Managing the marketing/entrepreneurship interface in small knowledge-based firms: a methodological approach

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Abstract: In this paper the authors address the issue of the management of the marketing/entrepreneurship interface in small entrepreneurial knowledge-based firms (EKFs). According to the perspective presented in this work, in such firms, the management of the interface is strictly related to ensuring a suitable balance of market and technological innovation capabilities throughout each phase of firm’s life. In order to contribute to the debate in this research area, the authors propose a theoretical framework based on both organizational configuration and resource-based theories. Within this theoretical framework, a methodology to evaluate firm’s innovation capabilities based on the use of fuzzy logic is described. The proposed methodology was tested in a field analysis whose results are presented in the paper. On the basis of these empirical results, some useful indications and practical lessons concerning the relationships between marketing/entrepreneurship and innovation in small innovative firms are discussed.

INTRODUCTION

The aim of this paper is to contribute to the management of the marketing entrepreneurship interface in small entrepreneurial knowledge-based firm (EKFs). By entrepreneurial-knowledge-based firms we mean those firms whose activities are mainly based on the entrepreneur’s high technical and professional skills. Examples of EKFs can be found, inter alia, in many areas such as management consulting, software production, research centers, and engineering companies. The main characteristic of such firms is that it
is individual knowledge, rather than other kind of asset(s), that play a crucial role in determining firm’s performance.

The role played by entrepreneurs is critical in both the organizational development and organizational life of this kind of firm. Above all, at the early stages of firm’s life, **firms’ competencies are strictly linked to entrepreneurs’ competencies**. Given that EKFs are usually founded by technical entrepreneurs, in the early phases of their life such firms have very good technical competencies but they very often exhibit a lack of **market development capabilities**, and above all, marketing competencies. As it will be shown later in this paper, this strong focus on technical aspects which is not balanced by an equal effort toward market aspects, will significantly orientate the early development of the firm and may constitute a menace for its successful growth.

According to our perspective, a fundamental aspect for the management of the marketing/entrepreneurship interface in EKFs emerges from the necessity of achieving the right mix of market and technological capabilities so that these basic skills can act in a synergistic way for the development and the reinforcement of firm’s competitiveness. On the basis of a recent research project carried out by the authors, we want to contribute to the following debate:

- how is it possible to ensure a balance between market capabilities and technological capabilities during the life of EKFs? … and …

- how is the development of market capabilities and technological capabilities through time linked to organizational transformations during the life of EKFs?

In particular, our intention is to propose some **conceptual and methodological instruments** focusing on the evaluation of the relationship between the organizational transformations of small firms and their ability to develop market and technological capabilities. To this end, we accept the perspective according to which the development of the EKFs can be considered as a traumatic transformation process rather than a gradual physical growth (Marchini, 1995; Lorenzoni, 1987; Mussati, 1990; Raffa and Zollo, 1992). From this point of view, small firms, especially innovative ones, are forced to carry out many substantial modifications to their resource base and skills in order to maintain and support their competitive advantage. Thus the development of a EKF does not evolve
along a continuous growth line but along an interrupted one, where phases of stability alternate with phases of crisis, characterized by the loss of professional resources, a fall in turnover and profits, and a reduction in market share.

The set of resources and skills typical of each development phase in the firm is defined as an organizational configuration (Meyer et al., 1993). The development of a small firm can be represented as a sequence of organizational configurations separated by critical events. The destruction and construction of resources and skills taking place during the critical events is therefore an essential requirement to maintain long-term innovation skills. Methodological problems arise in verifying such a hypothesis because it is necessary to analyze the evolution of both the firm’s performance and their set of resources and skills related to technological and market innovation.

In order to cope with such issues we adopted the theoretical framework of resource-based competition theory and organizational configuration theory. Within this framework and starting from previous research carried out by the authors, a method aimed at evaluating the relationship between the innovation levels and the organizational configurations of software small firms is proposed. The proposed method is based on the use of a quantitative model based on fuzzy logic aimed at representing the relationship between organizational configurations and innovation capabilities. On the basis of such method, three cases of small firms operating in the software sector and information services are analyzed. The discussion of these cases provides some useful indications about the efficiency of our approach in understanding the dynamics of small innovative firms.

