Revisiting complexity theory to achieve strategic intelligence

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Abstract: The present work aims to analyse the choice of strategic management conditions considering both, systemic and complexity perspectives applied by analogy to business. The approach represents the firm as a complex adaptive system, where management, to make strategic and operative decisions, must reduce complexity amplifying information variety. According to this approach the firm, in a turbulent environment, must develop different competences, especially in the field of innovation, in order to achieve survival/dynamic conditions through the creation and/or maintenance of relationships with numerous, diverse and heterogeneous stakeholders. This work aims to answer the following research questions: can the complexity theory meet the needs of managers and marketers as well as scholars’ theoretical foundations, to develop strategic intelligence to effectively manage the dynamism of organisations/brand in turbulent environments; does regarding organisations and networks as adaptive systems help scholars and managers in their decision making processes?

Keywords: complexity; dynamic decision making; problem solving; information variety; complexity theory; environmental dynamism.


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1 Introduction

In the last forty years, management and organisational researchers argued that, to achieve competitive performance, new paradigms, practices and cognitive capabilities and approaches are necessary to make sense of the expected changes triggered by a globally restructuring economy and advances in social, political and cultural domains (Hermiter, 1974; Tetenbaum, 1998; Kelly, 1994, 1998).

These scientific calls contextualise and validate well-established principles and capabilities in the field of market dynamics. The principles show the firm as a partially open system in constant change and/or adaptation, induced by the influences of context, endogenous organisational dynamics and by the effect of exchanges of resources, information, symbols, values with heterogeneous and relevant stakeholders (Beer, 1966; Dowling, 1983; Dixon, 1984; Yolles, 1999; Golinelli, 2000; Dolan, 2002; Barile, 2009). The capabilities are represented by strategic intelligence to anticipate competitors’ behaviour and preempt it. Moreover, ‘dynamic capabilities’ emphasise a firm’s
development of new resources, reconfiguration of existing ones, and combination of them in order to obtain significant value by the contextual change (Drnevich and Kriauciunas, 2011; Helfat et al., 2007; Schilke, 2014; Winter, 2003; Zahra et al., 2006; Zollo and Winter, 2002). In the strategic management domain, the interest in organisations’ dynamic capabilities stems from their potential influence on competitive advantage representing the key outcome variable of the dynamic capabilities view (Teece et al., 1997). In this context, a firm is said to have a competitive advantage when it enjoys greater success than current or potential competitors in its industry (Peteraf and Barney, 2003; Schilke, 2014). Literature on dynamic capabilities has emphasised particularly the role of environmental dynamism as a potentially important contextual variable (Helfat et al., 2007; Helfat and Winter, 2011; Zahra et al., 2006). According to Miller and Friesen (1983) environmental dynamism entails both, the fundamental characteristics of volatility (rate and amount of change) and unpredictability (uncertainty); for instance, changes in industry structure, the instability of market demand, and the probability of environmental shocks are important elements of environmental dynamism (Schilke, 2014).

The continuous exchange with the relevant stakeholders mark a state of information chaos requiring a continuous effort from the firm and the market to which it belongs in terms of cognitive capabilities and behavioural adaptive dynamics (Prigogine, 1984) in order to survive.

2 Theoretical design

Against this backdrop, the authors of this paper regarded it interesting to conduct a scientific effort based on an analogical approach resorting to complexity theory to design conceptual frameworks. The survival of the firm is regarded to be based on the cognitive and strategic capabilities to create and maintain relationships with different and heterogeneous stakeholders (complexity condition) contributing to differential performance under conditions of change (Helfat and Peteraf, 2015). To reach the condition of survival, the management has to reduce the complexity state amplifying their information variety.

In a systems perspective, the first and second thermodynamic laws sustained that in a system, without environmental exchanges, the entropic disorder is destined to increase. These theories, in fact, evoke how important it is for the firm to continuously acquire and exchange information with relevant stakeholders (Prigogine, 1955).

