and potentially meet the new market demand.

Given the open communities within which users innovate, it would also be reasonable to expect that members of the suppliers' staff can also take part in innovation activities outside their formal roles. Put differently, members of the suppliers' staff can themselves act as lead users. For instance, teams of engineers and designers of vehicles often include car

enthusiasts developing innovations during their spare time and networking with groups of other potential lead users.

From the above, we can conclude that the instances of innovation of various agents both within and outside an organisation's boundaries cannot be easily controlled by systems and processes associated with the traditional product development process. Suppliers, product experts, and company employees can adopt different roles at various organisational and social contexts and develop formal and informal networks that may resemble organisational structures. The argument we make here is that as agents' roles are changing in different organisational contexts, they develop organisational learning processes that address the exploration and exploitation trade-off.

This leads us to the fourth and final proposition of the paper:

Proposition 4: The process of changing roles of agents between lead users, product experts, and suppliers facilitates the flow of ideas from lead user groups to product development teams. This process can support both exploration and exploitation of new ideas.

Conclusions

In this paper, we set out to explain how agents external to an organisation's product development process interact with each other to develop their ideas into marketable solutions, and how they may support the exploration and exploitation trade-off. To meet these aims, we developed a theoretical framework that explained how lead users, key suppliers, and product experts can support the development of the product development process in terms of introducing entirely new products and supporting improvements to existing ones. Our framework suggests that close collaboration with the three agents will help improve existing product lines and as a result support exploitation. A summary of this framework is depicted in Figure 1:

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INSERT FIGURE 1 ABOUT HERE

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Close collaboration between an organisation and its external agents is likely to follow the product development team's rules and assumptions. The agents' ideas, including those of the lead users, are likely to be assessed using criteria and techniques similar to those used to evaluate ideas originating within the organisation. As explained by previous literature, implementing such rules may restrict the ability of individuals to innovate (Bonner, Ruekert et al. 2002), limiting their ability to introduce entirely new products.

Lead users' characteristics, on the other are hand, are such that they could help support the development of entirely new products. The relevant literature includes several such examples, particularly in the sports industry (Schreier and Prügl 2008), where lead users can help the development of entirely new products, and even entirely new industrial sectors. Our arguments in this paper, however, suggest that this can be the case when collaboration is irregular. Creative individuals become lead users when they try to use their skills to meet their own needs (von Hippel 1986). Identifying the need is therefore at the core of their creative behaviour. As such needs are probably going to arise irregularly, they will be able to support exploration only at similar irregular intervals.

From the above discussion, product experts, key suppliers, and lead users can, in different situations, support exploration and exploitation. Our final concluding point relates to the changing roles of these agents over time and their impact on the exploration and exploitation trade-off (March 1991). Our thesis here has been that the roles of these agents will change in different contexts. As their roles are changing they undergo a learning process that can support both exploration and exploitation. Taking into consideration these changing roles, agents are not supporting exploration and exploitation as two inconsistent organisational

states (Gupta et al. 2006). Rather, they do so as a continuous process of learning where close collaboration supports improvement and irregular collaboration, particularly with lead users, leading in turn the introduction of entirely new products.

Managerial Implications

Our propositions can provide some explicit guidance to product development and marketing managers aiming to embark on supply chain integration programmes. One relates to the impact of key suppliers and product experts. In line with previous relevant literature, our arguments would recommend that close integration would improve performance as it will help test and improve existing ideas. We would, however, recommend not integrating lead users closely into product development processes, as we anticipate that the performance improvements of doing so would be marginal. Instead, we recommend the identification of lead users who are able to modify existing products. Opportunities for entirely new products will arise when such users have new needs and provide novel solutions for them.

Future work

There are three avenues for both theoretical and empirical work as a direct result of the propositions we develop in this paper. The first relates to empirical testing of these propositions. Given that a significant element of the paper relates to the changing roles of agents, any empirical study would need to closely follow the product experts, key suppliers or lead users to explore how they change their roles and how they learn from this process.

A second and related recommendation relates to further exploring the interplay between exploration and exploitation and the effect of lead user theory and open innovation more generally. Recent theoretical frameworks have challenged the existence of a trade-off

between exploration and exploitation (Farjoun 2010) and have explained that this may also depend on the rate and direction of technological change (McCarthy et al. 2010). Our approach here supports the view that there is an interplay between exploration and exploitation (Gupta, Smith et al. 2006) aided by the changing roles of agents. Future theory could be developed to explore this argument in more depth.