Practical lessons concerning the relationships between marketing and entrepreneurship are discussed.

LINKING ORGANIZATIONAL TRANSFORMATIONS MARKET CAPABILITIES AND TECHNOLOGICAL CAPABILITIES: A DYNAMIC VIEW

The view of the small firm as a system of relationships among resources over which the management group exercises control, or co-ordination, to a greater or lesser degree of intensity, can provide an interesting perspective
for the organizational analysis of a small firm. To this end, the theoretical and methodological contributions supplied by the literature on resource-based competition link firm’s competitive skills to its interconnected set of resources (Conner, 1991; Grant, 1991; Rumelt, 1987).

In the resource-based competition framework, the firm acquires a competitive advantage in proportion to how well it manages to mobilize resources and skills which are not easily duplicated by its competitors (Amit and Shoemaker, 1993; Barney, 1991; Lado and Wilson, 1994). Through a careful analysis of the literature, Lado and Wilson (1994) provide two reasons to explain why an analytical and thorough identification of such resources and skills is neither possible nor convenient by arguing strongly that these key resources of the firm are often tacit and firm-specific. On a methodological level, the conclusion that they draw is that there is a limit to the analytical investigation that can be carried out on a firm beyond which a firm becomes opaque.

Many authors researching and writing in the organization field have considered such issues in order to try and overcome the limitations of the contingent approach, and one of the proposed solution was the theory of Organizational Configurations (Meyer et al., 1993). An Organizational Configuration being defined as an interconnected system of parts which react as a single whole to external events (Miller and Friesen, 1984). The configurational theory tries to go beyond both the deterministic and contingent approaches, since it assumes that the same performance may be explained in different, but limited number of ways.

In this paper we propose to use the configurational theory to analyze the relationship between organization, market innovation capabilities and technological innovation capabilities. To this end, firstly we introduce the following definitions:

- the degree of market innovation capabilities (MIC) as the measure of the firm's capability to enhance and innovate its market in a given instant of time;
- the orientation to market innovation (MI) as the temporal variation of the MIC;
- the degree of technological innovation capabilities (TIC) as the measure of the firm's capability to increase its level of technological know-how and expertise, in a given instant of time;
- the orientation to technological innovation (TI) as the temporal variation of the TIC.
Secondly, concerning the relationships between organizational configurations, MI and TI we hypothesize that:

a) this relationship is *dynamic* in the sense that the orientation to market innovation, and the orientation to technological innovation, are not linked to a specific organizational configuration but to a whole *sequence of organizational configurations* showed by the firm during its life; the passage between different configurations is determined by *critical events* marking significant organizational transformations;

b) the organizational configurations can be characterized through the amount of a set of *critical resources* managed by a firm in a certain period and playing an important role in determining firm’s innovative capabilities;

To identify the variables that can influence both the MIC and the TIC, we refer to the hierarchical classification of such variables (Raffa and Zollo, 1998) as shown overleaf in Exhibit One.

The values of the variables belonging to the higher levels of the hierarchy can be determined only if the values of the lower levels are known. For example, in order to calculate the amount of entrepreneurial resources devoted by a firm to increase the MIC, it is necessary to evaluate:

a) the number of persons forming the entrepreneurial group,
b) the amount of entrepreneurial group market know-how,
c) the number of entrepreneurs with previous management experience, and
d) the degree of involvement of the entrepreneurs in software design activity.

The amount of entrepreneurial resources devoted by the firm to increase the TIC can be obtained by a slightly different combination of resources such as:

a) the number of persons forming the entrepreneurial group,
b) the amount of entrepreneurs’ technical know-how,
c) the degree of involvement of entrepreneurs in software design and development, and,
d) the intensity of firm’s relationships with research and innovation centers.

