Investigating co-innovation in exploratory partnerships: An analytical framework based on design theory

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Abstract: Intensive innovation contexts push organizations to search for new partnerships in order to explore value creation opportunities and to access external resources. Recent literature shows that more and more partnerships are established before the object and the terms of the partnership has been determined. In such exploratory partnerships (Segrestin 2006), motivated by the prospect of joint value creation and co-innovation, partners explore and progressively construct a common project and an agreement on the sharing of tasks and outputs. In this work we investigate co-innovation dynamics of exploratory partnerships within the context of MINATEC IDEAs Laboratory® (MIL). MIL comprises several industrial partners from different sectors and a major scientific partner specialized in micro-nanotechnologies. Partners of MIL share resources to explore new project ideas and co-innovation opportunities. A particularity of MIL is that all its industrial partners come from different business sectors. The diversity of agendas, competencies and design strategies exhibited at MIL allow the examination of different dimensions of exploratory partnerships: Are there different configurations of exploratory partnerships? What are the dynamics of exploration? How does the exploratory process converge? An analytical framework based on CK design theory is used in order to examine the dynamics of exploratory partnerships within MIL.

Keywords: co-innovation, exploratory partnership, design theory, design oriented organizations, collective action

I. Introduction: MINATEC IDEAs Laboratory® as a distinguished context to study exploratory partnerships

1. Exploratory partnerships: exploring projects and synergies for co-innovation

Intensive innovation contexts push organizations to a constant adaptation process. The need for adaptation motivates organizations to establish new partnerships in order to explore value creation opportunities, to create new capabilities and to access external resources and competencies. This search for fruitful partnerships has been accompanied by a shift in the nature of partnership relations. Aside from the traditional supplier/customer type relationships, new forms of relations are sought after by the companies in the more upstream level where the outcome may have direct impact on the strategic level (Maniak and Midler 2008). Segrestin (2005; 2006) named such upstream partnerships as *exploratory partnerships*.

2. MINATEC IDEAs Laboratory®: a platform for exploring innovation opportunities

The proposed paper analyzes exploratory partnerships within the context of MIL. The organizational structure of MIL comprises several industrial partners from a large scope of businesses and a major scientific partner specialized in micro-nanotechnologies. Partners are continuously exploring collaboration opportunities in order to build new innovative projects and to acquire new competencies. Quite typically for the exploratory partnerships, the object of the collaboration should be built while the distribution of responsibilities and outputs should be agreed. However, by contrast to bi(or tri)polar exploratory partnerships reported in the literature (Doz 1996; Powell, Koput et al. 1996; Segrestin 2005; Segrestin 2006; Birkinshaw, Bessant et al. 2007), the increased number of partners and their business' diversity induces additional difficulties and a variety of dynamics through out the exploratory phase. The diversity of agendas, competencies and design strategies exhibited at MIL offers a rich context for the examination of different dimensions of exploratory partnerships: Are there different configurations of exploratory partnerships? How can cohesion be achieved when a huge number of partners are present? What are the basic mechanisms of co-exploration?

3. Analyzing exploratory partnerships: a framework based on CK design theory

The present work investigates these issues by considering the design process as the primary source for innovation. Adopting the view proposed by (Le Masson, Weil et al. 2006), the dynamics of collective innovation efforts within MIL are analyzed based on the observed design reasoning processes of the partners. In order to capture significant aspects of the reasoning processes and their interaction, the set of notions proposed by concept-knowledge (CK) theory of design reasoning (Hatchuel and Weil 2003; Hatchuel and Weil 2007) are used. CK theory describes design process based on the interaction and evolution of available knowledge and innovative (product or service) concepts. An analysis of some projects within MIL and the modelling of design reasoning of the involved partners, let appear that different start configurations are possible for exploratory partnerships. A typology of exploratory partnerships is derived thereof based on *the distances between concepts and knowledge of the partners.* The exploratory partnerships that take place within MIL are identified as distant concepts and distant knowledge partnership. Our observations posit that *any successful exploration process starts by approaching or connecting either the concepts or the knowledge of the partners*.