Indeed, all such systems, if isolated and therefore incapable of self-sufficiency undergo a reduction of transformational activity. This tendency for exhaustion and/or dissipation of resources causes the state of disorder or chaos culminating in implosion of the closed system. Hence, interaction with other systems, where there is a lack of information exchange process, is the cause of the dissolution of the system over time due to a growing disorganisation. Therefore, any isolated system naturally evolves towards the state of maximum disorder.

For years, thermodynamics scholars held that a system reaches a point of equilibrium in the absence of external input. Prigogine (1955) applying this principle to open systems argued that they could reach a state of dynamic equilibrium in the event of minimal production of entropy.

Analogous to the management field, a firm reaches a dynamic equilibrium when it can acquire increasingly information about the contexts developing the capabilities to create and maintain relations with the numerous and heterogeneous relevant stakeholders useful to satisfy their needs.
3 The firm as adaptive system

The firm’s/system’s ‘opening’ condition is fundamental to support the exchange and adaptation of managerial cognitive resources. Therefore, the system survives if it is open or partially open, and thus able to transform the capabilities possessed in interactions with other contexts.

So, contextualising these concepts at the firm and/or brand level we can sustain that the firm/brand survives if it is able to establish, develop and/or modify appropriate information, cognitive and adaptive behaviours and skills that would allow them to receive and provide answers in the area of systemic exchange (Kaufmann et al., 2012; Czinkota et al., 2014).

These adaptive conditions represent the state of systemic balance on which survival is founded and that phenomenon, given continuous adaptation, we could define as the condition of ‘dynamic order’ of the systems (Kangun, 1981; Monieson, 1981; Bass, 1974; Georgescu-Roegen, 1971; Boulding, 1966; Reidenbach and Oliva, 1983; Layton, 1989; Fantappié, 2011).

Based on Prigogine’s (1955) early work we could argue that it is not the lack of information exchange that allows the achievement of a steady state or order condition; rather it is this lack of it that contributes to an increase of chaos. Indeed, the absence of strategic capabilities in terms of information exchanges represents the isolation of a system that, to achieve the condition of order, should become self-organising, generating the conditions of survival independently based on a deterministic behaviour (Ashby, 1956; Emery and Trist, 1969; Boltzmann, 1965).

Applied to management studies two different situations could appear: either the firm works in a monopolistic industry or the management bases the plans on a deterministic approach in which the results are considered ‘linear and exact or cause and effect’ and characterised by a stimulus and response condition.

The firm, in the current market conditions, is a partially open system (still relatively isolated) that must be able, by means of their cognitive and strategic capabilities, to respond to environmental changes (i.e. conditions of turbulence) to survive, exchanging information and/or resources with an appropriate language-behaviour (i.e. brand, marketing and communication behaviours) with the relevant stakeholders.

This language is developed, based on partners’ needs and common coenetic variables (variables, inputs, stimuli, influences, interferences, standards and rules), in as much as they belong both to the cognitive schemata of the system under analysis and to those stakeholders/partners considered relevant by decision makers (Beer, 1966).

Teece (2007) suggests that in the system’s ability, survival plays a role in the cognition of the ‘sensing’, ‘seizing’, and ‘reconfiguring’ components of dynamic capabilities.

In fact, this adaptive capability is intended to create a new condition of equilibrium, with respect to the context, altered due to causal interference or disruption caused by the contexts. This dynamic adaptation of social agents occurs by means of some cognitive and structural processes (Beer, 1966; Maturana and Varela, 1980; Maturana, 1975).

Therefore, the adaptation phenomena in the systemic theory were defined as constituting a process where a new dynamic order, supported by cognitive capabilities in strategic view, emerges out of a chaotic state (Kauffman, 1994; Coveney and Highfield, 1995).

Control of company dynamics, in any form, is the typical process supporting the adaptation phenomenon (i.e. control of management, cost, finance, production etc.),
together with processes to adapt to changes in standards (i.e. laws, rules of conduct) that govern the dynamics of the market. These forms of control act as regulators committed to correct a disruption in the context of systemic relations.

Control, therefore, is a process directed towards achieving dynamic order, by reducing information variety (Ashby, 1956) within a certain amount of time (see Figure 1).