It is interesting to note that some indicators can affect the TIC and the MIC in an opposite way. For example a high involvement of the entrepreneurs in software development activity is usually shown by firms which are strongly oriented toward technological innovation rather than to market expansion.
EXHIBIT ONE:
ANALYTICAL INDICATORS RELATED TO FIRM'S RESOURCES
INFLUENCING THE MIC AND THE TIC

<table>
<thead>
<tr>
<th>Variables influencing the MIC</th>
<th>Variables influencing the TIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1: Entrepreneurial resources</td>
<td>C1: Entrepreneurial resources</td>
</tr>
<tr>
<td>C1.1: Number of persons forming the entrepreneurial group</td>
<td>C1.1: Number of persons forming the entrepreneurial group</td>
</tr>
<tr>
<td>C1.2: Entrepreneurs' know-how</td>
<td>C1.2: Entrepreneurs' know-how</td>
</tr>
<tr>
<td>C1.2.1: Percentage of entrepreneurs with market knowledge</td>
<td>C1.2.1: Percentage of entrepreneurs with technical knowledge</td>
</tr>
<tr>
<td>C1.3: Percentage of entrepreneurs with business and management experience</td>
<td>C1.4: Involvement of entrepreneurs in software design and development</td>
</tr>
<tr>
<td>C1.4: Involvement of entrepreneurs in software design and development</td>
<td>C1.5: Intensity of group relationships with R&amp;D centers, other software firms</td>
</tr>
<tr>
<td>C2: Resources linked to human resources</td>
<td>C2: Resources linked to human resources</td>
</tr>
<tr>
<td>C2.1: Total number of employees</td>
<td>C2.1: Total number of employees</td>
</tr>
<tr>
<td>C2.2: Percentage of software developers</td>
<td>C2.2: Percentage of software developers</td>
</tr>
<tr>
<td>C 2.5: Training</td>
<td>C 2.3: Percentage of internal software developers having a graduate degree</td>
</tr>
<tr>
<td>C 2.5.1: Marketing and management training</td>
<td>C 2.4: Job rotation</td>
</tr>
<tr>
<td>C 2.6: Marketing aspects</td>
<td>C 2.5: Technical training</td>
</tr>
<tr>
<td>C 2.6.1: Percentage of entrepreneurs involved in marketing activities</td>
<td>C 2.5.2: Technical training</td>
</tr>
<tr>
<td>C 2.6.2: Percentage of internal persons involved in marketing activities</td>
<td></td>
</tr>
<tr>
<td>C 2.6.3: Percentage of external persons involved in marketing activities</td>
<td></td>
</tr>
<tr>
<td>C3: Resources linked to external environment</td>
<td>C3: Resources linked to external environment</td>
</tr>
<tr>
<td>C 3..3: Intensity of commercial collaboration with other firms</td>
<td>C 3.1: Use of non proprietary tool or external methodology of software development</td>
</tr>
<tr>
<td></td>
<td>C 3.2: Intensity of technical collaboration with other firms</td>
</tr>
<tr>
<td>C4: Economic indicators</td>
<td>C4: Economic indicators</td>
</tr>
<tr>
<td>C 4.1: Total profit deriving from firm's software</td>
<td>C 4.2: Total profit due to non proprietary hardware and software</td>
</tr>
<tr>
<td>C 4.3: Total profit coming from extra-regional market</td>
<td></td>
</tr>
</tbody>
</table>
The impact of human resources in influencing the TIC depends on the total number of people working for the firm, by the number of software developers, by their qualification and competencies, by the intensity of technical training and by the presence of an intense job-rotation policy that asks for highly qualified resources and that allows employees to continually upgrade their technical know-how. The human resources’ influence in determining a high MIC is strongly determined by the presence of internal employees or external collaborators taking care of marketing and by the intensity of marketing and management training activity. Firms having a large percentage of software developers usually show a stronger attention toward technology than to market development.

Resources linked to external environment can influence both the TIC and the MIC. Frequent relationships with other firms centered on technical collaboration and an intense use of external software development methodology can imply a meaningful increase of the technological know-how, while significant relationships with other firms deriving from commercial collaboration are an obvious indicator of a particular concern for the market.

