

MODELLING STRATEGIC ASSETS AS A DYNAMIC SYSTEM OF 'PRIMARY' AND 'DERIVATIVE' RESOURCES

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Abstract

Particularly in the last decade, literature on the resource-based-view of the firm has been emphasising the relevance of strategic assets for business survival and growth. This paper suggests a taxonomy of strategic assets in a feedback perspective. Two main categories of strategic assets are distinguished: primary and derivative resources. Such taxonomy may allow policy makers to better understand the conceptual priority of some sets of resources on others, and to focus processes leading a firm to increase or lose its strategic assets. The paper is particularly focused on the analysis of cause-and-effect relationships between main primary and derivative resources, delays affecting their accumulation and draining processes, policy levers on which decision makers may act to improve them, in order to counterbalance business or environmental forces tackling growth.

1. Introduction

What can lead a firm to excel and develop a defendable competitive advantage, in spite of its small size and peripheral location? How sudden failures of uncontested and leading 'giants' can be explained?

Quite seldom the answer can be found in official company reports. The explanation usually lies in *strategic assets* (Amit R. and Schoemaker P., 1993), i.e. "firm-specific" interdependent tangible and intangible resources which allow a business to satisfy better than its competitors those expectations and needs emerging from different categories of "actors" (e.g. customers, commercial partners, banks, workers). Some examples of strategic assets are related to knowledge, image, entrepreneurial (personal) networks, production capacity, distribution capillarity.

According to the *resource-based view* of the firm (Wernerfelt B., 1984; Mahoney J. and Pandian R., 1992; Teece D. *et al*, 1997; Barney J., 1991), organisational rent can be explained as a business ability to build "firm-specific" assets generating distinctive competencies, leading to a sustainable competitive advantage and stable growth over time. Business long term growth is strongly influenced by the aptitude of the firm to balance the exploitation of existing resources and the development of new ones (Penrose E., 1959; Wernerfelt B. 1984). Understanding strategic assets' dynamics is the key to enhance a learning-oriented business analysis and diagnosis, leading to successful strategy formulation and implementation. This paper shows how the system dynamics (SD) methodology can provide a useful framework on this issue.

2. The concept of 'primary' and 'derivative' resource.

A commonly used perspective of analysis for strategic assets is provided by the distinction between *resources* and *capabilities* (i.e. services of resources) (Penrose E., 1959). According to this approach, resources are intended as "stocks of available

factors that are owned or controlled by the firm” (Amit R. and Schoemaker P., 1993, p. 35). They “consist of a bundle of potential services and can, for the most part, be defined independently of their use, while services cannot be so defined, the very word ‘service’ implying a function, an activity” (Penrose E., 1959, p. 25). Some examples of resources are related to know-how that can be traded (e.g. patents and licences), financial or physical assets (e.g. property, plant and equipment), human capital, etc. In contrast with resources, *capabilities* have been defined as “the firm’s capacity to deploy *resources*, usually in combination, using organizational processes, to effect a desired end ... Unlike resources, capabilities are based on developing, carrying, and exchanging information through the firm’s human capital” (Amit R. and Schoemaker P., 1993, p. 35). Main organisational capabilities have been referred to *routines*, tacit knowledge and organisational memory (Nelson R. and Winter S., 1982; Polanyi M. 1962). Based on this distinction, Mahoney and Pandian assert that “resources are stocks and capabilities (services) are flows” (1992, p. 366).

A more blurred distinction between resources and capabilities is made according to a different approach, that defines capabilities as “a set of ‘inert’ resources that are difficult to imitate and redeploy” (Kogut B. and Zander U., 1992, p. 385; Dierickx I. and Cool K., 1989) ¹. Such an approach is based on the implicit assumption that both resources and capabilities are *stocks*, whose level is affected by the rate of past strategic expenditures (Dierickx I. and Cool K., 1989; Morecroft J., 1997). Based on the above framework for analysis, this paper stems from three basic assumptions:

1. knowledge and capabilities are not the only factors influencing the business ability to acquire, co-ordinate and deploy resources;
2. the concept of *resource* as stock of specific production factors providing the firm a bundle of potential available services to be exploited ought to be broadened;
3. a feedback analysis of strategic assets dynamics can help decision makers to assess the consistency of their policies.

Referring to the *first point*, it is possible to argue that business capabilities and knowledge could not be enough to exploit the potential services that could be earned from a synergetic use of available resources. In fact, the ability of the firm to acquire, co-ordinate and deploy production factors also depends on the ‘quality’ of some other strategic assets that (likewise capabilities) are not related to a specific resource. Such assets mainly result from the accumulation of current internal and external business processes, that usually give rise to slow (but significant, in the long run) changes in many strategic *soft* variables. Some examples are: business image and reputation, workers’ morale, personal networks (e.g. with banks, suppliers, customers and various stakeholders), entrepreneurial values and business culture, which may significantly impact on long term performance.

