Setting up Innovation Networks: 
The Case of a Small Company in the Calibration Industry

Valentina Lazzarottia,*, Raffaella Manzini, Emanuele Pizzurnoa

aUniversità Carlo Cattaneo – LIUC, Corso Matteotti 22, Italy

Received 16 May 2010; Received in revised form 14 September 2010; Accepted 10 March 2011

Abstract

From the recent studies about open innovation paradigm, it emerges that the choice of the governance mode “right” to cooperate is still an interesting topic. Theoretical frameworks about the topic are available, suggesting the need for coherence among a series of factors and the governance mode to be selected. However, applications on concrete cases are still scarce, above all as concerns small companies. This empirical work aims at increasing this area of knowledge by describing the practical experience of a small company which had to choose the governance mode in order to organize and manage a New Product Development network. The first inconsistency between factors and form of government chosen leads to failure of the network. The next consistency turns failure into success, and this makes the case an interesting example of how to build an external innovation network. Moreover, peculiarities of small businesses emerge. In particular, has shown that some highly integrated governance modes, even if they could be the “ideal choice”, are not really feasible for small companies. Strong planning, control and formalization can anyway serve the scope of reinforcing the governance mode in terms of integration and commitment.

Keywords: Governance mode, open innovation, SME, innovation network

1. Introduction

Open innovation is increasingly recognised as a paradigm not just for big and high-tech companies, but also in other, less technology-intensive contexts as well as in small and medium sized enterprises. This is due to increased scientific and technological complexity, higher uncertainty surrounding innovative activities, higher costs of R&D projects and shorter innovation cycles (Christensen, 1997; McGrath and MacMillan, 2000; Chesbrough, 2003). Partnerships or networked cooperation enable companies to learn from a variety of sources and partners in a flexible setting of collaborations to combine externally and internally developed technologies and know-how in order to develop new products, new services, new processes, new businesses. Companies can access to external sources at different stages of the innovation process by opening their idea generation phase, the prototyping or engineering phase, or the production phase (Lichtenthaler and Ernst, 2009; Riccaboni and Moliterni, 2009; EmdenGrand et. al. 2006; Berger et al., 2005). Literature suggests that any action of networking can be described by various elements (Chiesa, 2001, Ritter and Gemünden, 2003): the actors involved; the resources allocated by them; the activities carried out to achieve the collaboration objective; the result obtained by

* Corresponding author. E-mail: vlazzarotti@liuc.it
collaboration; the governance modes adopted to organize and manage such elements. From the manifold studies regarding the open paradigm of innovation, it emerges that the choice of the governance mode “right” to cooperate is still an interesting topic as it is demonstrated by very recent contributions (van de Vrande et al., 2006; Ojasalo, 2008). The term “governance mode” refers jointly both to the particular organizational structure (i.e. merger and acquisition, joint venture, alliance, outsourcing, etc.) and its ingrained managerial features (i.e. level of integration; reversibility, level of control over activities, etc). Thus, network organizational form and network management essentially belong together. For this area of studies, literature has already given relevant theoretical frameworks to rationalize the involved variables. For example, the broad set of different organizational structures to collaborate has been studied and categorized as well as the factors driving the choice of such governance modes (Folta and Leiblein, 1994; Lambe and Spekman, 1997; Chiesa, 2001; Vanhaverbeke et al., 2002; Van de Vrande et al., 2006). However, the application of these frameworks on concrete cases in order to verify their validity is still scarce as it is declared by the same authors cited above. This empirical work aims at increasing this area of knowledge by describing the practical experience of a company which had to choose the governance mode for a New Product Development network. The networked collaboration in question was led by the company Scandura, a small enterprise operating in the high-tech sector of calibration systems. The purpose of the network was to develop a new product (i.e. a new pressure calibration system), deemed critical to the company's future competitiveness. Specifically, Scandura opened to external skills the whole NPD process in order to acquire complementary technologies and know how. First of all, the case is interesting because it has experienced an application of the frameworks available in literature in order to overcome a failure in the collaboration to ultimately achieve a fruitful one, showing that networks are necessarily evolving organisms (Ojasalo, 2008). During the first unsuccessful network, time and other resources were dispensed without achieving the final goal, i.e. the development of a new product. The failure was mainly due to an inconsistency between the governance mode and a number of factors (i.e. the nature of the network’s objectives, content and partners) that were intended to guide the choice. Later, the deep analysis of these factors, clearly pointed out in the frameworks suggested by literature, led to change the network governance mode, contributing to the success of collaboration. This makes an interesting case for students and managers of how to build an external innovation network.

Secondly, the case is particularly interesting because the company engaged in organising and managing the innovation network is a small firm (i.e. SME), while theoretical contributions are normally focalized on large innovators and empirical evidence is still minor, although with relevant exceptions (Roth, 1991; Hanna and Walsh, 2002; Wincent et al. 2009; Prashantham and Birkinshaw, 2008; Vanhaverbeke et al., 2008; Boiugrain and Haudeville, 2002; Narula, 2004). These contributions bring into evidence the main difficulties that small companies face in organising and managing innovation networks: the lack of financial, human and technological resources; the limited capability to attract excellent partners; the risk of opportunistic behaviour by partners; the lack of managerial competences for designing and managing the network; the lack (or the huge cost) of legal support; the organisational resistance. In brief synthesis, the literature suggests that, although SME can be forced to open their innovation processes in order to access to complementary resources and competences, this implies for them higher risks and costs than for big companies. In other words, small firms may have resource constraints that prevent them from implementing a fully effective and efficient network. Anyway, there is still few empirical evidence about SME, their typologies of networks, their resource limitations and resulting network performance as claimed by some contributions about such topic, which are a notable exception (Rothwell, 1991; Hanna and Walsh, 2002).
In summary, the paper firstly aims at practically studying literature suggestions on the choice of a network governance mode in order to assure its success. That in order to obtain useful information for companies in general, showing how external NPD networks can be created.