Systemic survival is, therefore, supported by the ability to create a dynamic order, i.e. coincidence of cognitive variety between strategic and operative organisational levels, that allows to understand information/influences coming from the contexts and the needs of relevant stakeholders (Kadirov, 2011; Kadirov and Varey, 2011).

Figure 1  Adaptive systems

4 Complexity, turbulence and reducing behaviours

At this point of the discussion, we can argue that the system’s competitiveness is based both, on the capability to create and maintain relations with relevant stakeholders and on capabilities resulting from great analytic skills and strategic intelligence interaction (Levine et al., 2017; Schumpeter, 1934).

Therefore, the continuous interactions between the firm and social and economic agents create a business and social environment characterised by two major dimensions: complexity and turbulence. The turbulence rather conveys the level of competitiveness and change in the business and social environment (Vorhies, 1998). The complexity reflects the rich context generated from of heterogeneous and different stakeholders that compose the business and social environment and with whom the firm must continuously create and maintain relationships (Mason, 2007). Furthermore, this concept is based on the combination of three main factors: economic, technical, and socio-psychological complexity.
Economic complexity concerns the degree of changing relationships among business players (e.g. increases in market size, low rates of economic growth, heterogeneity of demand, etc.). Technical complexity refers to technological development paths and the evolution toward smarter and more flexible technologies (i.e. the digitalisation of manufacturing brought by internet of things – industry 4.0 – big data analytics and artificial intelligence).

Socio-psychological complexity encompasses the social behaviour of the consumer, particularly evident in the changing consumer behaviour (i.e. more demanding in terms of availability of information, channel design and purchase experience) as well as in its evolution from ‘consumer’ to ‘prosumer’ (Dominici and Palumbo, 2013) or co-creator (Shams and Kaufmann, 2016).

Additionally, the complexity definition comprises three important characteristics. According to the first, complex organisations stimulate outputs that cannot necessarily be predicted simply by understanding all of the inputs. The second characteristic indicates that complex organisations create behaviours that are neither predictable nor unpredictable (the edge of chaos). The third concerns that the system’s history is irreversible (Dooley, 1996). For these reasons, the objective of marketing is reached by means of ever more dynamic strategic intelligences that take into account the several coenetic variables that make the context chaotic and dynamic.

Relying on Ashby (1956) who claimed that only variety can destroy variety, it can be said that the variety of contexts can be addressed by the manager/marketer, by equally information varieties which act as an attenuating factor on complexity (Ashby, 1956) (see Figure 2).

**Figure 2** Cycle model in goal-seeking behaviour (Ashby, 1956)

Regarding the top management decision makers, when they have insufficient information about the new problem, it is necessary for them to consider this condition as chaotic.

Therefore, they receive increasingly new information that amplifies the needs to increase their information variety to reduce this chaotic condition.
On this basis, the decision maker to plan strategic activities, particularly in the field of marketing, has to acquire knowledge and produce creativity to formulate ideas for settling concrete data (abduction).

The result of these processes shows the condition changing from chaotic to complexity; this state could be considered the first step towards the problem solution.

At this point, the decision maker’s increasing information variety is able to transform the ideas, produced in the abductive state, in an experimental hypothesis to verify.

In this condition, the decision maker is in a complication state characterised by the induction step in which much more information allow to reduce the uncertainty. From this step, the decision maker is capable to detect, to deduce, the problem individuating the other information useful for the definition of the problem (Barile, 2009) (see Figure 3).

Figure 3 From chaos to certainty (Barile, 2009)

The aim is to amplify the probability of creation and maintenance of relationships between firm and targets based on an adequate correspondence in the meanings of language, the semantics and behaviour (Kaufmann et al., 2012). The process of acquiring and capturing information and knowledge is largely supported through direct interaction among different subjects, for instance, between the firm and suppliers and customers (Nonaka and Konno, 1998).

In this regard, Wiener (1954, p.84) argued that “... learning is a form of feedback in which the behaviour of the model is modified, also, by past experience...”. Thus, feedback, as a form of behaviour, represents the learning process in which comparison is made between the conduct and the result to be achieved, so that success or failure changes future behaviour.