Financial resources are another asset that may significantly influence, in the long run, the ability of the firm to co-ordinate all other resources. In fact, business long-term survival and growth cannot be conceived regardless the aptitude of the firm to self-finance, at least partially, its expansion and to maintain a balanced “debts-to-equity” ratio. Even the most brilliant and successful business ideas, carried out by the brightest and motivated people sharing common goals, who are able to sell a leading product on a competitive market, are destined to fail if – at least on a medium time

¹ In particular, *combinative capabilities* have been defined as “the intersection of the capability of the firm to exploit its knowledge and the unexplored potential of the technology” (Kogut B. and Zander U., 1992, p. 391). Likewise, *dynamic capabilities* have been defined as “the firm’s ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments” (Teece D. *et al.*, 1997, p. 516).

horizon – the firm is not able to generate a positive income and cash flow from its current operations. Profitability and self-financing are the two main pre-requisites for the acquisition of other necessary resources to foster business growth ².

Concerning the *second* above stated point, if we adopt a broader concept of *resource*, related to “anything which could be thought of as strengths or weaknesses of a given firm [or] more formally ... (tangible and intangible) assets which are tied semipermanently to the firm” (Wernerfelt B., 1984, p. 72), also strategic soft variables such as competencies, business image, entrepreneurial personal contacts and values, corporate culture, etc. can be considered – *latu sensu* – as resources, although they are not directly related to a specified production factor or a group of them. Likewise other resources, they are potential services that can be exploited if the firm is able to generate a business idea whose components are consonant one another and with relevant external variables.

Concerning the *third point*, a feedback perspective is likely to foster a deeper understanding of: *a*) delays between adopted policies and related effects; *b*) short and long term effects on strategic assets related to decisions made, *c*) interdependencies between different resources affecting strategic assets, and *d*) internal and external factors which may weaken or limit strategic assets’ accumulation process (Ford D. 1998). Such an approach may allow one to describe strategic assets dynamics as the result of feedback relationships between two broad groups of production factors, i.e.: *primary* and *derivative* resources (Coda V., 1983, p. 101). *Primary* resources are those which mostly impact on the business aptitude to acquire, co-ordinate all other resources and to exploit their potential services. *Derivative* resources are all other production factors (e.g. production capacity, logistics support, organisation structure and operative mechanisms, product portfolio, customer base, cost structure flexibility, brand positioning) that are acquired, co-ordinated and deployed through business *primary* resources. In the next sections it will be shown how both sets of resources are mutually related in a feedback perspective.

3. ‘Primary’ and ‘derivative’ resources as strategic assets of the firm

It is opportune to differentiate *primary* from *derivative* resources as not all production factors have the same level of importance for a firm: strategic control must selectively assess them and support policy makers to affect their dynamics over time. A selective approach is needed as business performance usually depends upon a limited scope of factors which can be influenced by a bounded number of *policy levers*. Lack of focusing ‘key-factors’ and related ‘policy levers’ would, at the same time, increase the cost of information and reduce the capability of decision makers to promptly detect the areas where to concentrate analysis and action.

Primary factors have a conceptual priority over the *derivative* ones, as they determine the aptitude of the firm to improve their qualitative and quantitative profile over time. The quality of *primary* resources affects the ability of the firm to acquire, co-ordinate and deploy different production factors whose combinative worth is to be higher than the sum of the value of single services that each of them could individually provide (Grant R., 1991, chapt. 4, par. 4). In fact, one could theoretically introduce from outside the firm the ‘best’ machinery, the leading products ready to be sold on the market, the fastest and most efficient logistical systems, the most flexible and promptest information and reporting tools, the most qualified and skilled people.

² For instance, in a firm aiming at expanding its retail sites, the only site finding capabilities could not be enough to reinforce the virtuous process “site opening ⇒ learning ⇒ site-finding capability ⇒ site opening” (Warren K., 1998, p.9).

However, the above resources would inevitably be wasted if the firm would lack of a successful entrepreneur, a consistent business idea, motivated and skilled people able to co-ordinate and deploy available resources, in order to increase business image and reputation, organisational knowledge and financial resources. In a firm lacking of valid organisational resources and of any kind of effort aimed to build and improve them, all other (although valuable) production factors are destined to be lost or wasted. The quality of the business *primary* resources is determinant to the attitude of the firm to build up *derivative* resources. On the other hand, the accumulation of valuable and interdependent *derivative* resources is a pre-condition to improve the quality of *primary* resources ³. Both *primary* and *derivative* resources can be considered as *strategic assets* if they correspond to a “set of difficult to trade and imitate, scarce, appropriable and specialized” (Amit R. and Schoemaker P., 1993, p. 36) production factors that allow a firm to gain a competitive advantage. Strategic assets can be conceived as stocks, i.e. endowments of homogeneous groups of *primary* and *derivative* resources available in a given time. When the firm operates in a dynamic and complex environment, it must be flexible in adapting its strategic assets to industry evolution. It has to be able to promptly and selectively perceive relevant information on the *dominant logic* (Prahalad C. and Bettis R., 1986; Morecroft J., 1997, p. 580-581) underlying the accumulation of strategic assets in the industry where it operates, by taking into account the changing pattern of competitors’ strategies, technologies and customer needs. In order to manage its own *metamorphosis* (Glucksman M. and Morecroft J., 1998), a business has to learn, i.e. decision makers have to open their mindsets to new possible ways of fulfilling business activities, even though this may mean to abandon the dominant logic which allowed the firm to be successful in the past. In managing strategic assets, decision makers “face the daunting tasks of (1) anticipating possible futures, (2) assessing competitive interactions within each projected future, and (3) overcoming organizational inertia and internal dispute in order to realign the firms bundle of strategic assets” (Amit R. and Schoemaker P., 1993, p. 40). Very often decision making processes are made in uncertain and complex contexts, involving bias, illusion and sub-optimality that are related to cognitive limitations in decision makers’ mental models. Usually, bounded rationality in decision making is not related to lack of technical knowledge or expertise of decision makers on single problem issues; it is rather related to a poor understanding of the system structure and key-factors’ dynamics. The SD method can significantly help decision makers to understand strategic assets building or depletion processes, through the use of both conceptual and formal models. This paper will be more concerned on the conceptual “stock-and-flow” modelling of strategic assets as a dynamic system of *primary* and *derivative* resources.

