

**Backcasting as a Tool in
Competitive Analysis.**

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You can no longer wait for the competitor to make a move and then decide whether or not you're going to do something.

-- George S. Day, Professor & Director
Huntsman Center for Global Competition
and Leadership, The Wharton School

Abstract

The focus of this chapter is on the use of backcasting in competitive analysis to improve the understanding of the strategic directions and actions of a firm that may be a competitor or a potential collaborator. Intended for use as a competitive weapon, this tool is formulated to assess the distinct technological and organizational competencies a firm is exploiting. This we advocate in order to analyze a firm's strategic thrusts before they become obvious in the marketplace. Competitive analysis is concentrated on a level that can reveal discernible comparative advantage vis-a-vis other players, rather than merely looking at the end products a firm offers or the markets it serves. By examining a range of plausible futures and understanding the possible 'stepping stones' a firm intends to take in reaching its desired targets, competitive intelligence can facilitate countermoves through strategy formulation to gain advantageous maneuvering. Armed with this kind of planning framework, a firm can address the issues of *where*, *how* and *why*-competitors' intended actions could impact its own competitive leadership. One example is drawn from a study which has implemented this approach, the organizational competence analysis of a large Japanese multinational corporation. It is expected that the learning gained from this backcasting approach will improve the utility of competitive analysis in strategy formulation of firms harried by rapidly changing business environment.

Introduction

Since firms today must confront environments of rapid change which affect many facets of their business, they need to recognize the need to study competitors and collaborators, both present and potential. Firms operating in both product-

oriented and service industries have begun to pay increased attention to the process of competitive scanning and analysis. In fact, the sustained competitive leadership of Japanese firms in a number of key industries has been attributed to a networking system of information collection, interpretation and dissemination. Hence, the critical question is not *whether* firms would want to know their opponents' organizational competencies but *how* they can best detect and interpret them. Once the strategic futures of other firms have been analyzed then executives need to envision how they may advantageously maneuver themselves accordingly to outpace other firms into the future.

In this chapter we argue that if a firm's root of competitiveness can be uncovered, then backcasting can increase the utility of competitive analysis through interpolating the plausible scenarios (goals and paths) toward which that firm is likely to be headed. If a range of future strategic goals can be bracketed based on the analysis of the organizational competencies of firms, then the conceptual significance behind backcasting can be used to chart out the various paths (intended actions) of reaching the desired goals. By visualizing the strategic focus of other firms (competitors and potential collaborators), senior managers can imbed this type of intelligence into their decision-making process for strategy formulation. We first describe the underlying process of organizational competence analysis from which backcasting can be implemented. Next, the backcasting approach is explained. An example is given showing the application of backcasting and the insights realized by a North American firm in targeting a Japanese firm. Finally, managerial implications and lessons learned are discussed for firms trying to adopt the backcasting approach in competitive analysis.

Competence Analysis

Strategy has been defined as the "fundamental pattern of present and planned resource deployments and environmental interactions that indicates how the organization will achieve its objectives" [12,p.25]. By studying what resources firms possess, and their skills to deploy these resources, one may infer their strategy at the

corporate and business levels. In other words, it addresses the questions of *what* businesses it should be in and *how* it intends to compete.

Yet most intelligence monitoring and diagnosis of competitors focuses on a firm's existing and visible manifestations, such as end products and financial performance indicators. As a result of tracking merely the visible *fruit-level* and overlooking the *root-level* source of a rival firm's competitiveness, the emerging message may provide only an ephemeral view of the actual strengths or weaknesses of that firm. Instead of over-relying on the analyses of markets entered and products manufactured, attention should be shifted to the less-emphasized skill base and organizational factors.

The foundational skill base which operates at the individual, group and organizational levels, is the origin of a firm's long-term strategy in producing resources and developing capabilities needed to derive competitive advantages. Here, resources refer to a firm's assets that are owned or controlled; examples include technological, human, organizational, and financial resources [12]. A firm's capabilities can be thought of as 'intermediate goods' generated to provide enhanced productivity of firm resources, as well as strategic flexibility and protection for its final product [1]. Consider that a firm's resources are the source of its capabilities, and in turn capabilities are the main source of its competitive advantage [9].

When examining a competitor or a potential collaborator, the analysis should delve 'beneath' the surface of a firm's end products, to reveal the hidden picture which constitutes its distinct competitive competence. This strategic approach views firms as trees which 'grow' products from the root competencies [7, 19]. The root system is fundamental to the firm, and thus, is more enduring and persistent than the visible 'fruit-level' manifestations. While outward manifestations will change, the root system nurtures the firm's organizational competencies, and hence, influences its ability to survive and prosper [19]. By concentrating on the root system as the basis of competitiveness, the future direction of a firm can be inferred with greater confidence. Even when a firm moves into new markets, generally it does so to leverage a discernible competitive advantage through the acquired or newly developed organizational competencies.

Backcasting Versus Forecasting

Interpretation of organizational competencies can assist competitive analysts by evaluating future strategic opportunities of other firms. When a firm is developing strong roots in certain critical competencies for example, it emits subtle yet discernible signals that it is preserving and leveraging competitiveness in key areas into the future. The goal of competitive analysis is to analyze the strategic thrust and direction of firms before they become obvious in the marketplace. Therefore, it is of interest to analyze and understand what competencies are possessed by competitors or potential collaborators, and to envision how these firms may intend to compete accordingly.

