



Strategic foresight in corporate organizations: Handling the effect and response uncertainty of technology and social drivers of change

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ABSTRACT

Today many companies in many industries put a lot of efforts into monitoring and investigating emerging drivers of change in their business environment, particularly in relation to new technologies and events in the social, economic, political and ecological landscapes which surround their industry. So far scholars in the literature on foresight and future studies focused on the techniques and practices for analysing the “state” uncertainty about the likely path of evolution of emerging drivers of change. Anyway, less attention was devoted to the “effect” uncertainty about the impact of drivers of change on the competitive position of the firm and to the “response” uncertainty about how to take advantage of these drivers. These are the main issues we take into account, through a field research on firms that, notwithstanding they were able to properly assess the likely evolution (state uncertainty) of relevant drivers of change in their industry, either were successful or dramatically failed in handling the effect and response uncertainty of these drivers. Moreover, we carried out multiple case studies of some large companies that have established an organizational unit dedicated to strategic foresight. Overall, the results of our research may contribute to improve the effectiveness of strategic foresight and to increase its value added to the planning process of corporate firms, while providing helpful insight to public organizations that promote foresight exercises for enhancing the competitiveness of local firms.

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1. Introduction

Literature on strategy [1–3] and on organization theory [4–6] emphasized for a long time the external environment of the firm as a major source of uncertainty for managers in charge to detect emerging opportunities and threats and to respond timely to them. “Environmental uncertainty” has been defined as the lack of accurate information about organizations, activities and events in the external sectors of the business (micro and macro) environment of the firm, and as the difficulty to understand what the major changes are or will be [5–7].

According to Milliken [8], there are three specific types of uncertainty concerning drivers of change: uncertainty about their evolution (“state” uncertainty); uncertainty about their impact on the competitive position of the firm (“effect” uncertainty); uncertainty about the response viable to the firm (“response” uncertainty).

In order to cope with environmental uncertainty many multinational companies started back in the '60s to engage in future studies. The term “environmental scanning” became widely used to refer to the search for information about emerging drivers “in a company outside environment, the knowledge of which would assist top management in its task of charting the company’s future course of action” [9: p.1]. A large set of future-oriented techniques and methods have been developed and applied: roadmaps [10–12] and scenarios [13–17] are by far the most popular ones. But there are many others, e.g., Delphi, relevance trees, cross impact analysis, simulation modelling and systems dynamics, and game theory [18–20]. More recently, the term “Foresight” has become commonly

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used to encompass the wide range of approaches and activities which aim at helping managers to handle uncertainty [21–23]. In this paper, we use the term “strategic foresight” instead of “foresight”, in order to emphasize its tight relationship with the strategy formulation process.

Up to now research efforts of most scholars focused on “state” uncertainty, by analysing how and to what extent strategic foresight may help managers to anticipate the likely evolution of drivers of change. Anyway, handling state uncertainty is not enough: there are many cases of firms which properly foresaw the evolution of relevant changes in their external environment, yet failed to govern and take advantage of them in the long run. Future success depends as much on handling the “effect” uncertainty and the “response” uncertainty about drivers of change as it does on handling their state uncertainty, by addressing the following key issues:

- How to anticipate the impact of drivers of change on the industry structure and the competitive position of the firm? How to draw the implications of drivers of change for strategy formulation?
- How to cope with drivers of change? How should business managers define the most appropriate responses for exploiting these drivers and thus developing the new resources and organizational capabilities they require?

These are the main research questions we tackle in this paper. Given the open-ended nature of these questions and the lack of adequate analysis in the literature on strategy and foresight, we based our research on the case study approach [24]. First of all, we analysed the cases of: Kodak in the imaging industry; Nokia in the mobile phone industry; Luxottica in the spectacles industry; Starbucks in the coffee industry. All these firms provide meaningful examples, since they were all able to foresee the evolution of the main drivers of change (e.g., emerging technologies and shifts in social values) in their business (see Table 1). Anyway, they adopted very different approaches for assessing the impact of these drivers on the structure of their industry (i.e., Porter’s Five Forces) and on their competitive position, so achieving different results. By contrasting these approaches, we aim at drawing some lessons on how handling the “effect” uncertainty of drivers of change. The case studies were based either on published sources (conference presentations by top managers, financial reports, articles on both business magazines and scientific journals) and our interviews to top managers.

Moreover, we analysed the organizational and methodological framework of strategic foresight in a sample of large international companies. These firms are Shell, Nokia, Philips, Siemens, BASF, Morgan Stanley, and Daimler. In particular, we interviewed the top managers and executives of their strategic foresight team. All these firms provide very meaningful examples because they started a long time ago to engage systematically in foresight as a continuous process embedded in strategy formulation. As they gradually examined and reviewed the impact of foresight, they learned how they could improve their framework and integrate results in strategic decision making. The insights and materials we draw from these cases allow us to support and to refine our conclusions about the ways to handle the effect uncertainty of drivers of change and, most of all, to investigate the kind of behaviours and strategic postures a firm may adopt for handling the response uncertainty of these drivers.

We think that the relevance of our research lies in the uneven success and popularity gained so far by strategic foresight. While some scholars provide evidence that in the last two decades many large firms regularly relied on these activities and techniques [25–28], the impact of strategic foresight on the performance of the firm is actually blurred and some scepticism arises regarding its real value added [29–32]. In this context, we think that deepening our understanding of how to assess the effect and the response uncertainty of drivers of change is a key requirement for improving the effectiveness of strategic foresight activities and thus for fostering its diffusion and standing both in the business sector and the academic community. Moreover, it’s worth mentioning that foresight activities are performed not only by corporate firms, but also by other organizations (e.g., national and regional governments, trade associations, and chambers of commerce) which promote and support some foresight exercises in order to sustain the competitiveness of local firms [33]. Our research may help as well these public organizations to optimize their efforts, by improving the ways they scope and define the targets of their foresight activities.

The paper is structured as follows:

- firstly, we provide a literature review of the research studies on environmental uncertainty and strategic foresight;
- secondly, we discuss how to handle the “effect” uncertainty of drivers of change: we focus on the most appropriate analytical approach to be adopted in order to fully grasp their impact on the industry structure and the competitive position of the firm;
- thirdly, we outline some basic guidelines for coping with “response” uncertainty of drivers of change;
- finally, we conclude by pointing out the main contribution of our paper to the research stream of strategic foresight and future studies.

Table 1

Assessing the “effect uncertainty” of drivers of change: summary of the selected cases.

Industry (firm)	Driver of change	Source of identification	Evolution of the driver (state uncertainty)
Imaging (Eastman Kodak)	Digital imaging technologies	Technology Foresight; Strategic Competition Analysis	Progressive and complete substitution of film-based technology
Communication (Nokia)	1G and 2G wireless technologies	Technology Foresight; Strategic Competition Analysis	High penetration rate of mobile phones: establishment as mass market product
Spectacle (Luxottica)	Advanced materials; interest by fashion designers	Technology Foresight; Strategic Competition Analysis	Booming demand for fashion-oriented spectacles
Coffee (Starbucks)	New pattern of socialization	Social Foresight	Wide diffusion/consolidation of the new pattern

2. Literature review

2.1. Environmental uncertainty

Environmental uncertainty has been emphasized for a long time in the literature on strategy and organization as a key issue for business decision makers in charge of the future growth of the firm. Specifically, two strictly intertwined lines of research studies have been followed [34]: the first one regards the conceptualization of the “environment” and of its different components (sectors); the second one regards the construct of “environmental uncertainty”.