In fact, the aim of planning and control, applied according to a systemic methodology, is to detect possible gaps between what is expected from an applied model and what actually happens (a loop which represents the first homeostatic phenomenon) with the purpose of both, observing inability on the part of the model and supporting variety in the contexts, and, finally, to reformulate the model for next time.
5 Marketing and complexity

At this stage, the following research questions naturally arise: does corporate management, at the decision stage, act in accordance with a deterministic or a complex model? By effect of the complex dynamics, do different types of marketing models exist?

The firm, as a complex adaptive system, always needed to consider the development of various kinds of relationships with a number of heterogeneous stakeholders: investors, institutions, employees, customers, partners, competitors, and others. Market globalisation has produced exponential growth in the number and heterogeneity of the subjects with which every company develops its relations (Czinkota and Skuba, 2011).

The proliferation of relationships, made possible by new tools and new ways to communicate, is also accompanied by their increase in speed or, in other words, a different way of exploiting the time taken in business processes.

This scenario represents both the market and the firm as transient systems that increasingly express a kind of a probabilistic nature.

In all markets characterised by scarcity of supply compared to the request for demand and/or by a low turbulence level (stable environment), the bidding business not only governs demand by determining the quantities produced and then sold, but also has all the necessary knowledge (variety of information) to set up future activities (for instance Coca-Cola, Nutella and all those companies/brands that operate as leaders in mature markets) (Kotler, 1980).

The company’s entire value proposition is offered on the market, in this case, at a price defined by the manufacturer who does not normally accumulate stocks of a finished product. In these competitive conditions, the company information system tends to coincide with the system of internal records management, according to the inside-in type of information management model, characterised by the collection and processing of predominantly internal information and an internal projection of the results of these calculations.

Under these conditions, business phenomena are especially significant and are closely monitored and governed in order to continue to foster a firm system that focuses on itself, works in certainty condition and searches for continuous improvement in internal performance parameters (for the authors these situations characterise a static, predictable and implosive system).

Certainly, sectors of the economy that are experiencing conditions of co-operative and competitive intensity are much more numerous in global markets. This situation of excess of supply is characterised by the presence of a saturated demand, with no possibility of increasing purchases and consumption, and encouraging diversification policies, research and innovation and respect for market participants. In these markets, the only truly predictable phenomenon is the continuity of change operated by the actors (think of the information technology market or social networking companies such as Facebook and Google+).

Therefore, the collection of information is hence aimed at producing tenders or, better, offer profiles, able to intercept and aggregate the preferences of a variety of buyers (conditions that characterise highly dynamic situations).

This scenario represents a chaotic and an irreversible and unstable condition in which the result of planning is not certainty, but possibility that an event or condition may occur.
Planning for system behaviour, therefore, is designed to produce a dynamic result that by analogy to the laws of thermodynamics we defined above as dynamic order or consonance and then resonance (Dominici et al., 2013; Barile, 2009). These conditions express the momentary ability to meet the needs of the stakeholders, who had formerly communicated impulses and created disorder, through behaviours (e.g. products-services, social impact, environmental, and others).

6 Linearity vs. complexity

Of course, the Input-Output-(different) Input approach just represented is the essence of this work. In fact, the imperfect circularity represented in the previous process expresses the condition in which the firm and its management must seek survival.

This condition is no longer the expression of a purely deterministic approach, which corresponds to cause and effect process, but rather it is a complex scenario in which the cause of a given future effect is absolutely ‘indeterminable’ (Crane and Desmond, 2002).

At this point it is relevant to consider that, in contrast to numerous studies that tend to blame the deterministic approach as being exceeded or inadequate in relation to the evolution of the discipline, the firm, and its management/decision makers, find themselves working in market conditions that actually could require a deterministic or a complexity approach (Holbrook, 2003).

Such a scenario also emerges, by analogy, from the studies on dissipative structures by Prigogine (1955), who argued that relatively isolated systems could evolve into qualitatively different states, thanks to the continuous exchange of energy/information with stakeholders.

This consideration, therefore, leads us to represent the firm as a system that, based on the tacit and explicit knowledge possessed with respect to markets, consumers, stakeholders and competitors, can find itself in temporary conditions of balance, order and reversibility, and/or experiencing conditions of non-equilibrium, chaos and disorder (see Figure 4).