In military and security applications, intelligence has provided commanders with critical assessment of the enemy for anticipating their moves and actions. Such intelligence evaluates more than just the enemy forces or the locations of fortification and defense, it also assesses what the enemy will do under various circumstances [14]. In business organizations, this much more challenging task “involves not only deducing your opponent’s hand but also watching the way he plays, trying to understand his thinking and gauge how he will react to a challenge or an opportunity” [3, p. 32]. This is similar to a game of chess where the upper hand could be gained if one can deduce an opponent’s thinking ahead, and then reason backward toward a strategy that will lead to the highest value, say five moves hence [5]. This involves simultaneous strategy thinking by placing oneself in both his own and the other player’s shoes, and to figure out the best moves for both sides.

Realizing that future events are hard to forecast with any certitude, any prediction must necessarily deal with possibilities and probabilities, and not with certainties. For this reason, the objective of assessing the strategic moves of firms (competitors or potential collaborators) is to “clarify the range of possible futures and to create images of attainable and desirable futures” [22, p. 110], rather than seeking to make an apodictic (logically certain) statement as in a firm prediction. Due to volatile competitive environment, past assumptions held rigidly by senior managers may misguide and even interfere with planning their firms’ future. Gilovich has cautioned the overuse of associations to past experiences by extending

Santayana's maxim of "those who do not remember the past are condemned to relive it" to "those who do not forget the past can be led to misapply it" [8, p. 807-8081. In competitive analysis, it is helpful to differentiate the direction of forecasts as either opportunity-oriented (exploratory) or goal-oriented (normative). Exploratory "starts from today's assured basis of knowledge and is oriented towards the future, while normative...first assesses future goals, needs, desires, missions, etc. and works backward to the present" [13, p. 15]. Instead of asking *what futures are likely to happen* as in the former, the latter is concerned with *how desirable futures might be attained*.

This kind of thinking is evidenced in formulating energy policies. Robinson [20] has labeled goal-oriented forecasting as *backcasting*, to indicate the unorthodox approach to anticipating, and preparing for, the future. Backcasting is a way of inductive rather than deductive analysis, which firstly focuses on the range of alternative futures and their impacts, and then, determines the policy measures required to reach there. Rather than seeking accuracy-dependence of a predictive forecast as in conventional competitive analysis, backcasts indicate the relative feasibility and implications of different end states a firm may have set for itself. In this sense, the futures become the cause, rather than the effect, of present planning and actions. The thought process in backcasting is akin to future mapping, whereby a range of routes charted into the future from the development of possible end states "produces the confidence of hindsight and breaks away from the right/wrong concerns of forecasting" [17, p. 24]. The major distinguishing characteristic of backcasting over forecasting is a concern, not with what *future* is likely to happen, but with how desirable *futures* can be attained [21]. It is thus explicitly normative, involving working backwards from a range of desired future terminal points to the present in order to determine the feasible steps need to be taken by a firm to reach its desirable future.

The backcasting approach was also echoed in the strategic staircase concept [11]. Instead of projecting today forward, a firm should start from the mission statement it has developed and derive its milestones from working back towards the present. Successive application of this planning procedure allows one to work back

to the actions that must be taken now in order to build the future capabilities required. The initial question for managers should be ‘where would the firm like to be in the future (desirable futures)’ and then analyze ‘how can we prepare ourselves to get to where we want to go’. Hence, the process involves deciding what goals firms would like to accomplish, and then work back to identify the possibilities or stepping stones for achieving those goals [16]. Since backcasting postulates where other firms may be headed and evaluates backward to understand how they may get there, it is similar to cognitive mapping where plausible paths are mentally charted vicariously from the viewpoint of those firms [2]. From the above discussion, a comparison of forecasting can be contrasted with backcasting, as shown in Table 1.

Table 1 Comparison of Forecasting to Backcasting

	Forecasting	Backcasting
Question	what future is likely to happen?	how desirable futures can be attained?
Direction	exploratory (opportunity-oriented) from present to future	normative (goal-setting) from futures to present
Focus	Prediction and likelihood	feasibility and choice
Execution	one-time snap-shot	on-going monitoring
Analysis	extrapolation from historical data	interpolation from goal setting (futures) anchored in organizational competencies
Quality	accuracy-dependent	implication-oriented
Result	converge on the most likely future	diverge to possible futures with respect to freedom of action
Future(s)	preceded by present assessment	interpreted and envisioned from present assessment

Backcasting Scenarios

Recall that competitive analysis does not solely revolve around products and markets, but more importantly, it should focus on “assets that correspond to a

combination of current capabilities and expectations regarding future opportunities” [15, p. 385]. Therefore, if plausible futures of competitors or collaborators can be analyzed by framing the bounds of uncertainty through scenario analysis, interpolation of various paths could be derived. Rather than treating scenarios as simply some future predictive outcomes, we enlarge the concept to that of a hypothetical sequence of events consisting of both the end states and the paths needed to get there.