4. Managing strategic assets as a system of levels and rates: modelling how ‘primary’ resources affect (and are affected by) the accumulation process of ‘derivative’ resources.

When a firm is started, main available resources are usually a vision of a future business, entrepreneur’s knowledge and personal contacts (e.g. with banks, potential customers, public administration officers), values and behavioural norms driving decisions, financial resources to be invested as equity. Such factors are not yet business *strategic assets*; in fact, they have not yet generated a working business idea

³ This concept will be analysed in the next paragraph.

and cannot be still compared with competitors' *primary* resources. In order to become strategic assets, they have to be co-ordinated and deployed by the entrepreneur. The business idea is still to be conceptualised and focused; often it is formalised in a written business plan that helps the entrepreneur to focus critical issues such as the mission of the firm, products to be sold on the market, customer needs to be satisfied, sale price and payment conditions, *derivative* resources to be purchased, other *primary* resources (in terms of contacts, image, competencies and skills, etc.) to be built and developed, in order to pursue desired goals over a long time horizon ⁴. Once the business idea has been outlined, the firm is able to build up *derivative* resources. The entrepreneur's knowledge, personal contacts and invested equity allow the firm to gradually acquire, co-ordinate and deploy various resources (e.g., production capacity, loans, information, human resources education, raw materials, advertising).

There are several delays affecting the accumulation of *derivative* resources. In fact, beyond the time needed to outline the business idea, the accumulation process may be delayed by the time necessary to obtain different factors (suppliers are to be contacted, resources are to be delivered, etc.), to co-ordinate and deploy them. Both the above delays and the likelihood of acquired resources to give rise to strategic assets, through the synergies produced by the interaction between available factors, are affected by the quality of *primary* and *derivative resources* that the firm will be gradually able to build up (figure 1).

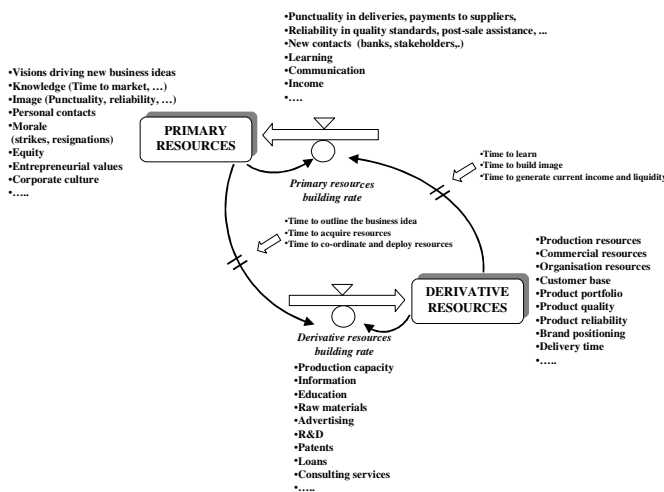


Figure 1: Primary and derivative resources building processes

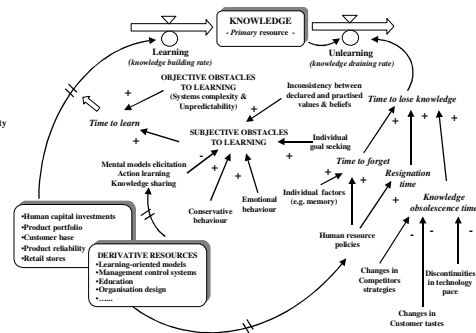


Figure 2: Business knowledge building and draining processes

Figure 1 also shows how from the co-ordination and deployment of *derivative* resources, through the existing stock of *primary* factors, the firm is able to improve the current state of its strategic assets system. In fact, synergies developed through the exploitation of services from different available resources may allow the firm to build a customer base whose qualitative and quantitative profile indicates the state of the business image and reputation on its market. Also the punctuality of business deliveries or payments to suppliers and reliability in quality standards or post-sale assistance may significantly contribute to build up company reputation.

Furthermore, the fulfilment of current activities usually adds new personal contacts to those that the entrepreneur and his direct collaborators have established with different "actors" in the competitive and social system (e.g. suppliers, competitors, banks,

⁴ Defining and formalising the *business idea* also allows the entrepreneur to evaluate its economic and financial feasibility, as well as the profitability of capital invested.

public administration officers), leading to a change in the stock of personal networks that constitute a valuable strategic asset especially in smaller firms.

Also learning and communication among people inside the business represent a flow accumulating into individual, group and organisational knowledge and morale. Such an accumulation process is triggered by an “intelligent” analysis of phenomena in which people are involved, dialogue and debate or even formal education programmes, on-the-job training, etc ⁵.

