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Autopoiesis in Organization Theory and Practice

Rodrigo Magalhães

RON SANCHEZ

AUTOPOIESIS IN ORGANIZATION THEORY AND PRACTICE

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AUTOPOIESIS IN ORGANIZATION THEORY AND PRACTICE

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United Kingdom • North America • Japan India • Malaysia • China Emerald Group Publishing Limited Howard House, Wagon Lane, Bingley BD16 1WA, UK

First edition 2009

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British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN: 978-1-84855-832-8 ISSN: 1877-6361 (Series)



Awarded in recognition of Emerald's production department's adherence to quality systems and processes when preparing scholarly journals for print



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PART I INTRODUCTION

Chapter 1

Autopoiesis Theory and Organization: An Overview

Rodrigo Magalhães and Ron Sanchez

We human beings are not rational animals; we are emotional, languaging animals that use the operational coherences of language, through the constitution of rational systems, to explain and justify our actions, while in the process and without realizing it, we blind ourselves about the emotional grounding of all the rational domains that we bring forth. (Humberto Maturana, 1988, p. 787)

1 Introduction

This introductory chapter elaborates some of the key ideas which shaped the concept of this book. The overriding idea is that autopoiesis theory has the potential to provide a unifying framework for the study of organizational phenomena in the 21st century. Although organization studies have recently had no shortage of new paradigms and approaches — such as postmodernism, phenomenology, ethnometho-dology, reflexivity, and critical theory — the field seems to be expanding in ways that make it increasingly difficult to comprehend, especially for the uninitiated.

In the 1950s and 1960s, open systems theory, together with sociological systems theory, was enormously influential in providing a coherent framework for the study of organizations and their environments. These approaches were in important respects motivated by ideals of order, stability, and predictability. So influential were they that the paradigm they defined is still prevalent today. Although today's organizations and their environments are often characterized by transformation, emergence, much unpredictability, and a strong emphasis on people, the systems approach to understanding organizations is still not being conveyed in a coherent manner, especially to students and managers. The reason for this, in our view, is the

Autopoiesis in Organization Theory and Practice

Advanced Series in Management, 3–25

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ISSN: 1877-6361/doi:10.1108/S1877-6361(2009)0000006002

lack of a unifying framework for explaining a spectrum of organizational phenomena, from stable to highly dynamic organizations and environments.

Autopoiesis is a concept developed through the pioneering work of Maturana and Varela (1980, 1992) in biology, primarily as a construct which enabled a distinction to be made between living and nonliving systems. The concept and its postulates have slowly been gaining ground and generating enthusiasm among many scientific communities. For Fritjof Capra, for example, Maturana and Varela's book *The tree of knowledge* (1992) contains no less than the "outlines of a unified scientific conception of mind, matter and life" (on book's back cover). King (1993) suggests that autopoiesis is developing into a new theoretical paradigm in the social sciences, and von Krogh and Roos (1995b) suggest that autopoiesis offers the basis for a new general systems theory.

We believe that the organization of the future needs an epistemology (i.e., a theory of organizational knowledge) which is radically different from epistemologies that have guided organizational thinking hitherto, and that autopoiesis theory, with due adaptations, can furnish such an epistemology. In this chapter we begin by providing a brief overview of the key tenets of autopoiesis theory applied to organizational settings. Next, we discuss the organization of the future, starting with the external pressures that are increasingly being exerted on social organizations of all types and inducing them to undertake new kinds of transformations. This chapter identifies important challenges facing organizational thinkers, now and in the foreseeable future, that exist not only as the result of the external pressures, but also as a consequence of internal developments in organization science and theory. The chapter concludes with an overview of the topics addressed by the contributors to this volume.

2 Key Tenets of Autopoiesis Theory Applied to the Study of Organizations

For many people, the adoption and use of concepts from autopoiesis theory in organizational analysis is uncontroversial. However, some organization scholars are reluctant to adopt autopoiesis concepts or theory because of concerns as to whether organizations really are autopoietic systems (Mingers, 2002, 2004). Thus, while some authors choose to apply autopoiesis theory to organization studies following strict ontological principles, others are less convinced theoretically and treat autopoiesis as a metaphorical perspective. The controversy between these two approaches is somewhat surprising given the freedom with which metaphors are used in much organizational theorizing (Morgan, 1997).