Economic indicators are simple measures for evaluating the scope and the width of firm’s market. Intense activity towards the commercialization of non-proprietary hardware and software usually means that the firm has a limited market for its own products; profits deriving from commercial activities are often used to sustain the innovation efforts and the development of new products.

THE METHODOLOGICAL APPROACH

The proposed methodology is aimed at identifying within small software firms, the relationships between transformations of organizational configuration through time and innovation. In order to apply the methodology, a field analysis was realized through the exploratory study of three case studies of small software firms within a specific geographic area. This analysis was performed through the following steps (and see Exhibit Two):

1) Field survey;
2) Identification of organizational configurations;
3) Critical resources analysis;
4) Analysis of the relationships between critical resources and orientation to innovation.
5) Quantitative measure of the orientation to market and technological innovation.
EXHIBIT TWO: THE PROPOSED METHODOLOGY

**Field survey**

**Objective:** to collect and analyze information concerning a sample of software small firms belonging to a specific geographic area with respect to their organizational assets and innovation performances.

**Output:** data and information concerning firms’ history and evolution, characteristics and composition of the entrepreneurial group, firms’ employees and software development teams, relationships and contacts with the external environment, careful analysis of firms’ market and products, identification and analysis of critical events (e.g. failure/starting of collaboration with other firms such as joint venture, supply relationships, failure/starting of relationships with important customers, loss/acquisition of critical professionals resources).

**Methodological approach:** unstructured interviews with entrepreneurs and employees and analysis of internal documentation; a case-study approach.

**Identification of organizational configuration**

**Objective:** to identify organizational configurations assumed by
firms between two critical events; identify sequences of stable configurations.

Output: identifications of organizational stages during firm’s life; identification of a set of variables defining the organizational configuration in a given instant of time.

Methodological approach: analysis of data collected through structured questionnaires.

Critical resources analysis

Objective: to identify a standard set of critical resources playing a major impact in determining firm’s innovation capabilities; to characterize firm's organizational profile in a certain instant of time on the base of the amount of critical resources managed by firms.

Output: identification and assessment of critical resources

Methodological approach: classification of key resources (KR) in the following groups:

a) C1: Entrepreneurial resources: in small software firms the entrepreneur plays a fundamental role in determining firm's organizational structure and development; this cluster contains a set of indicators describing the structure and the competencies of the entrepreneurial group.

b) C2: Human resources: since software firms are knowledge-based firms, information regarding people working in a firms contains fundamental indicators for the description of the organizational configuration; this cluster includes indicators related to the overall composition, the competencies, the development of the human resources of a given firm.

c) C3: Resources linked to external environment: the firm's know-how is strongly influenced by firm's ability in exploiting environmental resources; in this group it is possible to find indicators measuring firm's ability in setting up and developing contacts and collaboration with other firms and R&D centers or in acquiring new technologies.

d) C4: Economic Indicators: these variables measure firm’s market amplitude and characteristics.
Analysis of the relationships between critical resources and orientation to innovation.

Objective: to collect and analyze information concerning the relationship between firm’s innovation performance and firm’s critical resources.

Output: formal and synthetic representation of the relationships between resources and innovation through a tree hierarchical structure called explanatory tree (Zollo et al. 1999).

Methodological approach: elicitation of standard explanations linking the orientation to innovation to resources from interviews to experts (e.g. entrepreneurs, technicians).

Quantitative Analysis of firms’ innovation capabilities

Objective: to elaborate data related to key resources through a mathematical model described in the next section in order to determine a quantitative evaluation of the innovation level achieved by a given firm in a certain instant of time.

Output: quantitative evaluation of the degree of market innovation and the degree of technological innovation in several periods of time.

Methodological approach: data elaboration through a fuzzy multi-criteria aggregation model.

AN EVALUATION MODEL FOR THE DETERMINATION OF SMALL FIRMS INNOVATION CAPABILITIES

In this section a mathematical model aimed at evaluating the degree of technological innovation and the degree of market innovation is presented. Through the proposed model it is possible to evaluate the TIC and the MIC achieved by a given firm on the base of a set of variables expressing the amount of key resources managed by firms in a given instant of time.

