

A Resource-Based Approach to Strategy Analysis in Small-Medium Sized Enterprises

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ABSTRACT. Few articles have been published that specifically deal with how to support strategic analysis and management in small-medium sized enterprises (SMEs). In the last decade, however, literature on strategic management has paid considerable attention to the resource-based theory, which seems to fit well the needs of owners and executives of SMEs. The objective of this article is twofold: (i) to present a resource-based view of an SME's sustainable competitive advantage; (ii) to propose an approach to strategy analysis based on such a view.

Introduction

The literature on management of small-medium sized enterprises (SMEs) includes many articles dealing with strategic planning, most of which report empirical studies aimed at:

- showing the presence or the absence of strategic analysis and planning practices in SMEs (e.g., Sexton and Van Auken, 1985; Shuman et al., 1985);
- demonstrating the effectiveness of such practices in terms of positive impact on a company's performance (e.g., Aram and Cowen, 1990; Orpen, 1994; Bracker et al., 1988; Schwenk and Shrader, 1993; Lyles et al., 1993; Risseuw and Masurel, 1994; Piest, 1994; Olson and Bokor, 1995).

In contrast, little attention has been paid to how to support the entrepreneurial and managerial team in strategy analysis (e.g., Quinn, 1980; Ansoff, 1984; Curtis, 1993).

Final version accepted on August 26, 1998

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In the last decade, literature on strategic management has paid considerable attention to the *resource-based theory* (e.g., Grant, 1991; Collis and Montgomery, 1995; Barney, 1991; Mahoney and Pandian, 1992; Amit and Shoemaker, 1993; Sanchez et al., 1995; Peteraf, 1993), which seems to fit well the needs of owners and executives of SMEs.

The objective of this article, which is supported by empirical research based on 14 case studies, is twofold:

- to present a resource-based view of an SME's sustainable competitive advantage;
- to propose an approach to strategy analysis based on such a view.

This article is divided into three major sections. The first briefly reports some basic concepts of the resource-based theory. In the second section a resource-based view of a SME's sustainable competitive advantage is proposed. Finally, the third section describes the suggested approach to strategic analysis, using an example case derived from the empirical research.

1. The resource-based theory

According to the resource-based theory, which has its roots in economic theory (e.g., Penrose, 1959) and early strategy theory (Selznick, 1957; Ansoff, 1965; Andrews, 1971), the long-term competitiveness of a company depends on its endowment of *resources* that differentiate it from its competitors, that are durable and, that are difficult to imitate and substitute (e.g., Grant, 1991; Peteraf, 1993; Collis and Montgomery, 1995; Mahoney and Pandian, 1992; Barney, 1991; Prahalad and

Small Business Economics 12: 233–248, 1999.

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Hamel, 1990 and 1994; Stalk et al., 1992, Amit and Shoemaker, 1993; Porter, 1991).

Various definitions and classifications of resources have been proposed in the literature. The most important in the context of this article are briefly described here.

- A number of authors divide resources into homogeneous classes, such as, financial resources, physical resources (plant, machine, equipment, etc.), human resources, technological resources, reputation, and organisational resources (e.g., control management system, organisational climate, internal relationships) (e.g., Grant, 1991; Azzone et al., 1996).
- Others classify resources as *tangible*, such as human, financial or physical resources, and *intangible*, such as reputation, organisation, know-how or patents (e.g., Hall, 1992; Zahara and Das, 1993; Collis and Montgomery, 1995).
- Some contributions introduce the distinction between *assets*, something a firm possesses (e.g., brand, retail location), and *skills*, something a firm is able to do (e.g., advertising, efficient manufacturing) (Aaker, 1989; Hall, 1992). In particular Hall (1992) refers to intangible resources as *assets* and *competencies*: the former are divided into *legal assets* (e.g., contracts, licences, patents, trade marks, copyright, etc.) and *non-legal assets* (e.g., reputation, supplier network, databases), and the latter into *know-how* (possessed not only by employees and managers but also by the other stakeholders) and *organisational culture* (e.g., the company's attitude to quality and learning ability).
- A number of authors have taken the concepts of *competence* and *capability* further, seeing these as a body of resources (technologies, skills, organisational resources, etc.) and as a company's ability to manage, leverage and exploit them within the market (Prahalad and Hamel, 1989, 1994; Stalk et al., 1992; Meyer and Utterback, 1993; Azzone and Rangone, 1996; Amit and Shoemaker, 1993; Grant, 1991; Sanchez et al., 1995; Verdin and Williamson, 1994).

However, the resource-based theory does not consider *all* resources possessed by a company, but focuses rather only on *critical* (or *strategic*)

resources, i.e. those that are the basis of the company's sustainable competitive advantage. To determine such resources, various authors have proposed a number of "tests" (see also Barney, 1991; Wernefelt, 1989; Zahara and Das, 1993; Amit and Shoemaker, 1993; Collis and Montgomery, 1995; Mohoney and Pandian, 1992; Porter, 1991; Grant, 1991; Prahalad and Hamel, 1994), the most important of which are:

- *competitive superiority* test, which evaluates if and to what extent the resource contributes to differentiating the company from its competitors;
- *imitability* test, which analyses actual and potential competitors' difficulty in imitating the resource, due, for example, to its physical uniqueness, path dependency, casual ambiguity or economic deterrence;
- *duration* test, which measures if the resource's benefits will also be generated in the long term;
- *appropriability* test, that verifies if the company owning the resource is able to exploit the generated advantages generated in the market;
- *substitutability* test, which assesses how difficult it is for competitors to replace the resource with an alternative that gives the same advantages.