Secondly, it intends also to pay attention at the possible small firm-specific features to be considered in a network creation. Useful suggestions for small companies in particular, for which empirical evidence is still poor, can be thus drawn too.

The rest of this article is organized as follows. First, after a brief sight on the different governance modes (i.e. organizational forms and their managerial features), it introduces the theoretical background concerning the factors driving the choice of such modes. Second, farther on the methodology description, it illustrates the case and discusses the specific factors that led to changing the governance mode for the network. Specific considerations referred to Scandura as small company are also set out. Then, it draws the final conclusions by summarizing the contribution of this study.

2. The factors driving the choice of the governance mode for an innovation network

Before synthesising literature suggestions about the factors driving the choice among different governance modes for collaborating, a brief description of them is necessary to understand which major typologies can be identified. A number of scholars (Roberts and Berry, 1985; Biemans, 1990; Millson et al., 1996; Chatterji, 1996; Chesbrough and Teece, 1996; Chiesa, 2001; Vanhaverbeke et al., 2002; Ritter and Gemünden, 2003; Yoshikawa, 2003; van de Vrande et al., 2006; Ojasalo, 2008) have provided a broad list of different governance modes, ranging from acquisitions; equity-alliances such as joint ventures and minority holdings; non-equity alliances such as partnership agreements and joint RandD projects; outsourcing. Each of these governance modes can be ruled by a formalized contract that defines the partners’ role in terms of contribution, property of the results and exploitation rights. Moreover, a “manager” or “coordinator” can be formally or informally selected among the partners in order to have someone with an higher responsibility in the network (Ojasalo, 2008). A largely accepted way to categorize the various governance modes has been based just on those specific managerial features which can be represented as continuous variables: reversibility; commitment; level of integration; time horizon; level of control over people, activities, information flows; level of control over results in terms of opportunities (rights) to exploit the collaboration output; start up time/costs (see Figure 1, adapted from Chiesa, 2001; van de Vrande et al., 2006; Ojasalo, 2008). For example, in terms of reversibility, i.e. the extent to which the characteristics of the collaboration can be modified or the network itself dissolved, outsourcing contracts and non-equity alliances are rather flexible. Changing their characteristics (objectives, partners, etc.) or interrupting the collaboration requires relative short time and low costs. For opposite reasons, joint ventures are not very flexible (Millson et al., 1996) even if more flexible than mergers and acquisitions which can be found on the left end of the continuum. On the other hand, the level of commitment is increasing from left to right because the dedicated amount of resources and people is typically big in acquisitions whilst it becomes small moving towards alliances and outsourcing (Chiesa, 2001; van de Vrande, 2006).

Besides, the activities and the resources involved in the collaboration can be integrated in the partners firms with different levels of intensity. Similarly to the commitment, the lowest level of integration is observable in outsourcing, the higher in the acquisitions. As concerns the time horizon, i.e. the duration of the network, outsourcing has usually a brief time horizon. On the other hand, in the acquisitions it is not defined a priori a time horizon, thus they are the most intrinsically long-term oriented (Hagedoorn, 1993; Chatterji, 1996). Similarly, the level
of control (over people, activities, information flows, etc.) is increasing moving from the outsourcing towards the acquisitions. In effect, when a firm outsources an activity, it has no control over it. At most, it can make an ex ante assessment of the partner’s competences and an ex post evaluation of the output. On the other hand, acquiring a firm leads to take control over its activities and resources (Chesbrough and Teece, 1996). This type of control is usually medium level in the alliances (both equity and non-equity) since the property of the resources (e.g. in the joint ventures) or the management of the collaboration activities (e.g. in the partnership agreements) are normally shared with other partners. A different situation can be verified for that partner assuming the role of manager-coordinator for the alliance. In this case, such a partner has greater control over activities, because it decides how resources have to be employed. In any case, a contractual formalization of the partners’ role and management rules can reinforce control over activities, whilst, if such aspects are only informally defined, trust among partners becomes essential. Anyway, a certain (minimum) level of trust is always desirable in an innovation network since trust and control are basic elements of relationships (Wilson and Mummalaneni, 1990; Ojasalo, 2008). Indeed, the more there is trust, the less there is need for control (Ojasalo, 2008). The level of control over results follows instead a variable trend. It is very high in acquisitions, then it decreases moving towards alliances (because the property of results is shared with the other partners), to become again high in the outsourcing governance modes since the (buyer) company acquires the property of results and rights of exploitation. Finally, as concerns start up time/costs, they are usually the highest in the acquisitions because of the deep and formalized analysis that are necessary to conclude the transaction. Anyway, they are normally high also in alliances, given the typology and amount of allocated resources. Moreover, the need for contractual formalization can further increase time and costs. On the other hand, even when a deep and formalized analysis is conducted for outsourcing contracts, the limited scope, time and objectives of the contract make the analysis much easier and faster (Roberts and Berry, 1985).