In the first line, a core distinction was advanced between the “general” and the “task environment”. The latter one is made up by elements and sectors with which the firm has a direct contact and which directly affect its competitive position, day-to-day operations and goal achievement. The organization theory initially defined the boundaries of the task environment by including the sectors of competitors, suppliers, customers and regulatory bodies [4,7,34]. Afterwards the strategic management theory built on the concept of task environment by defining the broader concept of business “micro” environment: this identifies the key sectors (Porter’s “Five Forces”) that concur to shape the industry structure, i.e. competitors, customers, suppliers, potential incomers and substitute products [35] and providers of complementary products [36,37]. The general environment refers, instead, to sectors that affect a firm indirectly [4,34]; they are the political, economic, ecological, societal and technological landscapes which surround the business micro environment, and which are today commonly referred to as the business macro-environment [14].

In the second line of research, the concept of “environmental uncertainty” is built on the assumption that it arises from a lack of information about organizations, activities and events in the different sectors of the business micro and macro-environment [5,38,39]. Uncertainty consists in the inability of decision makers to predict some events accurately, that is the lack of confidence they understand what the major events and drivers of change in their environment are and/or the inability to assign accurate probabilities to the likelihood that some specific events and drivers of change will take place. Milliken [8], in particular, distinguished three types of uncertainty which act together to determine the overall level of uncertainty in the business (micro and macro) environment of the firm. The first type is “state” uncertainty and refers to the inability of understanding how components of the environment might change. Let’s consider the case of the automotive industry and as a driver the environmental (ecological) concern of public policy makers in Europe: will new laws be enacted in the next ten years? If so, how strict these will be? As wide is the range of the possible future states of a given variable (component) of the business environment, as great its state uncertainty is.

The second type is “effect” uncertainty and refers to managers’ inability to predict what the impact of events and changes in the environment will be on their organization. Let’s consider again the same example: will be citizens willing to pay a price premium for green products, or will they switch from a traditional product (e.g., fuel-based cars) to an innovative one (hybrid cars)? If so, how large will be this price premium?

Finally “response” uncertainty is the inability to understand what the viable responses are and/or to predict the consequences of a response choice (e.g.: should a car maker strive for decreasing the price of its fuel-based products? Should it bet on eco-friendly technologies?).

Two environmental features, in particular, bring about the general level of uncertainty: complexity and rate of change [5,38]. Complexity measures the number and heterogeneity of factors and events in the environment that are relevant to the organization: the larger the number and diversity of these key events and factors, the higher the complexity is. Rate of change is the frequency of changes that occur in the environment. A high rate of change implies that external events and activities take place continuously and shift quickly, so making it difficult for strategic decision makers to get accurate information about them.

Parallel (and strictly intertwined) with the stream on environmental uncertainty, a very relevant field of research concerns the role of managerial and organizational cognition in handling uncertainty. Managerial cognition refers to managerial beliefs and mental models that serve as a basis for strategic decision makers for framing the analysis of changes in their external environment and searching for alternative options in order to cope with these changes [40]. The cornerstone of this research field is the bounded rationality of managers [41,42], according to which their capability of making perfectly rational decisions is limited by the information about issues, opportunities and events in their business environment they can actually absorb, process and disseminate. Managers thus develop mental models as simplified representations of the environment in order to give it a shape and a meaning, and to be able to retrieve, understand and process information about it. The key problem for management scholars is that, while mental models may transform complex information about the environment into manageable one, at the same time they critically affect the manner in which decision makers perceive important changes in their business environment. Indeed, mental models may encourage stereotypic thinking and inhibit creative problem solving [40].

Tripsas and Gavetti [43] documented the difficulty of Polaroid in coping with digital imaging due to inappropriate strategic beliefs on business models held by top management. Holbrook et al. [44] found that the different cognitive beliefs of top managers in early U.S. semiconductor firms affected the capability of some firms to survive when the industry changed its technological basis. Kaplan et al. [45] also found that pharmaceutical companies differed in the timing top managers recognized the relevance of advances in biotechnology and made the associated strategic choices. Together these studies support the core idea that differences in cognition of top managers led to different decisions and outcomes in the face of changes in the external environment of the firm, due to the different ways they framed similar problems and thus they searched for responses [46].

2.2. Foresight activities

In order to handle environmental uncertainty, a specific research stream of future studies was developed since the 1960s. For instance, Royal Dutch Shell carried out in 1967 a “Year 2000” project through which it anticipated the discontinuities the oil industry was going to face in 1973, namely the impending scarcity of oil and the increase in its price [47]. A survey of the US companies revealed that in the early '80s almost half of the US Fortune 1000 industrial companies were using forecasting techniques in their planning processes [48,49]; a similar pattern was followed by European firms [50].

In particular, research on “environmental scanning” focused on *where* and *how* executives scan their business environment in order to detect and to learn about new events and drivers of change [9,51,52]. Research on future-oriented techniques focused instead on the most common practices developed in the business context for helping managers to anticipate the likely evolution of drivers of change and thus to support long term strategic thinking [53,54]. As such, “Environmental Scanning” and “Future-oriented Techniques” are the essential components of future studies, or more simply Strategic Foresight. Strategic foresight activities in corporate organizations can be classified according to three main criteria: the major focus (field of investigation); the scope (level of analysis); the organizational approach (see Fig. 1). This classification is derived from both our field research of many large multinational companies and the analysis of literature on foresight [25,27,28,54].

The first axe of classification of strategic foresight is the field of research. This regards the conceptualization of the many forces in the business micro and macro environments which contribute to give rise to uncertainty for decision makers. Traditionally one of the main fields of foresight has been science and technology (Technology Foresight). Technology Foresight is quite often complemented by marketing and social research, which analyses any changes in lifestyle and consumers' behaviour which may have an impact on customers' future needs and the exploitation of emerging technologies (Social Foresight). Moreover, foresight can encompass the monitoring of observable initiatives and supposed plans of competitors, suppliers and providers of complementary products, and therefore the strategies they are pursuing (or may pursue) for capitalizing on new technologies and customer needs (Strategic Competition Analysis). Technology Foresight, Social Foresight and Strategic Competition Analysis address the micro-environment of the firm, since they focus on the forces which originate inside the industry – or the industries – where the firm competes and on the main players within this industry (“market forces”). Anyway, strategic foresight may go beyond the micro-environment in order to investigate the political, economic, ecological, societal and technological landscapes which surround it (business macro-environment). Here the focus is on macro drivers of change which arise at a global scale, outside the boundaries of a specific industry, but which may strongly affect the industry structure as well (“non-market drivers of change”).

The second axe of classification of strategic foresight activities relates to the level (scope) of analysis, as it derives from the “customers' need-based” definition of the business environment of the firm [55]. Coherently with the customers' need-based definition of the business environment, we may have the *macro* level of analysis, which considers the different related segments of a broadly defined industry, such as the “energy” industry (oil, gas, and renewable sources); the *meso* level, which focuses on a

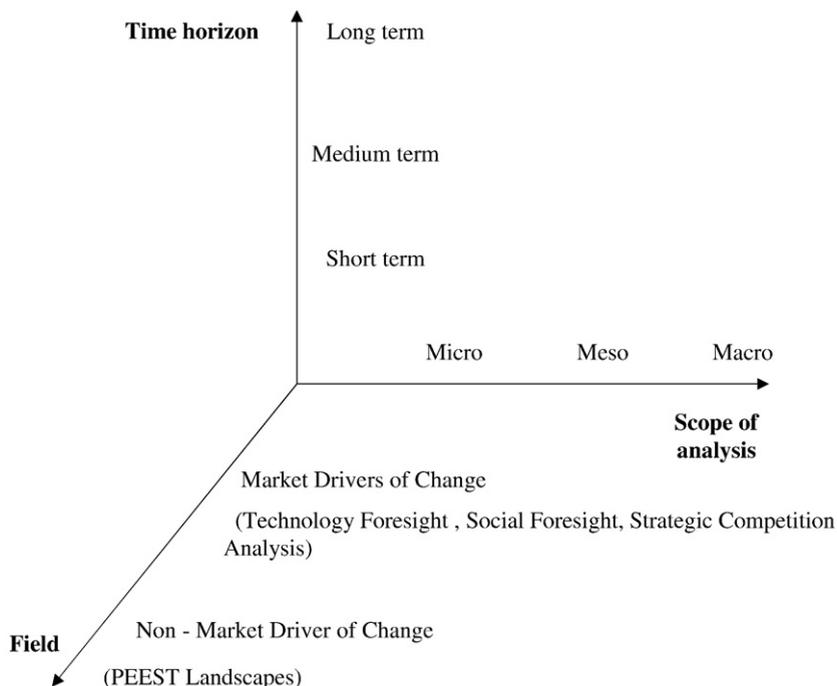


Fig. 1. General classification of strategic foresight activities.