The calculation of TIC and MIC

In this section a mathematical model aimed at evaluating the TIC and the MIC on the basis of the variables contained in Exhibit Two is briefly described with respect to the following salient aspects: a) representation of the relationships between variables; b) variables assessment; c) data elaboration.
**Representation of the relationships between variables.**

In order to represent the relationships between the indicators related to resources and the innovation indexes TIC and MIC, a model developed by Zollo *et al.* (1999) is proposed. According to this model the links between indicators and innovation performances are represented through a hierarchical structure referred to as an *explanation tree* (Exhibit Three).

Each knot of the tree with its leaves is called a fan (Zadeh, 1976). The root and the leaves of the fan are called, respectively, *explanans* and *explanandum*. An explanation tree is formed by one or more fan. The fan depicted in the exhibit can be interpreted in the following way: the TIC can be explained on the base of the amount of resources $C_1$, $C_2$ and $C_3$ possessed by a given firm. The score on $C_1$ can be justified by the values of $C_{1.1}$, $C_{1.2}$, $C_{1.4}$ and $C_{1.5}$.

**EXHIBIT THREE:**

**REPRESENTATION OF THE RELATIONSHIP BETWEEN INNOVATION AND RESOURCES**

**Variables representation and assessment**

A second issue in the construction of the model is to define a reliable procedure aimed at assessing the values of the variables. It is easy to verify that, among the ones contained in Exhibit One, that there are both
quantitative and qualitative variables. While, for example, it is easy to determine values such as the number of software developers or the amount of profit due to extra-regional market, it is difficult to assess the intensity of the collaboration with other firms or the degree of involvement of the entrepreneurs in software development. Moreover, because of a lack of information, a certain lack of precision could infiltrate the data. In order to cope with both the qualitative data and/or imprecise information, the elicited variables are represented as linguistic or fuzzy variables, that is variables assuming as their values fuzzy sets (Zadeh, 1973).

A fuzzy set is a set to which elements can belong with a certain degree represented by a real number belonging to the interval [0,1], with 1 and 0 representing, respectively, the full membership and the absence of membership. A fuzzy set $A$ is represented through a membership function $\mu_A(x)$ mapping the elements $x$'s of a universe $X$ to the interval [0,1] and assigning to each $x$ its degree of membership $\mu_A(x)$ to the set $A$. Since elements of $X$ can belong to $A$ with different degree ranging from full to no membership, it is not possible to identify a precise border that separates those elements belonging to $A$ from those elements not belonging to $A$. Fuzzy representation helps to take into account, and structure, the ambiguity and vagueness embodied in qualitative assessments. For example, if we consider the variable intensity of technical collaboration with other firms one could say that it is low, or average, or more or less high.

Because of their ambiguity, linguistic judgements can be represented in a more meaningful way through fuzzy sets rather than through numerical scales. Also the imprecision contained in statements such as about five or six software developers or a high amount of my time was devoted to software design can be better accommodated by a fuzzy representation. The rationale behind the fuzzy approach is that the transition between low involvement and average involvement is not sharply defined but it is a matter of degree. In those many real-life situation in which it is often impossible to determine what is the exact value marking the boundary between two categories, this approach is much more valid than the use of a binary point of view and thus the fixing of an arbitrary threshold.

**Data elaboration**

In this model, the issue of determining values for the TIC and the MIC is resolved through a fuzzy multi-criteria decision making approach. This
representation of the problem can be synthesized as follows: given an alternative \( A \) to be evaluated with reference to a set of \( n \) attributes or criteria \( \{C_1, C_2, \ldots, C_n\} \), the overall evaluation \( g \) of \( A \) with respect to the \( C_i \)'s can be determined in the following way:

\[
g(A) = f[c_1(A), c_2(A), \ldots, c_n(A)]
\]

where \( c_i(A) \) is the score obtained by \( A \) with respect to the criterion \( C_i \) and \( f \) is a monotonically non-decreasing aggregation function satisfying some intuitive criteria.