Backcasting utilizes scenario planning to imagine how the future might unfold with respect to the firm being analyzed, based on the analysis of that firm’s organizational competencies. In dealing with the instability of future outcomes, backcasting not only avoids extrapolating a firm’s past performance but also resists the temptation of projecting the status quo of product and market strength forward. Instead of making unjustified leaps of faith, backcasting unveils the desirable futures other firms are trying to aim at, based on the competencies they are presently investing, growing and exploiting. This is important since both the goal setting and intended action are the heart of the backcasting analysis. Initially, this involves envisioning where a firm is likely to be (say five to ten years from now), based on an organizational competence analysis and the exogenous factors that could impact the targets. Then, possible paths are examined to interpolate what that firm ‘ought to do’ to reach their desired targets in the future. Rather than aiming for a single-future prediction, a number of plausible scenarios are used to aid decision-making in the design of a competitive strategy. By concentrating on a number of prospective futures, managerial thinking would not be confined by past paradigms and present assumptions. As a result, strategic thinking can be stimulated to assess the potential consequences and implications of these multiple targets which have been envisaged and constructed for a particular firm.

Based on the forward-looking multiple futures, the analysis traces backward to determine the possible paths that firm can take to achieve its goals. For planners and managers, various paths of ‘stepping stones’ are helpful because they act as triggers and precursors to indicate the intended course a firm is trying to steer. As mentioned earlier, the necessary steps to reach feasible scenarios (goals and paths) in

the future will depend predominantly on the interaction of environmental driving forces and the firm's strategy in developing certain competencies. Their mutual effect may influence the speed and direction of the range of potential paths. These forces could stem from factors such as: technological breakthroughs and developments, global competition, customer demands, industry standards, environmental issues, and alliance formations.

To obtain a clearer picture of the interaction between environmental factors and organizational competence-building, a firm needs to develop its absorptive capacity in scanning data for competitive intelligence. From both electronic databases and manual searches, data sources can be combed for signals or cues that could provide clues in ascertaining the competitive strengths of firms. Indeed, given the importance of the role and the requisite consciousness of scanning, it is not adequate to pass this responsibility solely to information specialists [10]. Although they may be more adept at knowing 'where to scan' for information, the more important question of 'what to look for' and 'how to recognize a useful signal when you encounter one' must be answered by those with particular skill set. Hence, in addition to the information specialists, there needs to be those technical specialists who possess well-rounded 'breadth' to appreciate (and not ignore) issues outside their training and with sufficient 'depth' to recognize critical and relevant information [4].

Consequently, if a firm 'buys in to the backcasting analysis, it must necessarily marshal resources to monitor signals at the firm and industry levels. These signals have been defined as "any action by a competitor [or collaborator] that provides a direct or indirect indication of its intentions, motives, goals, or internal situation" [18, p. 75]. For effective strategy formulation, the monitoring of data sources must be continuous in order to update and verify the scenario analysis. Through such a focused effort in tracking a firm and its industry, decisions can be made using current information. For example, a firm's strategic goals may change and thus prompt a corresponding change in its course of action. The backcasting approach is graphically illustrated in Figure 1.

