Division of labor and division of knowledge: A case study of innovation in the video game industry

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Abstract In this work, we present an illustrative case study of the changing nature of governance structure in a small innovative firm. We show that the governance structure co-evolves with the division of knowledge and the division of labor. The presentation is organized as follows: first we define the distinction between division of knowledge and division of labor and highlight some specificities of the knowledge worker. Then, a case study of an innovative SME in the market for video games for mobile phones is presented. This case study allows us to characterize four different governance phases observed over a four year time span. We then link these four governance phases with the evolution of the relation between the firm and different types of communities (communities of practice in which programmers from other firms participate, user communities ...). We show that the evolution of the governance structure has commonalities with the evolution of the relations with the communities and that those relations influence the division of knowledge and division of labor. This analysis provides basic guidance to elaborate an integrated framework to understand the matching between the division

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of labor/division of knowledge and the modes and mechanism of community governance in a creative industry.

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The present work aims to answer the following question: How should an innovative firm which relies on a user community to achieve sufficient efficiency in some of the entrepreneurial dimensions, manage the division of labor and the division of knowledge?

Several studies show that one of the main difficulties for knowledge-based entrepreneurial firms in the early years of existence is the need to be simultaneously entrepreneurial on several dimensions (Burger-Helmchen, 2008, 2009; Maurer and Ebers, 2006; Leiblein, 2007; Witt and Zellner, 2007). Indeed, they must be entrepreneurial in the sense that they create a new product or a new service, but they must also be innovative in their business model and in the marketing strategy employed. Besides, they have to show some Schumpeterian entrepreneurial skills to bind those elements together.

To answer this question, we employ a methodology that fits with intermediate theory development, namely a longitudinal case study of a cell-phone video-game firm which relies on users to test and improve their games. Referring to Edmondson and McManus (2007:1165), an intermediate theory is research drawing from prior mature work to propose new constructs and/or provisional theoretical relationships. Here we reinvestigate a mature field of science (the division of labor) under the lenses of communities in a creative and entrepreneurial firm.

This study shows the changing role of users in that specific sector of activity. From our case study, we show that users play an increasing role for these firms. Beside the beta testing role, this firm also relies heavily on the users' hardware, namely their cell-phones. Today, the development of a game for cell-phones needs to adapt the game to a wide range of products; a game must be compatible with at least 300 models of phones the characteristics of which can differ widely. The firm cannot afford to buy 300 phones, so thanks to the variety of models owned by its users, they can indirectly test the compatibility of its program.

The case study allows us to formulate the following observation: - the user communities perform standard operative tasks (beta testing); the users communities, because of their association in that activity (video game as a work but also a hobby), also perform creative tasks; the infancy of the firm, with an organization still under construction, is influenced by the communities outside of the firm creativity as much as by inside development; the firm governance scheme is modified because of and by the relationships with the communities and the division of knowledge they imply.

This case study leaves open the way a private firm should manage the integration of the different types of entrepreneurial opportunity creation. Therefore, after the case study presentation and discussion, we investigate the governance approach of division of labor and division of knowledge so as to propose an integrated perspective of management of this type of entrepreneurial innovation. In this case, the core competence of the firm becomes its capacity to integrate different works done by user entrepreneurs. Consequently, the managers of the integration process are key elements because they ease the integration of the different bricks of the entrepreneur work and, somehow by their action, develop the firm's creative strategy.

These managers also play a key role in insuring the interface between the firm and the user community. Indeed, if ideas and knowledge are held by user entrepreneurs, who wish to turn their ideas into action, the role of the manager is then to organize that specific knowledge (Becker et al., 2007; Cohendet et al., 2000; Teece, 2007). In this respect, the social structure of the firm and the place of the manager become critical for the allocation of the inventive and integrative resources (Ethiraj, 2007; Kleinbaum and Tushman, 2007). However, little empirical work has examined how such communities help SMEs to manage production and creativity. In such modern production communities, contributors, independently of their employment context, voluntarily collaborate to create goods or services for either public or private benefit (von Hippel and von Krogh, 2003). Within recent years, online production communities have begun to produce creative information goods such as scientific knowledge, art and software.

The final point of this work, to conclude, offers a discussion on hybrid forms of governance and puts them in perspective within the division of labor/knowledge framework.