specific business area or on a specific industry segment, such as the “gas” industry; the *micro* level, which focuses on a specific organizational or operational unit, or on a specific investment project. According to these different levels of analysis, the results of strategic foresight are targeted and tailored to decision makers at different hierarchical positions: corporate, business and operational/functional executives.

The third axe of classification of strategic foresight is the time horizon. In particular, at micro (operational) level foresight tends to be short and medium term oriented, as very pressing and concrete issues (e.g. sales volumes for different products and regional markets) are to be dealt with. At meso (business) and macro (corporate) level foresight tends to be long term oriented. Anyway, it is worth noting that the notion of “long term” strongly depends on the business one considers: in the energy industry, it is usually over 20 years; in the ICT industry, it usually falls between 5 and 10 years. This is due to the rate of relevant changes, the difficulty of making reasonable assumptions, the payback period of investments in capital expenditure.

Field, scope and time horizon define the target content of strategic foresight in corporate organizations. Anyway, there are other two issues that fundamentally contribute to frame strategic foresight: they are the methodological and the organizational approaches, which determine the reliability and the value of the outputs of foresight whatever the target scope, field or time horizon are.

As the methodological approach is concerned, future-oriented techniques (roadmaps, scenarios, Delphi, relevance trees, trend-impact analysis, cross impact analysis, simulation modelling and systems dynamics, game theory,...) may largely differ in terms of complexity and sophistication. While some of them essentially rely on qualitative approaches and inputs, i.e. experts' opinions (qualitative techniques), others make extensive use of statistical and computational tools (quantitative techniques). Even for the same techniques, e.g. scenarios, literature reveals the co-existence of several and at times contradictory definitions, principles and methodological guidelines [29]. A further relevant distinction concerns the explorative vs. the normative nature (and use) of future-oriented techniques [20]. Explorative techniques generally deal with questions that regard what might possibly happen on the basis of the forces at play. Such techniques begin with the past and the present as a starting point and move toward the future in a heuristic manner, by looking at all conceivable possibilities. Instead, normative techniques are goal-oriented, as they tend to take into account the purpose of the organization, its mission, and, most of all, its expected achievements and outcomes. Then normative techniques move backwards, in order to understand if the objectives can be actually pursued, given the capabilities available or achievable by the organization.

Concerning the organizational approach, some firms have established an autonomous and permanent unit with a full time staff and its own budget. This foresight unit is established either at corporate or business level and may be either specialised on a specific field, such as science and technology for supporting the R&D planning, or a heterogeneous group of futurists, researchers and experts who deliver a more comprehensive investigation of many different fields in the business micro- and macro-environment.

Other firms did not establish a foresight unit with its own budget: foresight is embedded in other strategic activities in a corporate or a business department (e.g., R&D, marketing) usually by focusing on a specific field of investigation, and is carried out by a few people as one of their several tasks (explicit or implicit). Some other firms set up a temporary task force, which has to cope with a specific issue on an “ad-hoc” basis and may rely on the contribution of external experts. Finally, it is worth mentioning the growing number of multi-client foresight projects. These studies are financed by several companies and/or by governmental bodies in order to cope with some very complex issues of common interest, e.g. the “HyWays” consortium for promoting and developing a hydrogen infrastructure.

So far, literature on strategic foresight focused on how to design methodological approaches and organizational processes for anticipating the likely evolution of drivers of change, i.e. for dealing with their state uncertainty. Anyway, less attention was devoted to the effect and response uncertainty of drivers of change. The objective of this paper is to fill this gap, by linking the research streams on environmental uncertainty, managerial cognition and foresight. In particular, we aim at improving our understanding of the cognitive traps and pitfalls which may prevent the managers of a firm from fully grasping the impact of a driver of change they timely foresaw yet in terms of future evolution, and thus from figuring out the proper response for governing the driver. In this way, we hope to provide the broad outline of a conceptual framework which may help to enhance the value and contribution (in terms of both reliability and comprehensiveness) of whatever kind of methodological and organizational approach for strategic foresight, in relation to any kind of target content (field, scope, and time horizon).

3. Handling the “effect” uncertainty of drivers of change

What business managers need to know about drivers of change is ultimately the capability of these drivers to affect: i) the industry structure (i.e. Porter's Five Forces) and thus the sources which govern competition in the industry; ii) the value chain, namely the activities through which the industry players create value to their customers. A driver of change is to be considered as relevant and disruptive (i.e. “discontinuous”, which is the definition we use hereafter in the paper) as it is able, at least potentially, to elevate new sources of competition to the forefront (e.g., economies of scale and brand identification).

If one misses to recognize the impact of a driver of change on the sources of competition, he is unable to define the kind of new competitive advantage he may have to pursue for a sustainable growth in the long run. A key question arises however: how can traditional strategic management tools be used in an industry which is undergoing a deep change, as its current structure does not provide anymore a reliable basis for analysing competition and profitability? How sensible can it be to rely on the industry “Value Chain” and “Sources of Competition” in order to recognize and to assess drivers of change when it most matters, that is when the drivers themselves are going to turn around the industry value chain and the sources of competition?

The most common (and natural) cognitive attitude towards change is to conceive the evolution of the industry structure as a linear extrapolation of the current situation: How can we adapt the value chain to a driver of change? How can we leverage this driver to improve our products and services, and to enhance the customer needs we traditionally served? How can we embed the driver in the traditional business model, so capitalizing on traditional resources, processes, culture? This is exactly what we define as a “sustaining approach” to the industry evolution.

Such an attitude is due to the rational bounds of managers, who must rely on simplified representations of their business environment in order to perceive and analyse drivers of change. But mental models are typically based on past experience as opposed to the development of a fresh perspective of analysis. As a result, mental models tend to inhibit creative problem solving and to limit the range of alternative responses that managers are able to define, as well as the degree of novelty and distance (location) of these responses with regards to current behaviour. That’s the reason why organizations often achieve poor performance when they have to face radical changes and discontinuities.

In this context, the real challenge of strategic foresight is not only to detect drivers of change promptly but, most of all, to re-shape the strategic beliefs of managers. As one former head of the scenario planning unit at Shell explained:

“the real purpose of foresight is not to predict how a driver of change will evolve, but to change the mental models that decision makers carry in their heads”.