The plan of the paper is as follows: In section II, we present our methodology and the theoretical framework that CK theory provides. Section III presents an overview of MIL that we identify as a platform for exploring exploratory partnerships. In section IV, we proceed to a detailed analysis of these exploratory processes. Two example projects from MIL are used to illustrate the proposed analysis. Section V discusses the results.

II. Methodology and theoretical framework

1. Methodology

The present research follows an active participatory research approach. The findings reported here are the result of an in-depth empirical case-study investigation (Yin 1990) and participation coupled by an abstraction and theoretical modelling effort. During 15 months, two of the authors continuously observed how design teams (engineers, marketing specialists, sociologists, managers…) operate within inter-firm collaboration context that MIL provides. Beside observation and empirical data gathering, authors participated actively to operational projects (new technology-based projects and user centred design studies) and to managerial meetings (one meeting per month) taking place at MIL.

Several research paradigms similar to our approach are proposed in the literature for collective action and management research (see e.g. clinical field research (Schein 1987), grounded theory (Glaser and Strauss 1967; Strauss and Corbin 1990), intervention research (David 2001)). Among these approaches, ours would be closest to Intervention Research since, beside constant observation and interaction with the field, our team played active roles in organizational processes by participating to projects. This methodology allows understanding on-going organizational processes and problems from an insider point of view which in turn allows adapting the way the researcher interact with the field and adjust its investigation when trying to make sense of the field (David 2001; Hatchuel 2001).

During our intervention, data have been collected in several ways. Beside everyday participation to and observation of internal processes, interviews with the actors and analysis of internal documents (partnerships agreements, meeting documentations…) have been done. Empirical analysis and the ideas provided in the paper have been presented at MIL during several seminars (to operational members, steering committee and to experts) and have been progressively enriched and validated with their feedback and contribution. Reactions were fruitful, and discussions indicated that the proposed model was perceived to be realistic and actionable through operational project and methodologies.

In our presentation, although we will not be strictly bound to any particular project, we will make use of two projects to ground the discussion and to illustrate some of the ideas. Unfortunately, confidentiality issues will prevent us to give the exact information regarding some of the aspects of the projects and limit the level of detail during the presentation. These two projects will be referred to as "energy project" and "micro-fluidic project". "Energy project" aims to co-design valuable concepts related to new systems of power management and power supplies. It has lasted one year and lead to various

original concepts, some of them were proved by mocks-up and user-studies. Regarding "micro-fluidic project", objectives were to learn about a new micro-technology and to envisage opportunities in partners' business. Today, a mock-up is achieved and possibilities of patents are strongly evaluated. Although they have different duration, they are highly representative of exploratory projects conducted at MIL. Furthermore, both projects are examples of common projects at MIL and thus are suitable for analysing how “emerging” projects become “common”.

2. An analytical framework based on CK design theory

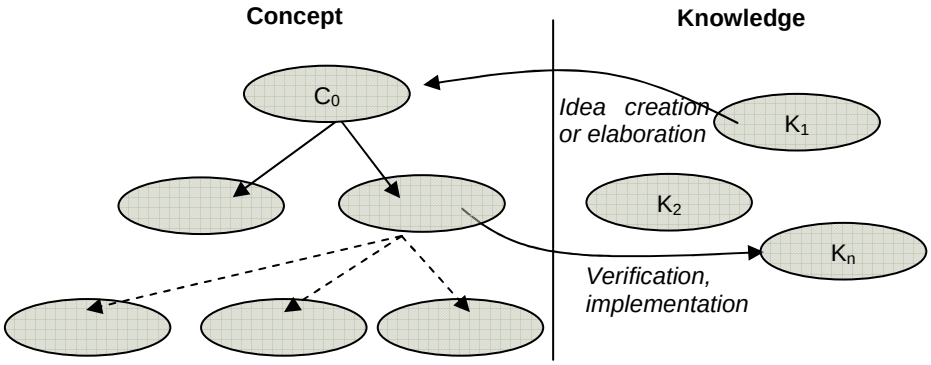

Fig1. CK design formalism

Our everyday participation and observation at MIL should ultimately yield to a theoretical understanding of its dynamics. To this end, our empirical investigation needs to be coupled by theoretical analysis. Since the primary objective at MIL is to design innovative products (using new technologies), we will use a theory of design reasoning to interpret our observations. In fact, design is the essential activity within MIL. For each partner, the unit representing that partner within MIL can be seen as a small design-oriented organization (Hatchuel and Weil 1999). Each such unit strive for creating new (product or service) concepts relevant to their own strategy and core business. Each such concept is both a final result *in fine*, but also, the process by which they are created provides the corresponding units a mean to leverage new and untapped knowledge.