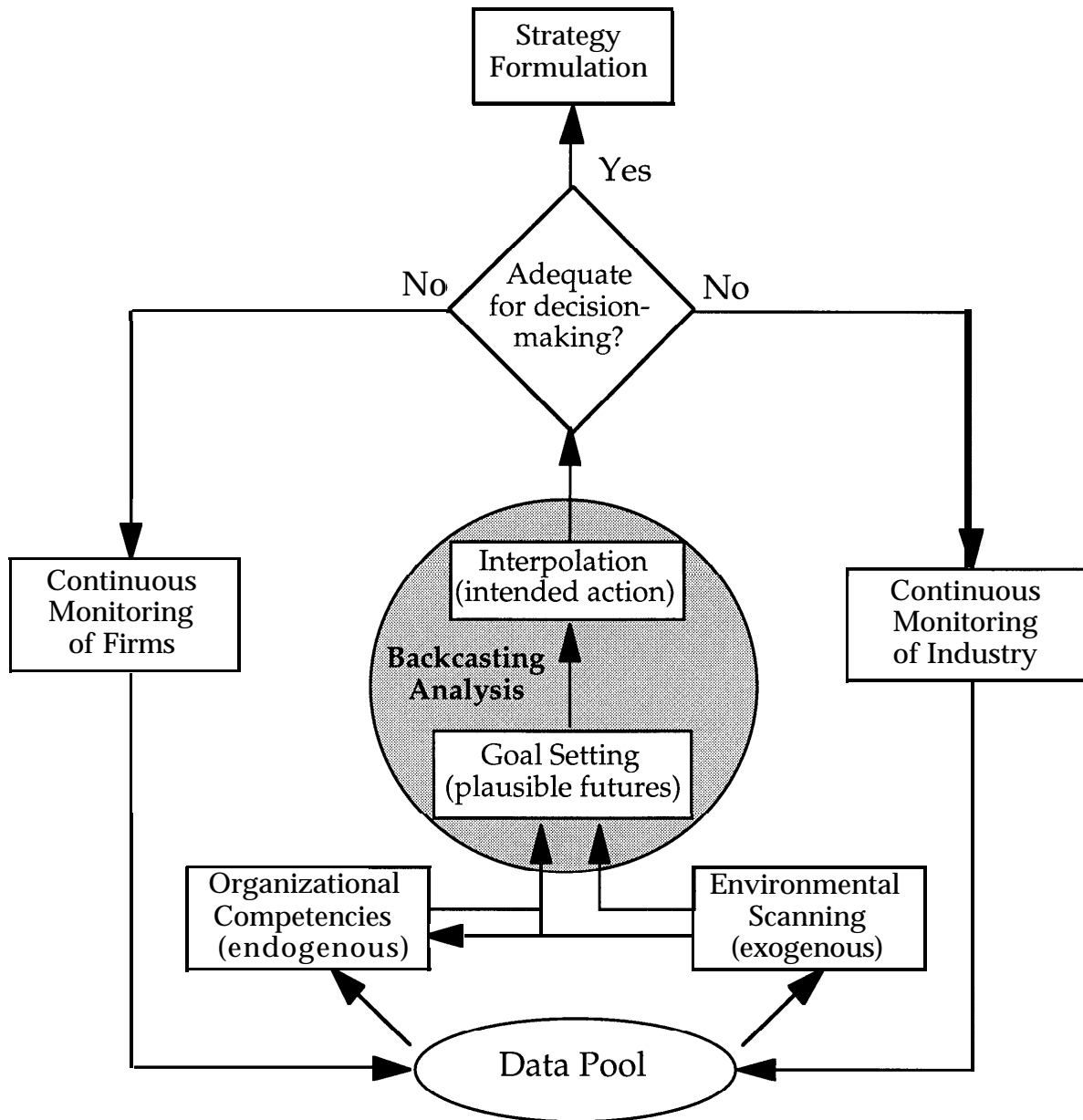


Figure 1 Competitive Analysis for Strategy Formulation

Case Example

For the purpose of illustration, backcasting as a tool was used in competitive analysis with the collaboration of a North American firm, fictitiously called Firm NA, in the information technology industry. The target Japanese firm was not a direct competitor of Firm NA, disguised here as Firm J. The mandate from the senior management consisted of a two-fold question. First, what inherent

competencies Firm J possessed which have fueled high growth rates in the last few years (more than 10% in sales and over 20% in net income yearly). Second, could Firm J encroach upon Firm NA's existing market and/or perhaps enter into new areas that may compete head-on with Firm NA in five to ten years time. The time constraint for the project was set at 8 weeks with a data collection budget of \$15,000 for mostly data base searches. An additional (smaller) budget was used for translating data from Japanese to English.

One analyst was given full-time priority along with four other specialists who were involved at different stages of the analysis. This study was unique in that the analysis of Firm J completed with Firm NA was later presented to managers at Firm J for evaluation. It was assumed that insiders from Firm J are best positioned to judge an outsider's analysis of their own competencies. Through an evaluation by the R&D researchers and managers at Firm J, the study helped to validate the effectiveness of the proposed backcasting tool. To respect the confidentiality of the actual analysis, information of this case application need necessarily be limited to a general, aggregated description rather than divulging actual details. However, the learning gained by Firm NA from the assessment of Firm J using backcasting will be described.

Data Collection

Data on Firm J were scanned and collected from numerous sources (mostly in English) in the public domain. Published sources were searched for the past five years such as business press (e.g., Business Week, Far Eastern Economic Review); trade industry publications (e.g., Electronic Business, Information Week); academic journals (e.g., Harvard Business Review, Journal of Technological Forecasting and Social Change); and published company documents (e.g., annual reports, promotional literature). On-line databases (American and Japanese) were also scanned for specific data such as patent records, technical papers, financial figures, product-market coverage and industry trends. During this stage, the knowledge and experience of information specialists were tapped, in order to know where to scan for the data required. Close to 20 different databases were used to scan for relevant information on Firm J. Like using a wide-angle lens of a camera, a broad overview

of the firm was scanned initially for a general understanding. This approach attempted to collect 'inclusive' data on Firm J (similar to using a drift net in the fishing industry) that could be gathered within the cost and time constraints. Once a general knowledge of the firm was established, the search strategy then zoomed in to capture a specific area of concern (by using a close-up lens). As mentioned before, to get at the 'what and how' questions, the responsibility of detailed scanning fell to those with sufficient technical expertise in being able to recognize potentially valuable information that might be critical to the analysis. The collection step is not once-for-all but iterative. During data processing there was the need to do more focused searches based on emerging patterns and conflicting indicators.

Output from the scanning step reached into thousands of pages of data. In order to avoid data asphyxiation, 'value' in terms of meaning and significance needed to be assessed and assigned to these data. Throughout this process, disparate chunks of data were collated via converging evidence. For example, data were assigned a 'high', 'medium' and 'low' value into more than twenty categories. Some categories were clear-cut such as financial figures and technological strengths (patent records and technical publications) while others tended toward the intangibles like corporate leadership and organizational culture. Data in the 'high' value group had higher potential of identifying and interpreting Firm J's competencies that were competitively unique vis-a-vis other firms. These data were corroborated to minimize subjectivity of the opinion of the data sources. If an article, say in California Management Review, reported a particular aspect of Firm J's marketing prowess, an attempt was made to validate that strength in other sources such as Business Marketing or Tokyo Business Today (triangulation).