A concurrent result of learning and communication accumulated into knowledge is the *generation of visions*, i.e. intuitions of opportunities that may evolve into new business ideas leading the firm to deploy its current endowment of strategic assets in other related or unrelated strategic business areas (Norman R., 1977, chapter 7).

Income resulting from company activities is another rate accumulating into primary resources (i.e. invested equity). Likewise for the accumulation of *derivative* resources, the quality of the above commented cause-and-effect process is also affected by the current endowment of *primary resources*. In fact, for instance, the higher is reputation, the higher will be – other conditions being equal – the aptitude of the firm to durably include a new client in its customer base.

It takes time, however, to accumulate (or deteriorate) *primary* resources. In fact, the aptitude of current processes enhanced by the stock of available strategic assets to generate a change in the *primary* resources endowment is affected by several delays. This paper will particularly focus three of them, i.e.:

- time to learn (and lose) knowledge;
- time to build (and lose) image;
- time to generate income.

The reason why our analysis will particularly dwell upon such delays is due to both the relevance of knowledge, image and equity in strategic assets building or depletion processes, and the possibility to refer to generic conceptual models, that may allow one to model them.

4.1. Knowledge building and depletion processes: factors influencing ‘time to learn’ and ‘time to lose knowledge’

Figure 2 depicts knowledge as a stock influenced by a learning inflow and an ‘unlearning’ outflow (Koenig U. and Membrillo A., 1998). The learning inflow represents the rate at which the current state of knowledge is being increased in a given time interval, as an effect of various activities performed by individuals and groups, ranging from a careful and “intelligent” accomplishment of current tasks, to the acquisition of new concepts/methodologies, the awareness and improvement of mental models, sharing of insights and information among people, etc. The quality of learning is affected by the available endowment of *derivative* resources that have been accumulated by the firm through the combinative deployment of different production factors. For instance, the bigger is the capability of the firm to create new products (knowledge stock) the larger – other conditions being equal – will be the product portfolio (derivative resource). Managing a larger product portfolio will be likely – sooner or later – to generate new knowledge and capabilities (learning-by-doing), especially if people are supported by proper organisational *derivative* resources ⁶.

⁵ An indicator of organisation morale and feel of belonging to the firm could be referred to the total number of workers’ strikes or resignations in a given period of time and, in small family-owned/managed firms, to complaints from entrepreneur’s relatives involved into the business.

⁶ e.g., learning-oriented models and tools, management control systems, education programmes and – more generally – human capital investments. The same causal relationships could be attributed, for

However, the above learning process is tackled by a delay that could be defined as *time to learn*. Such a delay is influenced by different subjective and objective (i.e. 'environmental') factors. Among the *subjective factors*, the most remarkable are related to: a) conservative behaviour (associated to personal obstacles in changing and adapting people's mindset), b) lack of will and/or proper methods to foster knowledge elicitation and sharing, c) inconsistency between declared and practised values and beliefs, d) emotional reactions, e) individual goal seeking. Among the *objective factors*, systems complexity and unpredictability are a major cause affecting time to learn ⁷.

The stock of available knowledge is drained by an 'unlearning' outflow, whose rate depends on the size of the stock and the average *time to lose knowledge*. It is possible to distinguish three main factors affecting time to lose knowledge: 1) knowledge obsolescence time; 2) human resources resignation time; 3) 'time to forget'.

Knowledge obsolescence time is influenced by several phenomena involving discontinuities in the competitive system where the firm operates. For instance, new technologies available at a reasonable cost could force the firm to update its competencies and capabilities in order to be able to keep abreast of competitors and/or customer tastes. Business knowledge could also be misplaced by rivals strategies aimed to build a competitive advantage based on different competencies and capabilities from those which are currently hold by the firm. Another factor influencing knowledge volatility is related to skilled human resources resignations. In order to tackle the risk of losing its human capital, a business has to adopt human resource policies implying proper investments in organisational assets (e.g. education, learning-oriented programmes and tools, budgeting and reward systems, etc.) aimed to increase employees' loyalty as an effect of their empowerment, of a higher awareness of their capabilities and a sense of commitment to the firm ⁸.

A third variable affecting time to lose knowledge may be defined as *time to forget*. It represents the time it takes for individuals or groups to neglect those competencies, skills, capabilities, experiences, etc. they have consciously, or even implicitly, accumulated over time as a consequence of their current working, communication activities and education. Time to forget knowledge is influenced by individual factors, such as memory or level of attention. Likewise for the resignation time, a firm may try to increase time to forget through proper human resource policies supporting people to practice their knowledge, leading to a higher empowerment.

4.2. Image building and depletion processes: factors influencing time to build and lose image.

Likewise knowledge, business image can be modelled as a stock that is influenced by a building and a draining rate, corresponding to an inflow and outflow. In order to

example, to knowledge and capabilities generated in managing a wide customer base or delivering a reliable product, finding new retail stores.

⁷ The higher they are, the longer it will take for individuals or groups to learn. In order to weaken the above obstacles to learning, a business may act on its organisational *derivative* resources system, e.g. through proper formal education programmes, or by improving task subdivision among people and the definition of responsibility areas, by pursuing a better link among budgeting, performance evaluation and reward systems, or even through proper models and tools supporting decision makers to better frame systems in which they are involved.

