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## Introduction

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“Coming together is a beginning, staying together is progress, and working together is success.”

– Henry Ford

## 1 Introduction

As complexity arises, agents – whether academic or not – are called upon to make a mighty effort to rejuvenate their ability to innovate. In so doing, they try to react to the serious challenges the competitive arena poses, shifting towards more collaborative strategies; this may allow them to adapt, profit and survive (Chesbrough, 2003). However, collaborative creation and development (CCD) efforts (Ramaswamy and Guillart, 2010) entail particular differences, depending on the ways agents move along the innovation continuum: they may indeed decide to pursue a specific degree of innovativeness (Garcia and Calantone, 2002; Baregheh et al., 2009), orienting their efforts towards the incremental or radical extreme. Each of the two extremes forces agents to think differently in terms of the quality and quantity of the innovative outcome, time frame requirements, and level of incertitude (Stirling, 2007). Indeed, in radical innovations, the notions of novelty and originality are highly demanding (Arts et al., 2013); multiple-heterogeneous agents are usually involved along different trajectories (Verganti, 2009), making the innovative effort longer due to lack of alignment; and, among the different categories of ‘incertitude’, agents seem further away than the more familiar category of risk (Stirling, 2007).

To the best of our knowledge, surprisingly little research has gone into understanding the significance of contrasting the diverse alliance portfolio for agents’ radical and incremental innovative performance with the categories of incertitude (e.g., Kang and Kang, 2010; Aguilera et al., 2012; Oerlemans et al., 2013).

In this paper, collaboration refers to joint work able to leverage differences in knowledge, skills, and resources in order to develop innovative, synergistic solutions to complex problems agents cannot solve on their own (e.g., Verganti, 2009). Some agents create what Verganti (2009) calls the design discourse, helping them to create new languages and new meanings without necessarily being user-centred. A more refined view of the discourse is provided by Hardy et al. (2005): collaboration represents a complex set of ongoing communicative processes among agents who act as members of organisational hierarchies, which remain separate. Such a discourse can be enacted in different ways, depending on the breadth dimension, which is defined as the number of partners involved. The term discourse should emphasise not only the quantity of partners involved, but also their quality, referred herein as diversity. The latter can best be characterised in terms of the non-spatial proximity characteristics of partners (Aguilera et al., 2012). All these characteristics can coalesce in the more generic concept of knowledge base.

In this paper, three levels of diversity will be referred to: high, meaning that partners who are going to be involved in the collaboration setting share very different knowledge bases from that of the agent who decides to start the collaboration; low, at the other end of the spectrum, meaning that partners who are going to be involved in the collaboration

setting share very similar knowledge bases with the agent who decides to start the collaboration; or moderate, meaning all the plethora of potential partners who are not so different, but at the same time entail a considerably different knowledge base.

On the basis of these two dimensions – breadth and diversity – a theoretical framework is advanced and explained in the light of the special issue contributions.

The remainder of the article provides a more detailed description of what is meant by innovating at the two extremes of the innovation continuum; then, a review of the most important contributions informs a discussion of the importance of doing things together and sizing up the process in order to achieve effective collaboration. The implications of the four papers invited to the special issue presented at the 15th International CINet<sup>1</sup> Conference in Budapest (Hungary) are discussed in the light of the framework proposed. Conclusions and avenues for further research are outlined in the last section.

## 2 Characterising the innovation continuum

A substantial part of the literature tends to pinpoint a number of product and service innovations at one of the two extremes of the innovation continuum: radical breakthroughs or incremental improvements.

Notwithstanding this polarisation, many new products and services fall into neither extreme category but somewhere in between (Tidd et al., 2005; Baumol, 2010). The degree of innovativeness can accordingly be described as the degree to which an output, whether or not it is material (Verganti and Öberg, 2013), represents a significant departure from existing technologies and their corresponding products or services in larger society (Marvel, 2012). Overall, the degree of innovativeness can be effectively comprehended through a number of definitions advanced in the literature of both management (Garcia and Calantone, 2002) and evolutionary economics (Nelson and Winter, 1982).