1 Division of labor and division of knowledge[1]

For several years, the vision of a firm as being simultaneously a processor of information and a processor of knowledge has existed. Considering the firm as "a processor of knowledge" (Fransman, 1994) rather than a "processor of information" requires a quite radical shift of perspective. In this latter case, the behavior of the firm can be understood as an optimal reaction to the information which comes from the environment: in principle, the behavior of a rational information processing firm can be fully described as a response to environmental signals. In the former case, we are in a world of imperfect environmental matching (Cohen, 1991), where the behavior of the firm is not fully and optimally determined by environmental signals: the same signals may give rise to very different patterns of action depending on the knowledge embedded in the firm, its set of routines, rules and practices. Informational problems

[1] More on the topic in Becker et al. (2007); Cohendet and Llerena (forthcoming, 2009).

traditionally at the core of the economic analysis of the firm, such as information overload, loss of control, etc., can be included, and considered from different perspectives, within broader cognitive problems of competence traps, relations between individual and organizational learning, dilemmas between exploitation of available and the exploration of new knowledge (March, 1991; Choo and Bontis, 2002).

This distinction has implications on all activities of the firm: its productive activities, human resource management activity, and of course creative activity. The knowledge based approach emphasizes that, in a world where agents differ in their perceptions of the environment, and where communication, acquisition of information and computation are limited and costly, coordination can only be achieved by means of the definition of a common set of rules, codes and languages which are well understood and shared by all the members of the organization involved in a certain interaction. In this case, communities, routines, rules, procedures, standards, etc. become central in the conceptual framework, and also incentive schemes and information sharing rules have to be analyzed as devices for the co-ordination of distributed pieces of knowledge and distributed learning processes.

This stream of research led several scholars to distinguish between the role of the manager and that of the entrepreneur, because it seems that a single person could not efficiently manage the information flows and the knowledge base of the firm. The former role requires hierarchical skills, efficient for standard production, but not for creativity outcomes, while the latter needs an apparently looser governance structure, beneficial for the creative workers but possibly counterproductive for a more standard labor. The distinction between standard managers and entrepreneurs has been analyzed in many studies, especially with the recent upsurge of interest for entrepreneurial firms for economic and political reasons.

That entrepreneurs are responsible for novelty is a very common argument since Schumpeter's definition, in which entrepreneurs carry out new combinations. Many other distinguishing features have been added since (uncertainty bearer, disequilibrium-equilibrium maker...). In a knowledge-based framework, the characteristics of the entrepreneurial capabilities can be stated as: (i) a specific "asset", i.e. the ability to manage strategically the adaptation, the integration and the re-configuration of internal and external organizational structure, (ii) an active interface between the internal and external environments of the firm, and finally (iii) the vision or business conception. These different points, corresponding to the primary entrepreneurial inputs (Witt, 1998, p.162), will impact the organization of the firm.

1.1 Knowledge worker

The "knowledge-based entrepreneur" is the upper layer of the "mental labor," in Babbage terms, i.e. framing the interpretation and the division of knowledge/labor of the innovative process. It is a specific role, related to the

organization and management of the collective cognitive processes in emergent and evolving firms, and has to be contrasted with a more Smithian view.

For Adam Smith, the division of labor leads to the division of knowledge. The development of skills is more a consequence than a cause of the division of labor, in particular through learning by doing mechanisms. The division of labor entails a process of learning by doing, that contributes to increasing skills and expertise and thus to enhancing the accumulation of specialized knowledge (Loasby, 1998; Brown and Duguid, 1998).

The opposite position is taken by Babbage. For him, the division of knowledge drives the division of labor: "the division of labour must itself be founded on the division of skills" (Marshall 1961:265 quoted in Hodgson 1993: 412).

In the Smithian view a progressive specialization of work induces progressive specialized knowledge through learning by doing. This occurs under the following conditions: the pre-existing division of labor, to be coordinated, to produce given (or even changing) artefacts. As a consequence, the firm organization follows a functional division of labor (Chandler). Routines are then the "memory" of organizations, truces to handle divergence of interests and conflicts, and the focus is on the "activities" and their coordination. The implications of the hypothesis « the division of labor precedes the division of knowledge » for the theory of the firm is that transactions drive competences and define boundaries. The explanation of networking, partnering, alliances, acquisitions, of a given firm mostly rely on strategic considerations related to the processing of information and to the level of transaction costs. In such a context, it becomes extremely difficult to explain the functioning of the innovative firm from the perspective defined by Nonaka and Takeuchi (1995, p. 56): "When organizations innovate, they do not simply process information from outside in, in order to solve existing problems and adapt to a changing environment. They actually create new knowledge and information, from the inside out, in order to redefine both problems and solutions and in the process to re-create their environment".