In the case of a discontinuous driver of change, thinking the future through the lens of the previous experience and strategic beliefs about the business environment and the business models that were successful in that environment may be considered as driving a car in proximity of a bend by just looking at the rear mirrors. By doing so managers will inevitably fail when it most matters, i.e. when the rules of competition are going to shift sharply. The existing value chain and sources of competition can be no more used as the foundation of strategy formulation: the driver itself must be the cornerstone of the analysis. *Discontinuous* drivers of change require to figure out *discontinuous* business models for exploiting them fully, by creating the highest value for final customers. It is necessary to focus on the intimate meaning of the driver of change, whatever an emerging technology or a shift in social values, and its intimate novelty compared to the customer needs the company was used to serve; it is necessary to understand which new needs the driver addresses and thus how industry products and services are to be re-conceived and re-designed in order to match these needs at best. Managers must give up their traditional strategic beliefs regarding the boundaries of their organization and shift their strategic focus on the driver in order to re-define the *objective* of the activities of the value chain, not just the way of performing them; they have to start from the driver and to think up what completely new configuration of these activities may be the most appropriate to maximize the value added for the end customers (*putting the driver first*). As we illustrate hereafter in this section of the paper, the *new configuration* of the value chain may require the creation of a new activity that did not exist previously; it may concern the deep redesign of a specific activity; or finally it may concern the relationships between several activities, i.e. the way they are integrated.

We define such a (cognitive) assessment of the impact of a driver of change the “anticipatory approach” to industry transformation. Only through an anticipatory approach the sources of competition candidate to be elevated to the forefront can be identified and therefore the impact of the driver on the industry structure can be fully understood. Only in this way a firm can define what competencies and resources are needed in order to cope successfully with the sources of competition that are going to become the most critical ones, and therefore to govern and to exploit them. Such an evaluation sheds light on the “gap” to be bridged, given the current resources, processes and culture of the firm (see Fig. 2).

Of course, not every driver of change is discontinuous, that is not every driver is able to affect the rules of competition remarkably. In many cases, a sustaining approach naturally brings to the business model that best matches the driver, as this may require just a linear evolution of the existing value chain, just an improvement of the processes, products and activities that are already performed. However, “putting the driver first” is the only way to assess its intimate power for discontinuous change. If a firm gives up such an analysis, it runs the risk of lowering the guard exactly when the greatest challenges are coming closer.

To illustrate our thesis and to describe with more details what we mean by “sustaining approach” (that is, *extrapolating* the value chain) and by “anticipatory approach” (that is, *putting the driver first*) to the industry evolution, we report a few cases of firms of different industries. These firms had to face discontinuous drivers of change that all of them identified timely, but they adopted different cognitive approaches for assessing their “effect” uncertainty, so that they achieved very different performance in terms of long term growth and profit.

We start with the imaging industry and the decline of its long standing leader until the mid '90s, Eastman Kodak, due to its sustaining approach with regard to digital imaging. Then we consider the case of Nokia and illustrate how it was able to fully exploit 1G and 2G technologies so anticipating the transformation of the mobile phone industry. Finally, we consider the case of Luxottica in the spectacles industry and Starbucks in the coffee industry and link their remarkable success to their anticipatory approach to social drivers of change and shifts in customer values.

3.1. Kodak and the imaging industry

In the early '80s, Eastman Kodak was the undisputed leader in the traditional, film-based imaging industry. Anyway, the firm had already started a few years before carrying out research activities on digital imaging for developing new products and services. In 1983 the company created an ad-hoc division for exploring new technologies in digital imaging and communications, electronics, computer science. Several people were hired and external consultants were engaged to drive the renewal of the

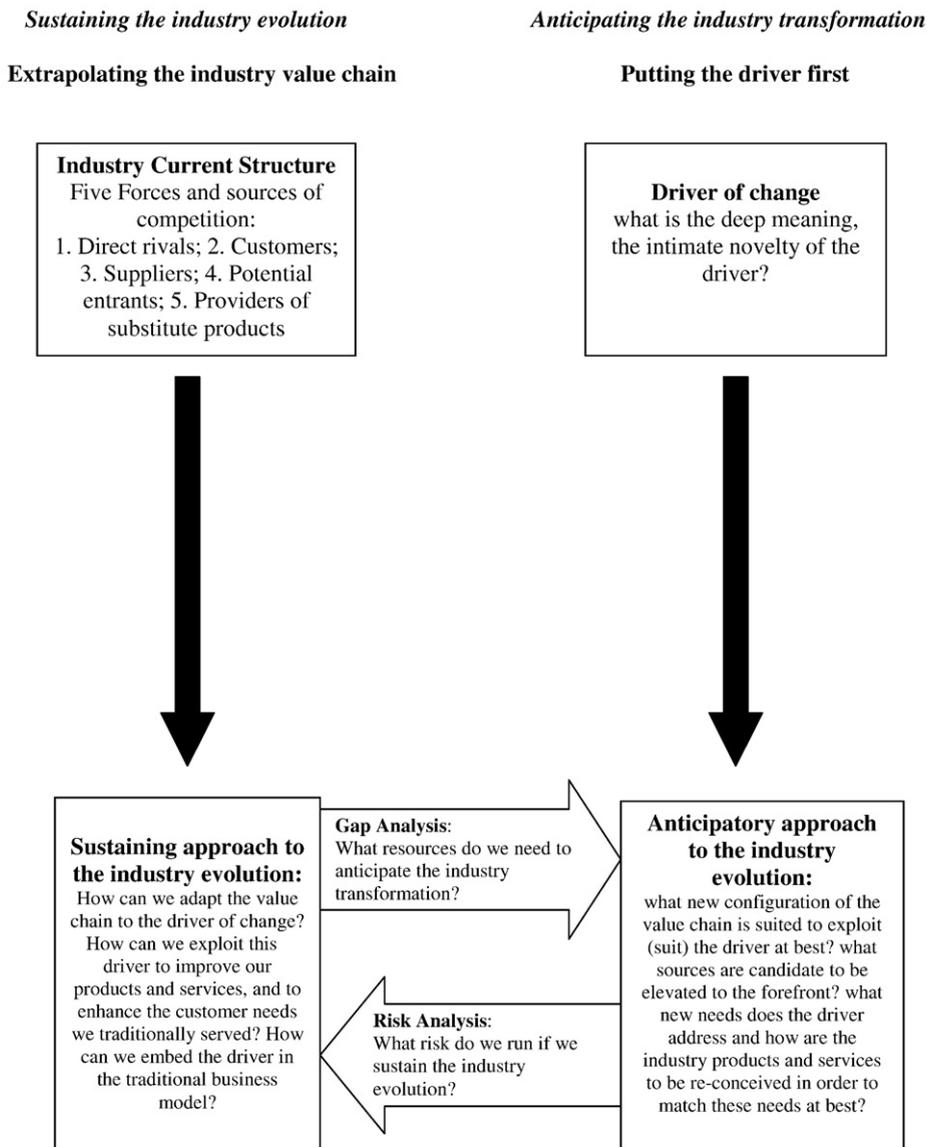


Fig. 2. Managing discontinuous drivers of change: bridging the gap between the sustaining and anticipatory approach to the industry transformation.

organization. The company gradually re-defined its mission and strategic vision around what the 1991 Annual Report defined the “film-based digital imaging” market: Kodak aimed at improving through digital imaging all the activities of the film-based industry value chain, as illustrated in Fig. 3. As the CEO in 1994 stressed, Kodak was a company built on “imaging”, not only on film, and great opportunities for growth could come from the exploitation of new digital technologies. Kodak had thereby to focus its efforts on the “profitable participation in the five links of the imaging chain: image capture, processing, storage, output, and delivery of images for people and machines anywhere”.¹