Underlying the idea of design-oriented organizations are recent advances from design theory. (Hatchuel and Weil 1999; Hatchuel and Weil 2002; Hatchuel and Weil 2003; Hatchuel and Weil 2007) propose CK theory of design – a theory of design reasoning based on the interplay between two different spaces – a space C of concepts and a space K of knowledge; Fig1. Knowledge space models all that is known by a designer (or, a group of designer). This may include knowledge about objects and services, users’ preference, competences of the firm, laws, norms and regulations, etc. In terms of the theory, knowledge space contains all the propositions the designer is capable of declaring as true or false. Concept space, on the other hand, contains *new* ideas (the novelty of an idea is relative to a given knowledge space of a particular designer). According to the theory, such propositions do not have a logical status when a design process starts. The designer cannot say whether such thing may be possible, nor can he say that this would never be the case.

Design starts with a concept that can progressively be built and detailed by partitioning (i.e. by adding new properties) using available knowledge. The structure obtained this way is a tree spanning from the initial concept; the paths of the concept tree are called design paths. Design paths correspond to object definitions. When a new and unprecedented property is introduced into the tree (by partitioning), a new definition is created – which might or might not lead to innovation. Such operations are called (conceptual) expansions or expansive partitioning. The new concepts that appear this way should be investigated, built and validated in the knowledge space. Often, this requires acquiring new knowledge - the expansion of the knowledge space. Design process can then be described by the interaction of two spaces: knowledge is used to further elaborate the product descriptions in concept space, while concepts are used to reorganize and expand the knowledge space.

III. MINATEC IDEAs Laboratory® : A suitable platform for investigating exploratory partnerships

1. Exploratory partnerships

Inter-firm collaborations are considered as a critical factor in the new generation of R&D (Miller and Morris 1999) and consequently, they have been extensively studied under various perspectives (see e.g. Kogut 1988; Brouthers, Brouthers et al. 1995; Gulati 1998; Hagedoorn 2002; Ring, Doz et al. 2005). However, most of the research concerns dynamics of collaboration when projects or partners roles are well defined. Contrastingly, more and more companies establish partnerships very early phases of innovation, even before the object of the collaboration is precise (Maniak and Midler; 2008). Such partnerships have been qualified as *exploratory* by Segrestin (2006). In such partnerships, degree of uncertainty is very high and the ability to manage efficiently collaboration is much more complicated. Segrestin characterizes exploratory partnerships with a double precariousness: the object of collaboration and the rules and responsibilities are not stabilized and should be progressively determined. Participants are searching both for "coordination" (a common project, job sharing, resource allocation, efficiency) and for "cohesion" (rules to settle disputes, to share the outcome, entering-leaving conditions). In the following section we overview MIL's structure, objectives and organization in order to show that it is a platform for building exploratory partnerships.

2. A brief overview of MIL

MIL is an innovation platform located in Grenoble, France, next to French Center of Research in Micro-nanotechnology, MINATEC. The platform was created in 2003 by France Télécom (a telecommunication operator), ST Microelectronics (semiconductor company) and Commissariat à l'Energie Atomomique (CEA, a French government-funded technological research organization). It has been progressively opened to new partners. Today, MIL is composed of six industrial partners - EDF, CEA, Renault, Bouygues, Rossignol and a confidential partner - and two academic partners from Grenoble - Université Pierre Mendès France and Université Stendhal. The participants of MIL aims at discovering and mastering new competencies (in particular, in the domain of micro-nanotechnology) through the attempts of creating innovative applications (products or services) for their base field of activity. For instance, the former industrial partner, Essilor, one of the world's leader eyeglass producers, explores concepts such as "informative eyes-glasses" which strongly challenges the very identity of the dominant design of the glasses (Abernathy and Utterback 1978), but also, the core competences of the firm (integration of electronic competences) (Veyrat 2008).

