Kazakov, R. and Kunc M (2016).

Foreseeing the Dynamics of Strategy: An Anticipatory Systems Perspective

Systemic Practice and Action Research Vol 29, Iss 1, pp.1-25

ABSTRACT

The paper explores firms as complex anticipatory systems which construct dynamic strategic configurations based on anticipation of their future possible states within the competitive environment. We argue that firm's performance depends on a) its strategy making process based on anticipation, and (b) its managerial capabilities which effectuate the anticipatory process in the following four stages: search across anticipated "what-if" resource configurations, the articulation and conversion of their meaning, and the finding and evolution of strategic patterns and courses of action for environmental fit. We performed an in-depth exploratory study with a group of senior managers in a pharmaceutical firm to uncover diverse anticipatory capabilities. The study was based on the development and re-assessment of a product market strategy for a new drug launch without and with the use of a simulation-based learning environment. The results show the existence of heterogeneous anticipatory process, which we name Search-Articulate-Find-Evolve (SAFE) of alternative resource configuration sets (ARCS), determining the managerial dynamic capabilities.

Keywords: Anticipatory Systems, Dynamic Capabilities, Strategic Management

INTRODUCTION

Cockburn, Henderson and Stern (2000) argue that the origins of competitive advantage lie on the firm's "ability to identify and respond to internal and external environment signals well in advance of observing performance oriented pay-offs", which enables them to get "earlier or more favourable access to resources, markets and organizational opportunities" (pp. 1123 - 1124). This implies that the managers' ability to anticipate, understand and interpret firm's internal and external environment dynamics better and faster than their competitors has a crucial role for achieving and isolating competitive advantage by reconfiguring and renewing its resources and distinctive capabilities in a timely fashion. Adequate strategic interpretation of the competitive environment is a vital ability but cannot do much if it is not coupled with timely anticipation of its changing dynamics (Kunc, 2007). However questions like how resources and capabilities that underlie competitive advantage are conceptualised and then built, and what is the relevant process still remained under researched. Causality and the ultimate origins of competitive advantage are still open questions that relate to the understanding of strategy as co-evolutionary dynamics of organizational resources and capabilities and the changing environment. (Cockburn et al, 2000; McKelvey, 1999, Olsen and Haslett, 2002). Cockburn et al. (2000) critical empirical question "how does one know" could be transformed to a more elaborate one: How does one know what configuration of resources and capabilities to develop?

We suggest that managers may build predictive models of their firms and their interactions with the competitive environment, which are employed in their strategic decision making process. More specifically, we argue that firms must be viewed as *complex anticipatory social systems* which *construct dynamic strategic patterns based on the anticipation of their alter-ego future possible states* within the competitive environment (Leydesdorff and Franse, 2009), i.e. firms construct idiosyncratic dynamic models of themselves which effectuate their strategic behaviour leading to performance heterogeneity. We name this process as 'anticipatory process' which is part of the managerial dynamic capabilities (Kunc, 2007). To illustrate our proposal, we performed an in-depth exploratory study aided by

behavioural experimentation with a senior management team of a pharmaceutical firm based on the development and re-assessment of a product market strategy for a new drug launch, using before – after control initially without (pre-treatment) and after that with (post-treatment) (Feldman and Hayes, 2005) the use of a simulation-based learning environment (Kunc, 2011) to identify heterogeneous anticipatory capabilities. We intended to explore how resources and capabilities that underlie competitive advantage are conceptualized and then built by the managers and mainly, what is the related process to the resources and capabilities conceptualization, configuration and orchestration? The new theoretical perspective from which we explored the above issue was the Anticipatory systems theory, and its relation to resource-based view theory –RBT– (Peteraf, 1993) and dynamic capabilities – DC– (Teece, 2007) literature, complemented by findings in complexity and configuration.

Our starting point is related to the fact that it is not yet revealed by research **what is the process of resources and capabilities conceptualization, configuration and orchestration** and believe that uncovering its structural stages would have huge significance and would add to the mainstream literature. The core hypothesis we intended to test is derived from the anticipatory systems theory, which argues that organisms control their behaviour using internal predictive models of future state of the organism or its environment in contrast with cybernetic or feedback control, where the behaviour is determined by a reaction from past behaviour (Rosen, 1985a). Therefore, we suggest **resources and capabilities conceptualization, configuration and orchestration follows an anticipatory process mode with four main stages: Search – Articulate – Find – Evolve alternative resource configurations sets, which we name SAFE ARCS**. We believe that in this respect our paper makes a significant contribution to the RBT and DC research and extends the theory by bringing in its scope the Anticipatory Systems perspective and by revealing the strategic anticipation and its stages as a key strategy making process.

THEORETICAL PERSPECTIVES AND CONCEPTS DEFINITION

Anticipatory systems theory posits **anticipation** is the process which enables a living system to contain a predictive model of itself and its environment, which allows it to adapt by changing its state in accordance with the model's predictions (Rosen, 1985a; Leydesdorff and Franse, 2009) and to base its course of actions on their anticipated effects. In cognitive science, anticipation is a core cognitive process responsible for the mental simulation of the would-be effects of human interaction with the external environment (Butz et al, 2007; Pezzulo, 2008).