⁸ It may also happen that the same lever could be used in a quite opposite way. For example, when a turnaround is started, in order to build a new company knowledge base aimed to recover business efficiency and effectiveness, it is common practice – particularly when top management is relatively old – to foster outplacement.

understand processes related to business image dynamics, we may refer to an example. How can a firm build a high product scope image, based on its knowledge and capabilities to provide clients different colours, or versions of a same product at a reasonable cost and in a short period of time? The rate at which business high product scope image is built depends on four main factors, i.e.: 1) the stock of knowledge and capabilities to manage production flexibility and a high product scope; 2) the qualitative profile of a *derivative* resource stock, which allows the firm to build image⁹; 3) the time necessary to build image; 4) the stock of accumulated high product scope image (figure 3). The way *primary* resources affect *derivative* factors' building process has been previously analysed and depicted in fig. 1. The higher are *derivative* resources consisting of flexibility and wide product portfolio, the higher will be the likelihood that a firm will strengthen its product scope image (e.g. by launching new product versions or colours). However, business reputation building rate is also influenced by the *level of business image* accumulated by the firm in the past and the *time* necessary to build it. In fact, the stronger is the stock of *business image*, the easier will be for the firm to gain new customers confidence and loyalty, due to word-of-mouth effects related to its consolidated business flexibility reputation. Moreover, the longer is *time to build image*, the lower will be – other conditions being equal – the image building rate. A main cause leading *time to build image* to increase is related to competitors' imitative strategies aimed to fill the gap between the business and their product scope reputation. In fact, if rivals try to gain a competitive advantage on the same critical success factor on which the firm has built in the past its own reputation, it will be harder for it – other conditions being equal – to further increase its own high product scope image. In order to tackle such obstacles in image building process, the firm may improve its communication policies and promotional strategies, based on commercial derivative resources and brand positioning, aimed to achieve a higher and/or better potential customer base.

Business image is also affected by a draining rate, which depends on the existing stock of current image and a time factor that is affected by three main variables, i.e.: technological innovation, changes in customer tastes and preferences, and business communication policies. Concerning technological innovation, discontinuities in current available technology due to innovation, may give rise to an obsolescence of current business knowledge and capabilities, leading to a declining image. Changes in customer tastes may be caused by several factors. Among them, the most remarkable are social-environmental trends and rivals strategies aimed to build a competitive advantage based on a different critical success factor from which the firm has built its own success. For example, competitors could aim to build competencies and image based on product reliability, in contrast to business high product scope reputation. The firm will be likely to lose its own image if clients will tend to appreciate competitors' product reliability more than product scope flexibility. In order to counterbalance such emerging threat, the firm could improve its communication and promotional policies towards its customers and potential clients, with the aim to stress the advantages related to a wide product scope support for them. On the contrary, if the firm could envisage that product reliability would be in the future the main critical resource on which to invest in order to gain a competitive advantage, it should be able to promptly manage its own metamorphosis (Glucksman M. and Morecroft J., 1998), with the intent to build a strong knowledge and image, based on the new critical success factor.

⁹ In our example, *production flexibility* could be a strategic asset generated by technical knowledge, leading to a proper acquisition and co-ordination of different production *derivative* resources (e.g., machinery, labour, production scheduling, plant layout).

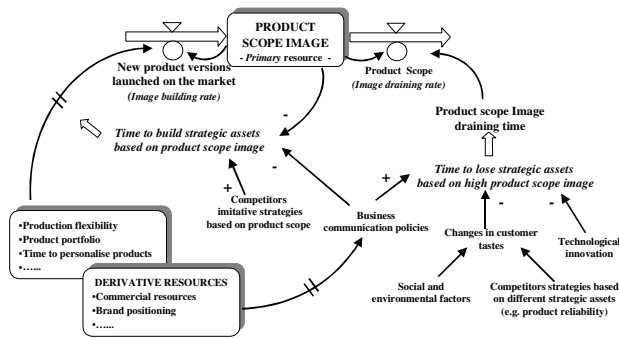


Figure 3: Business image building and draining processes

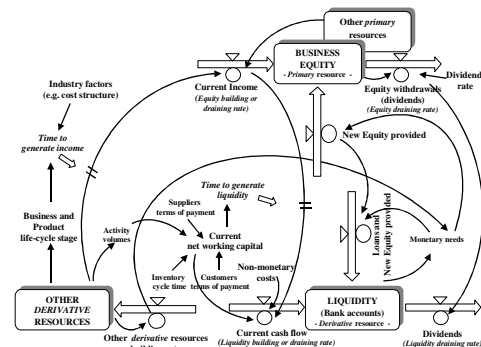


Figure 4: Equity and liquidity dynamics

4.3. Business equity building and depletion processes: factors affecting time to generate income.

Business equity is a third important *primary* resource whose accumulation process is usually affected by a number of delays that will be here analysed.

If observed on a *static perspective*, equity is the difference between assets and liabilities in a given time.