The reluctance that many authors show in applying autopoiesis to social settings may be partly due to the fact that both Maturana and Varela stated in their writings that autopoiesis is not a social theory. From his personal contacts with Humberto Maturana, Zeleny (2007) has added a further perspective, suggesting that the creators of autopoiesis were so careful in pointing out that the theory should be left out of the social domain because of the political climate of Chile in the 1970s. Zeleny suggests that Maturana and Varela may have been apprehensive about the misuse by the prevailing political powers of the mechanistic nature of their theoretical propositions in the biological sciences in the social sphere.

Nevertheless, in the following, we provide an overview of the principal applications of autopoiesis theory in organizational settings.

2.1 Organization and Structure

In the organizational world, there are forces which are informal, enduring, and hard to change (e.g., cultural norms), and others which are formal, often ephemeral, and more amenable to adoption (e.g., processes, procedures, and tasks). The latter are inevitably influenced and shaped by the former. In organizational theory and research, these two kinds of forces are usually treated separately, because it is often very difficult to reconcile them, although from the point of the practitioner, this is always disappointing. Autopoiesis theory, however, offers organizational theorists and researchers new possibilities to address such disparate organizational phenomena in a much more integrated fashion. Take the concepts of *organization* and *structure*, for example. Within the autopoietic perspective, *organization* means necessary relationships or network of rules that govern relations between system components and that thereby define the system conceptually. *Structure* means the actual relations between the components that integrate the system in practice and that satisfy the constraints placed by the *organization*.

Using the tenets of autopoietic theory, Zeleny (2005) interprets organizations as networks of interactions, reactions, and processes identified by their *organization* (network of rules of coordination) and differentiated by their *structure* (specific spatio-temporal manifestations of applying the rules of coordination under specific conditions or contexts). Following these definitions, Zeleny argues that the only way to make organizational change effective is to change the rules of *behavior* (i.e., the organization) first, and then change processes, routines, and procedures (i.e., the structure). He explains that it is the system of the rules of coordination, rather than the processes themselves, that defines the nature of recurrent execution of coordinated action (recurrence being the necessary condition for learning to occur). He states: "Organization drives the structure, structure follows organization, and the observer imputes function" (ibid, p. 197).

Espejo, Schumann, Schwaninger, and Bilello (1996) adopt similar terminology, but instead of *organization* they refer to an organization's *identity* as the element that defines any organization, explaining that it is the relationships between the participants that create the distinct identity for the network or the group. Organization is then defined as "a closed network of relationships with an identity of its own" (ibid, p. 75). Like Zeleny, Espejo et al. (1996) also see the organization's *structure* as being the differentiating factor. While organizations may share the same kind of identity, they are distinguished by their *structures*. People's relationships form routines, involving roles, procedures, and uses of resources that constitute stable

forms of interaction. These allow the integrated use and operation of the organization's resources. The emergent routines and mechanisms of interaction then constitute the organization's *structure*. Hence, just like any autopoietic entity, organizations as social phenomena are characterized by both an *organization* (or identity) and a *structure*. The rules of interaction established by the organization and the execution of the rules exhibited by the structure form a recursive bond.

The adoption of autopoietic notions of *organization* and *structure* by conventional organization theory may create exciting new opportunities to establish theoretical and practical links between the structurally determined or "engineered" parts of an organization, such as its business processes, and the emergent properties arising from the actions and interactions of human actors that jointly shape the organization's identity. Our understanding of the *heterogeneous engineering* (Law, 1987) of the multitude of soft and hard aspects of social organizations can greatly benefit from an elaboration of this dichotomy and the ways in which the two dichotomous parts interact and influence each other. We return to this point below.

2.2 Operational Closure, Self-Referentiality, and Recursivity

An *autopoietic system* is defined as a system that is generated through closed organization processes of production such that the same organization of processes is reproduced through the interactions of its own products (components). Thus, the organization of components and component-producing processes may remain relatively invariant through the interactions and turnover of components. If an organization (the specified relations between components or processes) were to change substantially, there would not necessarily be a change in that system's identity. What would change is the system's structure (its particular manifestation in the given environment) within the degrees of freedom allowed by the specified relations between components. In this way, the development of a system's structure is done recursively. In order to enable the evolution of structure through such recursive behavior — which is the essence of autopoiesis — the autopoietic system needs to be *operationally closed* (Zeleny, 2003).