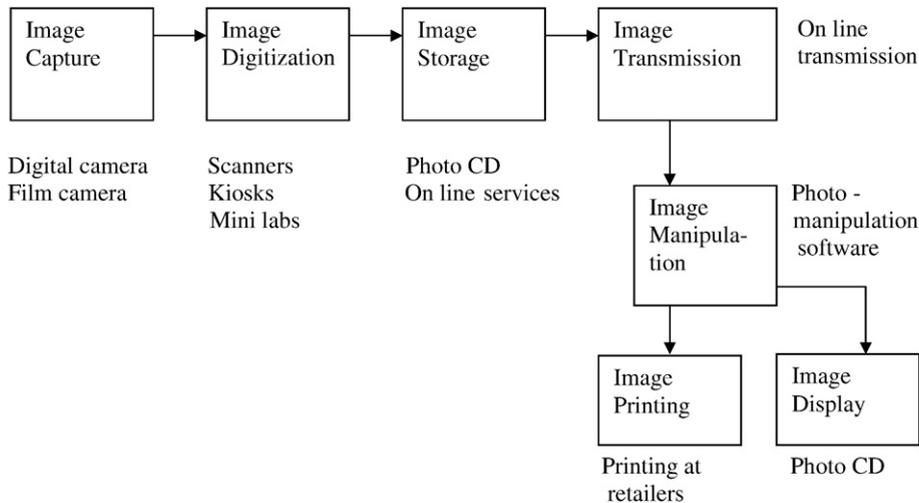
In relation to imaging capture, Kodak launched an impressive set of digital cameras for either professional or consumer use. Concerning imaging transfer, it developed professional equipment for printing digital images at retailers, either mini-labs or kiosks. As storage was concerned, Kodak launched in the early '90s a very innovative product, the Photo CD, which enabled pictures to be played on a television screen. Moreover, Kodak developed equipment for digital processing of traditional pictures at retailers and outstanding software applications for photo manipulation; finally, it partnered with best in class suppliers to provide on line services such as transmission, storage and sharing of pictures [56].

Notwithstanding these efforts, in the early 2000s Kodak faced a considerable decline of revenues and profits. Why? Kodak analysed the industry value chain as it was and adapted it to digital imaging. This approach anyway prevented the firm from

¹ PR Newswire, “Kodak’s CEO unveils new corporate strategy”, May 3, 1994.



Kodak's value chain before digital imaging: activities, products and services



Kodak's value chain after digital imaging: activities, products and services

Fig. 3. Merging traditional and digital imaging: the evolution of Kodak's value chain.

figuring out the critical and full impact of the driver of change. Extremely explanatory are the examples of imaging transfer and imaging display: Kodak made use of digital technologies in order to simply improve the established formula of printing photos at retailers and launched a product (Photo CD) that was exactly a new way of displaying pictures. However, if one looks at “digital” imaging products and services from a “digital” point of view, i.e. if one *puts the driver first*, he can realise that digital images are definitely *data*. Of course, high value and emotional data, but still data, the production of which involves several activities typical of the “Information and Communication” industry value chain, such as capture, storage, process, transmission, printing. This meant that after the coming of digital imaging the photography industry was no longer a standing alone business, but it was going to be absorbed by another one, the “ICT” business, the boundaries of which were extremely broader (see Fig. 4). This meant that Kodak had to compete on a completely new ground, with different rules of the game and different sources of competition. These sources were, first of all, another kind of differentiation, based no more on the excellent quality of specialised products and services for *imaging* but based on the versatility and flexibility of products and services designed for *data*, such as data printers for *home and office use* instead of professional equipment for printing pictures *at retailers*, and such as *data-CD drives* instead of *Photo CD*. The sources of competition were also economies of scale and scope and were in the hands of players such as Epson, HP and other PC makers, which had a privileged access to distribution channels in the ICT industry.

In the end, digital imaging required completely new strategic beliefs and mental models regarding the boundaries of the industry, as a sound competitive advantage could not be figured out and gained by companies focused on the traditional (film-based) value chain.

3.2. Nokia and the mobile phone industry

Let's consider the impact of wireless technologies on the telecommunication industry, when the first (1G or analogue) and the second (2G or digital) generations came in the late '80s and early '90s. Previously the phone had usually to be shared by a few people, for instance, all the members of a family or all the colleagues of an office. This meant that calls had to be shared; their contents and subjects were constrained by the accessibility to other people. As a consequence, phone calls were usually formal calls. However, thanks to the 1G technology people could do something more and something else than just communicating while moving: people could make personal and private calls at last, since their contents could be kept just for the people they actually

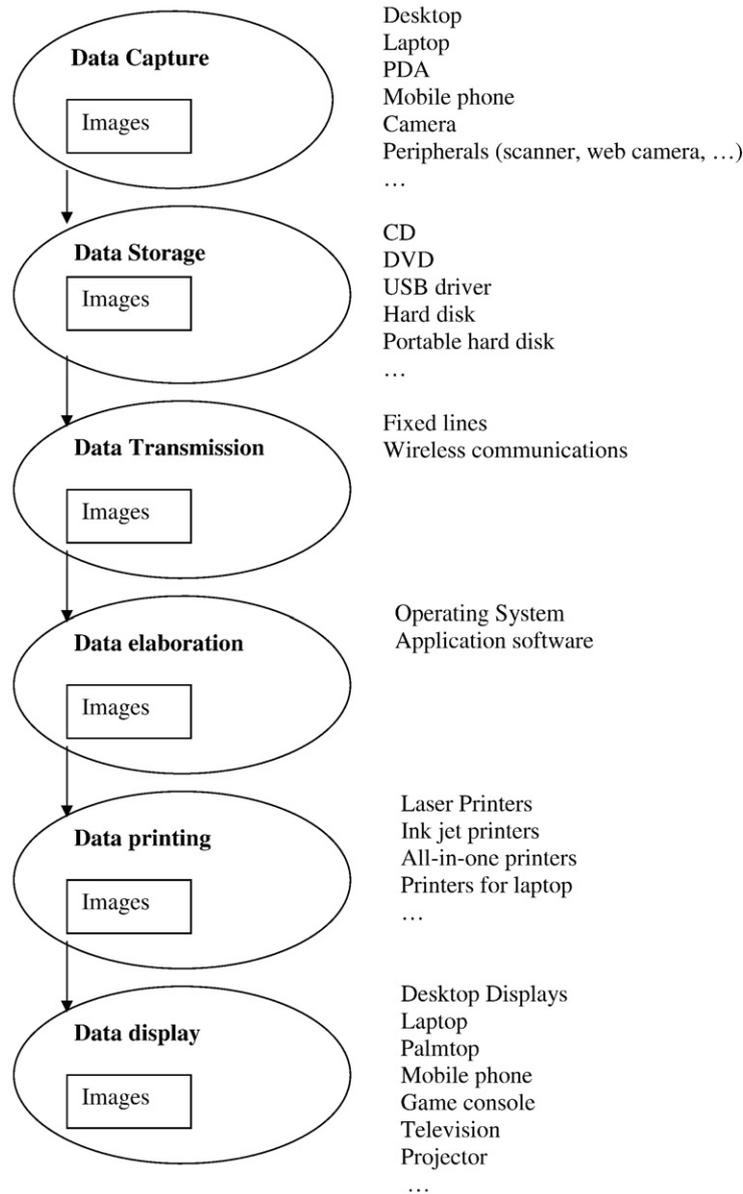


Fig. 4. The “Imaging” industry value chain and the “Information and Communication” industry value chain.

addressed. 1G technology definitely addressed a demand that could not be fully matched before. This new meaning of the cellular phone came to fore and really boomed with the 2G technologies, which cut the cost of both the services and the products and opened the door to mass consumption. Completely new idioms and communication forms were created: the first persons to learn this were schoolboys and teen-agers.

In this context, Nokia’s capability of anticipating not only the wide diffusion and demand for 1G and 2G technologies, but most of all their impact on customer needs and the industry structure was the main reason behind its growth.² Nokia did not pioneer just *mobile* communication, but *personal* communication: as a top manager at Nokia explained us, the key issue at the heart of the firm success was “the capability of gauging what people want from their mobile phone: a tool for enhancing their personal relationships”. Throughout the early 1990s, the Annual Reports of the company portray pictures of the members a family, friends and mates that stay in touch, while separate in different locations, through their mobile phones”.