If observed on a *dynamic perspective*, equity can be calculated as follows:

$$E(t_1) = E(t_0) + I(t_1-t_0) - W(t_1-t_0) + EI(t_1-t_0), \text{ where:}$$

$$E(t_1) = \text{Equity at period } t_1;$$

$$E(t_0) = \text{Equity at period } t_0;$$

$$I(t_1-t_0) = \text{Income (i.e. revenues } \textit{minus} \textit{ costs) during the time interval "t}_1\text{-t}_0\text{"};$$

$$W(t_1-t_0) = \text{Equity withdrawals (dividends) operated by business owners during the time interval "t}_1\text{-t}_0\text{"};$$

$$EI(t_1-t_0) = \text{Equity investments operated by business owners during the time interval "t}_1\text{-t}_0\text{"}.$$

Figure 4 shows that the income rate is generated from the co-ordination and deployment of available *primary* and *derivative* resources. The higher is their qualitative and quantitative profile, the higher – other conditions being equal – will be income. The time needed for a firm to earn a return on invested capital (*time to generate income*) mainly depends on two factors, i.e.: (1) the business and product life-cycle stage and (2) characteristics of the industry where the firm operates. ‘Time to generate income’ can be – other conditions being equal – higher during the early stages of business life-cycle or in the case where the ‘product portfolio’ is mainly made up by new products, which tend to absorb more liquidity than they can generate, implying also a lower profitability¹⁰. Also *industry-related* factors may significantly influence ‘time to generate income’. In fact, in the initial stages of business life-cycle, if the industry where the firm operates is characterised by higher proportion of fixed *versus* variable costs, it usually takes more time to achieve the necessary operating volume that allows the firm to reach the break even.

Figure 4 also shows that current cash flow is affected by: a) current income gross of non monetary costs, b) *time to generate liquidity*, and c) activity volumes influencing the net working capital¹¹. It is crucial for a firm to properly and timely perceive

¹⁰ In fact, the burden of start-up costs related to various long-term investments usually extends the time it takes for a firm to be profitable. Likewise, new products launching often requires large investments related to R&D, production, promotion etc., whose return cannot be obtained in a short time horizon, not only because of their considerable amount, but also owing to the low initial market demand.

¹¹ *Time to generate liquidity* is related to terms of payment allowed to customers and negotiated with suppliers and to inventory cycle time (i.e. how long inventories are kept on stock before sale).

variables affecting current cash flows. Not all potential profitable growth-oriented strategies are eventually successful, as they may not be compatible with business liquidity. In fact, increased *activity volumes* and variables influencing *time to generate* both *income* and *liquidity*, may give rise to negative cash flows that could seriously prejudice business available bank credit (Bianchi C. and Bivona E., 1999). Business operating strategies and policies are likely to generate a financial stress in two main ways: 1) during the *start-up and reorganisation stages*, when long-term investments in production capacity, R&D, promotion, distribution, organisation, etc. usually increase the time it takes to generate income from adopted strategies and require higher financial needs; 2) when the current *endowment of available resources* is exploited by pursuing *sales and market share growth*, based on aggressive commercial and production strategies¹². The concomitant effect of both the above delays and the influence that activity volumes are likely to gradually generate on the net working capital needs are a primary cause of system complexity and unpredictability in understanding and managing the dynamics of equity, liquidity and other strategic assets.

Figure 4 also shows that the acquisition of *derivative resources* (i.e. *other derivative resources building rate*) gives rise to monetary needs if available liquidity does not allow the firm to provide the necessary funds to finance investments¹³. In order to face such monetary needs, the firm may either negotiate loans or increase equity, or even may opt for a combination of the above two policies. From fig. 4 it is possible to argue that, likewise the equity increase rate, the negotiation of loans gives rise to a co-flow that, in this case, is accumulated into the stock of total debts.

The management of equity concerns the design of policies affecting equity withdrawal and increase rates that ought to take into account three main factors: 1) resource acquisition monetary needs, caused by lack of available liquidity; 2) the “debts-to-equity” ratio; 3) the extent to which business owners are willing or able to invest more equity and reduce their periodical equity withdrawals. The above three factors are to be systemically managed. Cause-and-effect relationships among them make more complex equity management. In fact, the higher is the acquisition of new derivative resources, if available assets are properly deployed, the higher income and cash flows – other conditions being equal – will be generated on a longer time horizon. However, in the short term, higher monetary needs caused by investments done could force the firm to find new sources of liquidity. Such sources could be found by negotiating new loans; nevertheless, the higher is the “debts-to-equity” ratio, the more difficult will be for the firm to negotiate new loans at profitable interest rates and the less liquid will be its financial position. Consequently, in order to provide the necessary monetary resources, decision makers could – at least partially – ask business owners to increase equity and/or reduce dividends. However, also this policy could be tackled, for instance, by a lack of the business owning family personal assets from which to draw liquidity to increase business equity and/or by resistance to divert resources into the business or to give up to periodical withdrawals of profits. The consideration of the above problems, could lead policy makers to reduce their investment programmes;

¹² Quite often such strategies give rise to a net working capital increase, due to higher activity volumes and longer terms of payment allowed to customers or even higher inventory cycle time. A higher inventory cycle time could be caused by increased safety stocks that could be necessary to provide a buffer in order to better pursue production and distribution flexibility, given a technology available in a short-medium time horizon.

¹³ In other words, *resource acquisition monetary needs* = other derivative resources building rate *minus* available liquidity from bank accounts.

nevertheless, if such decision could make more liquidity free in the short run, it could deteriorate long term profitability and liquidity.