Mingers (2001) argues that although autopoiesis cannot be applied as a whole to social theory, there are some key principles of autopoiesis that are applicable, namely the principle of an organization's operational closure. This argument is based on the assumption that throughout the entire hierarchy of systems proposed by Boulding (1956), all levels of systems exhibit characteristics of organizational closure. As we have explained above, in autopoiesis the main requirement for identifying *living*, *autonomous systems* is not the existence of a set of inputs and outputs, but an internal coherence that results from the interconnectedness of a system's inputs and outputs (Varela, 1984). In this respect, organizational closure "requires some form of *self-reference*, whether material, linguistic, or social, rather than the more specific process of self-production" [emphasis added] (Mingers, 2001, p. 111).

Organizational closure and self-referentiality are criteria that unequivocally define social systems. The various institutional systems and subsystems that make up a

social system become closed domains of communication, autonomous and independent, while maintaining strong forms of interdependence (structural couplings) because they rely on each other to perform many societal functions. Interactions between subsystems are often quite well defined, for example, in business organizations. Communications about the environment may give rise to strategic marketing communications that, in turn, trigger communications among product development, capital budgeting, and production subsystems. Such communication activity arises from interactions among organizational actors that may enhance or constrain further communication activity.

Understanding organizational closure is one of the most important insights that an autopoietic perspective can bring to organizational analysis. The influence of open systems theory has sometimes helped to popularize the notion that organizations are wholly open systems. However, there is host of organizational phenomena that cannot be explained as open systems phenomena, but that can be explained through autopoietic systems theory's concept of organizational closure. Organizational culture, for example, cannot be adequately explained by invoking the principles of open systems theory. In more practical terms, an understanding of the closed and recursive nature of its broader social system is crucial for an organization's actors to understand the environmental impacts of the organization's activity. Organizational closure also provides the conceptual and practical foundation for studying the systemic feedback loops that writers such as Argyris (1977), Senge (1990), and Sanchez and Heene (1996) have reinterpreted for the managerial world.

2.3 Structural Coupling

Goldspink and Kay (2004) suggest that autopoiesis also provides the basic concepts for understanding the mechanics of sociality and therefore of organizations. They state:

Humans exist in and through domains, which are the product of their structural coupling with an environment. This environment is the world around them, including other humans, and exists both physically and causally. As humans enter into reciprocal interaction over time there emerges, as a consequence of structural coupling, a certain alignment of their behaviors, including their linguistic behaviors. Hence we can refer to the resulting domain as a consensual domain. This domain now forms the basic unit of social analysis, and exists in a causal sense but not in a physical one. (ibid, p. 605)

Human beings are autopoietic, which means that as individuals we are all operationally closed. To illustrate, we have all experienced occasions when no matter what we say and explain to our dialoguing counterpart, he or she is unable to comprehend our point of view. This situation can last for a few minutes, or hours, or may endure for years and even lifetimes. Operational closure can be observed in our daily interactions at work, in the shopping mall, and in the family. The only way to overcome autopoietic closure is by building structural couplings. The nature and degree of structural coupling that emerges when two or more individuals interact is a defining feature of the macro system of invisible rules and procedures that characterize social institutions.

Organizational closure, however, should not be confused with the notions of "closed" and "open" systems from traditional systems theory. Maula (2006) argues that openness and closure are not only simultaneous phenomena, but they also necessitate each other. In other words, there are no environmentally "closed" systems. An organizational closed system cannot be completely closed to its environment, because it cannot be completely unresponsive to environmental signals and perturbations. Organizational closed systems are therefore closed with respect to their own organization and structure, but they may nevertheless maintain intense interactions with the environment. Through recurrent environmental signals, perturbations, and triggers, a system becomes *coupled* to its environment. Such coupling is achieved through changes in the system's structure, even while the organization remains autonomous and closed (Zeleny, 2003).