The idea of creation of an external structure as a solution to cope with exploration and exploitation is well known (Volderba 1996; Foss 2003). Beside that, a variety of reasons motivate partners of MIL to invest in the platform. We can note among other things that, by becoming member of MIL, partners meet industrial partners of unfamiliar business sectors, they expect thus to get new ideas. This is consistent with the social network theory of innovation where it is accepted that new ideas comes from *structural holes* – that is, from the interaction and idea exchange of persons from different social networks with different preoccupations (Burt 2004). MIL is also the opportunity for partners to access to new knowledge – in particular, the micro-nanotechnology of CEA. Thus, one common motivation for industrial partners of MIL is to localize and to acquire (or, at least, to access) advanced technological knowledge that may open new possibilities for their companies, and, by the same process, improve and reaffirm the image of their company as a hi-tech firm. From the view of the research partners, this creates an opportunity to finance their research and produce immediately applicable results, or industrialize potentially useful technological advances that are not yet disseminated.

Moreover, the platform allows partners to share risks and costs generated by technological innovation attempts. Each year, partners accept to invest a same amount of money and allocate same human resources. However, this last aspect induces the necessity to reach consensus on the innovation fields to be explored so that a maximum number of partners can benefit from the result. Due to the large scope of partners' businesses, a variety of project ideas covering a large domain like telecommunications, home automation, sport and leisure or even electronic interfaces are proposed and reaching a consensus on which project to pursue is not straightforward.

A steering committee, composed of the representatives of all the partners, meets regularly to address these issues and to supervise the activity of MIL, the advancement of different projects and discuss

courses of actions for newly emerging project ideas. The steering committee is a platform where interests and concerns of different partners are voiced and discussed. For each project idea (or, more generally, innovation field) whether it would be accepted, and if yes, participants, their responsibilities and the sharing of the outcome is negotiated.

We can observe defining characteristics of exploratory partnerships within MIL: Participants of MIL committed themselves to this partnership *prior* to any discussion and negotiation about a common project. Although each partner signs a contract to participate, the cohesion is a recurrent issue that needs to be revised in every steering committee meeting. Since the partners' interests may be very different and every emerging project idea does not necessarily concern all the partners, it may be difficult to find a common operational direction for the next working period. Partners, who have all invested in the platform, require having an equal utility from the knowledge and projects produced. Considering the diversity of the partners' core business this is not always possible and the tensions this may cause need to be reconsidered and resolved periodically. Between every committee meting, rather classical coordination issues follow where it is aimed to achieve objectives determined by the steering committee. This *cohesion-coordination cycle* in a context where the object and the conditions of the partnership is in constant revision and negotiation are the defining traits of an exploratory partnership. Nevertheless, MIL has a particular status due to the multiplicity of the partners, the constant renewal of projects and the continuous nature of the initiative – all of which are not usual characteristics of exploratory partnerships. From this perspective, MIL appears like an extreme case, which is not fully explained by the sole notion of exploratory partnership. Rather, *MIL seems like a partnership for exploring exploratory partnerships*! It is a platform for establishing exploratory partnerships.

IV. Dynamics of exploratory partnerships: co-construction of C and K spaces

1. A typology of exploratory partnerships based on C-K distances

Partners of MIL are from different and unrelated sectors. Generally, both their product ranges and competencies have little or no intersections. In terms of CK design theory, the difference between their innovation fields (new products (or new services)) can be explained by a distance between their concepts spaces. Similarly, the difference in competencies can be regarded as a distance between knowledge spaces. This notion of distance between respective C and K spaces can be used to characterize the particularity of the exploratory partnerships that take place within MIL: they are *distant C-distant K partnerships*. Is this the unique start configuration for exploratory partnerships? One can imagine other possibilities as well; Fig2.