In the Babbagian view, the differences in skills and "mental labor" precede the division of labor and are also subject to learning and specialization. Babbage gives the following example: "the master manufacturer by dividing the work to be executed into different processes, each requiring different degrees of skill or of force, can purchase exactly that precise quantity of both which is necessary for each process. . ." (Babbage, 1832, p. 175). This suggests that one can unbundle the labor skills and pay only for the exact quantity the firm needs to produce. Many conditions must be fulfilled for such a mechanism to operate. The main conditions are that there is an individual with all the necessary competences who knows how much of each type of labor must be acquired and that the required variety of labor also exists. As a consequence, the division of knowledge does not necessarily match the division of labor, and the organization/coordination of dispersed knowledge does not necessarily overlap with the organization/coordination of activities.

In this approach, the focus is more on the coordination of learning processes than of activities. The Babbagian view may be interesting in an economy driven by the evolution of knowledge, and the existence of dynamic capabilities, creation of new options, coping with high uncertainty. In other words, the Babbagian approach fits creative industry better, with an important pace of innovation, and the Smithian approach corresponds rather to the production of standardized goods.

This approach of division of labor and division of knowledge, and particularly the non-overlap of knowledge and activities, is a predominant reality for innovative firms organized in a network configuration with other firms. Of course, this non-overlapping induces many governance and managerial challenges. In the following section, we present a longitudinal study of an entrepreneurial video game company which exhibits such features as an illustration, but also as an insightful study basis.

2 Case study: An innovative entrepreneurial firm

In the following, we use ethnographic and archival data to explore how a small innovative firm coped with labor and knowledge division over a four year period, and how different conceptions of leadership in organization emerged over time. Such an inductive approach is well suited for studying emergent and imperfect phenomena and contributes to theory building (Strauss and Corbin, 1990; Edmondson and McManus, 2007).

2.1 Methodology and firm selection

The firm we selected is a small enterprise in the video game industry. This industry had been studied by us in several other papers as an example of a plural entrepreneurship and creative entrepreneurship industry relying on an external community, especially in Burger-Helmchen and Guittard (2008). We describe the firm below.

To grasp the evolution of the governance of this firm, we employ the governance appraisal methodology used by O'Mahony and Ferraro (2007). These authors distinguish four governance phases that we can also reinterpret as knowledge division and labor division phases (Table 1 lists the links between those different phases in their approach and our approach). The table is discussed just after the firm presentation.

2.2 Description of the firm

The firm was created in Strasbourg, France, in 2004 by three associates. The objective of the firm was to create high quality games for mobile phones. We identify the firm under the name F. Two of the associates came from the regular video game industry (PC games) and one from another multimedia firm; he was involved in web-site creation.

Table 1 Phase of governance and knowledge/Labor division

Governance phase (O'Mahony and Ferraro, 2007)	Example in our case study	Knowledge/labor Phase (Our work)	Example in our case study
Phase I: De facto governance Autocratic leadership emerges and is challenged	Governance stands out from the firm foundation. Each founder knows his responsibility and authority	*Phase I: initial knowledge base overflows labor qualification* $K > L$	Each founder, by his past experience has knowledge of all the tasks that must be performed, and could do them
Phase II: Designing governance Formal authority is developed, but limited	Growth of the firm implies some governance rules, especially on information divulgence	*Phase II: Use of external work for known tasks* $K = L$	The firm uses its community relations for some standard work and to create spare time for the firm members to do other tasks
Phase III: Implementing governance, high influence of the different community leaders	Use of external information and work made by different communities that necessitate the implementation of clearer governance rules	*Phase III: Work outsourcing to communities* $K < L$	The communities in relation with the firm perform a creative task, and so the labor done is higher than the initial knowledge base
Phase IV: Stabilizing governance A shared conception of formal authority emerges	Firm achieves maturity in organization and governance mechanism implementation	*Phase IV: Stabilizing of knowledge and labor division* $K= L$	The firm is organized so as to routinize the interaction with the creative communities; the knowledge overlaps with the labor division

We became familiar with the firm for the first time in late 2004, some months after it had started, and since then we have carried out interviews with the employees and users for several projects on a regular basis. This provided us with a good idea of the evolution of the firm. We had also access to a certain amount of information coming, among others, from reports, press releases and advertising articles for their products, which allowed us to determine the innovative nature of some games. Because these data can have different origins (internal or external to the firm), we checked their mutual coherence. For the present work, we summarize the stages and provide links to the community approach.