<table>
<thead>
<tr>
<th></th>
<th>Acquisitions</th>
<th>Equity-alliances</th>
<th>Non-equity alliances</th>
<th>Outsourcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reversibility</td>
<td>Low</td>
<td></td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Commitment</td>
<td>High</td>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Level of integration</td>
<td>High</td>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Time horizon</td>
<td>Long</td>
<td></td>
<td></td>
<td>Short</td>
</tr>
<tr>
<td>Level of control (over people, activities, information flows)</td>
<td>High</td>
<td></td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Level of control over results</td>
<td>High</td>
<td>Medium/low</td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Start up time/costs</td>
<td>High</td>
<td></td>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>

Figure 1. Governance modes of collaborations
The above classifications of governance modes are essential requisite for introducing that specific part of research which is focal due to the aim of this paper, discussing the choice of the different governance modes through the identification of a series of relevant factors. This part of literature argues that depending on the status of certain factors some main features are required (i.e. reversibility, commitment, formalization, etc.) and thus companies are more likely to choose certain governance modes. The set of the factors identified by the literature is very broad and it has been examined within different theoretical perspectives including the transaction cost perspective (Williamson, 1985; Vanhaverbeke et al., 2002; Alvarez and Barney, 2004; Verwaal et al., 2008), the resource-based view (Kogut and Zander, 1992; Zollo et al., 2002) and that of the real options (Kogut, 1991; Folta and Leibling, 1994; Folta, 1998). Farther on the perspective-specific contributions, some authors have explicitly recommended (Folta and Leibling, 1994) and thus attempted (Chiesa and Manzini, 1998; Chiesa, 2001; van de Vrande et al. 2006; Ojasalo, 2008) a combination of different perspectives reasoning. Following Chiesa (2001), the decision-making factors that influence the choice of the governance mode can be grouped in three categories, respectively relating to: i) the objectives of the collaboration, ii) the content of the work to carry out in collaboration, iii) the number and nature of the partners involved.

2.1 The objective of the networked collaboration

A first factor is the type of objective. It has been studied according at least three possible sights: i) the broadness vs. the narrowness of the collaboration objective; ii) the degree of learning orientation of the firm; iii) the expected reward from the network (emphasis on profit vs. partners’ personal self-fulfilment). As concerns the first sight, a broad set of objectives often requires a long-term relationship and relevant resources from each partner, thus leading to governance modes such as acquisitions and complex equity-alliances, such as joint ventures.

In contrast, when a precise and limited objective is defined, non-equity alliances and outsourcing are preferred (Chiesa, 2001; Hermens, 2001). Governance modes more reversible, less controlled and characterized by a low level of contractual formalization have to be chosen also when the objective of the collaboration is “maximise learning from partners” and thus sharing knowledge (Lawson et al., 2009; Bosch-Sijtsema and Postma, 2009; Hamel, 1991; Chiesa, 2001; Schildt et al., 2005). Informal mechanisms seem in fact to facilitate information flows and know-how diffusion among the partners. Within the last sight (i.e. reward from the network), the emphasis on profit maximization, particularly in the short term, requires high/medium control both over activities and results (Ojasalo, 2008). Some forms of equity alliances or negotiated outsourcing, reinforced by a high contractual formalization, could serve the scope.

Obviously, an excess of control can hinder innovation as discussed in the innovation and network management literature. However, the debate on this topic is still unsolved. On one hand, some authors emphasize freedom in order to promote innovation (O’Reilly, 1989; Judge et al., 1997).

In particular, Ahmed (1998) recognized in “formal reporting” and “many rules and set procedures” the main hinders of innovation. On the other hand, Drucker (2002) and Levitt (2002) criticize the over emphasized creativity and free inspiration and address that innovation processes should be controlled to a certain extent.

2.2 The content of the work

Literature has identified several factors that can be included in this category. In particular:

- The phase of the innovation process. In the early stages of the innovation process (i.e. the idea generation phase and early development), the industry uncertainty, both in its
technological (Steensma and Corley, 2000; Santoro and McGill, 2005) and market types (Roberts and Liu, 2001), is very high. In fact, opportunities for new technologies, products or processes are sought, but results are uncertain and, often, the content of the collaboration itself neither can be clearly defined. Under these conditions, flexibility is an important asset companies need in order to cope with unforeseen contingencies (van de Vrande et al., 2006). This flexibility can be obtained by choosing governance modes that involve low commitment and a high level of reversibility (Kogut, 1991; Lambe and Spekman, 1997; Chiesa, 2001). Moreover, knowledge exchange among partners should be favoured. Thus, flexible forms such as non-equity alliances and outsourcing are preferable, fundamentally based on trust rather than control (over activities) and with a low level of contractual formalization. Such governance modes seem in fact to enhance learning as it has been shown by literature (Schildt et al., 2005). In the late stages (i.e. development and commercialization), companies have obviously already taken the decision to invest in its innovation projects, according to the real options perspective (Kogut, 1991; Folta, 1998).

In fact, as industry uncertainty tends generally to resolve over time, companies have progressively a more reliable view on the innovation potential. Consequently, moving from the early stages to the late ones, the investments dedicated to such innovation have become gradually larger and irreversible. According to the transaction costs theory (Williamson, 1985; Vanhaverbeke et al., 2002), when company’s commitment and investments are less reversible, cooperating firms may behave in an opportunist way (van de Vrande et al., 2006). Consequently, in the development and commercial phases, a higher level of control (over activities and over results) is required and firms choose more structured governance modes, such as equity-alliances and acquisitions;

- The relevance for the firm’s competitive advantage. When collaborations concern a firm’s core technological competence, it is critical to keep control over such knowledge (Chiesa, 2001). Moreover, due to the fact that competence building requires time, the horizon of these collaborations is usually long. Hence, when there is a high potential for a firm to create and/or maintain competitive advantage through cooperation, governance modes characterized by high integration and control level (i.e. acquisitions and equity-alliances) are the most appropriate. On the other hand, collaborations on non-core technologies and competences do not require strong control. Thus, companies tend to maximize flexibility and to minimize time/cost for establishing the relationship, for example through non-equity alliances;