- Case 1. (close C - close K). This is a situation where partners have approximately similar knowledge and competencies and are situated in same business. An example would be the merging of Renault-Nissan, two companies from the industry automotive with knowledge about the same domains.
- Case 2. (close C – distant K). Partners explore similar concepts but have different competencies. For instance, we can imagine cooperation between two energetic utilities, one providing gas and the other electricity for domestic market. They collaborate to develop new air-conditionning system with significantly different core competencies.
- Case 3. (distant C – close K). This is the case where companies with similar competencies but different concepts decide to explore partnership opportunities. This might be the case when companies from different markets using the same core technology (e.g. injection molding) decide to co-innovate.
- Case 4. (distant C – distant K) This is the case of MIL, industrial partners are coming from different business and co-explore new concepts or/and competences.

No matter the initial start configuration, an exploratory partnership can begin between partners. We next report on some basic mechanism of co-exploration.

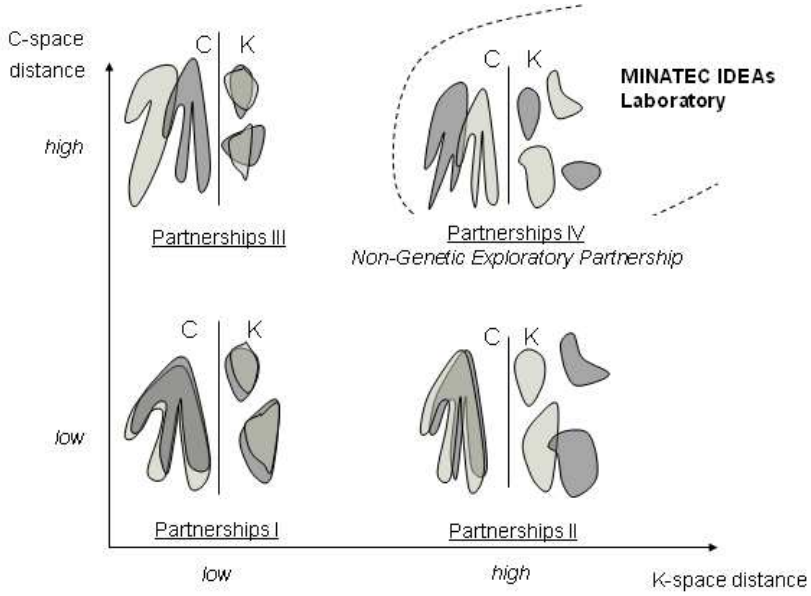

Fig2. A typology of exploratory partnership based on CK design theory

2. Basic mechanism of co-exploration: finding or building *collective* partitions and *complementary* knowledge

In order to co-innovate, each partner needs to explore other partners' C and K spaces to discover synergies. The process of co-exploration corresponds to a process of finding or creating intersections or complementarities between the respective concepts and knowledge of the partners. This can be characterized with

a) a process of **matching**; a process aiming at detecting existing intersections of partners' C spaces or K spaces.
b) a process of **building**; a process of creating intersections either in C spaces or in K spaces.

Globally, these two types of processes can be seen as *attempts to reduce C or K distances.* Those intersections could be more or less difficult to obtain. In practice, we have observed two basic ways of reducing this distance; Fig3 and Fig4.:

- **Investigating a new technology to explore knowledge of the partners.** An expert about a specific technology is asked to make a presentation to the partners of MIL (Gillier and Piat 2008). On the one hand, partners question and try to understand details of the technology; on the other hand, they try to come up with creative and useful ways of applying it. Project ideas thus created do not necessarily concern the partner who created it; it may as well appeal to other partners. The effort to understand the reach and potentialities of a technology often necessitates learning about the technology as well as partners' related knowledge – which allows approaching different knowledge spaces (Gillier and Piat 2008).
- **From specific concepts to general, unifying innovation fields**. Partners exchange about their mutual interests and project ideas. Usually, at the beginning, the exchanged concepts are very specific to the partner voicing the idea. Progressively, abstractions from the exchanged concepts are made to reach more general and unifying concepts, which may cover entire innovation fields (e.g.; starting with ideas specific to each partners core business, partners can reach broad concepts like "mobile energy" or "vision exchange").