Structural coupling is an essential concept in understanding the decentralized networked organization. The concept of coupling provides the basis for understanding how an organization may be fragmented in time and space while retaining its unity as a system. This autopoietic concept has a direct counterpart in the organizational terminology created by Weick (1976) when he refers to "loose coupling." He asserts that organizations are loosely coupled systems and defines loose coupling as "a situation in which elements are responsive but retain evidence of separateness and identity" (Orton & Weick, 1990, p. 203). In autopoietic terminology, "responsiveness" refers to compensating actions in response to perturbations from the environment. "Separateness and identity" refer to the maintenance of the network of interactions that defines the organization of the system. Orton and Weick (1990) further propose loose coupling in organizational design requires more *modularity* in organizational design (Sanchez & Mahoney, 1996), a broader range of requisite variety (Ashby, 1956), and greater behavioral discretion. They also suggest that an organization's compensatory mechanisms for loose coupling may include enhanced leadership, focused attention, and shared values.

The implications of the notions of *structural coupling* and *loose coupling* for organization theory are very significant. They underpin the representation of organizations as composites for which words such as *bricolage* or *assemblage* are increasingly being used as descriptors (Ciborra and Associates, 2000).

2.4 Language and Languaging

Von Krogh and Roos (1995b) made one of the most significant contributions to integrate autopoiesis into management theory and research. In so doing, they advanced an anticognitivist position in the organizational knowledge debate. They reject the notion that knowledge is a given and that the task of organizational systems is to represent it as accurately as possible. Instead, they argue that knowledge is embodied in human beings and that representations of the world in the human mind

come forth as a result of actions or observations by human beings. This point is illustrated by the often cited statement by Maturana and Varela (1992), "*Knowledge is what brings forth a world*." The following passage from von Krogh and Roos (1995b, p. 52) exemplifies this crucial issue:

Imagine that you are about to enter an office that is new to you. Your experience (knowledge) tells you to take an initial sweeping look in order to locate the reception desk, your assumed point of entry into the inner circles of the office. Having located what you believe is the reception desk (world) you take the first steps towards the desk. In doing this you get a glimpse of a corridor on your right-hand side in which you see a door and on which you locate a name plate (world). You recognize the name on the door to be the person you are supposed to visit (knowledge).

The ideas that the world is brought forth in knowledge and that knowledge is not abstract but is embodied in human action frame the discussion about individual versus organizational knowledge (Sanchez, 2001; Sanchez & Heene, 2006). Von Krogh and Roos (1995b) argue that the bridge between socialized and individualized knowledge is achieved by means of language. Language is what allows action to be coordinated in the organization, and such coordination is achieved through organizational members making useful distinctions about the organization (an important form of organizational learning). The first and broadest distinction is the concept of "organization" itself. Linguistically, the organization has to be distinguished from its environment. The emergence in social interactions of a new entity, in this case the organization, presupposes a languaging capability. Organizational members conceive of the organization they are working for through language, and from this very broad distinction (i.e., the organization from the environment), finer distinctions can start to be made. For example, there will be linguistic distinctions associated with the concept of "product" in a given organization. In this way, an organization develops its own languaging process and resulting language that conveys its own system of meaning. An organization's language-enabled system of meaning, in turn, develops its own autopoiesis.

"Languaging" is the expression used by Maturana and Varela (1980, 1992) to denote the act of using language. Given its dynamic nature, languaging fulfils a dual but conflicting function. On one hand, because languaging contributes to creating a unique identity for an organization (e.g., language is integral to its culture), languaging can be instrumental in bringing about change. On the other hand, language is important in maintaining the *status quo* and may thereby be a source of resistance to change, given the self-referential nature of autopoietic systems. Hence, "to allow for rules and languaging that give way for effective action" (von Krogh & Roos, 1995b, p. 101) is one of the main goals for and functions of socialized organizational knowledge. Von Krogh and Roos (1995a) suggest that knowledge development in organizations comes about through the innovative use of old and new words and concepts — for example, through managerial efforts to shape language development in an organization.