However, all these scholars tend to use this notion without reference to either antecedents or consequences. According to Murmann and Frenken (2006), in fact, innovations may be defined in either terms of their antecedents (sense 1, i.e. the scope of new knowledge required) or in terms of their consequences (sense 2, i.e. the increased performance they make possible). Given these two different dimensions, an innovation may be:

- incremental on both sides (*incremental<sup>2</sup>*), purely exploiting well-established technological trajectories
- radical on both sides (*radical<sup>2</sup>*), having the potential to reshape entire industries and open up new technological paradigms
- incremental in terms of the new knowledge required but radical in terms of the additional performance achieved (*incremental s<sub>1</sub> × radical s<sub>2</sub>*)
- radical in terms of the new knowledge required but incremental in terms of the additional performance achieved (*radical s<sub>1</sub> × incremental s<sub>2</sub>*).

### **3 The rise and importance of collaborative innovation**

In an era of the global scale and the knowledge-based economy, the complex and multifaceted nature of modern developments in innovation forces agents to expand and open up their horizons towards involvement in collaborative behaviours (Chesbrough, 2003; Deck, 2004). In this way, different agents' resources and capabilities can be optimally combined, thus creating significant reductions in R&D expenditure and time-to-market. Also, advances in technology make effective CCD – and the integration it demands – wholly feasible (Deck, 2004; Ramaswamy and Gouillart, 2010).

The most comprehensive definition of CCD is provided by Deck (2004): in a collaborative development partnership, two or more independent agents work together to design and release a new product development, service, or technology for mutual benefit. Such partnerships share the following characteristics:

- the parties interact closely over a period of time
- all parties are willing to invest in each other to achieve their mutual goals
- all parties stand to benefit from the success of the partnership.

Although many managers talk about their desire to engage in increasingly broader networks of partnerships, it emerges that doing so is exceedingly difficult and that failures are frequent (Ariño, 2003). One of the causes of such failures is due to partner selection (Cowan et al., 2007). An optimal situation of collaboration between partners requires at least the presence of non-competing goals and compatible cultures, which support future communication, knowledge sharing and reciprocal exchange of information (Chesbrough, 2003).

Despite the large and still growing literature on technological collaboration, the picture is still somewhat hazy when it comes to trends in the numbers of collaborations, their focus and form, and their technological basis and strategic nature.

### **4 From dimensions to dynamic configurations**

#### *4.1 Dimensions: breadth and diversity*

Due to the increased speed and sophistication of technological change, a single alliance or partner type is unlikely to provide all the necessary solutions (Aguilera et al., 2012). What allows agents to cope with such complexity is involvement of a number of different external sources or search channels, a dimension that Laursen and Salter (2006) define as breadth. Bonesso et al. (2011) argue that, especially in exploratory projects, focusing on external sources has a two-fold effect:

- a they encourage divergent thinking for the generation of novelty
- b they increase the possibility of accumulating knowledge in heterogeneous technological fields.

However, the decision whether to involve a few or many partners also depends on the opportunities a company faces, based on its position in the opportunity landscape; the ‘key/complementary’ capabilities at play (the company that has the key capability to go ahead developing the opportunity identified will automatically be entitled to drive the collaborative development process); the locus of control.

According to Prahalad and Ramaswamy (2004), patterns of interaction among the key agents can be different. However, the more these interactions are pushed towards involving multiple agents, the more complex the interaction itself will be (because of the rising complexity of the network); the other side of the coin being that opportunities for creation of unique value also increase.

Breadth might then be considered a necessary but not a sufficient condition for innovation, which also depends on the quality of the partners. To this end a second dimension is introduced: diversity. Diversity might be thought of in terms of the non-spatial proximity characteristics of partners (Aguilera et al., 2012; Kang and Kang, 2010). It is a function of a number of variables belonging to the following macro-categories: cognitive, technological, organisational, social, cultural, and institutional. The lower the level of non-spatial proximity, the more distant and diverse the partners involved, and vice versa. Diversity in knowledge structures enhances the agents’ potential for innovation by providing an opportunity to make novel linkages and associations (Lin, 2011). On this point, a valuable perspective is provided by Faems et al. (2005): they investigate whether evidence can be found for the idea that inter-organisational collaboration supports the effectiveness of innovation strategies. It emerges that agents taking part in a very diverse network of inter-organisational collaboration are better equipped to create and market new or improved products and/or services. Adopting a more exploration-oriented perspective, Christensen and Overdorf (2000) convincingly argue that collaboration with suppliers and customers will not be helpful in supporting innovation projects of a more novel nature.