Thinking about organizations as complex living social systems (Leydesdorff and Franse, 2009), it is logically assumed that anticipation is a key characteristic of the individual and group decision making processes related to strategy making behaviour. By means of anticipation individuals and organizations logically perform mental rehearsal of alternative decision scenarios, including their effects on their present and future state, and base their behaviour on the prioritization of the optimal configuration of their future actions. We propose the strategy search and selection process in organizations, related to resources and capabilities conceptualization and orchestration include the following key stages **search – articulate – find – evolve alternative resource configurations sets, abbreviated as SAFE ARCS**.

Configurations: Anticipation of Resource configurations

The purpose of strategy and strategic management is the creation, evaluation, manipulation, administration, and deployment of unique resource combinations (Peteraf, 1993; Sirmon et al. 2007), which in turn create and maintain value via the development of competitive advantage, under the form of aligned and well orchestrated structural and functional configurations (Miller, 1996; Galunic and Rodan, 1998 Galunic and Eisenhardt, 2001). However, the essence of strategy is about recognizing and shaping patterns which can emerge as well as be deliberately conceived (Mintzberg, 1987). The presented

explanation resembles very much the biological natural selection and the survival of the fittest organism or …mind. The difference comes with the cognitive ability for "detecting the subtle discontinuities that may undermine a business in the future", and the ability to "perceive important breaks" in the existing patterns as Mintzberg (1987, pp. 72) has defined it. In other words, the key is the cognitive ability to anticipate and act by the means of anticipation based search, selection, configuration and deployment strategic processes. But how this process of search is related to managerial cognition and decision-action-effect anticipation?

Fiss (2007) suggests a theoretical approach to studying configurations in respect to their equifinality, where a given system can reach to one and the same state in time using a variety of different means and paths, i.e. resource configurations, nevertheless starting from entirely different conditions (Katz and Kahn, 1978) and to their "limited diversity" characteristics. As organizations are viewed as bundles or clusters of interconnected structures, resources and activities, applying singular causation and linear relationships would not be a viable approach to understanding the complex causality and nonlinear relationships among configuration variables (Gary et al, 2008; Kunc and Morecroft, 2010; Fiss, 2007). In this line of thought firms can be considered to consist of all possible (but latent) configurations, subject to the law of limited diversity that not all possible configurations are realized and that certain organizational elements show a tendency to appear together (Meyer et al., 1993; Miller, 1986;). As Fiss (2007) suggests, limited diversity can help managers find ways to design better configurations by building robustness and redundancy into organizational designs.

Thus, anticipating alternative, but latent, successful configurations, which form different paths to achieving the same performance outcomes, can provide organizations with flexibility and adeptness to respond to environmental changes in advance with robustness, flexibility and speed, while optimizing their use of resources.

Complexity: Anticipating the dynamics of resource and capabilities configurations

Resources and capability configurations form functional competences. Competences in turn can also form further higher-order competence configurations by interacting between themselves and forming feedback loops (Kunc and Morecroft, 2010). Possible number of interconnections between resources and resource groupings can be extremely high, so configurations can be a source of considerable complexity endogenously rooted in organizations, while at the same time structurally coupled with the external environment (Kauffman, 1995; Kauffman et al., 2000; Robertson and Caldart, 2008; Sopelana et al, 2013). Organizations as dynamic, nonlinear systems, are formed by connections and interaction of components to creating the performance outcomes (Merry, 1999; Levinthal and Warglien, 1999; Rivkin and Siggelkow, 2007). Apart from the large number of interactive elements, complex systems have also emergent properties, i.e., causal relations and feedback loops lead to the appearance of patterns or emergent structures (or constellations) of tightly coupled components (Anderson, 1999). As a result, competitive advantage indeed appears more often as emergent rather than planned (Mintzberg et al., 2009) and managing such complexity is as much science, as it is an art.

Organizations as complex adaptive systems are believed to be analogous to biological systems which ultimate goal is to adapt to the changing environment by taking random walks on a variety of fitness landscape" (Kauffman, 1995; Merry, 1999). General biology considers that when a gene mutates, it does not do so on purpose or intentionally. However, anticipatory systems theory (Rosen, 1985a) contradicts this general Darwinian conception of natural (random) selection with the idea that genes mutate in relation to and by anticipation of the changes in their ecosystem, i.e. evolution is based on anticipatory and not on random selection. Similarly, cognitive theory holds by its ideomotor principle that human beings base their actions on the anticipation of their effect, i.e. on the associative incursive connection between the effect and the action (Pezzulo 2008; Butz et. al., 2007).