In addition to the company data, environmental change forces were analyzed. Emphasis was placed on the impact of environmental bellwethers to Firm J. The globalizing efforts in transforming Firm J from a centralized, export-oriented company to that of a decentralized global corporation with autonomous regional hubs (e.g., America, Europe) were seen as an important move in their corporate strategy in the past several years. This continuing trend appeared to elevate Firm J's status as a model corporate citizen toward all peoples and nations by reducing trade

friction in balancing exports and imports, especially between Japan and U.S. However, a closer scrutiny of the data from several sources indicated other reasons why Firm J was extremely eager to globalize. The analysis revealed that the main driving force behind this strategy was to mitigate adverse effects caused by the economic slowdown and the appreciation of the stronger yen. In other words, management at Firm J anticipated that to survive and prosper even during downturns in the economy, they needed to adapt with the external influences. Local procurement of parts and offshore production also minimized currency related risks, reduced expenses (e.g., labor costs are about 25 times lower in China than in Japan), enhanced efficiency in its trading structure, and compensated the growing shortage of labor in Japan. By shifting more mature products abroad (where growth is limited due to market saturation), this move freed manufacturing capacity at home to develop and produce more advanced products using embryonic and emerging technologies. Furthermore, the benefits included tapping into a rich source of intellectual talent elsewhere, especially in areas where Firm J was lagging, such as software engineering and computer animation.

Data Analysis

In this step, data analysis (conducted by the team of analysts) was aimed at identifying organizational competencies Firm J is developing, protecting, exploiting and renewing in establishing competitive advantage over rivals. From the 'high' value categories of data, interpretation of the competencies in terms of capabilities (organizational brawn) and resources (organizational brain) were assessed by the following criteria:

- Is it a source of Firm J's competitive power (perceived high customer value)?
- Is it recognized by Firm J as being valuable?
- Is it hard to imitate (can it be bought off-the-shelf or replicate easily)?
- Is it capable of simultaneous multiple uses regardless of divisional barriers?
- Does it feed inputs and outputs of Firm J's business activities (value chain)?
- Does it play a pivotal role in Firm J's strategy?
- Does Firm J consistently cultivate and harmonize it throughout the organization?

Eight organizational competencies were eventually identified of which two were commercialization process (resources) and environmental acuity (capability). The successful new product development at Firm J was characterized by a strong diversification strategy based on recognizing and exploiting original core technologies. The synergistic collaboration of core technologies such as electronics, precision mechanics and laser technology led to waves of end products ranging from business machines to broadcast equipment. Aggressive R&D efforts fostered a conducive environment at Firm J for curiosity-driven research yet motivated by successful product introduction. For example, one proprietary technology received 400 patents from which five key product families were successfully launched. In the words of one senior executive:

Creative inventions are certainly important, but the creativity involved in applying and commercializing a patent should not be discounted. Sometimes more creativity is needed in finding practical applications for a patent and developing it into products that can be marketed at a fair price. While there may be only one inventor, manufacturers need hundreds, maybe thousands, of people to develop and produce goods from a patent. I think the manufacturer that commercializes a patent has displayed a lot more creativity than the inventor.

A clear signal to develop the requisite atmosphere and vision for this and other innovative activities emerged through building a culture of mutual trust and open communications. Evidence indicated a number of product development projects which exhibited risk-taking, and employees not being afraid to challenge the status quo. By endorsing a 'free and playful' atmosphere, the rank and file were able to devote attention to creative, uninhibited design for the development of future product technologies. To encourage new and radical thinking, management at Firm J provided a small pilot grant (about \$10,000) to test the commercial potential of a new research project. If it went well, more people and a larger budget will be added.

Environmental acuity in terms of ecological awareness and ecological assurance came up consistently in a number of 'high' value categories in reference to materials (environmentally friendly substances); processes (elimination of chlorofluorocarbons and trichloroethane, and reduction of ozone emissions); and new energy sources. In fact, from R&D to manufacturing and packaging,

environmental concerns are firmly built into all of Firm J's activities. Consideration for the environment was given to everything from raw materials to delivery as well as to the disposal and recycling of products after their service life has ended. Thus, programs have been initiated to develop cleaner energy and manufacturing processes, reduce industrial waste and create a safe working environment. Campaigns were set up to promote the need to reuse and recycle (one such endeavor enabled Firm J to recycle and reuse 95 percent by weight of a high-volume component). Research centers were established to specialize in ecologically-related R&D projects such as photovoltaic systems to generate clean, non-polluting energy and bio-remediation to clean up the environment by using micro organisms to break down toxic substances in the soil. According to one executive, Firm J was convinced that no global corporation can ever hope to prosper without contributing to the welfare of people and society at large (sustainable development).

Backcasting

Based on the identification of Firm J's organizational competence analysis and the analysis of environmental drivers, the strategic direction was deduced by setting four desirable futures five years into the future. This process of backcasting is illustrated in Figure 2. It is helpful to envision the desirable futures as an insider in Firm J (e.g., as senior managers contemplating the future of Firm J: where are we likely to win in 5 years and beyond). One such future goal, for the purpose of illustration, is for Firm J to be a global leader in digital image processing (Future 4 in Figure 2). Here, there was an attempt to anticipate J's future actions without unrealistic claim to absolute predictive accuracy. Steps are interpolated from the futures to the present. For example, to arrive at Future 4 in the year 2000, Firm J must have taken step E by 2000, and for Firm J to arrive at step E, it must have reached step D in 1999, and so on, until the steps have linked Future 4 with the present state in 1995. A number of plausible paths can then be determined which Firm J might take in order to exploit its competencies, in reaching each of the four desired futures. Through interpolation, the steps for one possible path from Future 4 are shown in Figure 2. While counter intuitive to some, the forward-looking and

backward-thinking in backcasting is analogous to the steps taken in inventions as described by Gabor[6, p. 207-208]:

The mental processes of inventions are still mysterious. They are rational but not logical, that is to say, not deductive. The first step of the technological or social inventor is to visualize by an act of imagination a thing or a state of things which does not yet exist and which to him appears in some way desirable. He can then start rationally arguing backwards from the invention and forward from the means at his disposal until a way is found from one to the other. There is no invention if the goal is not attainable by known means, but this cannot be known beforehand.

