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AS THE TURBULENT ENVIRONMENT IN PERIODS OF ACCELERATED DYNAMICS MODIFIES STRUCTURES AND FUNCTIONS OF VIABLE FIRMS

Introduction and literature review

Managing the tougher and faster dynamic changes in the environment has been the main competitive challenge for firms in recent decades. Firms have experienced the not so easy task of adapting to these environmental changes by acquiring superior dynamic capabilities (Teece et al., 1997) based on both distinctive resourses (Rumelt, 1984) and knowledge management (Grant, 1997). Struggling for survival has turn into a continual learning process in order to adapt and self-renew both products and processes as well as the overall organizational structure (Volberda and Lewin, 2003).

Stemming from the perspective on organizational structure change, for more than forty years, the literature on organizations and firms considered as cybernetic systems has been rich in authors who favour this interpretation (Kast–Rosenzweig, 1972; Beer, 1981; Jackson, 1993) as well as in texts that affirm the difficulty if not the impossibility of considering organizations as cybernetic systems (Tannenbaum, 1972, Sutherland, 1975, Morgan, 1982).

This paper belongs to the first group. We are convinced that by nature organizations can adapt and thus survive environmental changes thanks only to the control systems that regulate their existence and, for this reason, they "are" "control systems".

For this reason, even without recourse to the metaphor of mechanistic organization, which stands opposite to the organistic/organic one (Burns and Stalker, 1961), and recalling Norbert Wiener's statement that Cybernetics is the science of the study, design and simulation of "control and communication in the animal and the machine" (Wiener, 1948), we hold that "organizations" due to their intrinsic nature as self-regulating systems can in fact be observed as cybernetic systems (Ericson, 1972) that are self-controlled in order to remain vital and carry out the processes for which they were created.

The objective of this paper is to identify a framework for organizational structure design that enables firms to better cope with and adapt to rapid environmental changes, especially in turbulent environments and in periods of economic accelerated dynamics. A theoretical model will be proposed and empirical examples will be developed which shall consider the organizations-firms as Autopoietic Control Systems which structure and which goal is to control and maintain in homeostatic balance the vital variables even in the presence of environmental disturbances.

In particular an organization appears as a social system made up of a multitude of individuals, structurally linked together, that act in a coordinated and cooperative way to form organs specialized in various functions and processes that carry out a network of recursive processes that give rise to an emerging macro process attributable solely to the organization as a whole (Mingers, 2002).

The organization as a Control System: the autopoietic view

There are several theories and models that allow us to represent the organization as a Control System in which man acts as apparatuses at any level.

Among the various approaches we consider first and foremost the autopoietic view, which considers the organization as an organizationally-closed system that appears in all respects as an autopoietic machine, which is" […] a machine organized (defined as a unity) as a network of processes of production (transformation and destruction) of components which: (i) through their interactions and transformations continuously regenerate and realize the network of processes (relations) that produced them; and (ii) constitute it (the machine) as a concrete unity in space in which they (the components) exist by specifying the topological domain of its realization as such a network" (Maturana, Varela, 1980: 131) that tends to endure by continually regenerating the coordinated and cooperative behaviors of its processors (organs) and the network of processes which is a necessary condition for maintaining over time the internal structural coupling among organs and individuals.

In order to demonstrate which *structure* and which *vital processes* should characterize all companies in order to remain viable and in order to survive in all conditions, especially in a *turbulent economy* we believe useful to consider above all the well known Stafford Beer's model, which is universally recognized as the Viable System Model, or VSM (Beer, 1979, 1981). This model interprets organizations as viable systems that are open, recursive and adaptable and that, thanks to their cognitive and control structure, which is capable of

communicating with the economic and non-economic environment, tend to endure for a long time through continual adaptation, even in the presence of disturbances not foreseen at the time of the system's design and implementation.

The five vital functions of the productive organizaton

The preceding models (autopoietic and viable system models) refer to all organizations independently of the nature of the processes they carry out. But what do production organizations and companies actually do to remain vital and effectively adapt to environmental changes?

To clarify this operative aspect, Piero Mella has introduced a particular framework in which he has identified five *vital functions* that are strictly necessary for any productive organization to survive for a long period of time overcoming turbulences with cognitive functions that all enterprises must play.

Mella's model (2005, 2012, 2014) interprets firms as systems composed of five interconnected sub-systems of transformation, each of which, operating with maximum efficiency, carries out a vital function similar to what is proposed in the VSM (fig. 2).

While the VSM represents organizations from the point of view of their structural synthesis, the Model of the Organization as an Efficient System of Transformation (MOEST) sees them from a functional viewpoint.

The struggle for survival induces firms to continually learn in order to adapt and self-renew both products and processes as well as their overall organizational structure (Volberda and Lewin, 2003).