Levinthal and Warglien (1999) accentuate that fitness landscape design must account more for the behavioural of the agents and their trajectories rather than focus on the identification of peaks on a payoff surface. When organizations explore rugged landscapes (possessing multiple peaks of high pay-off), they engage in operations like local adaptation, long jumps, and re-combinations (Levinthal and Warglien, 1999), while trying in parallel to exploit their past experience and knowledge by means of analogical reasoning (Gavetti et al., 2005; Gavetti and Rivkin, 2007; Gavetti and Levinthal, 2009). A mechanism to overcome competency traps (Levitt and March 1988), stemming from local incremental search is to engage in long-jumps and random exploration of distant parts and places of the landscape, argued Levinthal and Warglien (1999). However this proposition does not account for the ideas that agents and organizations behave in anticipatory selection fashion. Theory and research from an anticipatory systems perspective, as it argues that biological recombination does not happen in a random fashion, suggests neither human decision making nor cognition-action processes are based on purely random search and selection of alternative possible combinations to achieve a certain fitness value or goal (Rosen, 1985b). Meyer and Szirbick (2007) stress the importance of state anticipation ability of organizations, which leads to emergent behaviour of the whole system. Business information systems that support organizational business processes can enhance their anticipatory ability, as it supports the inclusion of a future oriented cognitive model of the organization inside the organization itself, as projections about future possible organisational states strongly influence current organisational behaviour and its decision making process.

Consider the example given by Levinthal and Warglien (1999) about pharmaceutical drug design as an analogy for local random search, positing that when designers know little about which molecules are effective, they often resort to random search in a vast molecular region. Contrary to this intuition, anticipation actually is present but it is not accounted for in the described process. Drug scientists do not just randomly search, their search is guided by their anticipation of possible positive outcomes, which initially constrain their search within the therapeutic field of the investigated molecular substance

combinations. With gaining more knowledge about molecule combinations by testing their proximity to the initially set therapeutic goal, scientist refine their anticipation of possible positive results thus narrowing the search and finally getting to more "promising hills". The above example is a metaphor for firms searching for technological or strategic innovation, explaining how anticipation of possible alternative configurations guides their search rather than just search randomly around co-evolutionary landscapes (McKelvey, 1999).

The above discovery process can be taken as a metaphor for firms searching for technological or strategic innovation, explaining how anticipation of possible alternative configurations guides their search. Thus, the strategic search process will not only be guided by anticipation but also will be contingent on the structural coupling and co-evolution of the internal and external configuration components within the firm ecosystem, thus forming a continually shifting landscape possessing multi co-evolutionary complexity.

SAFE ARCS: The process of search, articulate, find and evolve alternative resource configuration settings

Organizational and firm performance and the competitive advantage are, in essence reflections of managers' values and cognitive biases (Hambrick and Mason, 1984), i.e. the manager's dominant logic takes account for the portfolio of resources over time (Morecroft, 2007). Firms can be analysed as systems controlled by the management mental models (which is an interpretist view of business) which are transformed into real functioning organizations by the decisions and actions they take and follow (a functional view of business) (Kunc and Morecroft, 2009). Looking of the process of managerial resource conceptualization from the perspective of anticipatory systems view, the process needs to be expanded by a new activity denoting the development of firm's model of itself or 'firm's alter-ego' in the future, i.e.

future possible performances (Figure 1). In the context of the framework proposed "resource conceptualization" actually can be interpreted as conceptualization by anticipation of **alternative resource configuration settings** (ARCS) through the processes of searching, articulating, finding and evolving (SAFE) their realisation and implementation. Figure 1 denotes the anticipation process of resource configuration dynamics and its central intermediary interrelationship with the process of resource configuration conceptualization and resource configuration management structurally coupled with actual performance.

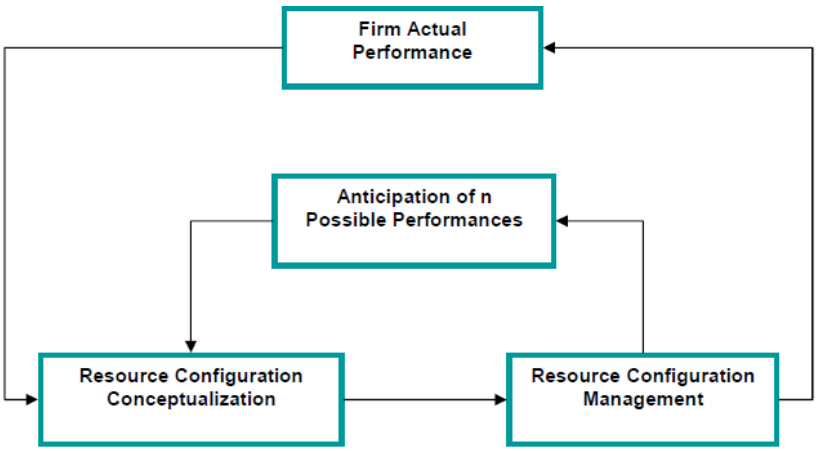

Figure 1. Alternative resource configuration setting (ARCS) conceptualization by anticipation.