A third avenue of future research relates to the impact of collaborations with the agents we examine in this paper on business success and failure. One of the main premises of this paper relates to how an organisation can introduce new product by making effective use of idea from external agents. Christensen, (1997) has explained how small and unconventional users have generated significant and disruptive changes in incumbents' products and markets. Our theoretical framework could therefore be extended to explain innovations from lead users or other agents can prepare an organisation for such disruptive changes.

Finally, we would encourage future work to include additional external agents, such as competitors and entrepreneurs. We have limited our discussion to product experts, key suppliers, and lead users. Including additional agents would help further develop the arguments we make here and explain how lead users can support the overall organisational learning process.

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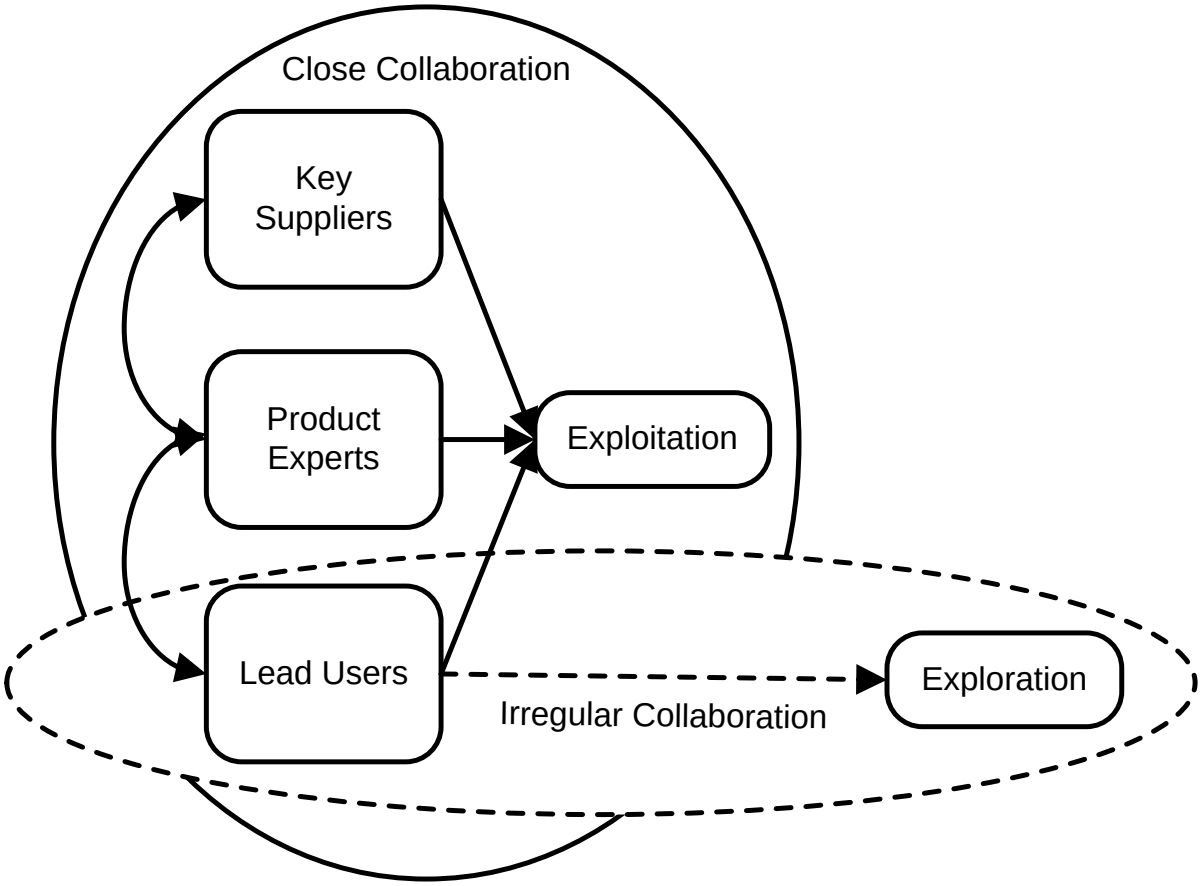

Figure 1 Summary of theoretical framework