- The technology life cycle. Mature technologies are usually diffused among competitors and they are not relevant for competitive advantage. Coherently with the previous factor, collaborations involving mature technologies do not need strong control, whilst they probably require to minimize start up time/costs. Besides, it is quite easy to find qualified suppliers providing such technologies. Thus, outsourcing is a rationale option. Opposite considerations concern the embryonic technologies, usually fundamental for creating and/or maintaining competitive advantage;

- The appropriability of the innovation. In tight appropriability regimes (i.e. the innovator is really protected by patent or copyright), a firm can collaborate without a strong control (over results) because it is protected from the risk of opportunistic behaviour (Williamson, 1985; Alvarez and Barney, 2004). In these cases, less integrated and low-control level governance modes are suggested. In contrast, in weak regimes the need of control leads to more rigid forms in order to avoid flows of critical knowledge to the partners;

- The firm’s familiarity with the content of collaboration. A first explanation concerning the impact of this factor on the choice of the governance mode was provided by Roberts and Berry (1985). If a firm lacks technical or market competencies, the authors suggest that alliances (both equity and non-equity) are preferred since these allow to access (at a lower
cost than acquisitions) to the partners’ complementary resources (scientific, technical, knowledge, managerial capabilities), whilst outsourcing normally does not allow it. More recently, several authors have faced the problem of the low familiarity by introducing the concept of relationship-specific uncertainty (i.e. endogenous uncertainty, Folta, 1998). Due to the fact that this aspect concerns the dissimilarities among the partners, and thus their typology, we will introduce it in the next point.

2.3 The typology of partners involved

- The knowledge differences among partners (“technological distance”). Endogenous uncertainty refers to uncertainty that can be decreased by actions of the firms (Folta, 1998), for instance through learning (van de Vrande et. al, 2006). Within the relationship among partners, this type of uncertainty can be the result of their differences in terms of knowledge base. Such “distance” causes information asymmetry among partners (Williamson, 1985; Reuer and Koza, 2000; Vanhaverbeke et al., 2002). In this situation, literature suggests that learning is a very important aspect in networks (Hallikas et al., 2009) and thus companies should prefer more flexible, low-commitment, low-control and low-formalization level governance modes, which allow to increase the learning effects resulting from the relationship (Schildt et al., 2005; Villalonga and McGahan, 2005). As technological distance decreases by means of learning investments, the level of commitment increases, which in turn leads to less reversible (i.e. more integrated) governance modes to enhance control (Hagedoorn and Duysters, 2002). It is worth to note that this sort of evolution in the collaboration (i.e. from a prior, more flexible cooperation to a more integrated one) is still debated in literature and different propositions are equally plausible, whilst they lead to opposite governance modes. In fact, if it is acceptable that prior cooperation favours more integrated firms by allowing companies to be less hesitant about commitment (Hagedoorn and Duysters, 2002; van de Vrande et al., 2006), it is also reasonable that prior cooperation, by building familiarity and trust among partners, reduces the risk of opportunistic behaviours and leads to choose a less controlled governance mode (Gulati, 1995). Choosing in practice probably needs to balance different factors and to establish priorities among several requirements;

- Cultural differences/distance. The concept of endogenous uncertainty can be referred also to this factor (Folta, 1998) as well as the suggestions by transaction costs theory (Williamson, 1985). “Distance” among partners, which come from different countries or sectors, causes information asymmetry leading to very reversible and low-commitment level governance modes, such as non-equity alliances and outsourcing;

- The relative bargaining power among partners. A more powerful partner (usually larger in terms of size) tends to choose integrated and/or formal modes of collaboration (i.e. acquisitions or alliances with contractual formalization) in order to impose the desired direction to the collaboration (Chiesa, 2001);

- Vertical vs. horizontal collaborations. Vertical collaborations (i.e. with suppliers and/or customers) are usually aimed at reducing time and costs of a specific project of innovation (Chiesa and Manzini, 1998). Well formalized rules to define partners’ role, medium-short term horizon and a high level of reversibility (the partners have to be quickly changed if the collaboration is inefficient and/or ineffective) are the main requirements. This makes outsourcing with contractual formalization the most appropriate governance mode. In contrast, horizontal collaborations involve competitors, mainly in the early stages of the innovation process. As argued above, high reversibility, but also high control (over activities), are priorities.

In this section we have analyzed lessons by theory on how different factors affect the
choice of the governance mode of the networked collaboration. From this lesson it emerges that the governance mode needs mainly to be coherent with the objective, content and partners of the collaboration. However, as clarified above, the various factors may lead to different requirements causing some trade-offs. For example, collaborations concerned with early stages require high reversibility and low control but if, at the same time, they are related to the production of knowledge critical for the firm’s competitive advantage (e.g. embryonic technology), the need to protect that knowledge will necessitate strong control and low reversibility. Thus, in most cases, it is necessary to balance opposite forces (Hendry, 1995) for decision making.

A synoptic view of the requirements associated with each factor is given in Figure 2. It provides an useful tool to attempt an application of lessons by theory to the Scandura case, by analyzing the more relevant factors and deriving the requirements that will lead to the governance choice. As will become clear from the case, its application has allowed to abandon a form of network inconsistent (which led to failure in innovation pursued) for a good practice in creating the kind of collaboration. In other words, its application provides an interesting example on how an external network can be properly created.