Search horizons can be narrow, tight to local basins of attraction, or broad, associated with long jumps on the rugged landscape (Teece, 2007; Kauffman, 1995) even though overcoming them can be difficult, path dependant and related to large investments. Uncertainty of the future makes managers to "make informed conjectures about the path ahead", which Teece (2007, pp. 1323) defines as a "working hypotheses that can be updated as evidence emerges." This is actually a very close description of how anticipation works: managers construct a model of alternative paths ahead, and at the moment of their recognition of a new evolutionary path they need to select and seize the emerging opportunity. In Teece's explanation the

"path ahead" is only one and it sounds that firms evolution is a bit deterministically subject to the "natural selection" laws of the local ecosystem. Under an anticipatory process, organizations build "forward models" of themselves (Pezzulo, 2008) thus simulating different pluralistic paths ahead with different outcomes. Managers look across and beyond boundaries of firms and anticipate the construction of configurations which may have the power to transcend the current market space by value creation for the customers, owners and society in a new and unpredictable by competitors way.

Therefore, firms use anticipatory models of themselves (Alter-ego simulated behaviour) to search, articulate, find and evaluate new strategic paths before they take actual decision for strategic action. Thus, managers conceptualize firm's resources and capabilities (competence) configurations following four anticipatory process stages: (*1) Search alternative resource configurations is associated with the process of creative search and cognitive representation (Helfat and Peteraf, 2014); (2) Articulation of optimal resource configurations (and accuracy of interpretation) is related to the interpretation of the possible "paths" ahead as they are envisaged in the form of co-evolutionary intra- and inter-firm resource configuration changes and related to the communication of meaning, i.e. sense making and giving (Leydesdorff and Franse, 2009; Pask, 1976); (3) Finding the right optimal resource configurations is related to identifying, selecting and legitimizing distant opportunities (Teece, 2007; Gaveti, 2012); and (4) Evolving firm's performance from present state to its future state in connection to the optimal resource configurations found is associated with seizing and asset orchestration (Teece, 2007; Sirmon et al. 2007;).*

RESEARCH METHOD

The research method employed is an in-depth exploratory study of a strategic planning process supported with before-after control by the use of a simulation model (Feldman and Hayes, 2005; Kunc and

Morecroft, 2010; Kaplan, 2011). The strategic planning process was conducted by a team of senior managers of a pharmaceutical company. The strategic planning process involved several meetings with the aim to review and eventually re-design a product market strategy for a new drug launch. Data collection approach includes unstructured interviews with the managers' team, think-aloud protocol, observation and taking field notes (Simon, 2000; Blumberg et al., 2008). The data collection process was split in two parts. In the initial meetings, the team conceptualized key factors that can influence the product market performance and to mentally simulate (anticipate) the contingency effects of different selected configurations (pre-treatment) (Feldman and Hayes, 2005). The following meetings, the managers were asked to perform the strategic planning process employing a system dynamics model (Sterman, 2000) and simulation interactive learning environment (post-treatment) (Morecroft, 2007). The goal of the two stage data collection process was to record and compare managers' anticipatory search and selection process of alternative resource configurations (Table 1). System dynamics was employed to structure the product market strategy problem and the analysis of the anticipatory model suggested by the management team. System dynamics has been widely used in modelling pharmaceutical market dynamics problems such as in Kunc and Kazakov (2013) and Paich et al. (2011).

	Interviews	**Observation and field notes**	**Think aloud protocol**
Pre-treatment /before using simulation model/ phase	The researchers asked questions about KPIs, influencing factors, product characteristics, and rival products in relation to communicating their predictive model of the product market dynamic condition	The researchers observed the strategy making process by the team members, related to their search, articulation and sense making, selection and implementation of resource and capabilities configurations, and took notes	Team members were asked to conceptualize /think aloud/ key factors that can influence the product market performance and explain why they chose one or another strategic resource configuration
Post-treatment /after using simulation model/ phase	The researchers used this phase to compare and control the experiment in regards to identification changes in the strategy making process characteristics and differentiate key process stages		

Table 1 Data collection process

The Case Study

A generic pharmaceutical company with sales of about US$ 700 million was set to launch a new generic drug (new for the firm's portfolio) to an Eastern European market. The company is a leading manufacturer of solid and liquid dosage forms and its shares are publicly traded in two CEE countries. The business development, regulatory (dealing with dossier and marketing authorisation registration of new drugs), marketing and sales functions have identified a prospective new molecule (oral anti-diabetic) coming out of patent to launch it on the market as a generic branded version of the original drug. The size of the relevant molecule market at the time was estimated to above US$ 10 million with yearly growth prospects of 5% on average and expected strong generic competition.

At the time of evaluation and selection for implementation, this new generic drug project was seen as highly prospective. However, due to delays during the development phase (negotiations connected to agreement of in-licensing the product, production and transfer conditions) coupled with a longer than expected dossier registration, administrative delays of the pricing and reimbursement decision, and inclusion in the national drugs list, the launch process for the product experience a considerable deviation of the initially expected launch time line (see more about Pricing and Reimbursement regulation, and generic drugs marketing in Kazakov (2007)). Then firm's competitors brought their generic drug branded versions faster to the market and have managed to position their products in the market. The market leader (the innovative company whose patent for the named drug had expired) continued to hold its market position tight, based on years of enjoying market barriers to new entrants and building strong brand loyalty among specialist doctors.