According to these authors, customers and suppliers – which in our model would be considered the closest potential partners in terms of non-spatial proximity characteristics – often have an interest in preserving the status quo and tend to preserve the dominant role of existing technologies and competencies by developing them further. On the other hand, collaborations with universities and research institutes – which in our model would be considered the farthest potential partners in terms of non-spatial proximity characteristics – are considered to be of a more explorative-oriented nature. Collaboration with such partners focuses on the creation of insights relating to new technologies that might eventually be translated into commercial development (George et al., 2002). In the same vein, Datta and Jessup (2013) advance the ‘exterior sourcing’ construct, i.e. tapping innovation outside the focal industry. For other types of partner, no straightforward diagnosis in terms of exploration or exploitation seems plausible. The contribution of the literature is ambiguous in this area (Faems et al., 2005), and so we will refer to this zone as the grey zone.

#### 4.2 Configurations: from local to discursive search

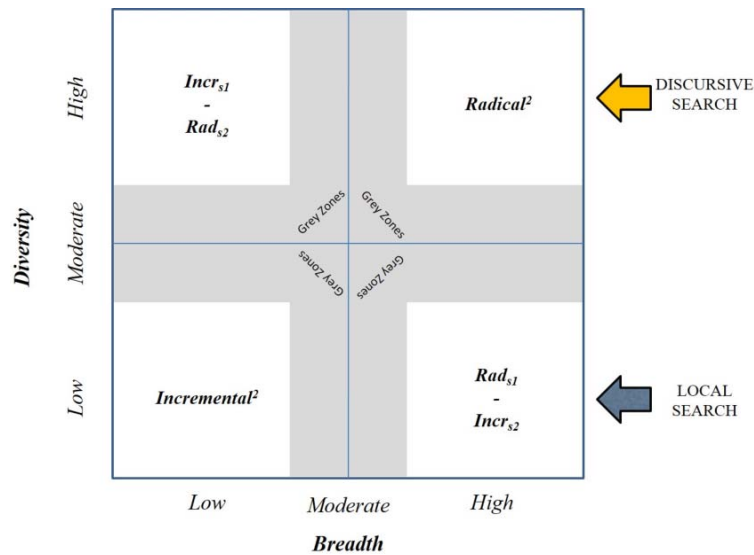
The two dimensions discussed above, along with their underlying categories, allow us to clearly identify four configurations in which agents may potentially be grouped, and their innovative outcomes in terms of antecedents and consequences (see Figure 1):

- *Incremental<sup>2</sup>*: if agents collaborate with few very ‘close’ partners, i.e. having almost the same knowledge base, then the chances of accomplishing a certain degree of radicalness on both sides ( $s_1$  and  $s_2$ ) are very low. We will therefore have *incremental- $s_1$  × incremental- $s_2$*  innovations (*incremental<sup>2</sup>*). This is a strategy in which the only category at play in Stirling’s framework is that of risk, as actors have a sufficiently well-defined set of outcomes (knowledge about outcomes) and a shaky basis of probabilities (knowledge about likelihoods). This strategy entails very short time frames.
- *Radical- $s_1$  × Incremental- $s_2$* : if agents engage in a one-to-many collaboration, which is however also intended to decrease levels of uncertainty and risk, while reducing time to market, the probability of obtaining an impactful innovation is low, despite the chances of creating a productive conversation which might even result in original recombination of knowledge. Time frames are so constrained from the beginning that this conversation would not deepen any original perspective. It is also low probability because the knowledge bases are very similar. This is much like LOCAL SEARCH behaviour, in which an agent’s R&D activity is closely related to the same agent’s previous R&D activity, creating incremental innovations and becoming increasingly expert in its current domain (Nelson and Winter, 1982). This is a situation in which there is at least a shaky basis for formulation of probabilities (knowledge about likelihoods), but a poorly defined set of continua and/or discrete outcomes (knowledge about outcomes). This strategy classifies as a context in which fuzziness prevails.
- *Incremental- $s_1$  × Radical- $s_2$* : if agents decide to collaborate with few very different partners, the chances of obtaining an original recombination are low because the risk of getting stuck in an average solution is very high. There is not enough cross-pollination of a wide range of ideas to permit these few diverse actors to create something revolutionary. This does not mean that they cannot create impactful innovations, but this impact will not be sufficient to reshape the industry or create new meaning (Verganti and Öberg, 2013). To trivialise, the two agents will just use the few things they need in order to make a particular project work, but will not have strong incentives to put all their key assets on the table. This is a situation in which there is no basis for formulation of probabilities (knowledge about likelihoods), but a sufficiently well-defined set of continua and/or discrete outcomes (knowledge about outcomes). This strategy classifies as a context in which uncertainty prevails.
- *Radical<sup>2</sup>*: if agents decide to involve many diverse partners (possibly also connected to one another), the discourse becomes very lively, the conversation fruitful and original, and novel recombination of knowledge is very likely; as such, these innovations may turn out to be revolutionary. In this case, we might have a DISCURSIVE SEARCH. The resulting solution will be authored by the collective. The category of Ignorance applies to this strategy: this is a state in which there are neither grounds for the assignment of probabilities nor a basis for definition of a