Table 1. Factors affecting the choice of the governance mode and the derived main requirements

<table>
<thead>
<tr>
<th>Factors</th>
<th>Main requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective of the networked collaboration:</strong></td>
<td></td>
</tr>
<tr>
<td>Broad vs. narrow</td>
<td>Long term orientation vs. short term</td>
</tr>
<tr>
<td></td>
<td>High commitment vs. low</td>
</tr>
<tr>
<td>Learning oriented</td>
<td>High reversibility</td>
</tr>
<tr>
<td></td>
<td>Low control</td>
</tr>
<tr>
<td></td>
<td>Low formalization</td>
</tr>
<tr>
<td>Profit oriented</td>
<td>High control</td>
</tr>
<tr>
<td><strong>Content of collaboration:</strong></td>
<td></td>
</tr>
<tr>
<td>Phase of the innovation process</td>
<td>Early</td>
</tr>
<tr>
<td></td>
<td>High reversibility</td>
</tr>
<tr>
<td></td>
<td>Low control</td>
</tr>
<tr>
<td></td>
<td>Low formalization</td>
</tr>
<tr>
<td></td>
<td>Late</td>
</tr>
<tr>
<td></td>
<td>High control</td>
</tr>
<tr>
<td>Relevance for competitive advantage</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Long term orientation</td>
</tr>
<tr>
<td></td>
<td>High control</td>
</tr>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Low control</td>
</tr>
<tr>
<td></td>
<td>High reversibility</td>
</tr>
<tr>
<td></td>
<td>Minimize time/costs for establishing relationship</td>
</tr>
<tr>
<td>Technology life cycle</td>
<td>Maturity</td>
</tr>
<tr>
<td></td>
<td>Low control</td>
</tr>
<tr>
<td></td>
<td>Minimize time/costs for establishing relationship</td>
</tr>
<tr>
<td></td>
<td>Embryonic</td>
</tr>
<tr>
<td></td>
<td>Long term orientation</td>
</tr>
<tr>
<td></td>
<td>High control</td>
</tr>
<tr>
<td></td>
<td>High integration</td>
</tr>
<tr>
<td>Familiarity</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>High control</td>
</tr>
<tr>
<td></td>
<td>High integration</td>
</tr>
</tbody>
</table>
Moreover, it has been applied here to a small firm, whilst it was already validated by literature but only as concerns big companies (see, for example, Chiesa and Manzini, 1998). Indeed, literature is still investigating the process followed by small companies to design their innovation networks and the relative managerial and organisational features (Rothwell, 1991; Hanna and Walsh, 2002; Prashantham and Birkinshaw, 2008; Vanhaverbeke et al., 2008; Boiugrain and Haudeville, 2002; Narula 2004). Several authors have pointed out that some lack of resources and managerial expertise may limit the ability of SME to create a network, especially if devoted to radical innovation, placing them in a peculiar situation compared to large firms. Indeed, literature highlights that small firm networks developing new products are extremely rare (Hanna and Walsh, 2002). Besides, lack of time and resources seem to prevent small company to identify and use important external sources of scientific and technological expertise (Rothwell, 1991). However, it has not been explored so thoroughly as these resource constraints can have an impact on the network setting up process and on the governance mode choice. The following case study investigates such topic and enriches this stream of literature on innovation networks for small firms, showing that often, given the resource constraints, the ideal choice is not really taken/available.

<table>
<thead>
<tr>
<th>Appropriability</th>
<th>Low commitment</th>
<th>Low control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medium/low reversibility</td>
<td></td>
</tr>
<tr>
<td>Partners typology:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technological distance</td>
<td>High</td>
<td>Low commitment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low formalization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High reversibility</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>High commitment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High integration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High control</td>
</tr>
<tr>
<td>Cultural differences</td>
<td>High</td>
<td>Low commitment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High reversibility</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>No particular requirements</td>
</tr>
<tr>
<td>Power/size</td>
<td>Different</td>
<td>High control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High formalization</td>
</tr>
<tr>
<td></td>
<td>Same</td>
<td>No particular requirements</td>
</tr>
<tr>
<td>Link with the firm</td>
<td>Vertical</td>
<td>Short term orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High reversibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High formalization</td>
</tr>
<tr>
<td></td>
<td>Horizontal</td>
<td>Long term orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low formalization</td>
</tr>
</tbody>
</table>
3. Methodology

The research method adopted in this work is based on a single case study. Despite the widely acknowledge limitations of this approach, especially in terms of reliability and validity (Ginsberg and Abrahamson, 1991; Yin, 2003), the case study method has the ability to capture the full complexity of the studied phenomenon, including its ‘softer’ aspects. Given that the aim of our empirical study was to investigate open innovation practices in-depth, the aforementioned advantage of the case study method was a critical factor in selecting the research approach.

The company Scandura was chosen as the subject of the study because it practically faced the problem of choosing the network governance mode.

Information was collected through direct interviews with Scandura’s management (whose general manager is also the company owner) and with the network participants. Internal documents were also consulted. The applied research methodology had two main limitations. First, because the empirical base was mainly built up from personal direct interviews with the company’s top manager, the results are susceptible to bias arising from distorted and subjective interpretations and rationalizations. Second, as in most single case studies, the empirical research does not permit any systematic generalisation. That said, the aim of this empirical investigation was not to generalise from a single case study, but rather to offer a detailed description of the phenomenon, to test theories given in the literature (Eisenhardt, 1989) and to offer some new insights for future investigations, aimed at generalising results.