2.5 Emotions and Emotioning

One form of communication in organizations is the *conversations* that can take place between two or more persons. When conversations happen and become recurrent among the same group of people, a social network, group, or community is formed. Conversations allow a structuration process (Giddens, 1984) to evolve, and once the structure of the network is formed, conversations become organizationally closed and self-referential. Metaphorically speaking, conversations have embedded in them the genetic code of a social network, through the three elements of structure — signification, domination, and legitimation (Giddens, 1984). The internal dynamics, roles, and values of networks, groups, and communities develop through conversations. Hence, for a newcomer to become part of a group — a behavioral domain — he/she has to learn, through participation, the group's genetic code and his/her role that is implicit in it. In this way, the social individual becomes structurally coupled to the social network.

Social membership means accepting the unwritten rules of a group and (thereby) being accepted by the group.¹ Without mutual acceptance on some basis, cooperation and social action are not possible. Social boundaries, social norms, and emerging social practices transcend the individual and remain even after individuals have departed. Particular members may join or leave, but the social organization carries on. Moreover, organizations are based on self-transcendence — the reaching out beyond one's own existence in order to create shared understandings with others. In empathizing with colleagues or customers in the process of socialization, the boundaries between individuals are diminished. In the process of committing to a group and becoming part of the group, the individual transcends the boundaries of the self. In the process of internalizing organizational knowledge, individuals cross the boundaries and enter the domain of the group or an organization (Nonaka et al., 2001).

The notion of *boundaries* of social systems implies a complementary notion of organizational *contexts*. Context can be understood as a situation in which individuals, work teams, or an organizational unit exerts a significant influence on internal and external interpersonal relationships. Kakabadse and Kakabadse (1999, p. 7) assert that "the power of context is substantial, for context helps form the attitudes and perspectives individuals hold about life, work, people, and organization." Viewed through the lens of autopoiesis theory, the notion of organizational context can be seen in a new light. Maturana (1988) argues that emotions form the background for the embodiment of all our knowledge and thus cannot be separated from logical thought in everyday action. For Maturana, emotions are *the* ingredient

¹Maturana (1988) argues that decisions about acceptance and rejection by groups are likely to be emotional rather than rational – i.e., emotions are the ingredient that makes social phenomena possible, through mutual acceptance (love, in his terminology). Sanchez suggests (here), however, that this view may also reflect Maturana's Latin cultural context in Chile, and that other cultural contexts may emphasize more rational bases for acceptance or rejection of members by social groups (e.g., trust among managers in a network of frequently transacting firms, commitment to adhere to the norms of a professional group, and a recognized common interest in a coordinated community response to an opportunity or threat).

that makes all social phenomena possible, through mutual acceptance. However, in our western-style management we have evolved a paradigm that encourages the separation of logic and emotion. One of the earlier voices to denounce this state of affairs was Selznick (1957, p. 80): "The importance of values is affirmed but the choice of goals and of character-defining methods is banished from the science of administration." However, this situation may be changing — for example, through the emergence of the idea of *karma capitalism* (which we will revisit further on) as exemplified by the notions of soft power and smart power put forward by Nye (2008). Such movements suggest that there is a renewed perception of the importance of intangible elements like attitudes, emotions, and values in the workplace. The merging of the economic and emotional contexts of firms, for example, is at the heart of the holistic representation of firms in new strategic management theory (Sanchez & Heene, 2004).

3 Organizations and Organizing in the Future

In this section we propose a view of the organization of the future in two important dimensions. First, we consider external pressures at the macro level that will increasingly exert a force for change for all types of organizations. Second, we suggest some major internal organizational challenges that both organizational researchers and practitioners will be challenged to face in the foreseeable future. Of course, both the external pressures and the internal organizational challenges are interrelated (see Figure 1).

3.1 New External Pressures

James March (2007) suggests that the field of organization studies may be entering a fourth "invasion" era characterized by the growing influence of information technologies and biological advancements on social life and by *the earth's declining ability to sustain the current conduct of the rapidly growing human species.*² We agree with this broad assessment and suggest that four trends will be decisive in shaping the organization of the future:

- The earth's declining capacity to sustain the current practices of the human species;
- New kinds of capitalism, leading to the individualized corporation;
- Technical and social networking as the basis for decentralized, autonomous organizational forms;
- A world fuelled by ubiquitous, real-time data and information.

 $^{^{2}}$ The previous critical landmarks according to March (2007) were (1) the Second World War; (2) the social and political protests of the 1960s and early 1970s; and (3) the collapse of the Soviet Empire and the triumph of the markets.