comprehensive set of outcomes. Put at its simplest, ignorance is a reflection of the degree to which “we don’t know what we don’t know” (Stirling, 2007). There may also be a threshold: due to ignorance concerning likelihoods and outcomes, and due to the extended time frames it takes to set up and nurture these collaborations, the relation between the overall strategy adopted and the degree of radicalness accomplished will be an inverted U-shape (Oerlemans et al., 2013). Although it is true that diversity can be a key factor in the promotion of beneficial forms of innovation and growth (Stirling, 2007), it is also true that too much diversity becomes detrimental for even starting a conversation.

For the other types of partners there is no straightforward diagnosis. A grey zone is present (Faems et al., 2005): by collaborating with partners which are not so different, but at the same time entail a considerable different knowledge base, the (subjective) probability of obtaining radical rather than incremental innovations seems to be equal. This is a zone in which the majority of local optima may potentially emerge.

**Figure 1** Theoretical framework (see online version for colours)



### 4.3 Changing configurations and moving across dimensions

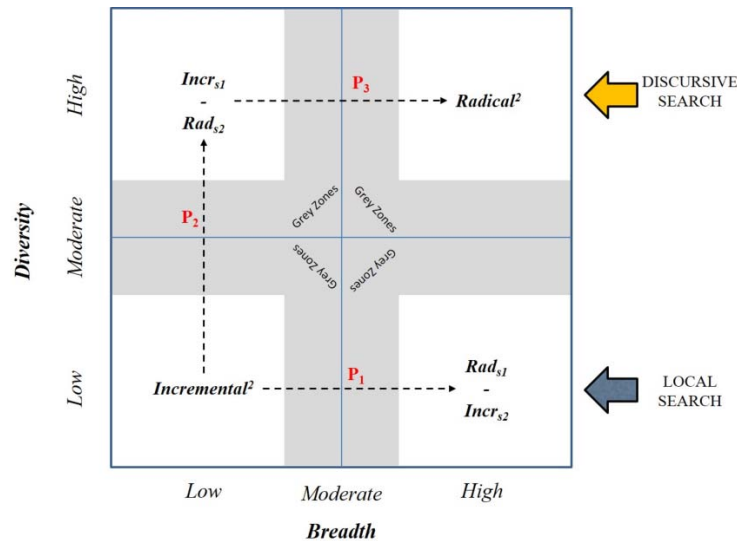
Having defined the five configurations, we may now identify and describe a number of paths. Assuming that a certain agent is currently collaborating with really close partners, thereby incrementally improving on their products/services (bottom-left quadrant), there are three paths for moving towards more potentially radical outcomes (see Figure 2):

- *Path 1 (P1)*: moving along Path 1 by involving multiple partners with more or less the same knowledge base implies achieving a configuration in which advantages can be accomplished, in terms of radicalness, only on the basis of antecedents. Such a transition will be ruled by an IC dominated by intelligent behaviours, in that the start and end points of the path are clearly visible. As path-dependency and former collaborative experiences do not imply revisiting the routine repertoire of the agents

in question, the inter-group transition may potentially occur in the short to medium term. The agent would then move from a situation in which the category of risk prevails to another situation in which knowledge of outcomes becomes fuzzy as increasingly more partners are involved; the quantity and quality of ideas would therefore cover a wider range. However, the ideas emerging from these collaborative efforts will coalesce within local search practices, this time entailing a more sophisticated local search routine. The probability of obtaining innovation with a certain degree of radicalness in terms of the antecedents (whilst being still incremental in terms of the consequences) is very high, conditional to undertaking P1, which means losing focus of the nature of the innovative outcomes that may be obtained, lowering the locus of control by democratising the generation process, and parallelising project management on the basis of how many former collaborations were in place before among the partners, giving form to a new network.