Starting from these basic concepts, some authors have proposed frameworks and approaches to support strategy analysis and planning (Hall, 1993; Amit and Shoemaker, 1993; Aaker, 1989; Zahara and Das, 1993; Williamson and Verdin, 1992; Quinn and Hilmer, 1994; Wernefelt, 1989; Peteraf, 1993; Collis and Montgomery, 1995; Grant, 1991; Prahalad and Hamel, 1994; Stalk et al., 1992). However, such contributions generally refer to large firms. This paper proposes a resource-based approach to strategy analysis suitable for SMEs. The main features are that it:

- is not too complex or time consuming, "forcing" the entrepreneurial and managerial team to pay attention to just a few variables with a major impact on long-term competitive advantage;
- does not require specialist skills in strategic analysis or sophisticated information systems.

The approach derives from a resource-based view of an SME's sustainable competitive advantage described in the next section.

2. A resource-based view of an SME's competitive advantage

Empirical research based on 14 case studies of SMEs in different industries (see Table I for data about the size and the products/services of the companies in the sample) has produced a model of an SME's sustainable competitive advantage based on three *basic capabilities*:

- *innovation capability*: that is a company's ability to develop new products and processes, and achieve superior technological and/or management performance (e.g., development cost, time-to-market, etc.);
- *production capability*: that is the ability to produce and deliver products to customers, while ensuring competitive priorities, such as quality, flexibility, lead time, cost, dependability, etc.;
- *market management capability*: that is a company's ability to market and sell its products effectively and efficiently.

According to this model, an SME explicitly or implicitly, consciously or unconsciously, puts its strategic focus on one or more of the above basic

capabilities. Hence, there are two extreme cases and a range of intermediate situations. The extreme cases are:

- SMEs that have a "mono-dimensional" strategic intent, i.e. their strategic attention is focused on just a single capability. For instance, Company 1 (see Table I) views itself as a "production system", working only as a subcontractor, and, thus, attributes very little importance to capabilities in innovation and market management;
- SMEs that pay strategic attention to all three basic capabilities. Company 9 (Table I), for instance, bases its competitiveness especially on production and marketing capabilities, but also considers innovation critical.

The extent to which a company possesses each of these capabilities depends on its specific strategic focus, which moulds its deliberate (i.e. explicitly planned) or emergent (i.e. the result of a set of local choices that together define a consistent pattern of action) strategies (Mintzberg and Waters, 1985).

The basic capabilities are founded, in turn, on a company's endowment of *critical resources*, that are those resources that meet the five tests reported in Section 1 (competitive superiority, imitability, duration, appropriability and substitutability). In this article, critical resources include: financial resources (internally generated funds), physical assets, human resources, organisational resources

TABLE I
The companies in the sample

Companies*	Size (turnover and employees)	Product services
1	0.7 million pounds, 15 employees	Made-to-order components in rubber and plastic
2	100 million pounds, 1200 employees	Disk braking systems for motor-cycles, cars and industrial vehicles
3	3.5 million pounds, 50 employees	Made-to-order pressed components in zinc
4	2 million pounds, 30 employees	Low, medium and high voltage electronic apparatus
5	5 million pounds, 100 employees	Small aluminium tubes for pharmaceutical products
6	0.8 million pounds, 20 employees	Written-to-order text for publishing houses
7	2 million pounds, 30 employees	Spring structures for mattresses
8	1.7 million pounds, 20 employees	Trade fair services
9	43 million pounds, 300 employees	Built-in domestic appliances
10	0.7 million pounds, 15 employees	Tooling machines
11	7 million pounds, 75 employees	Doors and windows for industrial and commercial vehicles
12	7 million pounds, 50 employees	Polyethylene film for packaging
13	10 million pounds, 200 employees	Super-rapid steel tools for tooling machines
14	20 million pounds, 200 employees	Cacao-based food-stuffs

* For reasons of confidentiality, the names of the sample companies are replaced by numbers.

(including external relationship networks), skills, know-how and competencies, brand and reputation (see also Grant, 1991; Ackers, 1989; Hall, 1992; Azzone et al., 1996).

To make the links between basic capabilities and critical resources operational, it is necessary to consider the company's *key performances*, which themselves depend on the industry's key success factors (Porter, 1980; De Vasconcellos and Hambrick, 1989; Hax and Majluf, 1985; Grant, 1991) and on the core customer benefits the company wants to address (Prahalad and Hamel, 1989 and 1994). Only critical resources that affect key performances should be considered.

Key performances can be divided into three categories, depending on the capability to which they are principally related: (i) manufacturing performances (e.g., quality, dependability, cost, etc.), which in literature on operations management are usually referred to as manufacturing competitive priorities (e.g., Anderson et al., 1989; Krajewski and Ritzman, 1990; Kim and Arnold, 1992; Vickery et al., 1991; Azzone and Rangone, 1996); (ii) new product development performances, which include both technological and managerial performance (e.g., development cost, time to market); (iii) marketing performances, such as brand awareness, brand reputation, customer loyalty, etc.