² In the early 2000s, Nokia established a dedicated foresight unit for coordinating its foresight activities and efforts, the “Nokia Insight and Foresight Team”. The field of analysis was widened to cover not only R&D, market trends and analysis of competitors, but also the PEEST landscapes.

Nokia conceived cellular phone no longer as a mobile handset only, but as a sort of repository of the private emotions linked with private calls. This entailed that product design and marketing were key activities to be radically re-defined in order to reach a strong hold of the emerging sources of competition of product differentiation and brand identification. Since its first 2G models, Nokia created the smooth, rounded and easy to hold shape that became its hallmark, simplified the software and introduced large displays, soft key touch pads, faceplates with different colours that could be changed according to the mood of the user. Contextually, Nokia carefully built its brand in order to enhance a sense of trust and friendship, and to convey the message that technology is only a tool for making customers enjoy a better life. Definitely, Nokia applied a really holistic approach, completely new and revolutionary for the communication industry, which considered for its deep reorganization every aspect of design, manufacturing, distribution and finally advertising. That is, after it fully grasped the meaning of the new customer needs enabled by 1G and, most of all, 2G technologies, Nokia formulated its strategy in order to pioneer exactly the “personal” dimension of the (mobile) communication industry, and took the best position for capturing the highest profits.

3.3. *Luxottica and the spectacles industry*

In the last two decades the spectacles industry underwent a deep transformation. This was due mainly to two discontinuous drivers of change: firstly, the development of advanced materials, in particular celluloid; secondly, the aesthetic research which started involving common-used objects in everyday life and therefore the interest of fashion designers, who grasped the potentiality of spectacles to “dress” customers' eyes and therefore to enrich this key feature of look and personality. As one senior manager at Luxottica explained:

“When spectacles started spreading widely in the last century they took on a negative meaning: they were basically a standard technical tool which aimed at curing sight defects. As such they were generally put up with by customers. But in the late '80s and the early '90s the situation radically changed: spectacles gradually acquired a completely different meaning, by representing a status symbol and distinctive mark of users' personality. By combining fashion and technology, spectacles have become more and more fashion accessories that buyers acquire even several times a year, as they use to do with scarves or shoes”.

This new meaning of spectacles entailed a radical shift in the industry structure and its attractiveness in the long run. Firstly, new sources of competition as product design and brand identification were elevated to the forefront, since the product aesthetics was even more critical than its technical function and manufacturers had to renew their own image accordingly. Secondly, contact lenses and surgery to correct eyesight defects were no longer very threatening substitute products and services. Thirdly, the market remarkably grew, since people wanted different spectacles for different situations during the day: this was in particular the case of sunglasses, which fitted very well with design experimentation and were more subjected to fashion fads and rapid obsolescence.

Luxottica's success and its establishment as the market leader lay exactly in its ability to understand customers' new needs for spectacles and thus the new rules of competition, and to develop its value chain correspondingly. As a senior manager at Luxottica explained:

“As fashion designers started featuring spectacles in their collections, we provide them our technical and production craftsmanship, by enabling them to create spectacles which interpreted the innovative message of their fashion proposals. The geographic and, most of all, the social proximity with the Italian fashion industry played a key role in the historical evolution of our mission, values and beliefs.”

Luxottica has today the widest eyewear collection, [57]. In particular, the company carefully developed its brand portfolio, by partnering with fashion makers like Prada and Dolce & Gabbana and acquiring historical trademarks like Ray-Ban from the Bausch & Lomb Group, which dismissed it as a non-strategic asset. Moreover Luxottica highly integrated and expanded the key activity of retail, by increasing the number of its stores throughout the world. In this way Luxottica was able not only to enhance customers' satisfaction with pre-sale, sale and post sale services, but, most of all, to obtain direct and timely market information, so reducing the inventories and optimizing production planning. As a senior manager at Luxottica explained:

“If you are in the hands of a wholesaler you cannot plan production and even less, growth. We create a range of models based on experience: once we create and propose the collection to our customers we check the monthly sales' trend for the various models and thus we have a better grasp of what the market wants. The collection for the next years is thereby defined on the basis of ongoing statistics: it's almost as the feedback we get from the market dynamically creates our next collection”.

3.4. *Starbucks and the coffee industry*

In the early '80s the demand for coffee underwent remarkable changes. The widespread adoption of a healthier lifestyle led people to replace alcohol with coffee and increased the consumers' awareness of this product. Of course, this contributed to expand the demand for coffee greatly and thus to sustain the industry evolution. However, another driver of change affected the industry in a more radical way, by creating completely new rules of competition: this was the establishment of a new pattern of socialization. People gradually moved away from dance clubs and started looking instead for quiet locations where they could

come together with friends or business associates and meet new people in a cosy atmosphere, simply responding to the quest for community and dialogue. Due to this new pattern of socialization, the need for a coffee became something more than the need for a drink, really the need for a social experience. As Francesco Morace, a futurist and sociologist who served as consultant for the illycaffè company,³ explained us:

“The fruition of coffee, to the full extent of its personal and social rituality, constitutes an important expression of the need of conviviality, which is the need for sharing and relationships. By simultaneously appealing to our senses of taste, sight and smell, the deep pleasure of a cup of coffee serves as a basis for an old-fashioned conversation, for the sort of conviviality typical of a traditional Italian café”.

Howard Shultz, the founder of Starbucks, was quick to gain such insight after a trip in Italy, in 1983, when he was inspired by the vast number of coffee bars in Milan. At the time Mr. Shultz was an employee for a retail company of coffee beans. When he came back he presented the Board of Directors his idea to expand the company into a coffee bar. Such an expansion would have required a deep change in the managerial cognition about the boundaries and the mission of the organization for serving at best the new customer needs regarding the coffee product: as his idea was rejected, Mr. Shultz left the company to start his own Starbucks venture. His success was due exactly to the ability of anticipating the shift in the rules of competition. Since the bulk of value and profit lay in the provision of a coffee-related experience more than in the coffee product itself, Starbucks established itself as a coffeehouse more than a coffeemaker, by reinventing its stores as a third-home place with the highest standards in terms of position, layout, lighting, furnishing. In this context, the firm built its in house team for store management, including real-estate managers, architects, designers, and it carefully trained its employees, especially the people (like bartenders) who directly affect the quality of the customers' experience.

The value proposal at the heart of Starbucks strategy is well described by the letter to the company's shareholders in the 1996 Annual Report: “With more than 20,000 dedicated partners (employees), we are creating opportunities every day for millions of customers around the world to enjoy the Starbucks experience. From selecting the finest Arabica beans to hiring the most talented people, we are committed to apply the highest standards of quality in everything we do [...]. It is our goal to offer more than just a great cup of coffee — we want to offer a memorable experience”.

4. Handling the “response” uncertainty of drivers of change

The “state” uncertainty about the likely evolution of a driver of change and the “effect” uncertainty about its impact play a key role for determining what kind of response (strategic posture) a firm should adopt for coping with this driver. Anyway a third key factor has to be considered on this regard, namely the “time pressure”. Time pressure is the lapse of time available to acquire or to develop the resources needed to take benefit of the driver of change. It results most of all from the nature of these resources (physical, financial, human, technological, reputation or organizational skills) and from the current resources of the company, as these may be completely different and useless compared to the new ones it requires. Moreover, it depends greatly on competitors' strategic postures and their accessibility to these key resources.

On the basis of the “state” and “effect” uncertainty of the driver of change and of time pressure, a firm has two main kinds of approach for responding and profiting from the driver: the first one is “betting” on it; the second one is “building strategic options”. Betting on a driver means investing highly in the acquisition or development of the resources needed to govern it. Building an option means to grant oneself the opportunity, but not the obligation, to invest later in these resources: that's exactly what Starbucks did, as the company started with a limited set of stores and then quickly expanded the store chain after it experienced the success of its business model.