Their first game was an original in-house production, commercialized at the end of 2004. Although the game was quite good for the standards of the time, the firm encountered difficulties in marketing, but it was noticed by a major

game publisher. The game publisher hired the firm to produce a mobile phone game for a franchise he owned dealing with PC and console productions. This was new for the firm which decided to produce games for the major publishers relatively standard in their conception, and to produce in parallel its own original games. Therefore we could say that the firm financed its creativity and research by exploiting its competence to produce franchised games for the major game publishers.

The creation of the firm corresponds to one step of the entrepreneurial process, often seen as the most important step. Many works describe the previous steps in the process (resource gathering, convincing business angels. . .) as part of the entrepreneurial process (Witt, 1998). We advocate that once the firm is created, the development of the governance rules, the organization and the practical implementation of the expected business model are also part of the entrepreneurial process. Therefore, the division of labor and division of knowledge have to be analyzed from an entrepreneurial perspective as much as from a managerial perspective. The three associates wished to create their own product and to commercialize it, and so they became entrepreneurs and founded their own small enterprise. At the origin of the firm, all founders were themselves involved in the production of games, doing programming, level design and testing. They still have good contacts with other programmers whom they have met in their previous employments. They form a community of practice.

Since its founding, the firm has grown in size, to reach in 2008 25 persons; it has produced 15 games in less than four years. Not only has the quantity of people involved in the firm increased, but also their qualifications and missions. For example, in 2005, the firm hired a person who had several tasks to fulfill – to organize the beta test with users, to market the original games they produced and to handle the relations with the game publishers. The organization of the beta test consisted of creating a group of users, who brought their own phones. The test session in the first years of existence of the firm consisted in downloading the game on their phones, and making them play, first in a free manner, but then asking them to accomplish a certain sequence of moves. If the game did not crash or show problems, it was deemed acceptable for that specific phone. In case of bug reports, the user was first asked to change some options of the game in a user friendly menu or to modify some elements of the phone (update the firmware), to see if it solved the problem. If the problem persisted, the organizer of the test session noted all the characteristics of the behavior leading to the bug. He summarized the results and informed the programmer of what the different users had found. Not only did the users report the bugs and errors to the integrator, but some of them even provided a solution. Those users were usually students in the field of informatics who were willing to show their knowledge and learn some tricks of the business. The users we observed helping the firm and other users during the tests were also curious and willing to test other products in development. We found here a link to another group outside of the firm, the user community.

The users were also asked to offer any suggestions for improvement or modification to enhance the quality of the game, but this was initially of minor importance for the firm. One of the main problems in this activity is the huge number of versions of the same game. There are more than 300 different versions of mobile phones for which the game must work in order to be distributed. Therefore, the founders began to develop a homemade tool to adapt their product to all mobile phones more rapidly and efficiently. The tool has been in use since mid-2005. This aspect considerably changed the relations with the users. From then on, the users where no longer simple hardware providers or beta testing executers; the relation between the users and the firm broadened, since the utility of users having different types of phone to track program bugs disappeared. The firm developed relations with users around the gameplay and organized test sessions. Gameplay corresponds in video game terminology to the overall experience of playing the game including, the immersion feeling, pleasure and addiction given by the game. The users were asked to list the elements of the game they liked and disliked, what they would like to see changed, and in which manner. Quite often the modifications were minor (change in color, speed, difficulty), and those modifications were neither a new idea nor an innovation. But every now and then, the proposals were more complex, and could necessitate a major program adjustment. The integrator told us that the first time users made such big change proposals he was very confused. It was a test on a game for a major company; he knew that they could not introduce the modifications (although they would have enhanced substantially the enjoyment of the game). They could not alter the product because of time pressure and because of the specifications the game publisher enacted.

However, the ideas were not completely discarded. If possible, they were integrated in the next game created. This corresponds to a third type of community/ firm relation, this time with a more important role on the product innovation side. What the user community tried to do is to influence the development of the product and shape the product in conformity with their taste, and also what they expected to be the future tastes of other players. These modifications required a major change of the interface and corresponding programming time. Also, when the game tested was not an original game of the firm, but one they had to make to order for a major game publisher significant modifications from the original project were not possible. Therefore it was not possible to implement these ideas in the current product, but the team managers were careful to implement them in the next game they developed, either in an original game, or as a sequel of a game in the project development phase before a major game publisher approved it.