Figure 1: Major external pressures and key challenges of the organization of the future.

In particular, we suggest that the environmental issues associated with global warming are bound to have a marked effect on many aspects of organizations and organizational life. A central challenge for organization researchers therefore will be to understand how organization studies can contribute toward a world that is sustainable, not only in business terms, but more fundamentally in terms of the survival of the human species. The role of organizations in dealing with the *earth's declining ability to sustain the human species* will depend to a large degree on the approaches and concepts adopted by organizations' managements on a global scale.

A related trend is the emergence of new attitudes and values in capitalism as a basis for economic organization, as exemplified by the development known as *karma capitalism*. The growing awareness of environmental issues that at least some corporations have been displaying in recent years is helping to bring about a new business ethos, which can be characterized as a more socially, environmentally, and morally concerned approach to business. In the past many companies would bow only to the demands of their shareholders and customers; increasingly, however, companies are forced to consider their impact on everyone with a direct or indirect interest. Growing numbers of business scholars are advising executives to pursue broader purposes than just making money and are urging companies to take a more holistic approach to business, taking into account the needs of shareholders, employees, customers, society, and the environment (Sanchez & Heene, 2004).

Developments like karma capitalism reflect the convergence of many global trends. The Nobel Peace award to Muhammad Yunus for promoting micro credit as a new form of capitalism for the very poor also reflects these trends. However, capitalism is also changing from within the firm, often leading to dramatic changes in the relationship between the firm and the individual. Such changes are captured in the notion of *The individualized corporation* as proposed by Ghoshal and Bartlett (1998). More than ever before in some firms, the individual worker is becoming the center of management concerns. This trend is due to the ongoing shift in the economy from traditional industries based on manual workers to new enterprises based on knowledge workers who are now the crucial asset in many businesses. At the same time, while many corporations can no longer guarantee employment, growing numbers of knowledge workers no longer need or are even concerned about guaranteed employment. As a result, the nature of the bond between the organization and its employees is changing radically, and the notion of a "moral contract" between a firm and its employees is beginning to replace legal contracts as the basis for employment (Ghoshal & Bartlett, 1998).

The organizational world is also being transformed by phenomena that run counter to the traditional command and control model of organization. Although the idea of the "networked organization" has been a topic of discussion for a couple of decades, we are now entering an era in which we can observe real decentralized, autonomous, networked organizations on a global scale. What is important in this development is that not only organizations as institutions are able to network with other organizations, but *people* are now able to network person-to-person as never before. Internet and mobile telecom technologies are enabling people to meet and to coordinate their activities in ways that are profoundly affecting their lives, both professional and private. Perhaps the best example of the positive potential of a global, decentralized, autonomous, networked organization is the World Wide Web. However, other examples such as Al-Qaeda, where individual networking capabilities seem to play a predominant role in organizing, show that such developments are not limited to corporate or high-tech domains. Both examples not only follow a decentralized, networked form, but also lack any kind of conventional management structure. In a similar manner, the Linux phenomenon has no formal structure, employees, or budgets, and its product is free. Yet Linux is already posing a serious threat to the largest software firms in the world (Hernes & Bakken, 2003).

Networking (individual and institutional) is of course intimately related to the proliferation of information technology (IT) in human society. Ever faster enterprise LANs, telephony over IP data networks (VOIP), mobile telephony, home networks, and Internet access in automobiles, planes, and trains are all having a major impact on an organization's and an individual's capability to transmit information. As citizens of the world, we are increasingly surrounded by *real-time* or near real-time data and information. When an ice sheet breaks loose in the Arctic, citizens of Africa learn about it a few minutes later. If a car breaks down in Outer Mongolia, the manufacturer's assistance services in Europe will be alerted instantaneously. Online DNA data is being used by international police forces to solve crimes in a fraction of the time it took to solve similar crimes in the past.

An even greater effect of IT than the ubiquity of information is its ability to represent large chunks of organizational life as information. Balanced scorecards, dashboards, value added analytics, customer relationship management systems, early warning systems, trend monitoring, and knowledge management are examples of systems that facilitate representation of many aspects of an organization. The ever increasing capability to collect, organize, transmit, and use information anywhere is bringing the notion of the real-time enterprise into reality (Kuhlin & Thielmann, 2005). There is a growing realization, however, that organizations need to harness such information by developing more sophisticated representational techniques to enable hitherto unthinkable levels of organizational self-awareness (Magalhães, Sousa, & Tribolet, 2008).