4. The case study

4.1 General information

Dott. Ing. Scandura and FEM Ltd is a small company operating primarily in the industrial sector, as a supplier of calibration systems and services. Calibration is the operation by which an instrument is adjusted to obtain a higher degree of accuracy. Scandura is therefore a supplier to companies that monitor their industrial processes using dedicated instrumentation, whose measurement accuracy needs to be periodically verified and – if necessary – corrected. Scandura currently has a staff of about 25 people, including employees and shareholders, agents and partners directly involved in the company. The principal applications of its products are in the following industries: (i) chemical and petrochemical; (ii) oil and gas; (iii) power generation; (iv) pharmaceutical; (v) automotive; (vi) iron and steel and (vii) food. In 2006, the company’s turnover was just under €5 million, equally divided between Italy and abroad.

4.2 Technological strategy

Although production processes typically incorporate a wide variety of measuring instruments, these can often be calibrated using only a single portable calibrator, either on-site at the plant (field) or in the laboratory. Due to these structural features, calibration has always been a niche market with very low volumes. The life-cycle of the devices is also very long (up to 20 years for laboratory calibration instruments, and 15 years for those used in the field). Consequently, the world market is divided between just a few international players:

- Large multinationals like GE Sensing (with the brands Druck, Ruska, Pressurement), Fluke (with the brands Fluke, Hart Scientific and Rytech) Wika (with the Wika and Mensor brands).
- Medium and small companies such as Eurotron, Beamex and Scandura itself.

There are also many small local producers that cover their own national markets.
Within such a competitive industry, Scandura’s differentiation strategy is to offer products that are highly integrated (a single unit is able to check and calibrate instruments for measuring pressure, temperature and electrical signals), coupled with a high level of service.

In line with this strategy, Scandura has defined two directions for the future of the firm: (i) to attain a leadership position in the field of pressure instrumentation – leveraging its already strong internal skills - and (ii) to gradually expand its market out from the industrial market (“end users” of calibrators) to the market of the laboratories that “calibrate” the calibrators. These are laboratories to which end users must regularly turn to verify that their calibrators are effectively maintaining the required accuracy. The market of accredited laboratories offers higher margins and less competition.

The product strategies of the company are planned according to the above aims, but also with an eye to profitability in the short-medium term. Scandura started its repositioning, particularly for gaining leadership in the pressure field, by extending its range to introduce some missing products for which there is market demand.

4.3 The new product and the first innovation network: the failure

The project was launched in 2000, when there emerged a need to create a new multifunction calibrator (called Pascal) to replace the existing B20 model. Although the B20 was still selling well, supplies of its components were facing worsening delivery times and rising costs. The main reason was that the components were being phased out production and replaced with new technologies incompatible with the B20 architecture. Suppliers thus had in some cases to produce ad hoc for Scandura, which combined with low volumes drove purchasing costs upward.

To accomplish the above, a project team was assembled that incorporated competencies of both internal resources and external partners. Three external partners, named here X, Y and Z for confidentiality reasons, were identified in order to complement Scandura competencies, with the aim to launch the new product into the market in two years. X was responsible for electronics, Y for firmware and Z for mechanical components and case. Even if Scandura is very familiar with the technologies of the collaboration, the support of external partners is essential to accomplish the project.

However, newly launched these collaborations, some typical SME features powerfully emerged. In fact, once identified the new potential partners, the strategic urgency, the lack of time, the few managerial resources involved, led Scandura’s management to believe that the only pressing issue was that of appropriability. From Scandura’s management point of view, the way to prevent the disclosure of know-how or sensitive information, knowledge spin-off or opportunistic behaviours was limiting any direct interactions among the partners. No analysis for different types of partners, their specific duties and responsibilities in accordance with the objectives and content of the collaboration was done. The result was a slightly controlled network, or rather a set of partners “left to itself”, that attempted to develop a new product, even with limited funds coping with the unavailability of financial and human resources. With this approach, Scandura did not create a real network, but simply made a set of dyadic buyer-supplier relationships: each partner was assigned a specific task, generic functionality and characteristics of each component were given to the supplier, together with the expected delivery time. No milestones and monitoring activities were planned before the delivery deadline. Moreover, the flows of information severely hindered by Scandura, put partners in difficult working conditions by making impossible to perform assigned task. Also Scandura, who had kept the task of integrating subassemblies and components developed by the partners, was not able to do it for this lack of coordinated information.

In summary, this first experience describes what management did, or rather did not, resulting in failure. In particular, the management devoted little attention to the relevant
The turning point came at the end of 2002, when the original team was dismantled and the development of the calibrator begun anew, this time under the direct supervision of an internal project manager with expertise in calibrators.

First of all, the technical specifications and features of the new product were precisely defined in terms of:
- Measurements (which);
- Metrological parameters (accuracy);
- Cost (value);

The components of the calibrator were chosen on the basis of: (i) functional performance; (ii) degree of standardization vs. customization and (iii) cost. Scandura defined the concept and the initial design of the product, carefully analysing how design choices influenced all the relevant performance and cost parameters. Only after a feasibility study demonstrated that all product-performance targets were fulfilled did Scandura proceed to the ensuing phase of industrial design and system integration. The industrial design phase began in early 2004; the core activities of the industrial design phase comprised:
- An investigation into the product development competencies already present within Scandura. For those skills not available internally, the comparative merits of accessing to external sources vs. internal development were analysed;
- If the external alternative proved suitable, a detailed evaluation of potential providers of the needed skills (among the companies that were already partners as suppliers of B20 components), involving intensive screening, verification and testing of potential suppliers.

This phase allowed to identify four new potential partners: the design company D, the hardware company H, the firmware company F and the electronics and software company E. Taking into great consideration the previous failure, Scandura has invested considerable amount of time and resources for the organization and governance decisions of the new network. Several good managerial practices have been implemented.