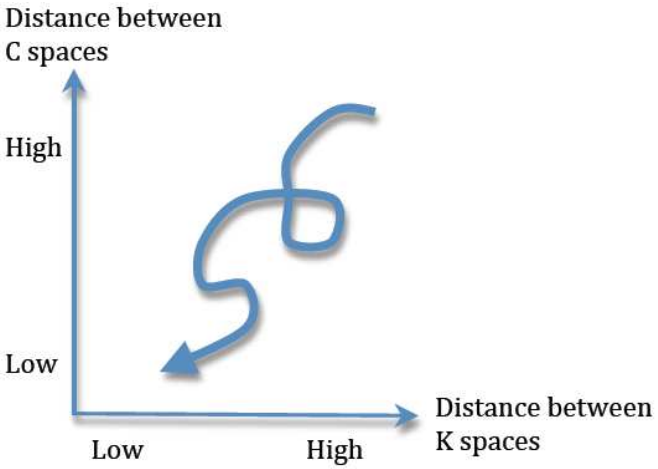

Fig3. Exploration of concepts and synergies resulting in the reduction of "distance" between concept and knowledge spaces of partners

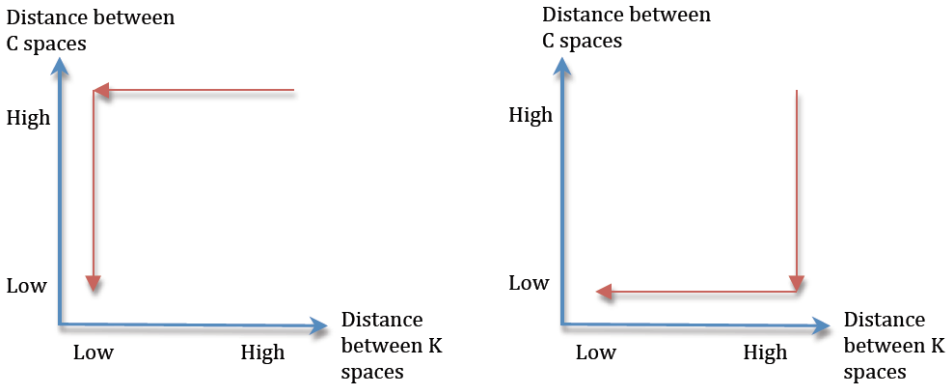

Fig4. Two basic strategies for approaching or connecting concept and knowledge spaces

3. Co-exploration of C spaces: restructuring C spaces to reach collective partitions

As we have seen, a first way to engage collaboration is *to explore intersections in C-spaces*. By matching or building existing C spaces, partners aim to discover interesting concepts (or simply, sub-properties) on which it is promising to work together. Such properties may be called ***collective partitions*****.** Les us consider an example from the "energy project"; Fig5. The core idea of this project has emerged out of some informal exchanges between two of the partners. Discussing about their own projects (smallest possible walkman and a “living” seat) partners discovered that, in both project there was a need to reconsider the way energy was provided for the corresponding artefacts. Firm A, looking for ways to reduce the size of the walkman concept, was considering ideas (or partitions) such as “not using a battery”, “using ambient energy”, etc. Firm B, working on the concept of living seat – a seat that reacts to its user needs, was interested in using sensors and other electronic equipment in the design of their seat. They needed a built-in energy source and they were considering potential solutions (including mobile sources). Realizing that the energy source was a common issue to both projects and anticipating other partners might be interested as well, they decide to submit a proposal to steering committee about an energy project. Some preliminary investigation showed that CEA might offer some interesting new technology for innovative ways of producing energy. As a result of discussions, each partner declared the project as a common generic axis on which to work together and accepted the investment.