3.2 New Internal Organizational Challenges

3.2.1 New Epistemological Approaches Inspired by Non-linearity and Complexity. Complexity research has its roots in long-standing traditions in economics (Adam Smith's hidden hand), natural evolution (Darwin's blind watch making), neuropsychology (Hebb's cell assembly), and computation (von Neumann's self-reproducing automata). From the point of view of the social sciences, complexity theory does not try to make detailed predictions, but rather raises new kinds of questions and possible organizational actions. Analyzing social systems from a complexity perspective does not ensure the derivation of specific outcomes, but may "foster an increase in the value of populations over time, whether populations are livestock, technical innovations, or new strategies for business competition" (Axelrod & Cohen, 2000, p. 19).

Experiments in artificial intelligence, for example, have shown that emergence and self-organization are implicate order phenomena which follow a bottom-up, parallel-processing, distributed-control logic in which local interactions within populations of semiautonomous entities are usually governed by a system of simple rules. When recursively applied to individual behaviors and interactions among the components of a system, unpredictable global behavioral patterns may be observed under certain conditions. Human waiting queues often exhibit, at least temporarily, the voluntary self-organization characterized by its own specific behaviors, rules of conduct, choice of interpersonal distance, and modes of communication. In short, as has been suggested by Gell-Mann, we are able to observe "surface complexity arising out of deep simplicity" (Lewin, 1992, p. 14).

In organizations the situation is analogous — i.e., whatever phenomenon one wishes to study will always be dependent upon a higher-level context, which in turn has dynamic links with the event under scrutiny. In effect, one needs to understand how individual components contribute to the behavior of a holistic organizational context, but it is also crucial to understand how the context influences the behavior of each individual component. As a case in point, consider how a system of local trading agents develops prices that cause global inventories to clear or how companies form networks of trust that ensure individual customers' loyalty and continued growth (Axelrod & Cohen, 2000).

Autopoiesis has a counterpart in the cognitive sciences — enacted cognition which may also be considered part of the complexity paradigm. Autopoiesis and enacted cognition are interrelated because in explaining the evolution of living organisms, autopoiesis invokes the notion of enacted cognition (Varela, Thompson, & Rosch, 1991) to suggest how human beings understand the world and how knowledge is formed. For Varela et al. (1991), cognition cannot be understood without "common sense," by which they mean our physical and social history, the mutual co-specification between the knower and the known or between the subject and the object. They use the term enactment to denote interpretation or the act of bringing forth meaning from a background of understanding. They adopt a nonobjectivist view of knowledge, in which knowing is the result of an ongoing interpretation process that emerges from our ability to understand and which enables us to make sense of our world. The notion of the embodiment of cognition has been strongly influenced by the philosophy of European thinkers such as Heidegger, Merleau-Ponty, and Foucault, who since the beginning of the 20th century have challenged one of the most entrenched suppositions of our scientific heritage — i.e., the rationalists' view of the world as independent from the knower.

The application of complexity concepts and theory to economics, management, and organization has attracted a great deal of interest and generated a large number of academic communications (see, for example, the specialized journal *Emergence: Complexity & Organization, E:CO*). At the risk of oversimplifying the issue, we mention the key conclusions from one of the earliest investigations in the field. Trisoglio (1995) posits that economics and much of management theory is based on reductionist, linear, and equilibrium-centered models of the world. Although they may be simple, such models would be seriously misleading as descriptions of a "reality" that is manifestly often nonlinear. Economies and organizations routinely manifest the properties of nonlinear and chaotic systems, exhibiting creation of both order and disorder as well as pattern and regularity.