From the above analysis, it follows that managing business equity and liquidity involves the consideration of a wider set of interconnected variables and the assessment of effects that decisions are likely to generate over a short and long time horizon. This is not an easy task for decision makers, not only because of limits in available information, but also because of human cognitive flaws (Sterman J., 1994). In fact, it may be difficult for policy makers to figure out the domain of relevant variables, in order to outline the *boundaries of the system* to be explored and to mentally process the impact that multiple cause-and-effect relationships characterised by sequential delays are likely to generate on the stocks upon which decisions are made.

4.4. Dynamic relationships among primary resources

In this paragraph, two examples of how dynamic relationships may be generated among *primary* resources will be provided. Figure 5 shows how corporate image and capabilities may affect workers' morale through co-flows. In fact, the higher is the change in image and/or learning, the higher is usually the change in workers' morale and motivation. Although there could be some delays between the two rates and the change in morale, e.g. due to communication lags between the firm and its employees, the extent to which people are satisfied and lured to work into a company strongly depends on how they perceive the business as a potential source of learning and a means to increase their level of self-esteem. A higher worker's morale not only tends to attract more people into the firm, but also reduces the average time elapsing between when people are hired and they resign (*time to leave*). A lower *time to leave* reduces (other conditions being equal) the rate at which skilled people resign in a given time period and – if the hire rate is higher than the resign rate – increases the business headcount. A higher headcount made up by motivated people is likely to give rise – given an education investment budget – to a further increase in learning, which strengthens motivation, leading to a self-feeding virtuous cycle.

Fig. 6 provides a different example of how *primary* resources may affect each other: how error correction and detection capabilities influence company product reliability image. The figure shows that the use of a given technology implies a normal rate of new production defects in a given time interval, which accumulates into a stock of total production defects. The latter increases when the firm has not developed a knowledge base consisting of capabilities which allow employees to detect and correct more defects than generated. However, if learning-by-doing is successfully enhanced, the firm is able to strengthen its error detection and correction capabilities over a longer time horizon. In fact, the more total production defects increase, the higher variety and number of problem issues employees will face; this will increase their skills in diagnosing and solving problems. A higher learning rate increases capabilities, leading to a higher error detection and correction rate. Until this last variable is lower than the rate of new production defects, the stock of total production defects continues to grow at a decreasing pace. When the errors correction and detection outflow becomes higher than the new errors inflow, as an effect of increased capabilities, the net change of the total defects stock becomes negative, causing total defects to drop.

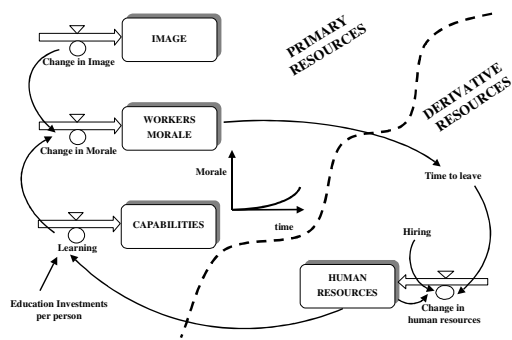


Figure 5: Dynamic relationships among primary resources: co-flows affecting their accumulation processes

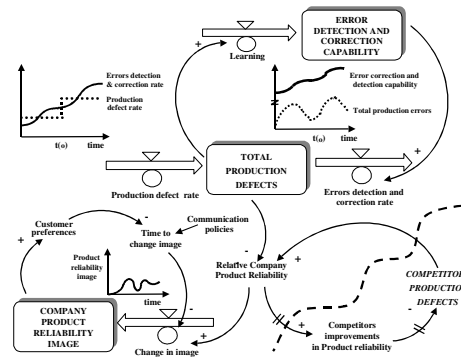


Figure 6: Dynamic relationships between primary resources: how error detection and correction capabilities affect image

When a new production technology is adopted by the firm (time t_0 , fig. 6) – e.g. in order to reduce costs, increase flexibility and/or volumes – a discontinuance in the business know-how is often caused. Such a phenomenon is due to the lack of experience at the start of a new technology cycle, related to the time it usually takes to get acquainted of new organisational and technical issues required by new production methods. Consequently, although capabilities may have reached a relatively high level concerning the past technology, they are not sufficient to support employees in detecting errors related to defects caused by the new technology. As shown in the graphs of fig. 6, if learning-by-doing is properly enhanced, an increase in production defects rate (due to the technology leap) gives rise to a new cycle consisting of increasing total defects that will further strengthen capabilities. Higher capabilities will allow again the firm to progressively empty the stock of total defects.

How does the dynamics of error detection and correction capabilities affect product reliability company image? Figure 6 shows that the stock of total production defects is inversely related to company relative product reliability, i.e. a ratio between total competitors' *versus* company's production defects in a given time. In fact, the more defective is production, the higher is product failure rate and the lower is reliability, which deteriorates image. Consequently, lower production defects resulting from higher error detection and correction capabilities, will increase relative company product reliability. However, it is quite rare that a higher business reliability is likely to immediately increase image. In fact, at least two variables may delay the image building process, i.e.: the effectiveness of business communication policies and customer preferences. The more a business is able to communicate to customers its progress on product reliability and the relevance to them of its superior performance, the lower will be the *time to change image*. However, business communication effectiveness not only depends on the policies the firm currently adopts, but is also affected by other factors, such as customers negative or positive preconceptions/expectations towards the firm, which are mainly related to the image that the company has built in the past. Another factor influencing *time to change image* is related to customer preferences. This is an external variable, related to the extent to which product reliability is perceived by customers as an important factor to satisfy their needs.