Most of the factors and requirements concerning objective and the content of the collaborations have been deepened, leading to more appropriate forms of managing the network. In particular, a differentiated analysis by type of partner was carried out. In fact, for partners D and E, mainly four were the factors that determine to seek a form of organization characterized by a medium-low level of integration (as suggested by literature and synthesised in Figure 2):
- A narrow objective for collaborations;
- A limited learning orientation by Scandura;
- No familiarity by Scandura with the content of collaboration;
- A medium-low strategic relevance of the collaboration content.
In fact, Design company D was introduced into the network with the narrow intent of providing a safe case for the new Pascal, which had also an appealing shape. However, although Scandura had not familiarity with this aspect, it was not learning oriented (the only factor that probably pushed to strengthen a little the level of integration). Finally, attractive aesthetics and colours were not considered as main competitive factors. Relationship with Partner E (a big company characterized by a long experience and knowledge in electronics, software and industrial processes instrumentation, able to provide many “shelf solutions”) presented similar characteristics, if compared to partner D.

On the other hand, completely different were the status of partners F and H and the analysis of the relevant factors. A higher strategic relevance of the collaboration content and thus its long term orientation, combined with some familiarity by Scandura as concerns the technological competencies involved, seemed to require a significant degree of integration, although mitigated by a high learning intention.

In fact, the output of partner F, a firmware company, was fundamental in order to achieve the desired performances of the new product, while it was with the partner H (the “hardware” partner) that Scandura could boast a low technological distance and thus it was able to control the work in progress and the technical decisions taken by this supplier. In synthesis, the aforementioned factors seemed to recommend a medium-high level of integration.

The specific features of the four partners and the analysis of the relevant factor are summarised in Figure 3.

Table 2. Theoretical study of the organizational form of collaboration with each partner

<table>
<thead>
<tr>
<th>Partner</th>
<th>Relevant factors for the choice of the organisational form</th>
<th>Main requirements</th>
<th>Optimal level of integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Narrow objective; no learning; no familiarity; medium-low strategic relevance</td>
<td>High control over time and costs; high reversibility; medium time horizon</td>
<td>Medium-low</td>
</tr>
<tr>
<td>E</td>
<td>No learning; no familiarity; different dimensions (E bigger); no strategic relevance</td>
<td>Low control; limited time and costs; high reversibility</td>
<td>Low</td>
</tr>
<tr>
<td>F</td>
<td>Learning; similar dimensions; high strategic relevance</td>
<td>Medium control; long term orientation; high commitment</td>
<td>Medium-high</td>
</tr>
<tr>
<td>H</td>
<td>High strategic relevance; some familiarity; similar dimensions</td>
<td>High control; long term orientation</td>
<td>Medium-high</td>
</tr>
</tbody>
</table>

Considering and balancing the conflicting pressures of the several factors, Scandura clearly realized that, given the nature and relevance of the new product, a quite high level of integration was necessary with partners H and F, that turned out to be the most critical to manage, but at the same time the most precious. Figure 4 shows the theoretically “ideal” network, which is in practice a form of collaboration quite similar to an acquisition/joint venture with those two aforementioned partners.
However, the management felt that Scandura dimension and limited resources did not allow implementing forms such as joint ventures or acquisitions. These forms have been widely discussed by Scandura’s managers, but they decided not to adopt it (for example, equity alliances require excessive financial resources and timing for all essential related activities: from business evaluation to negotiation, from exchange ratio of shares to huge fiscal and administrative tasks, etc.), while it was preferred an intermediate solution, best suited to the limited resources of a small business. As a consequence, the choice of a medium-low level of integration with each partner was chosen, and, in order to increase the level of control over activities and results (and assure their appropriability), a strong planning and control activity was hypothesised and then explicitly included in the contract with each partner. In other word, a low-integrated organisational form was “reinforced” by means of the contract. The main terms of the agreement can be summarise as follow:

Each partner was assigned a precise output, whose characteristics and functionality were clearly described in quantitative, measurable terms;

The output of each partner was checked against the assigned characteristics and functional specifications, before it was delivered to other partners.

The contract clearly defined the tasks and outputs assigned to each partner, as much as possible in quantitative, measurable terms. In particular, the timescales, costs and outputs of each partner's task were clearly established;

The role of each partner within the network was clearly enunciated. A leading partner was designated, recognised and approved by all the other network partners. A synthesis of the main elements of the contract is reported in Figure 5.

Furthermore, Scandura planned some interactions among the partners, but always under supervision of some Scandura employees, often visiting the suppliers’ premises according to a detailed plan. Furthermore, applications for public funding to totally/partially cover the capital or interest, which would allow the development time to be shortened and to ensure the necessary continuous monetary funds for the project. Figure 4 shows the actual network, in which Scandura chose almost the same governance form, with a medium-low level of integration, with each partner (gray arrows in the figure). However, in order to increase the level of control and interaction with partners F and H, as suggested by the theoretical analysis, strong and relevant contractual specifications were introduced with these two partners (white arrows in the figure).
In summary, management realized that rational choices of organizational form and related good managerial practices had certainly improved the quality of the network, leading to the success of the collaboration. Nevertheless, the choice of ideal form of network had not been fully pursued because of the limited resources, as typical in small companies. Thus, management took another very important lesson: the limited set of resources available within SMEs forced them to use an even more rigorous and structured process (than big firms), studying appropriate contractual solutions for creating innovation networks.