The VSM outlined in fig. 1 characterizes the vital organization as a structure composed of five interconnected sub-systems (SS):

SS1: Operations. This represents the operational units, which in turn are viable systems whose purpose is to achieve the operational objectives at the various levels by connecting with the environment, to which they are structurally coupled.

SS2: Coordination. The operational units of SS1 – which employ common resources and are potentially in competition regarding the objectives –are usually interfering systems that can thus produce, in their local values, an oscillatory dynamics that may cause inefficiencies. For this reason SS2 is charged with coordinating the interconnected operational units according to a logic entirely analogous to the one illustrated in fig. 2.

SS3: control. The operational units of SS1 each pursue local objectives. They must therefore be directed toward the achievement of the higher-order objectives, which refer to the organizational unit, based on a common programme. The SS3 are charged with this function. The same term used by Beer – the SS of control – clearly reveals that SS3 is a typical Control System based on planning. Since it is capable of activating a range of control levers, SS3 is charged with formulating the utilization strategies of the levers for the various objectives. Nevertheless, SS3 cannot detach itself from subsystems 4 and 5, as it forms together with them a higher-order subsystem that carries out cognitive activities and represents the organization's intelligence.

SS4: research of information on the environment (intelligence). The survival capacity and vitality conditions of the organization depend on the latter's capacity to continually observe the environment and forecast its "future" state in order to allow SS3 to formulate programmes of action to which it adapts the units and activities of SS1. SS4 represents the viable system element charged with proposing the vital objectives – based on foreseeable future scenarios – and translating these into programmes of action whose implementation it oversees.

SS5: policy. SS5 is necessary precisely to guarantee that the organization will have a unitary management, together with an entrepreneurial and managerial capacity that can define the policies needed to achieve the vital objectives.

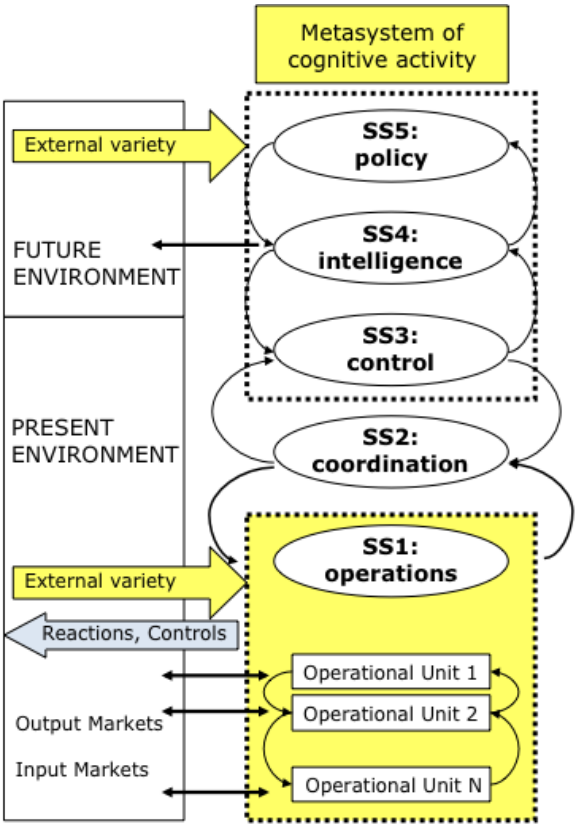

Fig. 1 – A synthesis of the Viable System Model

The MEST shows, above all, how each firm must necessarily carry out three efficient "technical" transformations, so defined because they concern the productive, economic and financial functions

instrumental in allowing the organization to maintain its functionality in order to satisfy the needs of its stakeholders.