The implementation of innovation in such a creative industry is possible under certain condition (the existence of creative slack) and follows a logical order (between micro and macro creativity). That innovations and improvements occur during the development phase is nothing new in the video game industry. Cohendet and Simon (2007) report two types of creativity in the

development process of a video game, micro and the macro-creativity. The micro-creativity corresponds to what emerges during the daily activity of the programmers, while macro-creativity corresponds to what is created and decided once and for all at the beginning of the project by the team manager. In our example, the important, innovative ideas are incorporated during the macro-creative phase. Also, we could make a distinction between the creative improvements coming from the firm and those coming from the users outside the firm. We circumscribe the firm creativity at the beginning of the project as macro-creativity, and, because the creativity coming from the users is developed after the programmers did their work (micro) and is integrated not in the current game, but in the next generation of products (macro), we label it meso-creativity. To exploit this type of creativity, the firm installed at the beginning of 2008 a dedicated web site to manage the relation with the different user/innovator/programmer communities. Such a representation has implication for the knowledge/labor division as we will see later.

In the same line of observation is the notion of creative slack that refers to the notion of organizational slack proposed by Penrose (1959), who suggested that organizations always have some stock of unused, or underused, resources (e.g., knowledge, relationships, reputation, managerial talent, physical assets, etc.) that inevitably accumulate in the course of developing, producing, and marketing any given product or service. In her view, these unexploited or underexploited productive resources are the primary factors determining both the extent and direction of growth, which is the dominant motivation of firms, limited only by the administrative capacity of the organization.

In the case of the firm we have observed, our view is that the organizational slack is essentially creative, and plays the role of an important reservoir of opportunities of innovative knowledge for the organization, guiding to a large extent the growth of the organization. In line with Penrose's vision, the firm which has accumulated a creative slack is better prepared than any other organization to derive benefits from the creative potential of the slack. The creative slack is shaped by the culture of the firm and is essentially understandable through the jargon of the organization. Because of these idiosyncrasies, it is much cheaper to valorize the slack within the firm which holds it than through any other organization (including any isolated community). Some may argue that the creative slack appears as a *cushion of redundancy* which is costly to maintain.

The remarkable point is that the potential of the slack is diffused in the communities of users that has memorized (thanks to the knowledge brought by their members) parts of the learning. Although it is well known that organizations have extreme difficulties in memorizing what has been learnt during a project, the interest of communities with regards to this issue is that they rather easily memorize the routines practiced by their members. As Cohendet and Llerena (2003) suggested, "a routine that has naturally emerged within

a community of economic agents sharing strong common social norms will probably have a much stronger power of replication than a routine which results from the functioning of a temporary team project constituted from heterogeneous agents who never met before".

Thus creative slack has an ambiguity: it constitutes a specific advantage for the firm which is the only entity able to take benefit from it, yet at the same time it is held, nurtured and maintained at rather low cost by the communities of users (which are out of the organization), sometimes even without an explicit awareness of the managers. It is as if the firms, while concentrating internally on the formation and exploitation of the creative slack as its key internal core competence, had delegated the building of creative capabilities to the communities of users.

The evolution of the relation between the firm and the community (as beta tester, gameplay tester, quality enhancer, creative partner) links with the evolution of the governance of the firm. To see how all of these evolve jointly, we summarize the different observation in one figure. In Fig. 1, the vertical axis distinguishes the different dimensions involved. With respect to our case study, we retain four dimensions: (i) organization development, (ii) project development, (iii) development of governance, and (iv) development of division of labor and of knowledge. The horizontal axes correspond to the development of each dimension through time. On this representation, each time a different type of community/firm relation is involved, we mark it with a circled user sign. This figure will help us to better understand the links between the governance schemes and the division of labor and division of knowledge.

We start our discussion on the upper left part of Fig. 1 with the organizational development of the firm. Two major phases can be identified: the launching of the firm and the development of the firm. The launching of the firm corresponds to the moment when the three individuals founded the firm to exploit a product they designed for their own pleasure and that they expected would please other players (mark C1 for community stand one). They worked as a community of practice, applying the techniques they learned and shared with individuals in other firms. The second phase of organizational development corresponds to the situation in which the firm engaged in the development of several projects simultaneously and developed its own tool for adapting all the products to the large number of phone devices. This corresponds to mark C3.

The next dimension on the figure corresponds to product innovation. The user community helped the firm in two ways along this dimension. First, by seeking errors in the program, possible bugs that appeared to be dependent on the phone device employed. This corresponds to the C2 mark on the figure. Second, by proposing substantial modifications and creative ideas that could result in an innovative new product. This activity refers to what we called meso-creativity, when the ideas of the users community are implemented in the next generations of products. This corresponds to the C4 mark on the figure.