In our representation \( A \) is the firm to be evaluated with respect to the TIC or the MIC, \( C_i(A) \) is the amount of a given resources managed by the firm in a certain instant of time, \( c_i(A) \) are fuzzy scores expressing the values assumed by each resource. The aggregation of the scores is performed at each level of the explanation tree structure according to a bottom-up approach.

Several fuzzy multi-criteria aggregation operators \( f \) have been proposed in literature (Chen and Hwang, 1992). In our study we used a family of aggregation operators called OWA, Ordered Weighted Average operators (Yager, 1988). It is possible to demonstrate that an OWA operator can be associated to a fuzzy quantifier, i.e. a fuzzy set representing vague linguistic quantifiers such as, for example, \( \text{few}, \text{many}, \text{most}, \text{almost all} \). In the TIC and MIC calculations we used the quantifier \( \text{most} \). By aggregating single scores through the quantifier \( \text{most} \), the evaluation of the TIC or the MIC is high if a firm is able to manage a high amount of \( \text{most} \) of the critical resources.

**RESULTS**

In this section, three case-studies of software small firms are evaluated according the fuzzy model proposed in this paper. A description of firms’ characteristics is provided in Exhibit Four: Exhibit Five shows the firm's innovation performance for the three cases over time. These figures have been obtained by calculating the parameters TIC, and MIC over several years by means of the evaluation model presented in this paper. By observing the temporal evolution of the MIC and TIC in the three figures, it is easy to recognize three different behaviors that we define, respectively, as: market-oriented, technology-oriented and oscillating behavior.
**EXHIBIT FOUR:**
**THE THREE CASE STUDIES - DESCRIPTION**

<table>
<thead>
<tr>
<th></th>
<th><strong>Case One</strong></th>
<th><strong>Case Two</strong></th>
<th><strong>Case Three</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Birth</strong></td>
<td>1980</td>
<td>1979</td>
<td>1978</td>
</tr>
<tr>
<td><strong>Entrepreneurs’ cultural background</strong></td>
<td>High knowledge of the market; past management experience in large companies</td>
<td>High level of technical knowledge</td>
<td>High level of technical knowledge</td>
</tr>
<tr>
<td><strong>Main activity</strong></td>
<td>Development of software for warehouse and stock management</td>
<td>Development of software for structural engineering; software package for accounting</td>
<td>Software for telecommunications</td>
</tr>
<tr>
<td><strong>Other activities</strong></td>
<td>None</td>
<td>Software commercialization</td>
<td>Hardware and software commercialization</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Training services</td>
</tr>
<tr>
<td><strong>Main customers</strong></td>
<td>Large supermarkets</td>
<td>Banks, engineering societies</td>
<td>Very innovative customers (large Italian firms)</td>
</tr>
<tr>
<td><strong>Market scope</strong></td>
<td>Regional</td>
<td>Regional</td>
<td>National</td>
</tr>
<tr>
<td><strong>Number of employees</strong></td>
<td>From 3 to 9</td>
<td>From 7 to 15</td>
<td>From 4 to 35</td>
</tr>
<tr>
<td><strong>Organizational structure</strong></td>
<td>Very flat: entrepreneurs as project managers and involved in software development</td>
<td>Two project groups in engineering support software and managerial software coordinated by entrepreneurs</td>
<td>Project teams; entrepreneurs are not project managers; presence of a R&amp;D unit</td>
</tr>
<tr>
<td><strong>Professional competencies</strong></td>
<td>Technical, marketing expert support</td>
<td>Technical</td>
<td>Technical and marketing</td>
</tr>
<tr>
<td><strong>Competencies management</strong></td>
<td>Internal and external market and technical training activities</td>
<td>Internal technical training</td>
<td>Internal and external market and technical training; job rotation</td>
</tr>
<tr>
<td><strong>Software development methodologies</strong></td>
<td>Internal</td>
<td>CASE, methodologies of project management</td>
<td>Advanced methodologies of software engineering</td>
</tr>
<tr>
<td><strong>Innovation configuration</strong></td>
<td>Slow decline</td>
<td>Rapid decline</td>
<td>Discontinuous configuration</td>
</tr>
</tbody>
</table>