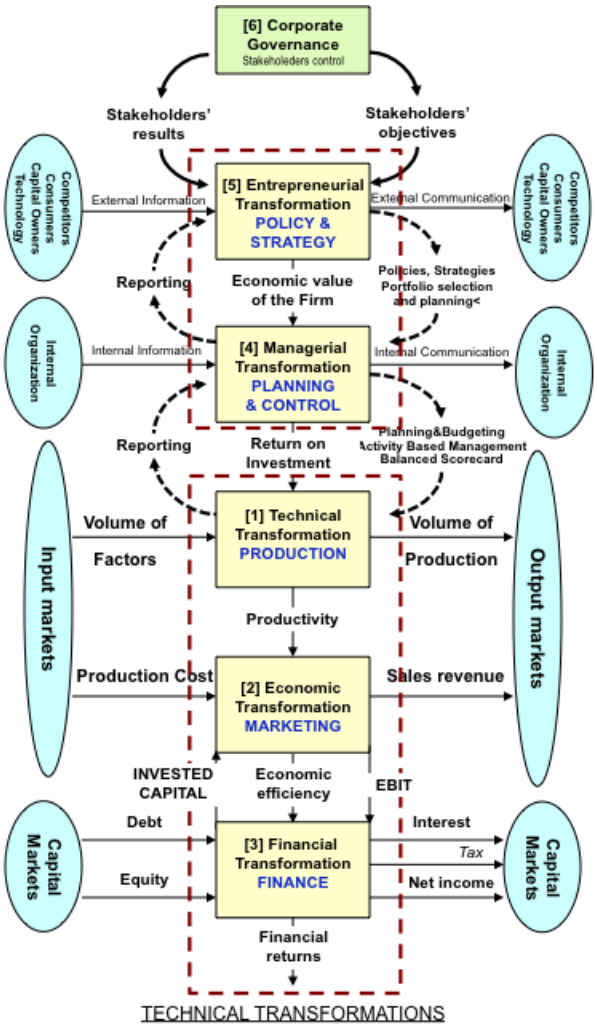

Fig. 2 – The MEST in synthesis (source: Mella, 2008).

1. PHYSICAL PRODUCTIVE TRANSFORMATION [TR1-P]. Inputs, having a given utility, are transformed into products capable of producing a greater utility. The efficiency of the productive transformation is measured by productivity, understood as the capacity of the transformation to generate maximum productive output with the minimum input (consumption) of factors, and by quality, understood as the maximization of the use function of products.

2. ECONOMIC OR MARKET TRANSFORMATION [TR2-E]. The firm tries to increase the value of the productive factors, or unit cost, by employing these factors to obtain products that can be traded at remunerative prices, greater than unit cost. Economic efficiency, understood as the capacity to cover the cost flows with revenue flows, is measured by the difference (or ratio) between revenues and the cost of production in a given period.

3. FINANCIAL TRANSFORMATION [TR3-F]. To carry out the economic transformation the organization must invest the capital necessary to build the productive structure. This capital – at least during the initial phase of the organization's existence, when it cannot be obtained by self-financing – must be obtained from investors who, with the expectation of a significant return, accept the risk from the business activity and provide their capital as a relative risk (financing, loans and various forms of debt) or an absolute one (underwritings, equity, shares). From this it follows that the firm must transform the capital raised – relative or absolute risk capital – into remuneration in the form of interest (for loan capital) and profit (for capital contributions). The efficiency of the financial transformation is determined by profitability, which is measured as the ratio between the average return on capital and the average amount of capital, with reference to a given period.

4. A necessary condition for the firm to carry out the first three "technical" transformations is the undertaking of two "cognitive" transformations: the entrepreneurial (n. 5) and the managerial (n. 4) transformations, whose function is to control the "technical" transformations (we will first consider the entrepreneurial transformation).

5. MANAGERIAL TRANSFORMATION [TR4-M]. This is typically a transformation of internal and external information into decisions and planning and control procedures – concerning production, market and financial transformations – which are aimed at achieving the system's performance objectives. Managerial thinking is typically procedural or conservative, in the spirit of carrying out only successful actions and never repeating the same error twice.

6. ENTREPRENEURIAL TRANSFORMATION [TR5-E]. This is typically a transformation of external and internal information into strategic decisions – creative, explorative or innovation-generating (Davenport, 1993), and not only adaptive or reactive decisions – regarding the business portfolio to manage, the technology, markets, prices, and the financial structure. The entrepreneurial transformation, especially in corporations, is subordinate to a system of corporate governance, which is the expression of the stakeholders that chooses the decision-makers and controls their activities.

Conclusion

The policies and strategies elaborated by the TR5-E represent the foundation of the Control System, normally defined as strategic, which acts at the business and general function level, as shown in Fig. 2. The TR4-M translate the vital survival objectives, identified by the TR5-E, into operational objectives for whose

achievement an operational managerial Control System is developed based on planning and budgeting.

The TR5-E, in turn, is subject to the Corporate Governance (C.Gov) of the stakeholders. From the previous models we can derive that firms can be conceived of as cognitive, intelligent and explorative agents whose long-lasting firm survival depends upon the continual learning process, which allows firms to adapt and self-renew both products and processes, as well as on the overall organizational structure (Volberda and Lewin, 2003). In this activity, and by acting as a living system, organizations are capable of forming representations of the external world and of acting (reacting or pro-acting) to regenerate and re-equilibrate the network of vital processes (Von Krogh and Roos, 1995) in order to couple themselves successfully to the environment and survive to its dynamics even by modifying their own structure in line with the variations permitted by the genetic and operative programme (Uribe, 1981).

As a cognitive and viable system, the organization-firm becomes, in all respects, an intelligent and rational economic agent that develops the capacity to control its own structure, its own processes and its own dynamics in order to achieve increasingly higher levels of efficiency, according to the MEST logic.

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