Figure 4 Disorder vs. equilibrium
The deterministic condition, showed by the linear relation between stimuli and response, is applicable when the respondent behaviour is produced or elicited by the input of particular completely predictable stimuli.

The point that separates deterministic and complexity conditions is defined as discontinuity or edge of chaos (see Langton, 1992; Waldrop, 1992; Hibbert and Wilkinson, 1994; Capra, 1997; Holland, 1999).

This area is characterised by a limited condition between the predictable and impulsive system and one in which order may be upset by minor changes and which, therefore, requires the capacity to support the creation, the abduction, of new features (Winston, 1995).

In this respect, Prigogine and Stengers (1979) in La Nouvelle Alliance points out that the historical/ temporal path that the system/firm goes through (market information, market share, total invoice, and others) is characterised by two kinds of conditions.

The first is a stable condition, in which the deterministic approaches are applied. In this condition, the management works in a dynamic and competitive environment but with high information level and in regular relationships with suppliers, customers and other stakeholders. This situation epitomises a firm with a top down organisational model, a strong brand, and a strategic approach mainly based on the imitative competitor strategies/behaviour defined ‘me too’ (at this regard we could think of the competition between Coca Cola and Pepsi Cola, in which the strategies are strongly imitative or ‘me too’, and both organisational models are top-down).

The second is an instable condition, close to the edge of chaos, in which the firm chooses different strategies and behaviours on the basis of the low level of information about the stakeholders. In this case, the firm presents a bottom up organisational model that shows a networking approach with numerous and heterogeneous stakeholders to add more information to support the abductive decision maker condition. Usually, the competitive strategy applied in this conditions that could be defined ‘with you or between us’ (we can think about the Apple case, which to survive planned a connective strategy/behaviour adding at his historical business, producer of hardware and software, also the mobile phone production and the ICT entertainment). In this case, the firm works to go towards the edge of the chaos strengthening the relationships and/or the brand.

The difference between firms that work in a deterministic area and those operating in a complexity area is that the first face conditions in which the dynamic order is more enduring and the structural and/or organisational changes occur only in less frequent turbulence. In the complexity area, the firm works in circumstances that are far from the order condition. Therefore, in the latter case the firms/brand operate in different industries and are frequently characterised by multi-face brand.

7 Conclusion

The systemic views, as discussed in the present paper, could be used to provide new lenses through which to analyse the management and organisation strategic capabilities to increase, in complex conditions, the information variety useful to plan behaviours to meet unpredictable scenarios.

To this end, the work presented a scientific and methodological basis on which to enrich the strategic intelligence literature, to stimulate empirical research, and to demonstrate the validity of the approach presented by other researchers and marketers.
In complex conditions, a variety of stimuli will affect the goals in ways that are different from simple S-R relationships. Rather, the changes can be related more appropriately to shifts in the cognitive models of the whole organisation that are themselves integral to world-view changes.

Managers and marketers could compensate for this weakness by considering complexity theory as a new way of reading dynamics and planning behaviours.

Empirically, this condition would be met by developing the information variety considering increasingly numerous and heterogeneous contextual variables to create dynamic plans to continually adapt the firm/brand behaviour to the stakeholders needs.

These variables treated stochastically (i.e.: average income, consumption capacity, changes in turnover of distribution channels, and others), allow managers to identify possible dissipative phenomena. This ability would allow marketers to identify the marketing and communications behaviours and/or conduct by the company necessary to contribute to the adaptation of the market system and, therefore, to reduce the instability that would otherwise be generated.

The paper aimed to raise the researchers’ and practitioners’ awareness to a new concept of management and marketing, understood as a process conducted in dynamic and unstable conditions.

These conditions no longer require a rational and linear approach from businesses/managers, designed to maximise results, but need to use greater analytic skills to increase the information variety to reduce the complexity level while better understanding the dynamic environment governed primarily by stochastic influences.

Finally, it is possible to conclude that also the management and the entrepreneurship are increasingly non-linear activities and processes.

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