Case One represents a typical example of market oriented behavior. Like the majority of small software firms, the firm described in this case shows an initial very rapid growth of the TI due to the high innovative content of its early products followed by a period of decline. In this case, the attention of the entrepreneurs to market aspects has allowed the firm to survive for a long period of time (1983-1993) with good economic results despite the absence of substantial technological innovation efforts. Nevertheless, because the strong market orientation was not accompanied by a real technological innovation this policy was able only to slow down but not to prevent the firm's TI decline.

Case Two represents a typical example of technology-oriented behavior; in this case, as in the previous one, the firm presents an initial strong orientation toward technology followed by a rapid decline of firm's TI. The substantial difference from the previous case-study lies in the fact that in this case the firm was not able to sustain the increase of the MI by developing an effective policy of market expansion. It can be argued that a small firm following this pattern either could die, or, survive in a very limited market niche (local or linked to a very specialized product), as happened in this case. This case also showed that innovation in
organizational structures and in design methodologies that are not followed by an adequate innovation transfer to new products is insufficient to produce an increase of innovation firm's capability.

Case Three is an example of oscillating behavior: the firm is able to alternate phases in which there is a strong attention to technological innovation (TI is high) with phases in which market aspects are enhanced (MI is high). What is fascinating here is that the TI and the MI have evolved oppositely. In respect of technology-orientation, the initial growth ends because of firm's inability to exploit the market potentialities of its products; in respect of its market-oriented behavior, the firm is able to expand the market but it does not manage to maintain a satisfying level of technological innovation. In both cases, it is plausible to argue that small software firms between the third case and the first two cases lies in the fact that, in the market phases, the firm does not neglect the technological focus and it is able to achieve a certain balance between market and technology.

All the firms considered show some common features. All were founded by technical entrepreneurs and were born around a product idea developed for a specific market and often limited to a regional market. The acquisition and the updating of initial know-how takes place in several ways: through relationships with large firms or by means of close relationships with technical groups or research centers which allow the firm to experiment with high levels of technological innovation and specialize in a well defined market segment. The field analysis showed that almost all firms, thanks to the high degree of technical expertise of the founders and to their network of relationships with other technical centers, reach a high level of innovative capabilities in the first years of their life. This tendency is showed in all the presented cases in which TI is always very high at firms’ birth.

Nevertheless, the strong focus of the group on the technological aspects usually implies that they are neglecting market vision and development (customer fidelity, marketing and commercialization, services and assistance, connections with other firms). For this reason the majority of small software firms have to live through a dramatic market crises - essentially that of an inability to enlarge the market beyond the local area coupled with a difficulty in maintaining growth. This crisis is particularly evident in the first two cases (see the MI graphs).
Such a (market) crisis causes a reorganization of firms' activities, involving both the original group of entrepreneurs and the internal professional skills. In general, one or more entrepreneurs move from product development activities towards market development or managerial roles.

The reorganization of the firm following the market crisis signals the beginning of the decline in the firm’s innovative ability. Most of the firms reduce their engagement in product development and progressively concentrate on the supply of IT services or limit themselves to update the initial product, as with cases one and two, in which it is possible to observe a remarkable fall of the TI while MI increases or remains stable. In case three, the firm managed to interrupt the decline with a reorganization of activities to take advantage of occasions arising from a new relationship with the market. This firm shows a continuous progress in innovative activities (the TI increases again after the initial fall).

What emerges clearly from the field analysis is that the efficiency of the organizational configuration is never fixed, but is always temporary. Each configuration has its own life cycle and, sooner or later, its performances will begin to diminish and firms will be forced to change. One could interpret each organizational configuration tried out by them as an attempt to respond to the dilemma of how many resources to allocate on the technological front and how many to allocate to the market. Since there is no rule which guarantees a priori what is the right balance between technological resources and market resources, a small firm will experiment with configurations oriented both at technology and at the market throughout its life-span. Transition from one to the other may take place in a period of crisis, and the result can be moving toward innovation or moving toward the market. From this perspective, small firms behavior appears to be always reactive with respect to external events that firms are not able to control or monitor.