Figure 1 summarizes the above considerations in a tree structure (referred to as "resource tree") showing the links between basic capabilities, key performances and critical resources.

Figures 2 and 3 show the resource trees of companies 1 and 9, respectively.

It should be noted that the three basic capabilities can be strictly related to each other. In particular, a given critical resource can act on more than one capability. For instance, Company 9's customer relationship network affects both its market management capability and its innovation capability (customers are effectively involved in the new product development process) (Figure 3), while the service centres network acts on both production capability and market management capability (in terms of service support).

According to this model, an SME's competitive advantage depends on critical resources possessed by the company and their alignment with the company's strategic intent (and thus key performances). The model does not say anything about how the single firm exploits such a competitive advantage on the market: to grow or to increase profitability. A company that has a sustainable competitive advantage relative to its competitors, due to an adequate endowment of critical resources, can in fact pursue a growth strategy or a high margin strategy: according to the first

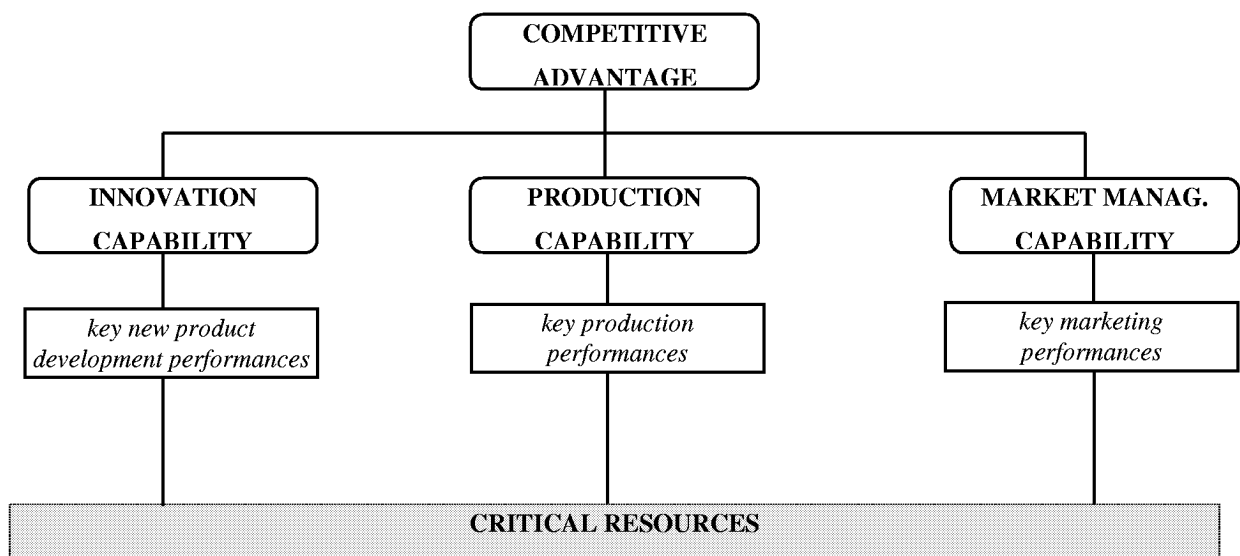


Figure 1. The resource tree.

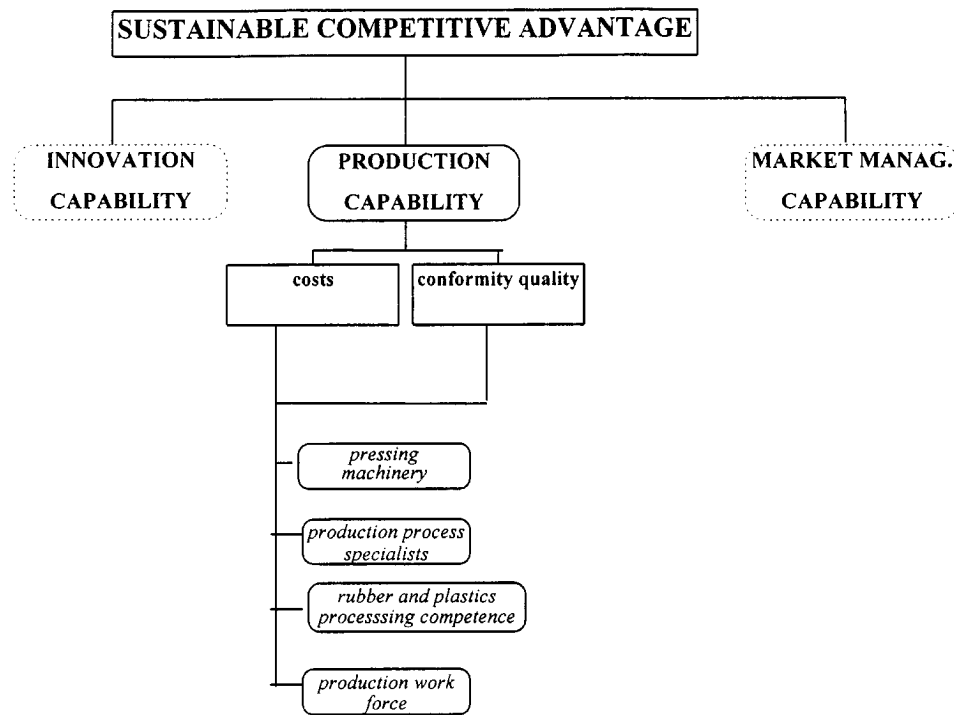


Figure 2. Company 1's resource tree.