Scandura’s role within the network was:
- To design the electronics, mechanics and software. These are critical activities because they determine the size of the final product (a key characteristic for competitive advantage); also, electronics and software are undoubtedly the most important and sophisticated components of the product.
- To coordinate the network, integrating the work of its different members so as to govern and control the re-design of each part. The suppliers were given scope to improve the design, but any revision of the original project had to be approved by the Scandura Project Manager.
- To provide the legal know-how required for new product development (legal opinions relating to quality, safety, etc.), which Scandura already possessed internally; this expertise, coupled with that in hardware and firmware, guided the development of the interface, i.e. the lay-out visible to the end user of the calibrator.

The role of the group of partners was:
- To supply electronic, mechanical and software parts in line with Scandura’s design. Only one mechanical part—the case for the portable model—was entirely designed and developed by an external company, able to confer appealing aesthetics and colours.
- To supply physical prototypes (sometimes hand-made) of the developed components and sub-assemblies. These were used to operationally verify that each part or component effectively met the design specifications, as well as to monitor, in itinere, the behaviour of each network partner.
- To assure that the supplied parts or components could be effectively integrated with the other parts and components. The collaboration contracts explicitly set out each partner’s responsibility for any incompatibilities and for conducting a final test of the product’s functionality, with specific monetary penalties imposed for non-conformity. Such tests were conducted not just during the development phase, but also on pre-delivery of the new product to the customer.

The contract also specified:
- Network’s objectives
- Relationships among the various network’s nodes
- Specific objectives assigned to each partner / knot of the network, with the related expected time
- The level of risk of each objective / task assigned to the partners
- The flow of human resources within the network, with the relative time
- The monetary flows among the knots / partners of the network, with the relative time
- The information flows within the network, among the different partners / knots, with the relative time
- The flows of physical products / components / parts or work in progress within the network, with the relative time

Figure 3. Main elements of the contract signed by Scandura with the partners

Figure 4. The actual Scandura’s innovation network
5. Conclusions

The case analysed in this paper gives a clear example of the several challenges a company should face in order to actually exploit the great opportunities provided by innovation networks. As a matter of fact, in its early experience, Scandura created a network without evaluating carefully how this was to be organised, which coordination and control mechanisms were to be put in place, which partners were to be involved. It can be argued that this is the result of poor (or bad) management. Literature suggests instead the necessity of coherence among a series of factors (dealing with the objective, content and typology of partners involved in the network) and the governance mode for a successful network. Scandura clearly highlights this need, suggesting that networks are necessarily evolving organisms in order to achieve success: the company in fact learnt by prior mistakes and incoherence and started a process of changing of the governance mode. In particular, it “applied” the framework drawn from the literature, pursuing consistency between the factors and the form of government, providing to students and managers an interesting example of how external NPD networks can be created. This is, in our opinion, a first contribution of this paper to the current literature on innovation network, where applications on concrete cases are still welcome.

However, going more in depth, we believe that the paper gives also some interesting, albeit limited, suggestion/enrichment even to the stream of literature exploring the innovation network for small companies and to the comparison with the large firms. The case gives in fact a clear example of the several difficulties a small company should face in order to create an innovation network. In particular, it exemplifies the general observation of “poor resources context” for SME, by linking it specifically to the choice of the organizational form of the network. It highlights how the lack of resources (i.e. of time and of management), typically for small firms, has an impact both on the first stage of failure and on the second successful stage. In the former, the shortage of resources does not allow time for thorough analysis and application of appropriate managerial levers. In particular, time is a critical resource for decision makers, that everyday are involved in many different types of decisions, from strategic to tactic. In Scandura, this led to choose the partners without careful evaluation of their competences and to rapidly define the network organisation, without studying the necessary coordination, communication and control mechanisms nor the coherence among the objective of the network, the content of the work to be done and the partners characteristics. Another critical resource within SMEs is the set of information available: SMEs quite often access to a limited set of data and information, with respect to big ones. This, again, may lead Scandura’s decision makers to set up the network without precise information about the partners, which actually do not have the appropriate competences for achieving objectives.

Moreover, even in its second successful experience, the Scandura’s shortage of resources was felt, preventing the adoption of the ideal form of governance (i.e. high-level integrated form of governance, such as joint venture). As a matter of fact, such forms of collaborations imply for the use of huge amount of resources, not only financial, but also human and organisational, and excellent managerial competences, that very often are not available. Furthermore, a high level of commitment is perceived as very risky, particularly because the risk of opportunistic behaviour by partners is always higher for small than for big companies (Prashantham and Birkinshaw, 2008). Consequently, the suitable forms of collaboration for setting up a network of innovators exclude joint ventures, mergers and acquisitions and are limited to medium and low levels of integration. As a small company, Scandura was forced to “reinforce” in some way their technological collaborations, by means of a contract in which it introduced all those elements that were not automatically guaranteed by the form of collaboration: the control over activities and results, the partners commitment, the respect of
role and tasks assigned within the network. Given the risk of opportunistic behaviour, the contract explicitly shared costs and risks among all the network partners since the beginning of activities. Similarly, the financial commitment of each partner was clarified, the monetary flows within the network were carefully planned in order to ensure that the necessary resources were dedicated to the project. In other words, the limited set of resources available within SMEs should force them to use an even more rigorous and structured process (than big firms), studying appropriate contractual solutions for creating innovation networks.

Given the limitations deriving from a single case study, other networks formed by small innovators could be studied, in order to verify whether these conclusions can be generalised. This could be an interesting future step in research.

Acknowledgments

This research was partially founded with a Grant (2005.1913/11.0556) from the Cariplo Foundation.

References