If a driver of change seems able to elevate new sources of competition to the forefront and its “state” uncertainty is fairly modest, betting comes out to be the most natural strategic posture; however, such a case is very rare. When uncertainty is high and the likely impact of the driver on the industry structure is difficult to assess, strategic options are very valuable tools, as they give the opportunity of probing the direction of evolution of the driver. In particular, in many companies we investigated the technique of scenario building is systematically combined with the formulation and analysis of strategic options. Scenarios provide a sound basis for the design, evaluation and decision making about when the options have to be exercised. Remarkable cases are provided by BASF, as it decided to make large investments in China in the '90s, far before its competitors, thanks to the confidence about the future of the country it acquired by means of scenarios; and by Morgan Stanley, as it promptly exited from retail financial services in Japan at the time of its merger with Dean Written, so it avoided the huge losses that other competitors suffered from.

Strategic options may give not only the opportunity of looking into the “state” uncertainty of a driver of change, but also of evaluating the real feasibility of new business models. In such cases, options can take the shape of venture capital activities. A venture capital firm provides useful information and insight at a relatively low cost and, most of all, the opportunity to play a role in the game when the “state” uncertainty lowers and the medium and long term attractiveness of an emerging business area can be reasonably assessed. For this purpose, Nokia has built its Nokia Venturing Teams, with the aim of being early exposed to innovative ideas coming from Nokia employees and external sources. Likewise, Siemens built its Siemens Technology Accelerator.

On one hand, in any business continuous learning and experimentation are a necessity; on the other hand, they contrast with time pressure. Unavoidably time comes when one cannot postpone irreversible investments any longer, even if the “state”

³ The illycaffè company, based in Trieste, is a leading coffee brand, with a worldwide recognition for its high-quality coffee-related products.

uncertainty and the “effect” uncertainty have not been yet completely cleared. The key point is to be the first to put one's hands on scarce resources, such as assets or licences to operate in an emerging market, or to build and to achieve higher technological and organizational skills. Delays have intrinsic costs: they allow rivals to reach a better understanding of emerging drivers of change and give them the opportunity to be the first to get the resources required to govern the industry evolution. For this reason strategic options should be looked at and used carefully, while keeping in mind that the largest payoffs are gained by the ones who bet first.

In particular, in such fast changing industries as the technology driven ones, the time lapse available in order to take benefit of a new driver of change is usually very short. In these cases it is impossible, if not damaging, to wait until uncertainty is low; one has to bet before the potential opportunity is compromised. More than this, betting can be the only way to solve “state” and “effect” uncertainty in one's own favour, as Nokia did on mobile phones as a mass market tool for personal communication and as Luxottica did on spectacles as fashion accessories. Usually, investing heavily and early turns out to be the only option available to followers or newcomers; however, options could not be available also to incumbents, when simply the experimentation of new business models can undermine the current ones. Let's consider Kodak's response to digital imaging and its choice to push printing at retailers, in order to exploit its longstanding network of partners. Such decision prevented the firm from focusing its efforts onto the development of printers for consumers, so contributing to pave the way for its decline. On this regard, the current activities, resources and culture of the firm may be a serious constraint and barrier not only to the design of new business models, but also to their implementation.

Therefore, the intrinsic value and benefits that come from an “anticipatory” assessment of the likely impact (effect) of emerging drivers of change lie also in making the firm aware of the risk it runs in case of delay or inactivity. That is: if an incumbent, whatever its bargaining power is, does not maximize, by means of its activities, the value that a discontinuous driver of change can bring to the final customers, it will give followers or newcomers the opportunity of overtaking him, by setting up and exploiting exactly the re-configuration of the industry value chain that match the driver at best. That's why discontinuous drivers confront industry leaders with the most severe decisions: betting on a discontinuous driver can be the only option available for long term survival and profitability.

5. Concluding remarks

The formulation of the business strategy of a firm is intrinsically linked with the “strategic foresight” analysis of the emerging drivers of change which are potentially able to affect the structure of the industry and the competitive position of the firm.

In order to perform this critical task different methodological frameworks and techniques have been developed and are currently adopted in large corporations, with the basic aim of helping managers to find out timely new drivers of change and anticipate their likely evolution (“state” uncertainty). The prompt detection of emerging drivers of change, however, is not enough: what it really matters, is the ability of achieving a deep understanding of their consequences (“effect” uncertainty) on the sources which govern competition in the industry. The traditional strategic management framework of analysis, based on tools like Porter's Five Forces and Value Chain, is still of great value. However, when an industry is candidate for being restructured, the way these strategic management tools are used is to be revised. In order to recognize the full implications and consequences of discontinuous drivers of change, these are to be “put first”, as the starting point of a strategic analysis which aims at figuring out what new configuration of the industry value chain can match these drivers at best. Only after this kind of analysis, the key resources a firm needs to cope successfully with emerging drivers may be figured out, as well as the ways to get these resources (“response” uncertainty).

Up to now strategic literature omits to provide some conceptual frameworks for assessing clearly the core implications of emerging drivers for strategy formulation, namely for help business managers to handle the “effect” uncertainty and the “response” uncertainty related to drivers of change in their business environment. The provision of such frameworks, namely the theses we broadly outline in this paper, could be an important step forwards for strategic foresight and the enhancement of its value added to strategy formulation, and could contribute to foster the diffusion of future studies among corporate organizations.

Moreover, many national and regional governmental bodies, trade associations and foundations have carried out in the last decade and are currently carrying out foresight exercises in order to support local firms [30,33]. As long as foresight activities by governmental bodies and trade associations improve the assessment of the “effect” uncertainty about new drivers of change, their results may be more helpful and easier to be used by the targeted companies. For instance, in the case of the many public foresight exercises which aim at assessing the criticality of a list of emerging technologies for the local industries, new criteria of evaluation based on “an anticipatory approach” to the industry transformation may be introduced in order to foster the generation of fresh new ideas (and thus to carry out a more thorough analysis) about the impact (“effect” uncertainty) of these technologies.

References

- [1] H.I. Ansoff, *Strategic Management*, Macmillan, London, 1979.
- [2] R.E. Miles, C.C. Snow, *Organizational Strategy, Structure, and Process*, McGraw-Hill, New York, 1978.
- [3] H. Mintzberg, *The Rise and Fall of Strategic Planning: Reconceiving Roles for Planning, Plans, Planners*, Free Press, New York, 1994.
- [4] W.R. Dill, Environment as an influence on managerial autonomy, *Admin. Sci. Q.* 2 (1958) 409–443.
- [5] R.B. Duncan, Characteristics of organizational environments and perceived environmental uncertainty, *Admin. Sci. Q.* 17 (1972) 313–327.
- [6] P.R. Lawrence, J.W. Lorsch, *Organization and Environment*, Harvard University Press, Cambridge, MA, 1967.
- [7] J.D. Thompson, *Organizations in Action*, McGraw-Hill, New York, 1967.