As a result, the firm's initially planned first-to-market generic strategy transformed into last-to-market entry. The company has invested time and money to bring this project to life but now they saw it as just a new drug addition to their broad therapeutic portfolio of products without having much prospects for

good performance. The strategic question which the firm wanted to tackle in the strategic planning process was: Would there be any possible courses of product market strategy redesign and correction to compensate for the late market launch and lowered prospects for the return on investment and economic value creation?

RESULTS

Pre-treatment: Configuration exploration before working with the simulation model

The team initially identified only three variables as key for their strategic decision:

- Drug's price which is linked to the reimbursement regulation
- Number of doctor visits is the standard activity for influencing prescribing behaviour
- Marketing budget as a fraction of the target gross profit and the resource to finance visits.

Their choice can be considered as the standard practice which every rival follows in the market. Any new generic drug entrant sets price below the current reimbursement level (100% paid by the health insurance funds) in pursuing a lower price – quick uptake and high volume strategy. However, most of competitors usually adjust their prices to the new lowered reimbursed level hoping to maintain their sales volume on the expense of their gross margins. Only the original drug company doesn't follow this strategy because as a market leader has built its brand loyalty position with doctors, maintaining high sales volumes and high profit margins through the years of patent protection. The market leader can afford to keep price and margin levels, as additionally can rely on the achieved reinforcement effect between volumes and marketing budget. Usually the leader increases just the number of doctor visits, but does not enter into a price erosion cycle.

After the key factors have been identified and explained, the team explored combinations between the three factors with the aim to achieve expected market performance. Total combinations possible between

the three factors are 2^N or $2^3 = 8$. The exploration of the above combinations was done within a number of scenarios, in which the team tried to account also for 1) reactions to rivals moves and 2) possible reactions from rivals to firm's actions. More specifically, the team explored four situations (50% of the total possible combinations) generated by the chosen three variables as displayed in Table 2. Table 2 represents a record of the managers' key resource configuration exploration and performance expectations, excluding the notes in the last column which reflect researchers' observation on the managers' strategy making process. The scenarios were put in the context of rival possible actions and reactions. The data in the table represent the explored number of combinations between the key three variables, chosen by the management team: product price, doctors' visits and product budget, as observed and recorded by the researchers.

Key Factors			Expected pay-off relevant to managers performance expectations	Researchers observation notes
Price	**Visits**	**Budget**		
0	0	1	Not explored	The team did not believe initially that increase in budget to support additional activities other than visits is worth exploring, because such action would just undermine revenues; budget reduction was out of the question provided that key rivals enjoyed bigger budgets
0	1	1	Best if a reaction to rivals actions is needed	Increase in budget will increases number of visits in case rivals get more aggressive in protecting their market share, so it is worth exploring
1	1	1	Less favourable	Price can only decrease once it is set, as it is regulated only downwards by the local authorities, and also is viewed as the key competing tool on the generics market; budget and number of visits could vary together with price, and optimal price setting is key to strategy so worth exploring
1	0	0	Least favourable	A decrease in price could happen either due to authorities regulation or due to rivals price competition; it should be explored although adjustments in budget and number of visits would not be optional
1	1	0	Not explored	The team did not believe initially that Re-scoping number of target doctors coupled with price reduction is a relevant scenario
1	0	1	Not explored	The team did not believe initially that they need explore other activities to support sales force by increase in budget, except visits, especially coupled with a decrease in price
0	1	0	Not explored	Re-scoping number of target doctors and number of sales force was not viewed as an option worth exploring
0	0	0	Preferred	Do nothing was the best option as it does not include any deviation from the dominant logic on the market, so the team preferred to just copy key rival's strategy by matching price, number of visits and budgeted activities closely to the competitor's

Table 2 Explored number of combinations between key variables, chosen by the management team.

Development of an Anticipatory model for evaluating alternative configurations

The model was developed based on the workshops held by the team of four senior managers – the firm's business development manager, the medical and regulatory affairs manager, the sales manager and the brand portfolio manager. The detailed causal relationships between the key factors discussed by the management team is represented on Figure 2, which was developed by the researchers to reflect the managers group mental model, i.e. how they think about the interrelations between the key product market factors and resources.