**PRACTICAL IMPLICATIONS**

The field analysis results allow us to hypothesize a general model of the relationship between organizational models and technological innovation. If we call, respectively, $T$ and $M$, the technology-oriented and the market oriented configuration, $ic$ the innovation crisis and $mc$ the market crisis, it is possible to identify the following typology of evolution patterns:
a) \textit{T-mc-M-ic-T} (oscillating behavior): firms with the best performance and a discontinuous progress of innovative activity. (Case Three shows a development path of this type). In the presence of a market crisis, firms slow down their efforts directed toward technological innovation and take charge of market aspects. When products begin to become obsolete, firms react by increasing again the technological innovation efforts. A positive feedback is established since resources coming from market expansion are successively employed to increase technological innovation, while technological innovation becomes the pre-condition for market success.

b) \textit{T-mc-M-ic-M} (market oriented behavior): firms with a path like this (Case One) do not manage to renew their own technological know-how and are strictly linked to their early products. These firms, in order to survive to the combined effect of both a market and technological crisis, gradually diversify their activities towards services. Market ability and diversification usually helps firms following this pattern in surviving for quite a long period notwithstanding the low innovative content of their products.

c) \textit{M-ic-T-mc-T} (technology oriented behavior): the firm with such a pattern (Case Two) is essentially unable to develop activities related to market development; this incapacity usually brings firms to a rapid decline. Firms following this pattern are able to develop high technological innovation efforts but their growth is strongly limited by their substantial lack of market vision.

Examples of events characterizing a market crisis are rapid market saturation due to a very small market usually limited to a regional or local area, failure of collaboration with other firms (joint ventures, supply relationships), failure of relationships with important and critical customers, loss of marketing professionals due to high human resource turn-over. Examples of events associated with an innovation crisis are a decrease of software production together with development of professional services, inability in developing new products, absence of innovative customers, inability to shift towards new software and hardware platforms.

According to the model that has emerged from this study, the following general sequence may be observed:

a) the firm begins with a technology oriented configuration (\textit{T}) based on the entrepreneurial resources employed in product development,
b) a market crisis (mc), felt as a difficulty in widening the market beyond its initial scope, usually follows;

c) firms develop a market oriented configuration (M) when the attention of the entrepreneur shifts from product development activity to market development activities;

d) an innovation crisis occurs (ic) when a firm cannot manage to develop an innovation activity capable of using the new opportunities which market expansion can offer;

e) in some cases, the firm manages to give rise to a new configuration which is oriented towards technology (T), reorganizing resources and technical skills. Most of these firms are not able to resolve innovation or market crises.

CONCLUSIONS

The case-studies analyzed seem to suggest that small firms can sustain high innovative capabilities if in the course of its life, they alternate configurations oriented towards technology with others oriented towards the market. Therefore a hypothesis which tries to link firm’s innovative capabilities with a given type of organizational configuration does not seem acceptable. On the contrary, even if data are limited, it seems that the relationship between technological innovation and organization are of the dynamic rather than static type.

As it is possible to observe, each organizational pattern experienced by the small firms can be considered as an attempt to respond to the dilemma of how many resources they should employ on the technological front and how many on the market front. From this perspective, small firms’ behavior appears to be always reactive with respect to external events that firms are not able to control or monitor.

As far as the practical implications concerning relationships between marketing and entrepreneurship, what emerges clearly from the field analysis is that the effectiveness of any organizational pattern is never fixed, but it is always temporary. Each pattern has its own life cycle. Sooner or later performances of any pattern begin to diminish and firms are forced to change. Since there is no rule which guarantees a priori what is the right balance between technological resources and market resources, the small
firm will experiment with patterns oriented both at technology and at the market throughout its life-span. Transition from one to the other may take place in a period of crisis, and the result can be moving toward innovation or moving toward the market.

REFERENCES