strategy, the firm exploits its competitive advantage to increase sales, by, for instance, selling products with performance superior to competitors' at the same price; following the second strategy, the firm exploits its competitive advantage to increase profitability/unit margin, by, for instance, making customers pay a premium price for the superior performance of its products. A firm can of course pursue both those strategy simultaneously.

It should be noted, however, that the endowment of critical resources cannot be directly related to a company's financial performance, as the latter also depends on the specific structure and attractiveness of the industry in which the company acts, and on the ability of the company to translate resources into capabilities and, subsequently, competitive advantage. With regards to this last point, a fundamental role is played by the entrepreneur(s), who can be seen as a "special" resource supporting all the others.

3. A resource-based approach to strategic analysis

The approach to strategy analysis in SMEs proposed in this article involves the following major steps:

1. define the company's strategic intent and key performances;
2. identify the company's resources influencing key performances;
3. assess the strategic value of resources, i.e. their ability to create and sustain a long term competitive advantage;
4. assess the strategic consistency of resources in contributing to the achievement of the strategic intent;
5. generating strategic options.

Step 1. *Defining the strategic intent and key performances*

The first step in the approach involves the definition of the company's strategic intent by the entrepreneurial and managerial team. According

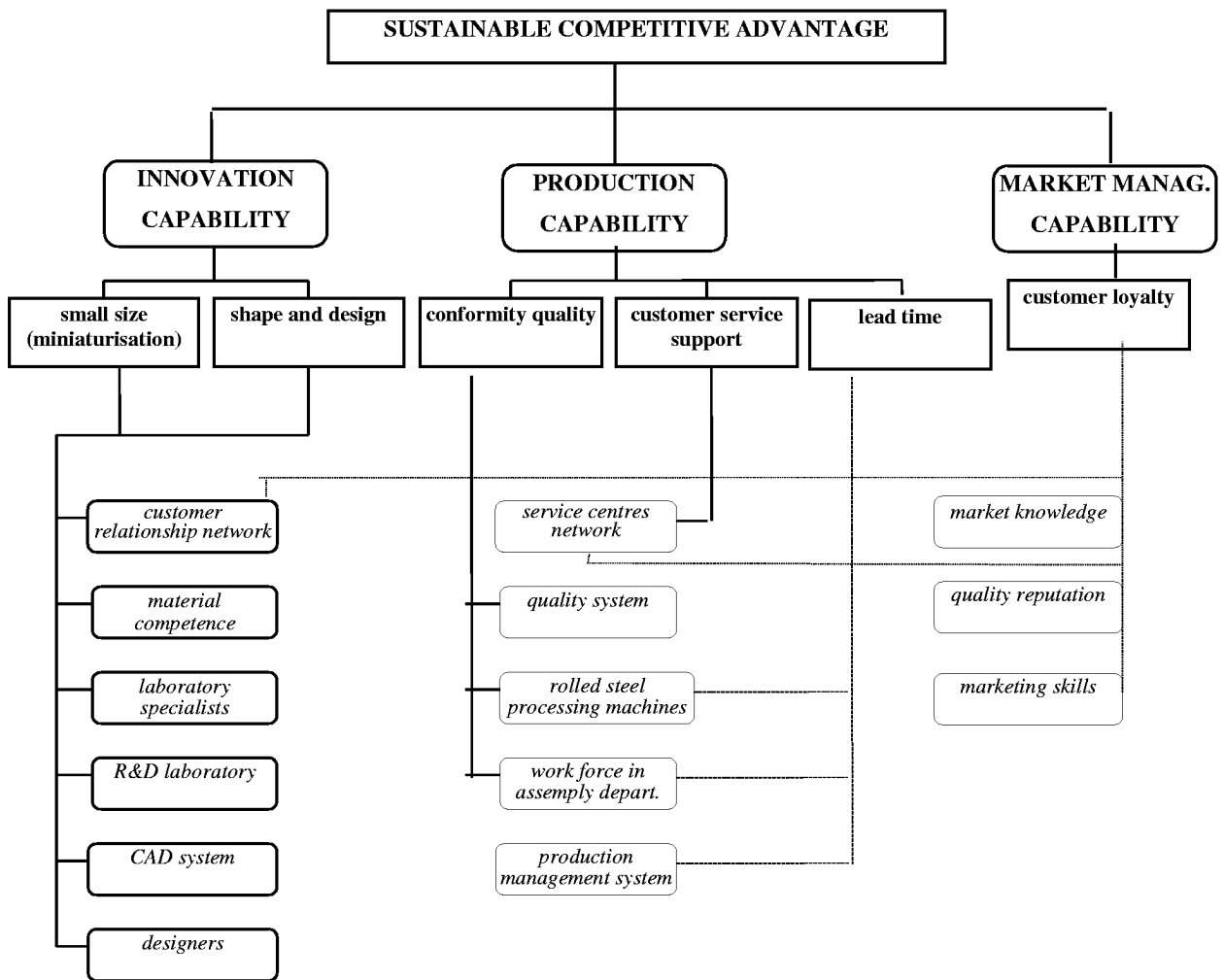


Figure 3. Company 9's resource tree.

to the model of sustainable competitive advantage described in the previous section, this implies two, strictly related, levels of choices:

- definition of the basic capabilities on which the firm will rely. This means focusing on a single capability or pursuing two or all three basic capabilities;
- definition of the key performances to achieve, on the basis of the industry's key success factors and the core benefits the company wants to ensure to its customers.