The various scenarios consisting of the desirable futures and their associated paths were then discussed with the management at Firm NA, the firm implementing the competitive analysis of Firm J. The key questions that need to be raised based on the results of the backcasting analysis are: what are the impacts and how will they affect Firm NA. When a firm's strategic moves based on its competencies have been adequately evaluated, the intelligence picture should reveal options, and should be assimilated by the managers and be imbedded in their decision-making. We echo Porter's contention that "gathering data is a waste of time unless they are used in formulating strategy" [18, p. 74]. The implications of Firm J's intended actions through backcasting could play a dominant role in the competitive arena of Firm NA. For Firm J, the competence mapping revealed an apparent weakness in a certain key technology enabler as compared to Firm NA. Hence, possibilities exist for Firm NA to exploit that technological advantage since Firm J need to either develop that competence internally or explore potential linkages through joint ventures or acquisitions. Furthermore, backcasting provided an awareness of indirect threats in a few areas to Firm NA, though most of Firm J's intended actions were more complementary than competitive to Firm NA. Therefore, Firm NA may consider partnering with Firm J to access their organizational competencies. However, in order to decrease potential risks in any future strategic alliances with Firm J, NA's strategy formulation needs to factor in Firm J's strategic direction and focus since they might shift more into Firm NA's arena in due time.

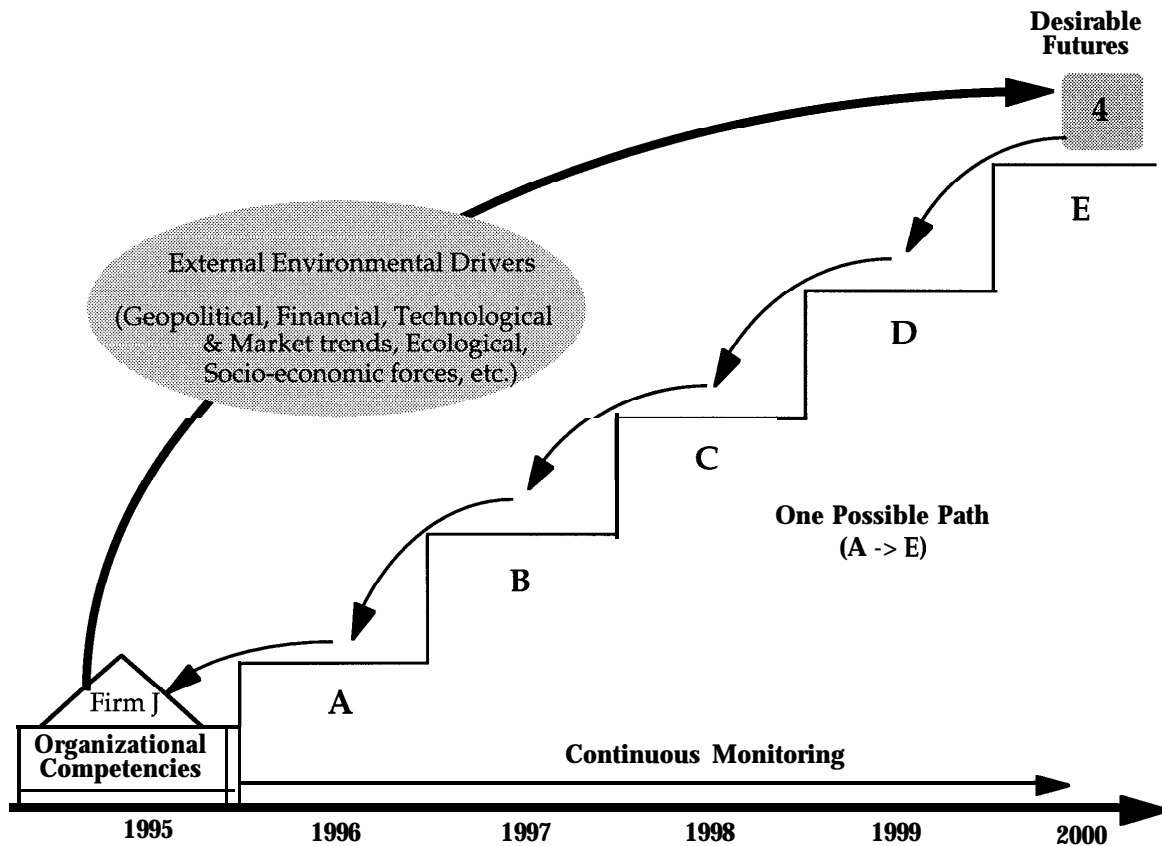


Figure 2 Backcasting Analysis of Firm J (only Future 4 is shown)

The direction and speed of Firm J toward its futures were assessed through continuous monitoring of the anticipated steps (precursors) by the team of analysts. To arrive at step C say, one would expect Firm J to reach step B first. Using communications technology as an example, digital services need to be adopted in an evolutionary manner, first in narrowband and wideband before broadband can appear. Again, the steps interpolated were not meant for accuracy but for impact assessment. A measure of misfit was tolerated and even expected between the present and the intermediary steps. With on-going monitoring at both the firm and industry levels, Firm NA can better detect the anticipated arrival of Firm J (to show up on their radar) in moving toward Firm NA's competitive space.