Product reliability image is also affected by competitors policies. In fact, after a perception delay, they could react to improvements in relative company product reliability, by undertaking programs aimed at restoring the performance gap.

On the basis of the above remarks, it is possible to conclude that product reliability company image will be likely to fluctuate over time as a consequence of: (1) oscillations in business' and competitors' error detection/correction capabilities, (2) delays, (3) evolutions in customer preferences.

In order to manage business image, decision makers need to understand how to affect relevant *primary* resources, such as competencies, that will allow the firm to increase its performance and – hence – to improve image. Decision makers must also understand delays between causes and effects and outline the relevant boundaries of the system embodying several internal and external forces generating business image oscillations. For instance, changes in consumers' preferences or competitors' behavior could significantly affect the dynamics of image over time. Understanding system structure is the necessary step to figure out the reasons underlying its behaviour and to set proper goals and policies to effectively pursue a stable and durable growth.

4.5. Modelling the firm as a dynamic feedback resource system.

Figure 7 provides a synopsis of processes underlying *primary* and *derivative* resources dynamics. The above analysis has shown how a firm can be seen as a dynamic resource stock and flow system, characterised by multiple relationships often implying non-linear cause-and-effect relationships and delays between relevant variables, leading to oscillating behaviour. Strategic control must support policy makers in understanding how to manage such a dynamic system, in order to improve qualitative and quantitative strategic assets growth over time. A main difficulty related to the implementation of strategic control is due to the deficiencies of traditional accounting systems in monitoring non-financial parameters and detecting feedback loops, delays, external variables, in order to have a clearer picture of the system on which decisions will impact in the short and long term. Measuring non-financial parameters, such as reliability or knowledge, is not simple. In fact, applying subjective rating scales to a given set of variables (that are often fuzzy) may lead to inaccurate, or even wrong estimations. However, the conclusion that a higher risk of inaccuracy ought to suggest a firm to give up control over its strategic assets system cannot be accepted for two main reasons, i.e.: 1) also many financial evaluations may be inaccurate (e.g. inventories or accounts receivable) or wrong; 2) the role of non-financial evaluations is not to provide a specific, absolute, value related to a *single* variable, but is instead to focus a *pattern of behaviour* over a given period of time, related to a *group* of variables that are *systematically* associated one other

We believe that when the goal of business control is not measurement *per se*, but instead to support decision makers' learning, it is better to have imprecise, but prompt, estimations rather than lacking any kind of help. If the above view of strategic control is adopted, decision makers are helped in understanding how and why *primary* resources change, they do affect *derivative* production factors and results are obtained from the co-ordination and deployment of both groups of resources, thereby affecting *primary* factors again. In such a perspective, the firm is analysed and managed as a feedback system, whose present state is affected by past decisions and affects the future state.

The awareness of feedback loops and time delays between causes and related effects allows decision makers to better explain system dynamics, i.e. why a given state of the business system has been achieved as an effect of *results* generated by our past *activities* and external variables.

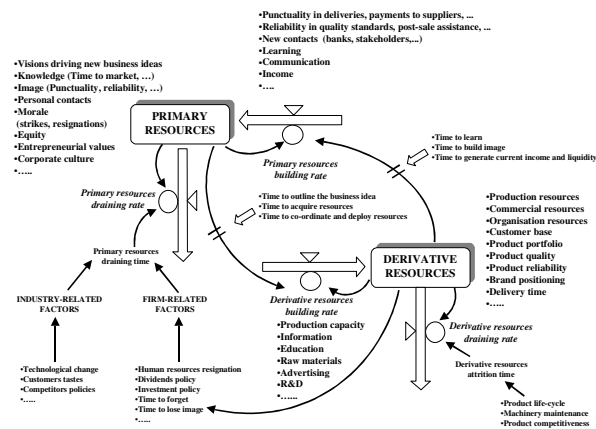


Figure 7: A synopsis of primary and derivative resources building and draining processes

The *feedback approach* goes beyond an “input-output” view of the business system (structure \Rightarrow activities \Rightarrow results). Quite often, a non-systemic view of the firm leads decision makers to emotionally react to those problems which seem to be as the most urgent and compelling. As a consequence of such behaviour, short term positive results achieved by policies aimed at “plugging” emerging crisis symptoms are offset in a longer time horizon by unintended negative consequences which may generate into a deeper crisis.

Another implication of emotional decision makers’ behaviour is related to *limits to growth misperception*. In fact, crises may be also caused by irrational growth policies, which do not take into account the availability of internal resources which may sustain the expansion of business activities. “Key resource constraints include: (1) shortage of labour or physical inputs, (2) shortage of finance; (3) lack of suitable investment opportunities and lack of managerial capacity. Penrose considers the growth of the firm as limited only in the long-run by its internal management resources ... In Penrose’s theory ‘management (is) both the accelerator and the brake for the growth process’” (Mahoney J. and Pandian J., 1992; Starbuck W., 1965). Other undetected limits to growth may also come from external variables, such as potential market.

The SD methodology can substantially help decision makers to understand how business strategic assets can be affected in the short and long run by their policies.

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