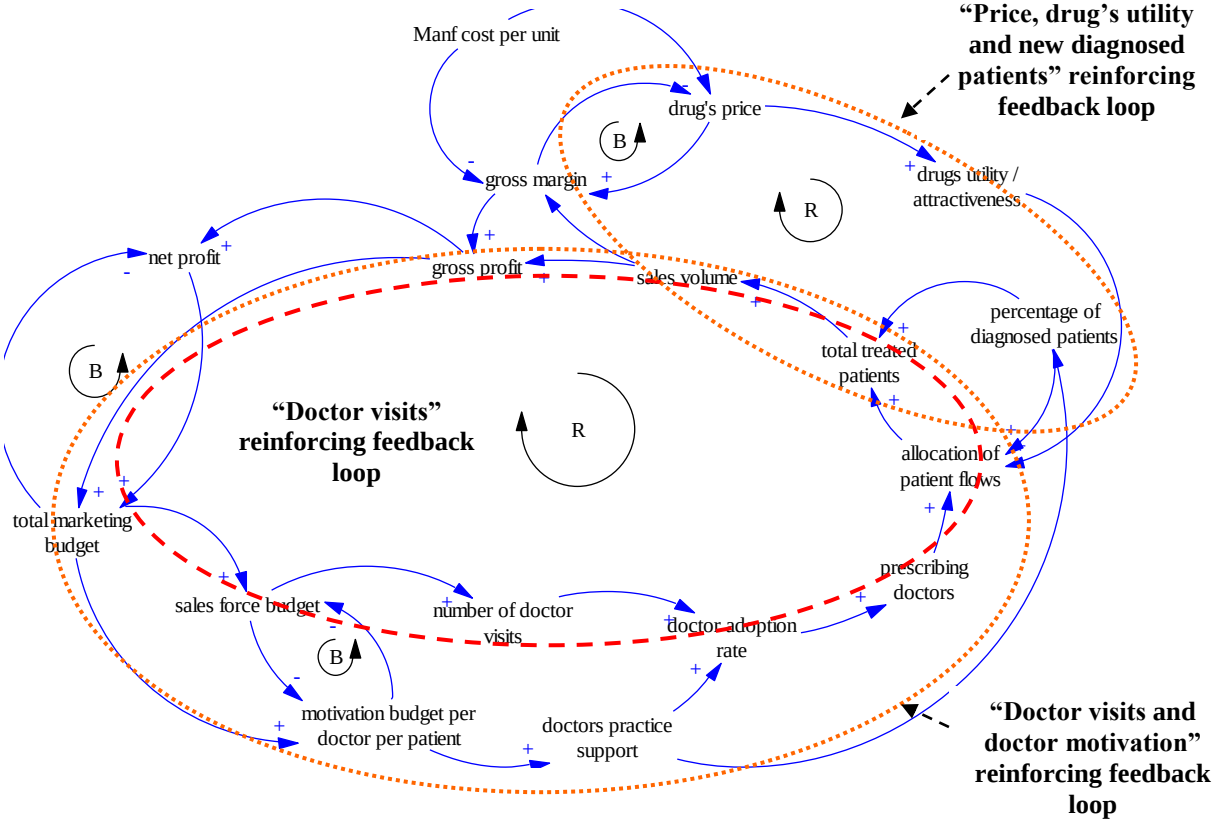

Fig. 2 Causal-loop diagram (Sterman, 2000) of the model [1]

[1] Arrows and polarities mean that there exists a positive (+).or a negative (-) relation between a pair of variables. Causal loops denote afeebdack process, either reinforcing (R) or balancing (C), between the interconnected factors, in accordance with system dynamics theory (Sterman, 2000).

The key variables and causal loops were connected to the firm's total marketing budget, which consisted of sales force budget and motivation budget per doctor. Marketing budget can influence on the number of doctors' visits and doctors practice support, which in turn influence doctor adoption rate. All of the previous factors influence the accumulation of a key factor which is the prescribing doctors and form the "Doctor visits" reinforcing feedback loop. Another key factor for the product market strategy is the total treated patients and their accumulation rate, which is generated by the fraction of new diagnosed patients, and is a central part within the "Price, drug's utility and new diagnosed patients" reinforcing feedback loop. An important observation is that patients' accumulation rates are distributed among competing drug treatments by doctors' decision process, which is influenced by the attractiveness of the relevant drug treatment. The attractiveness of the drug treatments is a relative measure and includes medical, pharmacological and toxicological conditions of the drug treatments (which should be equal in a generic drug competition), including drug's price and patients co-payment. Drugs price, manufacturing costs per unit and sales volume affect firm's profitability.

Alternative configurations evaluated

Although the team members agreed on the model variables and causal links between them displayed in figure 3, they insisted that in the context of the competitive dominant logic existing on the market, the following variables will not produce much difference to the expected performance, as they believed that the magnitude of their effect would be insignificant:

- Drug price (as it was restricted by the pricing and reimbursement regulatory rules and administration);
- Drug utility/attractiveness (as all the rival brands possessed nearly the same, as perceived by the doctors);

- Percentage of new diagnosed patients (as it was a responsibility of the government through the healthcare system, and because it was considered that investment in such activities would not make a return to the firm as the investment would be dissipated to rivals);

Thus, the team initially conceptualized its strategy as constrained within the inner reinforcing feedback loop ("Doctor visits" reinforcing feedback loop) while leaving other factors out of scope, which form another broader reinforcing cycle such as the feedback loops "Doctor visits and Doctor motivation" and "Price, drug's utility and new diagnosed patients". New factors related to product market strategy were identified as being the "Prescribing doctors" and the "Currently treated patients" on one side, and on the other side the process of "allocation of patient flows by doctors".

As it will be seen in the next section, the exploration of different alternative resource configurations will be embedded in the second phase of this study by linking the configuration search and selection processes, which aim is to shed light over the managerial process from an anticipatory systems perspective. From a behavioural perspective, the process of anticipation, which guides managerial strategic choice, includes the process of exploration of strategic ideas and configurations and a double feedback learning: from actual and virtual experience (Kunc and Morecroft, 2010). Virtual learning stems from the mental simulation of alternative factor configurations or from the anticipation of their causal effects (Kunc, 2011).