- *Path 2 (P2)*: if agents move through Path 2, this would entail entering the grey zone. Moderate time frames seem necessary, in cases of both low and high breadth, as the level of diversity of the partners involved is higher than in the former situations. Agents move towards areas in which traces of uncertainty and ignorance start to become intense: the uncertainty relates to a component linked with the difficulty of partnering with less close partners, together with a component linked to the result emerging from this collaboration. The latter makes the probability of obtaining radicalness equal on both sides, regardless of whether the agents undertake P2. Furthermore, when going through the grey zone, agents may achieve radicalness with low breadth (local optima), not seeing any incentive to enter more uncertain areas of collaboration. This is because the managerial mindset required to undertake this composite pattern is imbued with bounded rationality, even though companies use their intelligence and intuition in a balanced fashion.
- *Path 3 (P3)*: if agents decide to be much more open, they start a collaborative development with a few really ‘distant’ partners; we then have a conditional probability of achieving radicalness in the outcome. Afterwards, a second movement may be undertaken, depending on the ability of the agents to enter a domain in which any reference to the identification of likelihoods and definition of a clear domain of outcomes becomes extremely demanding. Moving towards *radical*<sup>2</sup> configurations implies long-term strategies in unknown domains, which for the majority of the agents may be untenable due to incomplete knowledge, contradictory information, data variability, conceptual imprecision, divergent frames of reference and the intrinsic indeterminacy of many natural and social processes. Finally, such a strategic move forces agents to rethink their routines, managerial mindsets, IC, position in a widely dispersed network, capability to align their business models, technological platforms, cultures, and languages. The innovative outcome of such a configuration is very difficult to attain, but highly rewarding in terms of radicalness as the density of (still few) globally optima solutions is higher.



**Figure 2** Collaboration paths (see online version for colours)

## 5 Overview of the invited articles for the special issue

The four papers included in this special issue offer important insights that further advance our understanding of inter-organisational and collaborative innovation perspectives. The four papers will be briefly introduced and explored in the light of the theoretical framework described above.

*Abrell and Durstewitz's* invited paper, 'The role of customer and user knowledge in internal corporate venturing: the viewpoint of the corporate entrepreneur', investigates the role of corporate entrepreneurship as a strategy for coping with the challenge of continuous innovation; to this end, they argue about the involvement of customers and users in the front end of innovation projects and study why they can be considered a driver for corporate entrepreneurship. The authors focus on a European business-to-business (B2B) manufacturing context in which listening to the voice of both customers and users is not common practice. Through a mixed research methodology (structured and semi-structured interviews with key informants, document analyses, design probes, co-creation workshops, data triangulation), the authors conduct an in-depth analyses of five sub-cases all referring to the same corporation, which employs more than 50,000 people worldwide and offers high-tech investment goods in a B2B environment.

The results show that the B2B manufacturing context in which the internal corporate venturing unit is situated has a significant influence on the use of customer knowledge and user knowledge. However, as this company is safety-conscious and risk-adverse, it does not allow corporate entrepreneurs to access customers in the early stages of internal

corporate venturing, but only to rely occasionally on their knowledge. A chronic lack of both systematic channels and a coherent vision for the exploitation of external knowledge sources may threaten the emergence of fresh and diverse ideas. In such a context, two types of corporate entrepreneurs are now emerging: *developer corporate entrepreneurs*, who typically play a role in the development process but pursue an initiative beyond their current role, and *user corporate entrepreneurs*, who are users themselves and develop their initiatives on the basis of their own needs. The former make reference to user knowledge while actually using customer knowledge, then neglecting the potential of its use and relying exclusively on what von Hippel (1998) defines as knowledge about solution possibilities. Instead, the second type of entrepreneur relies heavily on their user experience, and knowledge coming from the context of use is highly desirable for their products. Sticky knowledge is for them an invaluable source for engaging in new product development.