Validity Test

To validate the usefulness of the backcasting analysis as a tool, we conducted on-site interviews at Firm J supplemented with questionnaires. We assumed that

Firm J is best positioned to assess an external analysis of their own competencies and future directions. The backcasting approach anchored in organizational competencies was presented to both researchers and managers at Firm J. Before disclosing the results from the analysis, they were asked to complete a questionnaire to assess the overall picture of the source of competitiveness that best characterized Firm J based on their perceptions. The intent was to evaluate the accuracy and thus the validity of the backcasting approach. The questionnaire was developed from the backcasting analysis of Firm J and involved eight sections. It was designed with an 11-point rating scale describing the effectiveness of various items that contributed to the overall source of J's competitiveness (0 = not at all to 10 = extremely). The eight sections are categorized according to: end-products, technology, R&D, manufacturing, marketing, organizational factors, management and competitive scanning. Under each section a number of items were listed for the respondents to answer (ranging from 16 to 30 items). To facilitate clarity of understanding, the questions appeared both in English and Japanese.

Based on the analysis of Firm J using the backcasting approach, a prior ranking of the top five sources of competitiveness was made for each of the eight sections. For example, the top five organizational factors of Firm J's competitiveness as determined by the backcasting analysis were: 1) consistent long-term strategies, 2) global company, 3) employee commitment and motivation, 4) organizational structure, and 5) management style. The thirty respondents, however, placed different ranking on these factors. The five aforementioned factors were ranked as 19, 4, 3, 11 and 9, out of a total of thirty items. The other seven sections were similarly compared. The Friedman two-way ANOVA revealed no significant difference between the pre-determined and the actual ranking (chi-square ranged from 1.2 to 7.6). This result points to the high predictability of a firm's source of competitiveness along the eight sections tested using the backcasting approach.

To confirm the results from the questionnaire, interviews involving three managers were conducted. They had previously completed the questionnaire and were experienced in several R&D projects as well as being knowledgeable about their firm's overall activities. Further discussion regarding the derived

competencies and backcasting scenarios clarified the validity of the external interpretations by the internal perceptions of these managers.

Of the four futures, it was found that one future envisioned for Firm J was too optimistic. One manager felt that a longer time frame was needed for their firm to reach the goal as a global technological and market leader in that area. Since there are at least ten key technologies being pursued concurrently, the progress toward commercialization will not only be technology driven but accelerated by market demand. In the words of one manager the delay in reaching one of the futures from Firm NA's backcasting analysis may extend beyond his firm's control in that particular technology:

Patenting is difficult in [technology X] in general...That is the first problem...we have to combine this new technology with traditional technologies...For example, a systemic approach is needed for our final commercialization...In order to secure the leadership position you will need to have external partnerships or alliances to develop more technologies...We need a variety of peripheral technologies for the successful commercialization of [technology X] . ..maybe we need another 10 years to achieve such application using [technology X] .

The other three futures were thought to be realistic for Firm J within the five-year time frame. The managers also described organizational mechanisms which confirmed the backcasting analysis. A number of factors were repeatedly cited: the encouragement of curiosity pursuit within the general framework of the research area (bounded freedom), the ability to attract both young, energetic engineers and more experienced mid-career personnel from other firms (multiple and even conflicting perspectives), team management with a rigid structure and a flexible thinking (hierarchical yet utilizing a team approach), and patenting emphasis in complicated, non-established fields of research (internally developed technologies using proprietary methods). Although these managers represented three different technological areas, they all had a positive evaluation of the results from the backcasting analysis. They were able to describe their own technologies within the competence mapping and backcasting scenarios. Some of the general comments were:

Your picture for future is very interesting and I think this is very close to our actual choice for future. I think our work is to realize your picture by team management.

This method [backcasting] is often used in R&D planning. I think applying the method to long-term management strategy is new.

Despite the positive feedback concerning the conceptual picture presented based on the backcasting approach, the managers indicated the importance of continuous monitoring to watch for deviations from the various paths leading to the desired futures. If backcasting made the steps too rigid, then the firm doing the analysis may be blindsided by changes, whether gradual or discontinuous, which could shift the firm being analyzed onto a different path, or even a different goal. The paths leading toward the desirable futures need to be constructed in a flexible manner, taking into account the possibility of unforeseeable drivers, both internal and external to the firm, that could change the strategic velocity (speed and direction) of the firm. They also emphasized the need of studying industry and other environmental drivers. For example, the advent of a digital, networked office environment will present business machine manufacturers both a threat and an opportunity since the markets in computer peripherals and office equipment will converge.