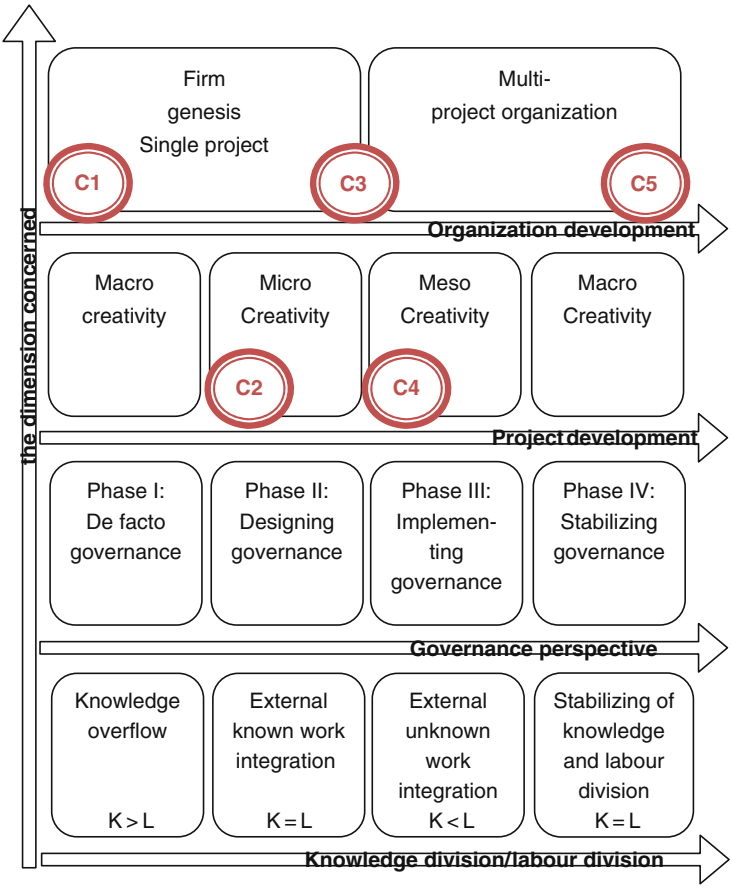

Fig. 1 Organization, project development, governance and knowledge-labor division dynamics

The final dimension we observed corresponds to the stabilizing of the organization around the different communities. We mark this C5. The relations between the different communities and the firm are institutionalized, in particular through a dedicated web site.

3 Governance of divided labor and divided knowledge

In this section, we present the results of our case study analysis and qualitative data to show the way in which the firm governed the knowledge division and labor division interactions with the different communities. As mentioned, we used the four distinct phase process of O'Mahony and Ferraro (2007) and adapted it to our situation. These four general phases appear also in our case

study but not with the same duration as in their work. We also consider a parallel with knowledge division and labor division (see Table 1).

3.1 Phase I: De facto governance with an initial overflow of knowledge

This phase (C1 on Fig. 1) corresponds to the launching of the firm. We found that, in the first months, the firm operated reasonably well without any formal means of representing the governance. This is easy to understand, as there was only one project undertaken, the founders knew each other very well, and each had a specific task to do. The governance was *De Facto*.

From a community perspective, each founder was involved in a community due to his previous work. Therefore, we may refer to this as a known community relation with standardized interaction.

From a knowledge/labor division point of view, the three associates knew all the steps of the game creation and there was no technical problem. They divided the labor in an efficient manner between them. We can assume that, at the beginning, there was a good match between the division of knowledge and the division of labor (assuming that each associate had a good overview, and each performed the task in which he was most competent). This is the case, since, at this stage, each founder had the necessary knowledge to create the game entirely due to his past experience, and was perfectly accustomed to community relation. Therefore, we note in Table 1 that the initial knowledge base overflows the labor qualification. We mean by this that, together, the three entrepreneurs had more knowledge than required for performing the step of the entrepreneurial process. As we will see in the following, when the activities of the firm broaden, the stock of knowledge will become relatively less important in comparison to the new labor task that must be performed.

3.2 Phase II: Designing governance, and knowledge/labor division equilibrium

This phase (C2 and C3 on Fig. 1) corresponds to the passage from a single project to a multi-project firm, to relying on users for testing the compatibility and errors in games that led to the creation of a dedicated tool.

From a community perspective, a new type of community is involved, user communities doing the beta test and detecting errors.

From a governance perspective, the involvement of a new community and the increase of the staff created the need to implement some rules to manage the information flow. The increase in the number of employees corresponds to an increase in specialization in the tasks performed, and so some organization schemes had to be defined.