Let us consider, as an example, Company 13 (Table I), which operates in the super rapid steel tools sector. The key performances defined by the

entrepreneur and executives are given in Figure 4. This company considers all three basic capabilities to be strategic (even if no specific key marketing performance is defined).

Step 2. *Identifying resources influencing key performances*

In this step, resources that can influence key performances have to be identified (at this point of the approach, the attention has to be paid to all relevant resources, as it is not yet possible to determine which are *critical* and which are not). To this end, a process-based approach can be followed: for each key performance, the major



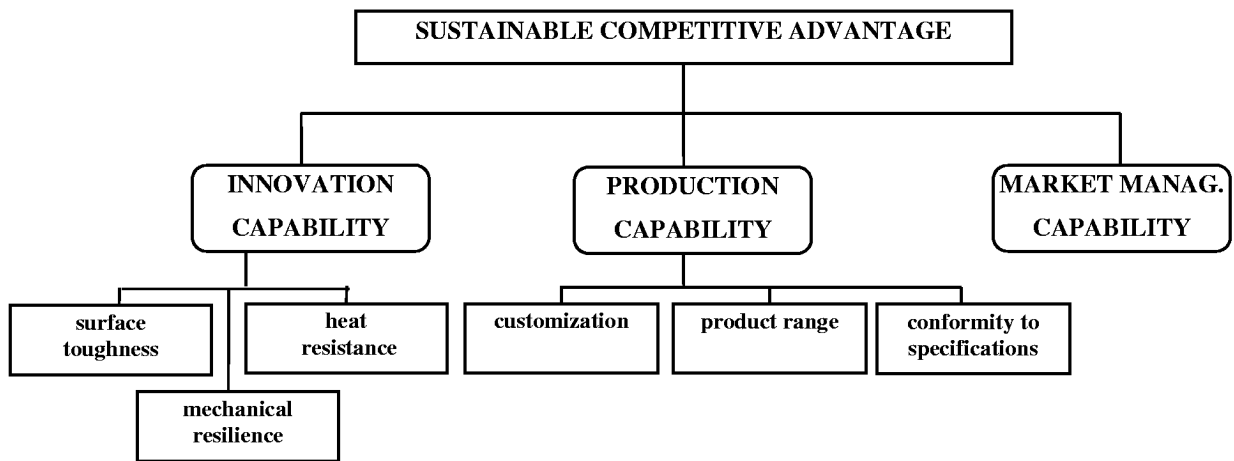


Figure 4. Company 13's key performances.

activities acting on it are analysed so that the resources necessary to carry out these activities and to link them each other can be determined. This approach could lead to process reengineering (Hammer and Champy, 1993; Davenport, 1993; Hall et al., 1993; Edwards and Peppard, 1994), in which case, the resources that have to be considered are those related to the activities included in the reengineered process.

Figure 5 reports resources deriving from this procedure for Company 13.

Step 3. *Assessing the strategic value of resources*

According to the resource-based theory, the strategic value of a resource, i.e. its ability to create and sustain a long term competitive advantage, depends on the results of the five tests given in the first section of this article: competitive superiority, imitability, duration, appropriability and substitutability. Table II shows an example of how a resource (Company 13's customer relationship network) can be assessed with these tests.

With such evaluations, the entrepreneur and executives can assess the strategic value of each resource qualitatively. Table III reports linguistic evaluations of the value of Company 13's resources, expressed on the following scale: "low; medium; high". This step can be supported by more sophisticated analytical tools, such as any multi-attribute decision making techniques, to arrive at more precise assessments. The Appendix

gives an example based on a scoring method of how to analytically calculate the strategic value of resources. For further details of other multi-attribute decision making techniques, see, for instance, Rangone (1998).

As already pointed out in Section 1, in the resource-based theory, only resources with a "good" strategic value can be considered *critical* and, thus, able to provide competitive advantage.

TABLE II
An example of the application of the tests to one of Company 13's resources (customer relationship network)

Tests	Resource: customer relationship network
Competitive superiority	The customer portfolio of the company includes some important and large customers, even though most do not have an exclusive relationship with the company and are also served by major competitors.
Imitability	It is not easy to sell for the first time to the major customers in the market, but most important competitors already sell to such customers.
Duration	Customer loyalty, particularly of the most important clients, is not very high, hence customer relationships are expected to be medium-term.
Appropriability	The company is able to exploit the customer relationship network, so reducing, for example, the unpredictability of demand.
Sustitutability	The customer relationship network cannot be replaced by another resource.