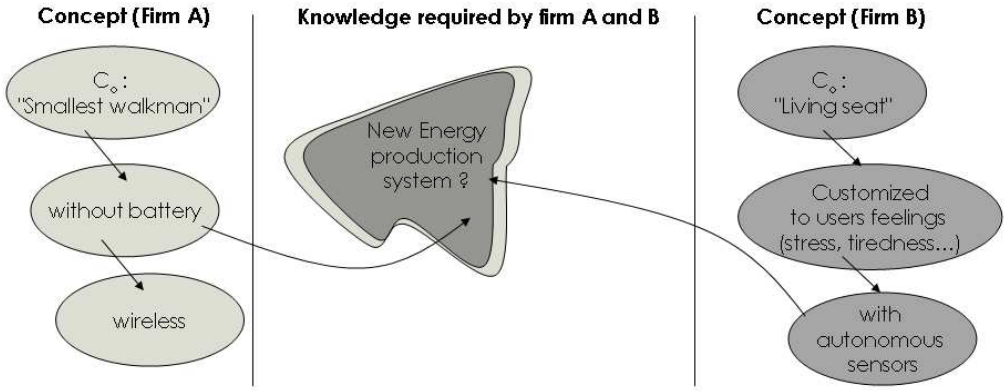

Fig5. Detecting collective partitions

One of the interesting points with this project is the restructuring of the partners' concept spaces. In fact, *matching and building common partitions has the result of co-constructing a new and common C space*; Fig5. We see here the dynamic nature of partitioning: in order to reach a common project, partners reorganize the order of the partitions: *the priorities of the partitions in the respective concept spaces of the partners changes.* In the example, at the beginning, the partitions related to the energy issue were *lower* in the object description and were not seen as a central issue. Consequently, each partner could have continued the design with his or her own initial concept without necessarily innovating on the energy topic. However, as soon as the energy issue has been identified as a collective partition, it became central for both partners. It is interesting to note that this reversal of priorities does not prevent or hinder in any way the partners from pursing their original project. On the contrary, advances made on the energy project open up new possibilities for both partners since *cross-partitioning effects* become possible; Fig6. For instance, Firm A can decide to design a "smallest walkman customized to user's feeling" and may use firm B's knowledge regarding stress measurement.

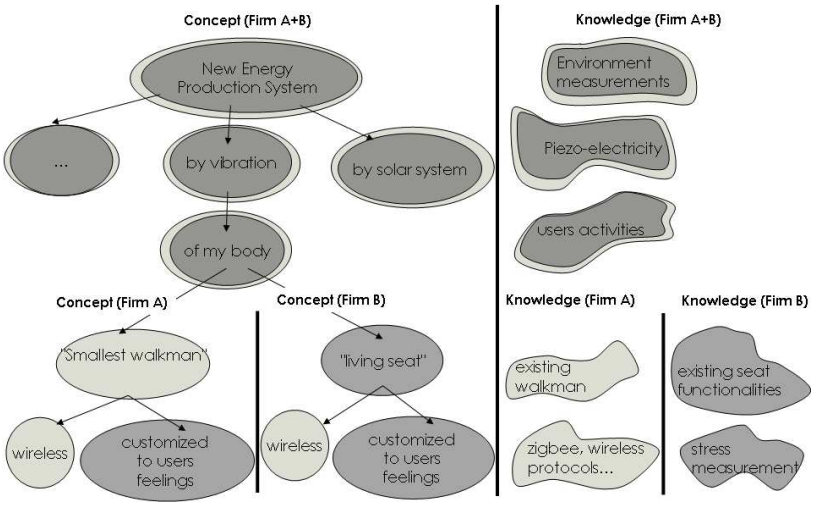

Fig6. A new Concept space : highly superposable

4. Co-exploration of K spaces: New knowledge as a medium for exploring partner's old knowledge

Collaborative opportunities may also appear by joint exploration of new knowledge. At MIL, this is undertaken systematically. Experts from CEA about various specific technologies are invited to MIL to present the specificities of that technology. Partners question and try to understand details of the technology. A methodological approach is applied routinely to understand both the properties of the technology and its possible functions and uses (Gillier and Piat 2008). One such exploration has been realized for micro-fluidic technology; Fig7. The partners learnt from the expert the functions of this technology such as "moving drops". Discussion and exchanges with the expert made appear more

details such as the size of the drops that can be moved or the properties of the liquid (e.g. solvents can be moved as well).