From a knowledge/labor point of view, the firm used the communities to do routinized work and to liberate time for the staff members. Therefore, the labor division was encompassed in the knowledge base of the firm. But

as external work became more important, and more skilled users participated in the community, the knowledge division ability became balanced with the labor division. By balanced we mean that the knowledge division and the labor division are adequately matched, this having became possible by extending the knowledge community outside of the firm.

3.3 Phase III: Implementing governance and creative work outsourcing communities

This phase (C3 on Fig. 1) corresponds to the use of an in-house program for technological specification beta testing instead of using a user community. Communities are now relevant for doing more evaluation test (gameplay) and for participating in the creation of new designs and the diffusion of ideas.

From a community perspective, this corresponds to an enhancement of their importance, in a qualitative sense.

From a governance perspective, the rules need to be enforced as well as the integration mechanism of the different information flows. The need to coordinate interdependent member activities and integrate member contributions in a production context was likely to exacerbate the need for a shared basis of authority. The firm tried to enhance the existing rules, or to adapt them. It rapidly became clear that the firm could not impose its rules, but only give a broad direction. The firm needed also to have a more democratic relation with the communities.

From a knowledge/labor point of view, the communities in relation with the firm perform a creative task, and so the work done by the communities becomes larger than the initial knowledge base, which is a standard characteristic of creative knowledge communities. The communities began to create by themselves, and expanded the tasks performed to a greater extent than what the direction of the firm intended.

3.4 Phase IV: Stabilizing governance and knowledge and labor division

This phase (C5 on Fig. 1) corresponds to the creation of a dedicated website for managing all the communities, their interaction, and the collection of information flowing from them.

From a community perspective, there is no major change in comparison with the previous point.

From a governance perspective, to achieve the efficient outcomes, some form of rationalization was necessary. How communities resolve this conflict is a difficult question, and the way in which a private firm engages in this rationalization between communities eases the process. The firm tried to do this by creating the dedicated website and by asking the web moderator to supervise the exchanges.

From a knowledge/labor point of view, the firm is organized so as to routinize the interaction with the creative communities. This better overview

and daily monitoring implied that the knowledge base and the labor division extended at the same pace. This is the last phase we observed in mid-2008.

3.5 A dual governance structure

Such firm / communities relations are difficult to govern as noted by Shah (2006), but they are of the utmost importance for innovative SMEs. Therefore, scholars and practitioners see them as increasingly important to a knowledge-based economy (Amin and Cohendet, 2004). These creative production communities differ from previously studied forms of communities in three ways. First, unlike communities of practice or occupational communities, creative production communities are not associated with a single workplace or employer. Second, unlike most online communities in which each member creates a piece that can be used separately by everybody else, here the creative production must be integrated to obtain a unique product (and so there is a higher need of coordination mechanisms). Third, the firm must be able to assure the property of the production by opposition with other communities for which the efforts are oriented to the community in a broad sense.

Taken together, these distinctive features suggest that the firm/community relation must be handled in a very specific way. We suggest that the complicated nature of directing individual efforts toward a common goal without the benefit of contractual or hierarchical reinforcement cannot be done by a single person. We found here another possible use of the dual manager-entrepreneur governance structure of the firm (Cohendet and Llerena, 2005).

Such a dual governance structure is based on the following hypothesis: The firm manages simultaneously competences/dispersed knowledge and transactions, but it does so according to a lexicographic order (due to limited attention). This order is linked to the Babbagian view presented earlier. The Babbagian view allows us to reinterpret our case study with new considerations about the governance structure.

Two considerations follow:

i. The firm focuses its limited attention and chooses the domain of its competences, giving priority to the process of creation of resources. The firm's domain of competences is not considered to be tradable on the market: activities are "disconnected" from the transactional make-or-buy tradeoff. Here the domain is first the adaptation to different phone devices, which leads to the creation of an in-house program to obtain better performances than could be had by relying on external beta testers. Then the domain of competences becomes the integration capacity of the different reviews and opinions of the users.
ii. The firm selects according to transactional criteria the domain of "currents activities", the "periphery" (driven by a process of allocation of resources). As a result, for example, the division of knowledge (i.e. the

knowledge encapsulated in the firm) may not correspond to the division of labor (i.e. the activities organized within the boundaries of the firm). The former has to deal with the existence and development of dynamic capabilities, the latter with cost efficiency. In our example, this periphery evolves from one phase to another.