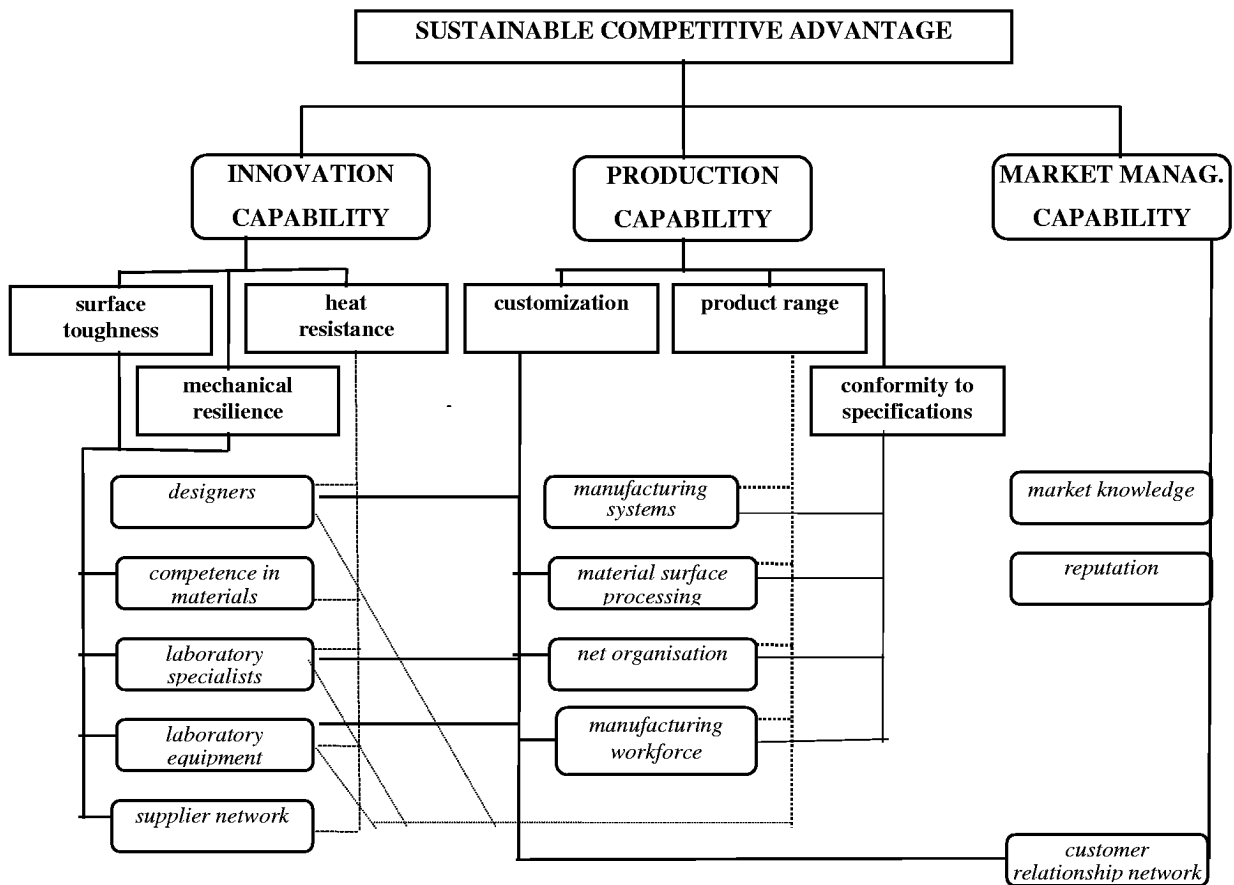


Figure 5. Company 13's resources.

TABLE III
Company 13's qualitative assessments of strategic value of resources

Resources	Strategic value
Customer relationship network	Medium
Quality reputation	High
Market knowledge	High
Supplier relationship network	Low
Competence in materials	High
Laboratory specialists	Low
Designers	Low
Laboratory equipment	Medium
Manufacturing system	Medium
Material surface processing machinery	Medium
Organisation	High
Manufacturing workforce	Medium

In this case, resources scoring high or medium are taken as critical.

It should be noted that critical resources are

indeed only potentially able to provide long-term competitive advantage, as they must also be consistent with a company's strategic intent, and, thus, with key performances. In other words, in order to create and sustain a competitive advantage over the long-term, there must be consistency between a company's strategic intent and its endowment of critical resources. The next step assesses this strategic consistency by calculating the importance of each resource in contributing to the achievement of the company's strategic intent.

Step 4. *Assessing the strategic consistency of resources*

A resource's strategic value measures its potential ability to generate and sustain a firm's long-term competitive advantage, but it says nothing about the resource's consistency with the company's strategic objectives, i.e. its ability to



contribute to the achievement of the company’s strategic intent. We will refer to such an ability as *strategic consistency*, since it measures the resource’s alignment with the company’s strategic objectives.

In order to assess the strategic consistency of resources, the following steps have to be carried out:

1. determine the relative priorities of the basic capabilities and the relative importance of key performances, for each capability;
2. determine the impact of each resource on key performances (as highlighted in Section 2, a single resource can act on more than one performance);
3. assess the strategic consistency of resources by integrating the relative priorities of capabilities and key performances (step 1) with the resources’ impact on performances (step 2).