*Goto and Gemba's* invited paper, 'Implicit patent alliance acquiring the appropriability of innovation', touches on a fundamental topic in management studies: appropriability of innovation. They do this by first describing the nature, functioning, and conditions of what they define as an *implicit patent alliance* and then investigating its application in a case study involving inkjet printers. An implicit patent alliance neither possesses an agreed-on goal nor maintains control over the performance of assigned tasks. It works in situations in which few companies hold the essential patents and only cross-license them amongst themselves, without licensing to competitors who have no essential patent; a collection of these cross-licenses would work as a virtual alliance which can occupy essential patents. Implicit patent alliance creates appropriability of innovation thanks to occupation of essential patents even in markets where a product consists of many different patents.

The authors report on the case of the inkjet printer market, in which Canon, Epson and Hewlett-Packard applied this schema. While concrete evidence supports the statement that implicit patent alliance supports the appropriability of innovation, the authors take this one step further, identifying some major underlying factors:

- 1 alliance companies are able to maintain an exclusive position as essential patent holders
- 2 alliance companies are able to create a barrier to patent-infringing products.

And these factors significantly differentiate such a strategy from strategic alliances.

*Markowski and Dabhilkar's* contribution, 'Collaboration for continuous innovation: routines for knowledge integration in healthcare', pinpoints the influence of management on how routines are implemented and their role in recombining knowledge coming from a variety of actors. Specifically, the authors investigate how knowledge is integrated in search routines for innovation, and how search routines differ between contexts. They then develop a framework for analysing search routines for innovation, with a focus on empirical cases in clinical healthcare. The conceptual framework advanced by the authors emerges from an articulated discussion of routine antecedents (e.g., task aspects, knowledge aspects, cooperative aspects) and routine characteristics (e.g., how interaction takes place, how collaboration takes place, how the search for new knowledge takes place). The explicative power of this framework is a result of application of two cases, in which a distinction is made between *sequential care* (entailing structured problems about patient conditions in which the therapy is well-known and defined) and *iterative care*

(entailing unstructured problems concerning cases in which physicians are unsure how to proceed).

The results show that in cases of sequential care, incremental process innovations take place: new procedures are easily adapted to the existing ones, knowledge diversity is low, task interdependence is also low and, consequently, uncertainty does not appear. Finally, the collaborative process is interactive but limited in time. In cases of iterative care, instead, knowledge stemming from several different specialists must be integrated. Knowledge diversity is very high and since there are no standardised procedures, the level of uncertainty is very high. A dynamic process of collaborative interaction and problem-solving is instrumental for identification of the right care solution.

*Stefan and Bengtsson's* invited paper, 'Appropriability: a key to opening innovation internationally?', highlights the importance of opening the boundaries of organisations towards external sources of knowledge, and studies it from the perspective of the different types of intellectual property protection mechanisms (IPPMs). In their work, the authors distinguish between formal, semi-formal and informal IPPMs. They then investigate the appropriability-openness relationship, focusing attention on what kind of IPPM mechanism enables what kind of collaboration. Furthermore, how the partners' location dimension moderates such a relationship is also studied.

The results show that the choice of the appropriability type of IPPMs varies across openness dimensions (partner variety or depth of collaboration) and further differs according to the kind of partner. More specifically, semi-formal IPPMs explain the variety of partners for the firms in their sample; the depth of collaboration with academic or public partners is explained by both formal and semi-formal IPPMs, while informal IPPMs are significant for value chain partners. When it comes to considering the partner's location, more fine-grained demarcations between choices of appropriability and openness emerge, providing a preliminary solution to the paradox of openness (Laursen and Salter, 2014).

## 6 Exploring the functioning of the framework

In this section, we will attempt to interpret the key findings of the four invited papers in the light of the framework we introduced.