One of the main consequences of this "lexicographic" choice (first focusing on competences, then managing the periphery) is in terms of governance structures. The ranking of activities seems to suggest the need for the firm to define at least two distinct governance priorities:

i. A structure to manage competences in order to align dispersed knowledge and expectations. Within this "core" structure, some contractual schemes may naturally be implemented (e.g. stock options, or specific rewards for inventors within the organization), but these are not essential when compared with the priority given to the stimulation of collective learning processes. In our case study, this structure is the firm as an organization.
ii. A structure conceived along the transaction costs criteria to manage the periphery. Within this second structure of governance, classical contractual schemes are dominant to ensure the information processing that is central to the functioning of the periphery. In our case study, this structure is the dedicated web site.

In a dual manager/entrepreneur approach on this firm/community relationship, the task of the entrepreneur would be to handle the relation with the creative communities. The task of the manager is then to handle the in-house productive phase.

This discussion on the governance phases and the evolution of the governance structure in an entrepreneur-manager perspective has other implications for the dynamics of the organization for innovative firms. We discuss some of these in the following section and propose an aggregating framework for further research.

4 Discussion: a dynamic organization representation for innovative firms based on dualities

The firm governance dynamic depends on the interaction of several activities, individuals and competences. In our sense, the firm is stretched by a multitude of dualities: the manager/entrepreneur duality, the knowledge/information duality, the division of labor/division of knowledge duality, the exploration versus exploitation duality, the doing in-house or externalizing/buying on a market duality, and so on.

Those different dualities have a direct influence on important features of the firm. In this work, we only slightly touched the effect of these dualities

on the governance and organization of an innovative firm. Such an approach could help us to understand some relations that occur within the firm, or could it provide managerial insights which are ultimately the endeavor of research on governance (Antonelli, 2006).

Antonelli (2006) noted that the governance mechanisms adapted to knowledge generation are not those corresponding to the knowledge exploitation. In a large corporation, where knowledge generation and knowledge exploitation are clearly two different activities, this is of limited consequence. But it becomes a difficulty for a small firm where knowledge generation and exploitation are performed by the same individuals. This situation is relatively common in small enterprises; it is trivial in creative industries. Almost by definition in creative industries, the exploitation and the generation of knowledge are performed at the same time by the same individuals. Therefore, those small firms have to be ambidextrous (O'Reilly and Tushman, 2004; Ben Mahmoud-Jouini et al., 2007).

Three main mechanisms of governance can be listed for such knowledge generation activities: (i) quasi-hierarchies for tacit and sticky knowledge, (ii) constructed interactions for articulable knowledge and (iii) coordinated transactions for codified knowledge (Antonelli, 2006).

Here we discard two of these governance structures: the quasi hierarchies and the coordinated transaction. The quasi hierarchies approach is jettisoned because it deals with tacit knowledge. In our case study, all the video-game programmers and designers hold tacit knowledge. But the novelty introduced by the users must be grasped and somehow materialized. Looking only at tacit knowledge in this work would lead us to miss what is the most important. The second governance mechanism we did not employ here is the coordinated transactions governance mechanism that corresponds to codified knowledge. Contrary to the argument used for tacit knowledge, we did not consider this outcome because when the firm and the users interact, they do not strictly speaking codify ideas. There are no such things as a common codebook/wordbook, common patterns of analysis, and so on. In our case study, the most relevant feature for us on that point was the failure of the web site the firm launched. The purpose of this web site was to collect the reaction of the users and to speed up the implementation of opinions. The web site worked well for collecting gameplay reactions, but not for collecting suggestions for developing other features or for collecting creative ideas.

We consider the exchange between the firm and the communities as an exchange of articulable knowledge. Articulable knowledge is between tacit and codified knowledge. It is more than tacit knowledge and therefore can be detected by the firm, and less than codified knowledge, so only the firm that interacts with the users can collect it, not other actors (this implies that other actors must be kept away from those users).

This leads us to propose two governance priorities: the alignment of dispersed knowledge (being able to collect the creativity of the users and to

articulate it), and the management of the periphery and contracting costs (to prevent other firms from grasping this creativity).

This research shows the possible links between knowledge division and labor division and firm governance. Our findings are consistent with previous work on the topic of governance of community and innovative firms (O'Mahony and Ferraro, 2007; Amin and Roberts, 2008), but also with the standard specification of the evolutionary approach of the theory of the firm and recent developments in that field (Dosi and Marengo, 2007; Gavetti and Levinthal, 2004).

The presentation of the dynamic relation in an innovative firm suggests further work to (i) make a case study on the division of labor and division of knowledge on other functions of the firm than the governance function (i.e. the innovation, prevision and strategy functions), and (ii) to find a way of operationalizing the division of knowledge argument in a way not only useful for the economic analysis but also for management.

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