Post-treatment: Configuration exploration after working with the model.

Now the team conducted an interactive search for alternative configurations using the system dynamics model and measured pay-offs related to the variations in the degree of the achieved performance. The team started exploring combinations between six factors (see Table 2) with the same goal as before - to achieve and improve expected market performance. After that, the team made a comparative analysis of the explored alternative configurations and associated pay-offs from before and after the use of the

simulation, which was encoded in the following table format (Table 3). Total combinations possible between the six key factors are 2^N or $2^6 = 64$. The exploration of the above combinations was done again within a number of scenarios, as chosen by the team, and accounting again for 1) reactions to rivals' moves and 2) possible reactions from rivals to firm's actions. The team explored 32 configurations (50% of the total possible number) that considered feasible and relevant. Table 2 presents an extracted record of chosen eleven most discussed by the team important factors configurations, initially between the three key factors ("drugs price", "doctors' visits" and "sales force budget"): denoted by I-a, I-b, I-c and I-d; and after that between all six factors ("drugs price", "doctors' visits", "sales force budget", "motivation budget", "percentage of diagnosed patients" and "Manufacturing costs per unit"): denoted by II-a, II-b, II-c, II-d, II-e, II-f, II-g. The data in the table is a record of the managers' resource configuration exploration and performance expectations, excluding the Notes in the last column which represent the researchers' observation of the managers' strategy making.

Price	Visits	Sales force budget	% of diagnosed patients	Manufacturing costs per unit	Expected pay-off relevant to performance expectations	pay-offs scale: marked on a scale with a base case = 100	Researchers notes and commentary based on observation on the managers strategy making: I. denotes first, and II. – second exploration by the team (pre- and post-treatment)
0	1	1	X	X	I-a. Best configuration if a reaction to rivals actions is needed	110	Increase in budget will increases number of visits in case rivals get more aggressive in protecting their market share, so it is worth exploring
1	1	1	X	X	I-b. Less favourable configuration	90	Price can only decrease once it is set, as it is regulated only downwards by the local authorities, and also is viewed as the key competing tool on the generics market; budget and number of visits could vary together with price, and optimal price setting is key to strategy, so worth exploring
1	0	0	X	X	I-c. Least favourable configuration	70	A decrease in price could happen either due to authorities regulation or due to rivals price competition; it should be explored although adjustments in budget and number of visits would not be made
0	0	0	X	X	I-d. Preferred configuration	100 (taken as a base case)	Do nothing was the best option as it does not include any deviation from the dominant logic on the market, so the team preferred to just copy key rival's strategy by matching price, number of visits and budgeted activities closely to the competitor's, exhibiting clearly a satisficing behaviour mode

0	0	0	1	0	II-b. Even better than configuration II-a.	130	Other activities to support sales , initially not viewed as feasible were explored by the team connected to motivating prescribing by doctors and increasing the percentage of diagnosed patients
0	0	0	1	1	II-c. Best configuration option	140	The team explored the above configuration (II-b) coupled with variations in the Manufacturing costs per unit, which initially was taken as a fixed figure without the scope of the teams decision power
1	1	1	1	0	II-d. Not favourable configuration as net margin will be depressed too much	70	A Trade off b/n sales force and motivation budget was identified by the team; gross margin could not be compensated by decreasing manufacturing costs, as the other factors would increase expenses which could not be balanced by the price
1	0	0	1	1	II-e. Good enough configuration	120	In case of expecting a decrease in price reimbursement level, the team explored a possibility to compensate a decrease in revenues with decreased marginal costs and activities related to motivating prescribing by doctors and increasing the percentage of diagnosed patients
1	0	0	0	0	II-f. Configuration not preferable at all	60	Just motivating prescribing behaviour by budget raising to compensate expected price fluctuations was explored and viewed as not sufficient at all

1	0	0	0	1	II-g. Good configuration but not enough	110	This configuration was evaluated as good but not enough good. The team realised that a budget raise for motivating doctors prescribing behaviour could not be compensated by just a decrease in manufacturing costs without undertaking activities to increase the percentage of diagnosed patients

Table 3 Exploration of diverse configurations aided by the simulation based anticipatory model

DISCUSSION

The results reported in the previous section exhibit evidence related to the anticipatory structure of the strategy making process, related to the main question of how managers conceptualise, configure and orchestrate organisational resources and capabilities. The study showed that initially managers' product market strategy search-and-selection process was restricted to a few key resources with little complexity related to resource configuration alternatives. As the study went into its second phase controlled by the simulation model learning environment, the resource conceptualization and configuration process became more elicit, as it included a search among larger number of resources with considerably increased complexity of alternative resource configuration settings.

Thus the observed anticipatory process consisted clearly of for key stages: **search – articulate – find – evolve** (SAFE) related to the explored alternative resource configuration sets (ARCS) which we initially hypothesized and abbreviated as SAFE ARCS process in the light of the Anticipatory systems theory.