Discussion

Due to technology fusion (from diverse but related technologies), for example, it is possible for less familiar ('invisible') competitors from outside a firm's competing industry to encroach upon existing market share as well as to open up new markets. Furthermore, with increasing benefits of cooperative ventures, potential collaborators need to be identified and screened for strategic alliance formations. Backcasting as a tool in competitive strategy provides a way of understanding the source of a firm's (competitor or potential collaborator) long-term sustainable competitive advantage as viewed from 'outside in'. Based on the identification of that firm's organizational competencies, desirable futures can be envisioned without inducing unjustified leaps of faith, and subsequent stepping

stones or critical events can be mapped to reach the intended targets. Backcasting enables analysts to generate a number of plausible futures and paths. In this sense, backcasting can challenge managerial mindset regarding the strategic focus of the firms being analyzed since it enables managers to improve their understanding of where, how and why these firms are headed.

As alluded to earlier, backcasting provides more than just a snapshot of the competitor's moving target, it enables the analysis of the velocity of the various plausible paths that could be taken to reach the intended goals of that firm. This in turn empowers firms implementing the competitive analysis to countermove through strategy formulation. It has been demonstrated that the backcasting as a tool can contribute to the increased contribution of competitive intelligence in strategy formulation. The on-going monitoring of the futures and paths of other firms allows a constant assessment of the necessary actions that are undertaken. The 'strategic' approach as proposed in this chapter, seeks to improve managerial decision-making which could result in better competitive strategies at the corporate and operational levels, to derive sustainable competitive advantage. In this way, backcasting may better equip them to prepare for or even preempt the future.

Not only can a firm conduct an objective self-awareness of itself using this technique, but other firms can also be analyzed through injecting relative 'stability' amidst chaos of change in the environment. At the same time, this method does not pretend to reveal a greater level of 'certainty' than the competitive analysis permits. Instead, backcasting analysis including continuous monitoring, increases a firm's acuity and enables managers to make efficient discriminations regarding other firms' strategic directions and actions. In this sense, backcasting provides an alternative approach to monitor, map and anticipate future competitive moves by other firms. More applications using this tool will be forthcoming and may contribute to learning for analysts and managers in competitive analysis.

REFERENCES

- [1] Amit, R. and Schoemaker, I.J.H. (1993) "Strategic assets and organizational rent", *Strategic Management Journal*, Vol. 14, pp. **33-46**.
- [2] Anthony, W.P., Bennett, R.H., Maddox, E.N. and Wheatley, W.J. (1993) "Picturing the future: using mental imagery to enrich strategic environmental assessment", *Academy of Management Executive*, 7, 2, pp. 43-56.
- [3] Ball, R. (1987) "Assessing your competitor's people and organization", *Long Range Planning*, Vol. 20, No. 2, pp. 32-41.
- [4] Curry, I. (1992) "Building keyhole people to increase organizational flexibility", *Proceedings of the Third International Conference on Management of Technology*, Vol. 1, T.M. Khalil, and B.A. Bayraktar (Eds.), pp. 458-467.
- [5] Dixit, A.K. and Nalebuff, B.J. (1991) *Thinking Strategically*, New York, W.W. Norton & Company.
- [6] Gabor, D. (1964) *Inventing the Future*. New York, Alfred Knopf.
- [7] Giget, M. (1988) "The bonsai trees of Japanese industry", *Futures*, April, pp. 147-154.
- [8] Gilovich, T. (1981) "Seeing the past in the present: the effect of associations to familiar events on judgments and decisions", *Journal of Personality and Social Psychology*, Vol. 40, No. 5, pp. 797-808.
- [9] Grant, R.M. (1991) "The resource-based theory of competitive advantage: implications for strategy formulation", *California Management Review*, Spring, pp. 114-135.
- [10] Guild, P.D. and Wang, C.K. (1993) "Organizational competence analysis as a competitive weapon", *Proceedings of the International Conference on Technology Management*, Denver, Colorado, pp. 568-581.
- [11] Hay, M. and Williamson, P. (1991) "Strategic staircases: planning the capabilities required for success", *Long Range Planning*, Vol. 24, No. 4, pp. 36-43.
- [12] Hofer, C.W. and Schendel, D. (1978) *Strategy Formulation: Analytical Concepts*, St. Paul, West Publishing.
- [13] Jantsch, E. (1967) *Technological Forecasting in Perspective*, Paris, Organisation for Economic Co-operation and Development.
- [14] Kirkpatrick, L.B. (1969) *Captains Without Eyes*, London, Macmillan Company.

- [15] Kogut, B. and Zander, U. (1992) "Knowledge of the firm, combinative capabilities, and the replication of technology", *Organization Science*, Vol. 3, No. 3, pp. 383-397.
- [16] MacNulty, C.A.R. (1977) "Scenario development for corporate planning", *Futures*, April, pp. 128-138.
- [17] Mason, D.H. and Wilson, R.G. (1987) "Future mapping: a new approach to managing strategic uncertainty", *Planning Review*, May/June, pp. 20-24, 29.
- [18] Porter, M.E. (1980) *Competitive Strategy*, New York, The Free Press.
- [19] Prahalad, C.K. and Hamel, G. (1990) "The core competence of the corporation", *Harvard Business Review*, May-June, pp. 79-91.
- [20] Robinson, J.B. (1982) "Energy backcasting", *Energy Policy*, December, pp. 337-344.
- [21] Robinson, J.B. (1990) "Futures under glass", *Futures*, October, pp. 820-842.
- [22] Schwarz, B., Svedin, U. and Wittrock, B. (1982) *Methods in Futures Studies*, Boulder, Westview Press.