- [8] F.J. Milliken, Three types of perceived uncertainty about the environment: state, effect, and response uncertainty, *Acad. Manag. Rev.* 12 (1987) 133–143.
- [9] F.J. Aguilar, *Scanning the Business Environment*, McMillan, New York, 1967.
- [10] R.N. Kostoff, R. Boylan, G.R. Simons, Disruptive technology roadmaps, *Technol. Forecast. Soc.* 71 (1–2) (2004) 141–159.
- [11] R.N. Kostoff, R.R. Schaller, Science and technology roadmaps, *IEEE Trans. Eng. Manage.* 48 (2) (2001) 132–143.
- [12] R. Phaal, C.J.P. Farrukh, D.R. Probert, Technology roadmapping – a planning framework for evolution and revolution, *Technol. Forecast. Soc.* 71 (1–2) (2004) 5–26.
- [13] J. Coates, Scenario planning, *Technol. Forecast. Soc.* 65 (1) (2000) 115–123.
- [14] L. Fahey, R. Randall, *Learning From the Future*, John Wiley & Sons, New York, 1998.
- [15] J. Gausemeier, A. Fink, O. Schlake, Scenario management: an approach to develop future potentials, *Technol. Forecast. Soc.* 59 (2) (1998) 111–130.
- [16] P. Schwartz, *The Art of the Long View: Planning for the Future in an Uncertain World*, Doubleday Currency, New York, NY, 1991.
- [17] M. Godet, *Scenarios and Strategies: A Toolbox for Problem Solving*, Cahiers du LIPS, Special Issue: Paris, 1997.
- [18] J.C. Glenn (Ed.), *Futures Research Methodology*, American Council for the United Nations – The Millennium Project, Washington, 1999.
- [19] S. Makridakis, S. Wheelwright, V. McGee, *Forecasting: Methods and Applications*, 2nd ed, John Wiley & Sons, New York, 1983.
- [20] A.L. Porter, B. Ashton, G. Clar, J.F. Coates, K. Cuhls, S.W. Cunningham, K. Ducatel, P. Van der Duin, L. Georghiou, T. Gordon, H. Linstone, V. Marchau, G. Massari, I. Miles, M. Mogee, A. Salo, F. Scapolo, R. Smits, W. Thissen, Technology futures analysis: toward integration of the field and new methods, *Technol. Forecast. Soc.* 71 (3) (2004) 287–303.
- [21] H. Grupp, H.A. Linstone, Foresight activities around the globe: resurrection and new paradigms, *Technol. Forecast. Soc. Change* 60 (1) (1999) 85–94.
- [22] G. Hamel, C.K. Prahalad, *Competing for the Future*, Harvard Business School Press, Boston, 1994.
- [23] B. Martin, Foresight in science and technology, *Technol. Anal. Strateg.* 7 (2) (1995) 139–168.
- [24] R.K. Yin, *Case Study Research* 3rd ed, Sage Publications, Thousand Oaks, 2003.
- [25] P. Becker, Corporate Foresight in Europe, A First Overview, RTK2 Scientific and Technological Foresight, European Commission, 2002.
- [26] D. Daheim, G. Uerz, Corporate foresight in Europe: from trend based logics to open foresight, *Technol. Anal. Strateg. Manage.* 20 (3) (2008) 321–336.
- [27] F. Ruff, Corporate foresight: integrating the future business environment into innovation and strategy, *Int. J. Technol. Manage.* 34 (3/4) (2006) 278–295.
- [28] R. Vecchiato, C. Roveda, Foresight in corporate organizations, *Technology Analysis & Strategic Management* 22 (1) (2010) 99–112.
- [29] R. Bradfield, G. Wright, G. Burt, G. Cairns, K. Van Der Heijden, The origins and evolution of scenario techniques in long range business planning, *Futures* 37 (2005) 795–812.
- [30] K. Cuhls, R. Johnston, Corporate foresight, in: C. Cagnin, M. Keenan, R. Johnston, F. Scapolo, R. Barré (Eds.), *Future-oriented Technology Analysis, Strategic Intelligence for an Innovative Economy*, Springer, Berlin Heidelberg, 2008.
- [31] A. Martelli, Scenario building and scenario planning: state of the art and prospects of evolution, *Futures Res. Q.* (Summer 2001) 57–70.
- [32] T.J.B.M. Postma, F. Liebl, How to improve scenario analysis as a strategic management tool? *Technol. Forecast. Soc.* 72 (2) (2005) 161–173.
- [33] L. Georghiou, M. Keenan, Evaluation of national foresight activities: assessing rationale, process and impact, *Technol. Forecast. Soc.* 73 (7) (2006) 761–777.
- [34] L.J. Bourgeois, Strategy and environment: a conceptual integration, *Acad. Manag. Rev.* 5 (1980) 25–39.
- [35] M.E. Porter, *Competitive Strategy*, The Free Press, New York, 1980.
- [36] R.M. Grant, *Contemporary Strategy Analysis*, 5th Ed, Blackwell Publishing, Oxford, 2005.
- [37] M.E. Porter, *Competitive Advantage*, The Free Press, New York, 1985.
- [38] R.L. Daft, J. Sormunen, D. Parks, Chief executive scanning, environmental characteristics, and company performance: an empirical study, *Strateg. Manage. J.* 9 (1988) 123–139.
- [39] D.S. Elenkov, Strategic uncertainty and environmental scanning: the case for institutional influences on scanning behaviour, *Strateg. Manage. J.* 18 (4) (1997) 287–302.
- [40] J.P. Walsh, Managerial and organization cognition: notes from a trip down memory lane, *Organ. Sci.* 6 (1) (1995) 280–321.
- [41] J.G. March, H.A. Simon, *Organizations*, McGraw-Hill, New York, NY, 1958.
- [42] R. Cyert, J.G. March, *A Behavioral Theory of the Firm*, Prentice-Hall, Englewood Cliffs, NJ, 1963.
- [43] M. Tripsas, G. Gavetti, Capabilities, cognition, and inertia: evidence from digital imaging, *Strateg. Manage. J.* 21 (10–11) (2000) 1147–1162 Special Issue.
- [44] D. Holbrook, W.M. Cohen, D.A. Hounshell, S. Klepper, The nature, sources, and consequences of corporation differences in the early history of the semiconductor industry, *Strateg. Manage. J.* 21 (10–11) (2000) 1017–1042 Special Issue.
- [45] S. Kaplan, F. Murray, R. Henderson, Discontinuities and top management: assessing the role of recognition in pharmaceutical firm response to biotechnology, *Ind. Corp. Change* 12 (2003) 203–234.
- [46] G. Gavetti, D. Levinthal, Looking forward and looking backward: cognitive and experiential search, *Admin. Sci. Q.* 45 (2000) 113–137.
- [47] P. Wack, Scenarios: uncharted waters ahead, *Harvard Bus. Rev.* 63 (5) (1985) 73–90.
- [48] R. Linneman, H. Klein, The use of multiple scenarios by US industrial companies, *Long Range Plann.* 12 (1) (1979) 83–90.
- [49] R. Linneman, H. Klein, The use of multiple scenarios by US industrial companies: a comparison study 1977–1981, *Long Range Plann.* 16 (6) (1983) 94–101.
- [50] P. Malaska, M. Malmivirta, T. Meristo, S. Hanson, Scenarios in Europe: who uses them and why? *Long Range Plann.* 17 (5) (1984) 45–49.
- [51] G.S. Day, P.J.H. Shoemaker, *Peripheral Vision*, Harvard Business School Press, Boston, 2006.
- [52] D.C. Hambrick, Environmental scanning and organizational strategy, *Strategic Management Journal* 2 (1982) 159–174.
- [53] J.C. Glenn (Ed.), *Futures Research Methodology*, American Council for the United Nations – The Millennium Project, Washington, 1999.
- [54] J. Coates (Ed.), *Futures Res. Q.*, 2001, 17(3).
- [55] T. Levitt, Marketing myopia, *Harvard Bus. Rev.* 38 (4) (1960) 45–56.
- [56] B. Uppin, Kodak's Digital Moment, *Forbes*, 8 Feb. 2000.
- [57] G. Brunetti, A. Camuffo, *Del Vecchio e Luxottica: come si diventa leader mondiali (Del Vecchio and Luxottica: How to Become Word Leaders)*, ISEDI, Turin, 2000.

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