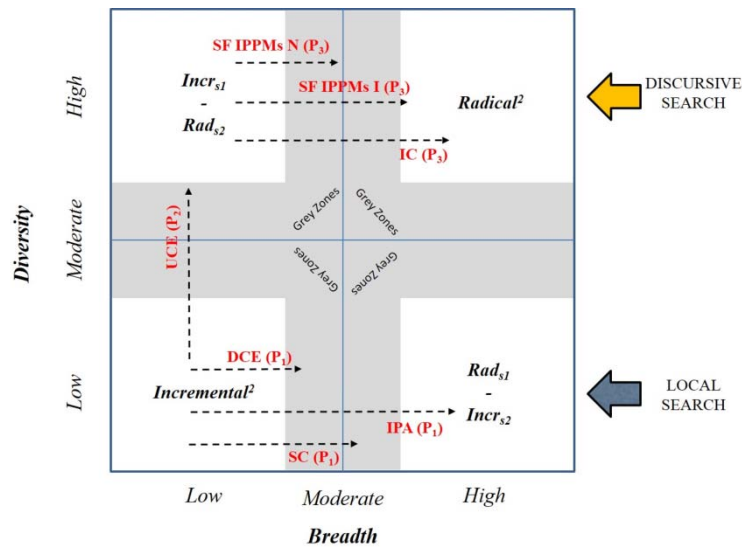
*Abrell and Durstewitz's* contribution explains the way different types of corporate entrepreneurs make use of customer and user knowledge in different ways. If we were to read it in the light of the two main dimensions in terms of which we described the framework, we might say that developer corporate entrepreneurs tend to move towards contexts characterised by higher breadth and lower diversity (Path 1). This means that by interpreting innovation through the lenses of the developer, the corporate entrepreneur will be more likely to indulge in local search behaviours where some forms of incremental innovation can be accomplished. On the contrary, user corporate entrepreneurs heavily relying upon users' sticky knowledge tend to force their organisations to undertake Path 2. They leverage upon the inherent diversity characteristic of users, and can also take advantage of only a few of them. The company may then decide to pursue a different degree of radicalness, identifying (ideally in the long run) a strategy based on the discursive search.

*Goto and Gemba's* article unveils an appropriability mechanism that is based on no explicit agreement to form a strategic alliance. The presence of essential patents shapes

the landscape of potential (implicit) collaborations. However, this seems to be effective in markets where essential patents are in the hands of few players. In the light of this framework, such a schema may force companies to favour breadth, but in the fields of expertise. Undertaking Path 1 (whether consciously or not) is the natural option, as implicit patent alliances are more likely to be established among companies operating in the same ecosystem. As a matter of fact, the established virtual alliance in the inkjet market occurred between the three giants, Canon, Epson, and Hewlett-Packard, with almost no cross-pollination of technological streams coming from very distant domains.

Markowski and Dabhilkar’s article touches upon a very important topic, knowledge integration and routine characterisation (Martini et al., 2016). Their framework describes two extreme cases: sequential care, in which the health care organisation would prefer to keep the uncertainty level low, not introducing diversity into routines; on the contrary, it would like to open its organisational routines to small process modifications undertaken by a significant number of experts with a high percentage of knowledge in common. The iterative care gives the organisation the potential to concretely enter the discursive search domain. This kind of routine forces organisations to enter a state of ignorance, but if they are successful, it guarantees high returns on innovations. Such a state is effective only if the routines entail a certain degree of flexibility and organisations are ready to adaptively learn and unlearn. It requires organisations to concurrently unlearn traditional practices and learn to be receptive to new ones (Levinthal and March, 1981).

**Figure 3** Theoretical framework with the invited papers’ contributions (see online version for colours)



- Notes: DCE – developer corporate entrepreneur (Abrell and Durstewitz);  
 UCE – user corporate entrepreneur (Abrell and Durstewitz);  
 IPA – implicit patent alliance (Goto and Gemba);  
 SC – sequential care (Markowski and Dabhilkar);  
 IC – iterative care (Markowski and Dabhilkar);  
 SF IPPMs N, semi-formal IPPMs with national partners (Stefan and Bengtsson);  
 F IPPMs I, formal IPPMs with international partners (Stefan and Bengtsson).

*Stefan and Bengtsson's* contribution shows that semi-formal IPPMs spurring collaboration with a variety of different partners encourage organisations to undertake Path 3, while adoption of formal IPPMs is strongly promoted when collaboration is with academic institutions or public partners. Before crossing national borders, managers should rely on formal IPPMs (e.g., patents) as a mean of extending their collaborative network. A higher degree of diversity, moderated by formal IPPMs, seems to be tolerated in situations in which organisations open up their boundaries internationally; at the national level, semi-formal and informal IPPMs feed diversity. Overall, the tradeoffs between breadth and depth of collaboration find a solution when both appropriate IPPMs and partners' locations are disentangled (West and Bogers, 2013).