Even if the above steps can be qualitatively carried out by a company’s entrepreneurs and executives, an analytical tool can be still used, as shown in the Appendix.

Table IV shows the qualitative output of this phase: the strategic consistency of resources is assessed using a linguistic scale (low, medium, high).

Step 5. *Generating strategic options*

Depending on their strategic value and consistency, a company’s resources can be mapped in a matrix similar to that reported in Figure 6 which allocates the resources to one of four squares:

- resources with *high consistency* and *high value* are coherent with the company’s strategic objectives and can generate a sustainable competitive advantage (square 1);
- resources with *high consistency* but *low value* are aligned with the company’s strategic objectives, but are not able to support long term competitive advantage (square 2);
- resources with *low consistency* but *high value* could be critical under a resource-based perspective, but are not aligned with the company’s strategic objectives (square 3);
- resources with *low consistency* and *low value* are not relevant.

TABLE IV
Company 13’s qualitative assessments of the strategic consistency of resources

Resources	Strategic consistency
Customer relationship network	Medium
Reputation	Medium
Market knowledge	Low
Supplier relationship network	Low
Competence in materials	Medium
Laboratory specialists	High
Designers	High
Laboratory equipment	High
Manufacturing system	High
Material surface processing machinery	Low
Organisation	Medium
Manufacturing work-force	High

Figure 7 shows the map of Company 13’s resources in the “strategic consistency/strategic value” matrix.

By analysing the map of a company’s resources in the “strategic consistency/strategic value” matrix, an SME’s entrepreneurs and executives can deduce guidelines for company strategy. Such guidelines can be divided into two different levels:

- the first level refers to the overall alignment between the company’s strategic objectives and its critical resources;
- the second level is concerned with the “most suitable” strategies for the different resource classes.

With respect to the first level, the matrix verifies the level of consistency of the company’s endowment of resources with its strategic intent:

- if most resources fall into squares 1 and 2, consistency is ensured, but
- if many resources are in square 3 (high value

	Strategic consistency	
	LOW	HIGH
Strategic value		
LOW	Not significant	2
HIGH	3	1

Figure 6. The “strategic consistency/strategic value” matrix.



Strategic consistency \ Strategic value	Strategic consistency			
	LOW	MEDIUM	MEDIUM	HIGH
LOW	<input type="checkbox"/> Supplier network	<input type="checkbox"/> Material surface processing machinery		<input type="checkbox"/> Laboratory specialists <input type="checkbox"/> Designers
MEDIUM		<input type="checkbox"/> Customer relation network		<input type="checkbox"/> Laboratory equipment <input type="checkbox"/> Manufacturing system
MEDIUM				<input type="checkbox"/> Manufacturing workforce
HIGH	<input type="checkbox"/> Market knowledge	<input type="checkbox"/> Reputation <input type="checkbox"/> Competence in materials <input type="checkbox"/> Organisation		

Figure 7. Mapping Company 13's resources in the "strategic consistency/strategic value" matrix.

and low consistency), there is significant inconsistency.

In the latter case, a revision of the company's strategic intent should be considered, with a view to a better explanation of critical resources. Such a revision evidently must consider external variables and, in particular, the industry's key success factors (see step 1).

With respect to the second level, i.e. using the map to identify the "most suitable" strategies for the different resources, the following guidelines can be highlighted:

- resources in square 2 (low value and high consistency) should be developed through specific investments, in order to increase their value;
- resources in square 3 (high value and low consistency) should be exploited without further investment and, if possible, converted to support other key performances;
- resources in square 1 (high value and high consistency) should be exploited as before to support key performances and nurtured to avoid any loss of value.

Appendix – Analytical support of the resource-based approach

An example of how the resource-based approach to strategic analysis can be supported analytically is given. The example is based on a scoring method, a multi-attribute technique with the great advantage of being mathematically trivial and simple to implement (e.g., Buss, 1983; Canada, 1986). The example is derived from the case study of Company 13.

Using a scoring method, the strategic value of a resource can be calculated as follows:

- the suitability rating of each resource with respect to the five tests is expressed by integer numbers from 1 to 10 (let SR_{ij} be the suitability rating of the i -th resource with respect to the j -th test);
- the strategic value (SV_i) of each resource is obtained by multiplying the above ratings and, thus, calculating the root to the power 5:

$$SV_i = \sqrt[5]{\prod_{j=1}^5 SR_{ij}}$$

TABLE A1
Numeric assessments of Company 13's resources with respect to the five tests and their resulting strategic value*

Resources	Competitive superiority	Imitability	Duration	Appropriability	Substitutability	Strategic value
Customer relationship network	6	5	6	8	10	6.8
Reputation	10	7	9	10	7	8.5
Market knowledge	10	8	8	9	8	8.5
Supplier relationship network	4	2	2	6	4	3.3
Competence in materials	9	9	8	7	7	7.8
Laboratory specialists	2	6	4	4	4	3.8
Designers	2	6	4	4	4	3.8
Laboratory equipment	8	4	8	8	6	6.6
Manufacturing system	8	6	8	6	4	6.2
Material surface processing machinery	6	6	8	8	4	6.2
Organisation	10	8	8	8	8	8.4
Manufacturing workforce	6	6	6	6	6	6

* The correspondence between the scoring reported in the last column of Table A1 and the qualitative assessment of the strategic value of Company 13's resources shown in Table III can be established on the basis of the following relationships: scores below 5 are judged "low"; scores between 5.1 and 7.5 are considered "medium"; scores above 7.6 are judged "high".