The **"search"** stage appeared to be related to initially (ex ante system dynamic modelling and simulation) conceptualising a narrower scope of strategic paths or options connected to product market resource configurations strategy, than during the ex post system dynamics model experimentation when the managers team extended their cognitive search capability to encompass a wider scope of conceptualized strategic resource configuration options (Kunc and Morecroft, 2010) and is further related to strategic imagination.

The **"articulate"** stage was related to generating meaning about the alternative resource configuration options and their attractiveness related to expected performance results, which ex ante exhibited a narrower scope of efficiency than ex post working with the system dynamics model, which simulated alternative configuration performance results. This articulation capability is further

theoretically connected to the literature on conversation (Pask, 1976) and communication of meaning (Leydesdorff and Franse, 2009).

The **"find"** stage was related to the identification of attractive optimal resource configurations, which in the behavioural experiment ex ante the simulation model were not identified at all, than ex post model experimentation and simulation when a number of innovative and optimal resource configurations were found by the managers. The cognitive capability of finding is further related to the dynamic capability for strategic innovation (Teece, 2007).

The **"evolve"** stage was related to the "mental preparation" or mental rehearsal (*cognitive anticipation*) of the selected resource configuration implementation in the most effective and efficient way, so that the company can achieve strategic surprise and outcompete its rivals (Feldman and Hayes, 2005; Kunc and Morecroft, 2010).

The exploration of the latter by the managers made the researched process much clearer and as it was observed and recorded, revealed its four key stages consistent with the Anticipatory systems theory, proving that managers attempt to perform a predictive model of alternative resource configuration settings and related expected performances, this way searching for the optimal one by articulating, selecting and mentally implementing alternative strategic scenarios.

On other hand, the process of alternative resource conceptualization and configuration setting showed a contingent relationship to the levels of the managerial dynamic capabilities to form predictive model of the product market dynamics before and after the experimentation with the anticipatory simulation model. The anticipatory capabilities before the use of a simulation modelling were narrow which constrained the conceptualization and search-and-selection process effectiveness related to firm's expected alternative performances. The anticipatory simulation model raised considerably the levels of the team's dynamic capabilities, which in turn expanded the scope of the search-and-selection process by supporting not only local search but also more distant configurations exploration and articulation of meaning, which in turn lead the team to the discovery and selection for implementation of an innovative alternative resource

configuration setting (ARCS). The firm's ability and accuracy of anticipation of future alternative resource configuration settings (ARCS), i.e. its predictive model of itself situated in static or changing environment, and their effect on expected performance was greatly enhanced by the use and the support of an additional self-predictive simulation model. In this respect, the team exhibited a behaviour which was entirely consistent with the theory of anticipatory systems, which in a sentence can be defined as the following:

An agent or an organization, being an anticipatory system, bases its action-decision making on the predictive model it constructs about the effects of a range of alternative actions or paths it can take related to resource and capabilities conceptualization, configuration and orchestration. The accuracy, efficiency and effectiveness of the anticipation process is contingent on the agent's or the organization's levels of cognitive anticipatory capabilities. The broader the scope of these capabilities, the higher the chances for selecting optimal resource configuration settings and evolving the organization towards a superior performance relative to competition.

The strategic planning case study provided an examination of how managers think about formulating strategy and make relevant decisions, related to search, selection and development of new resource configurations. However, there are some limitations such as linking the results with the long term performance of firms. Additional research can be performed to highlight the links between managerial cognition and anticipatory decision making with the dynamics of sustainable value creation by firms, including contemporary perspectives of sustainability and sustainable value added, encompassing the stakeholder view of value creation (Barbier, 1987; Charreaux and Desbrières, 2001; Hart and Milstein, 2003; Figge and Hahn, 2004).

CONCLUSIONS

Strategic decision making follows an anticipatory process of mental search, articulation of meaning, finding and evolving alternative resource configurations (which we named SAFE ARCS process), and that the effectiveness and efficiency of this process is contingent on the level of the managers' dynamic cognitive capabilities. When managers increase the level of their dynamic cognitive capabilities (DCC) by the use of a strategizing tool, e.g. system dynamics modelling, an improvement in the firm selection of a more robust and optimal resource and capabilities configuration setting could be obtained.

Bringing the anticipatory systems perspective into the behavioural theory of strategy proposed by Gavetti (2012) can greatly enhance the understanding of how firms fall short or overcome the rational "limitations of human behaviour" in the light of the bounded rationality paradigm (Simon, 1955, 2000) and the limitations of search as having predominantly local properties (Cyert and March, 1963), The behavioural bases of superior performance, the path to which was found by the managers' SAFE ARCS process, stemmed from their ability to overcome their behavioural bounds (Gavetti, 2012) which was based on the enhanced (by, in this case, system dynamics modelling and simulation) scope of their previously limited cognitive dynamic capabilities.

The understanding of the SAFE ARCS anticipatory model for strategic search and selection proposed here can enhance firms' ability to manage their asset conceptualization and orchestration processes in such a way so that they can reach distant foresight, as well as re-representation and re-categorization of the strategic problems they face, by means of alternative resources configurations search and articulation of an innovative strategic representation.

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