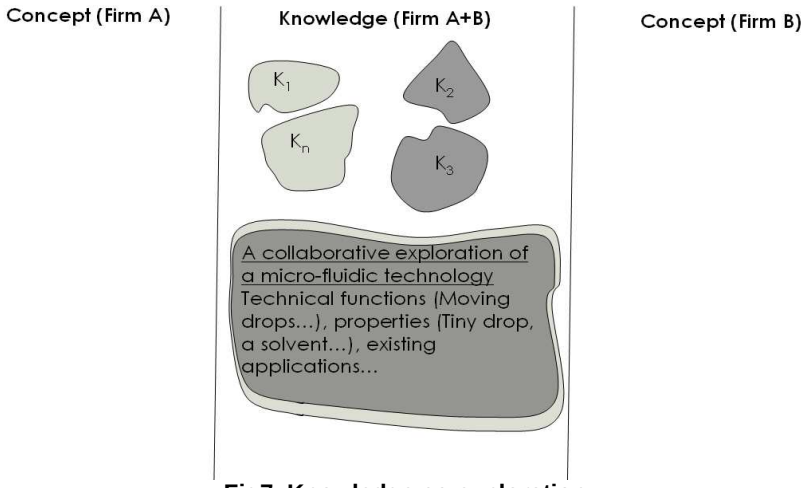

Fig7. Knowledge co-exploration

Such newly discovered knowledge, combined with each partner's old knowledge, may allow the ideation of new concepts. For instance, an on-going innovation process about avoiding micro-bacteria may be expanded with the "cleaning" functionality that the new technology offers. The new uses and functions discovered during the exploration of the new technology can thus be injected to (the C spaces of the) on-going innovation processes; Fig8.

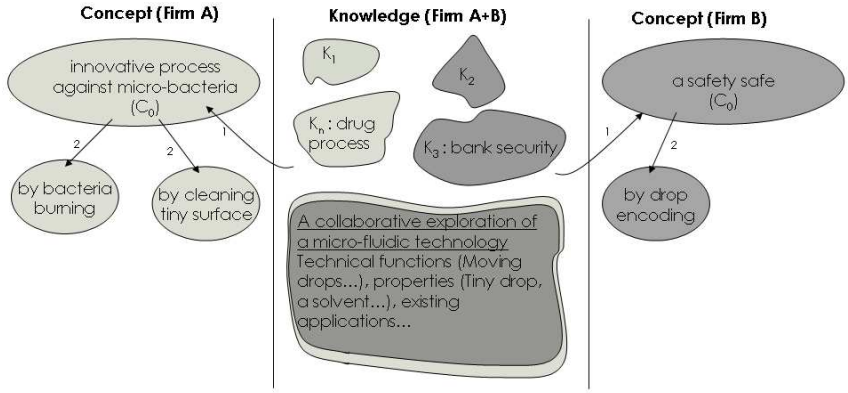

Fig8. Transfer knowledge to C-spaces

The effort to understand the potential uses and impact of a new technology allow learning about the technology *but also about partners' related knowledge.* This may create further synergies since project ideas created during this exploration do not necessarily concern the partner who created it; it may as well appeal to other partners.

V. Discussion

The paper analyses the dynamics of exploratory partnerships in the context of MIL - a partnership of several leading French companies and a large size hi-tech government laboratory specialized on microelectronics and nanotechnology. Based on our observations within a participatory research approach, we identified MIL as a platform for exploring exploratory partnerships. In a theoretical modelling effort, the data we gathered were structured on the basis of CK design theory. A typology of exploratory partnerships has been proposed based on the distances of product ideas and competencies (viz. C-K distances). MIL has been described as a distant C-distant K partnership. We described some basic mechanisms of co-exploration that aims to reduce the distance. In particular, we showed that:

a) In order to reach a common project (in C space), partners explore each other's concepts to detect collective partitions that allow building common concept spaces.

b) New knowledge (e.g. about new technologies) can be used to explore partners' capabilities and competencies (partners' K space) to establish common innovation topics.

The dynamics that we described in this paper raises a number of questions regarding the notion of open innovation (Chesbrough 2003) and cognitive distance (Noteboom, Van Haverbekeb et al. 2007) criteria for selecting partners. These will be addressed in future extensions.

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