As far as the calculation of the strategic consistency of resources is concerned, the application of the scoring method requires the following steps:

- the relative priorities of the basic capabilities and of key performances for each capability are defined by numeric weightings expressed as real numbers from 0 to 1, whose sum is equal to 1 (let Rc_k be the relative priority of the k -th basic capability and R_{kl} the relative priority of the l -th key performance acting on the k -th basic capability);
- the assessment of the impact of each resource on key performances is made using the same scale as in the previous step (let I_{ilk} be the impact rating of the i -th resource with respect to the l -th key performance of the k -th basic capability);
- the strategic consistency of each resource (SC_i) is calculated by averaging its score with respect to every key performance with the corresponding weighting:

$$SC_i = \sum_{k,l} Rc_k R_{kl} I_{ilk}$$

Tables A2, A3 and A4 report the numeric weightings of the basic capabilities and key performances.

TABLE A2
Weightings of Company 13's basic capabilities

Basic capabilities	Weightings (Rc_k)
Innovation capability	0.4
Production capability	0.4
Market management capability	0.2

TABLE A3
Weightings of Company 13's key performances relevant to production capability

Key performances	Weightings (R_{kl} with $k =$ production capability)
Conformity to specificatons	0.3
Customisation	0.5
Product range	0.2

TABLE A4
Weightings of Company 13's key performances relevant to innovation capability

Key performances	Weightings (R_{kl} with $k =$ innovation capability)
Surface toughness	0.4
Head resistance	0.2
Mechanical resilience	0.3

Tables A5–A11 report the scoring attributed to the resources impact on key performances and on market management capability.

TABLE A5
Scores for the impact of Company 13's resources on conformity to specifications

Resources	Scores (I_{ik} with $l =$ conformity to specifications and $k =$ production capability)
Manufacturing systems	0.2
Material surface processing machinery	0.2
Network organisation	0.1
Manufacturing workforce	0.5

TABLE A6
Scores for the impact of Company 13's resources on customisation

Resources	Scores (I_{ik} with $l =$ customisation and $k =$ production capability)
Manufacturing systems	0.2
Material surface processing machinery	0.1
Network organisation	0.2
Manufacturing workforce	0.1
Laboratory specialists	0.2
Laboratory equipment	0.1
Designers	0.1

TABLE A7
Scores for the impact of Company 13's resources on product range

Resources	Scores (I_{ik} with $l =$ product range and $k =$ production capability)
Manufacturing systems	0.3
Material surface processing machinery	0.1
Organisation	0.2
Manufacturing workforce	0.1
Laboratory specialists	0.1
Laboratory equipment	0.1
Designers	0.1

TABLE A8
Scores for the impact of Company 13's resources on surface toughness

Resources	Scores (I_{ik} with $l =$ surface toughness and $k =$ innovation capability)
Supplier relationship network	0.1
Material competence	0.3
Laboratory specialists	0.4
Laboratory equipment	0.2

TABLE A9
Scores for the impact of Company 13's resources on mechanical resilience

Resources	Scores (I_{ik} with $l =$ mechanical resilience and $k =$ innovation capability)
Supplier relationship network	0.2
Competence in materials	0.2
Laboratory specialists	0.2
Laboratory equipment	0.4

TABLE A10
Scores for the impact of Company 13's resources on head resistance

Resources	Scores (I_{ik} with $l =$ heat resistance and $k =$ innovation capability)
Supplier relationship network	0.1
Competence in materials	0.3
Laboratory specialists	0.2
Laboratory equipment	0.1
Designers	0.3

TABLE A11
Scores for the impact of Company 13's resources on market management capability

Resources	Scores (I_{ik} with $l =$ market management capability)
Customer relationship network	0.3
Market knowledge	0.2
Reputation	0.5

Finally, Table A12 shows the overall strategic consistency of each resource.

TABLE A12
Numeric assessments of resources' strategic consistency*

Resources	Strategic consistency (SC_i)
Customer relationship network	0.06
Reputation	0.08
Market knowledge	0.04
Supplier relationship network	0.04
Competence in materials	0.088
Laboratory specialists	0.144
Designers	0.052
Laboratory equipment	0.1
Manufacturing system	0.088
Material surface processing machinery	0.052
Organisation	0.068
Manufacturing workforce	0.88

* The correspondence between the scoring reported in Table A12 and the qualitative assessment of the strategic value of Company 13's resources shown in Table IV can be established on the basis of the following relationships: scores between 0.045 are judged "low"; scores between 0.046 and 0.08 are considered "medium"; scores above 0.081 are judged "high".

On the basis of the numeric values calculated above, it is possible to map resources in the "strategic value/strategic consistency" matrix more precisely.

Acknowledgements

The author also thanks Vittorio Ragazzini for helpful support and data on case studies.

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