## 7 Envisioning avenues for future research

Taken together, the four contributions in this special issue both theoretically and practically advance our understanding of collaborative innovation within and between organisations. They also provide fresh insights and perspectives on the means, drivers, and barriers for arranging effective settings for collaboration; and finally, they all focus their attention on the importance of such mechanisms for collaborating to achieve continuous innovation, whether characterised in an incremental or a radical way.

Future research should thoroughly investigate four important streams: the ability to recognise and value opportunities on the scientific and technological landscape; the role played by bounded rationality in characterising the ways organisations choose and operate; the degree of change the managerial mindset should undergo for organisations to be receptive of new collaborations and knowledge sources; and finally, the role of time.

In order to collaborate, organisations should recognise opportunities (or threats). We may assume that each organisation has a kind of 'inspection capability' (IC) that allows it to navigate the opportunity/threat landscape. IC may be thought of as a combination of intelligence and intuition. According to Bergson (1903–1923), intelligence points to ways of looking at – and organising – what exists. An organisation proceeds from a settlement of things to a re-settlement of things, and necessarily drops what happens in between the two instants. Intuition allows us to read through the pattern, instead of analysing only the start and end points. It introduces the concept of duration and mobility.

This stream is strictly related to the first in that, although intelligent and intuitive, organisations are still boundedly rational. Bounded rationality asserts that decision-makers are intentionally rational; that is, they are goal-oriented and adaptive, but because of human cognitive and emotional architecture, they sometimes fail, occasionally when making important decisions. There are two types of limits on rational adaptation: procedural limits, which limit how we go about making decisions, and substantive limits, which affect particular choices directly (Simon, 1991; Jones, 1999).

The third stream is about CCD requiring a new managerial mindset (Bettis and Hitt, 1995), especially when it comes to considering the multiple actors involved in the collaborative effort. The watchword here is flexibility in decision making in order to maintain flexibility in the deployment of critical resources. Managers must develop a mindset that allows cooperation. Firms cannot remain static even if they operate in mature industries. Dynamism requires firms to concurrently unlearn and learn. Levinthal and March (1981) therefore argue that learning can improve organisational performance, but also limit future improvements. The self-reinforcing nature of learning helps sustain a

current focus (e.g., core competence). By doing this, companies become vulnerable. One of the most important capabilities companies need to develop is adaptation, especially in networks in which agents self-adapt their organisational routines to ongoing changes in context. Self-organisation denotes a system of synergistically cooperative elements with patterns of global behaviour which are distributed (i.e., no single element coordinates the activity) and self-limiting in nature (Foster, 2000; Bonabeau et al., 1999). Self-organisation usually relies on three basic ingredients: a strong dynamic nonlinearity, which need not necessarily involve positive and negative feedback; a balance of exploitation and exploration; and multiple interactions.

The temporal dimension must be better addressed (Iansiti, 1995; Golder et al., 2009). In order to make their innovation process increasingly more effective, companies need to leave the window of opportunity open as long as possible, overlapping it with the development window. Most radical innovations take considerable time to be accepted (Iansiti, 1995). Also, the more you speed up the product development process, the higher the probability of discarding radicalness. On this point, Golder et al. (2009) examined 29 radical innovations, from the initial concept to commercialisation. They found that these innovations were developed over an average of at least 50 years, and divide this long development period into distinct stages. They also found that the duration of a stage is longer when different firms lead product development at the beginning and end of the stage. But, if we were to consider collaboration as discourse and as a means of creating a collective identity, this would be the norm, because collaboration as discourse tends to distribute responsibilities horizontally rather than hierarchically.

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## Notes

- 1 CINet stands for Continuous Innovation Network (<http://www.continuous-innovation.net>), a global network set up in 2000 to bring together researchers and industrialists working in the field of Continuous Innovation. CINet members study the innovation processes through which the on-going interaction between exploration and exploitation fosters a synergistic combination of operational effectiveness and strategic flexibility – allowing firms to achieve superior performance (for reviews on the CINet research, see: Boer and Gertsen, 2003; Magnusson and Martini, 2008; Martini et al., 2012, 2013).