The link between autopoiesis, complexity, and social organizations has been described by Goldspink and Kay (2004):

Autopoiesis provides a model of how phenomena (which we may now call social phenomena) *emerge* from the complex (and non-linear) interplay between the heterogeneous (in having unique ontogenies) agents (people) which make it up. Complexity then allows us to explain the resulting dynamics by describing the generative processes that link *empirical* observation and causal *actuality*. Social systems can be seen as a specific class of complex systems and it is autopoiesis which clarifies the distinguishing characteristics of this class, in particular the linguistic/reflexive character of social agents. (ibid, p. 615)

3.2.2 The Search for a New Organizational Paradigm. The situation in organization science/studies today is that the overwhelming majority of textbooks used in graduate and postgraduate courses convey linear, reductionist representations of organizations that are typical of what we might call the old paradigm. An example is the book by Scott and Davis (2007) which undertakes to bring together much of the accumulated wisdom in rational, natural, and open systems views of organizations. Although warning about the dangers of clinging too much to the past when trying to

move toward the future, these authors nevertheless present an overview of organization theory that offers a fairly simplistic divide between the old (closed systems) and the new (open systems); see Table 1.

As is demonstrated by continuing organizational failures in every area of activity, open systems theories have not "solved" the problems of organizations. One reason for this may be the current relative neglect of "old fashioned" closed systems approaches, according to the summary of schools of thought expounded by Scott and Davis (2007). Although open systems have brought crucial advances in organizational thinking — especially in fostering new understanding of the contingent nature of organizational designs — the open systems view still has major unresolved problems. Behind this state of affairs may be the way that the open systems framework has been utilized by the research community in the organizational sciences.

Almost three decades ago, Pondy and Mitroff (1979) pointed out that "we have seriously misunderstood the nature of open systems and have confused them with natural or control systems" (ibid, p. 22), and that "organization theorists seem to have forgotten that they are dealing with human organizations, not merely disembodied structures in which individuals play either the role of in-place metering devices (...) or the role of passive carriers of cultural values and skills" (ibid, p.17). These comments by Pondy and Mitroff were early warnings about the inherent limitations of an emerging new organizational paradigm. Three decades later, however, these problems persist.

So, why is change moving so slowly? Is the debate between open versus closed systems ended? Why do we find it so hard, as an intellectual community, to move away from overly simplistic input–output organizational models — as if the issue of the interchange between the organization and its environment were clear-cut and unproblematic? Given the current institutionalization of organization studies, can autopoiesis theory play a role in renewing systems theory as applied to organization studies?

3.2.3 The Turn Toward Practice, Transdisciplinarity, and Multidisciplinarity. Organization theory is paradigmatic because of its deep (and sometimes unrecognized) underlying assumptions. The organization — a concept — can be researched from a considerable number of perspectives, as Morgan's (1997) metaphors amply illustrate. A tendency within the field has therefore been to adopt multiparadigm or transdisciplinary research approaches that do not favor any one approach. Gibbons et al. (1994) suggested that there are two opposing modes of knowledge production in society. Mode 1 refers to the traditional practices of science and research focused on developing and testing theories about the social world, while Mode 2 focuses on developing ideas that have relevance and can be applied in contemporary organizations. Many proponents hold a view that the organization sciences are moving toward Mode 2, and that they need to be not only more transdisciplinary but also more problem-oriented.

The turn toward Mode 2 for knowledge production comes with a strong assumption that a similar turn is under way in the theories of organization and strategy (Whittington, 2006). However, as we are well aware, an organization is a social construction that cannot be engineered as neatly as a bridge or a molecule.

Levels of analysis	Closed syst	ems models	Open sy	tems models
	1900–1930, Rational models	1930–1960, Natural models	1960–1970, Rational models	1
Social Psychological	Scientific Management (Taylor, 1911) Decision Making (Simon, 1945/	Human Relations (Whyte, 1959)	Bounded Rationality (March & Simon, 1958) Contingency Theory (Lawrence & Lorsch,	Org
Structural	Bureaucratic Theory (Weber, 1947)	Cooperative Systems (Barnard, 1938)	Comparative Structure (Woodward, 1965; Pugh et al., 1969; Blau, 1970)	Soc
	Administrative Theory (Fayol, 1949)	Human Relations (Mayo, 1945)		
		Conflict Models (Gouldner, 1954)		
Ecological			Transaction Cost (Williamson, 1975)	Org
			Knowledge-Based (Nonaka & Takeuchi, 1995)	Res (1 Inst (1) R &

Table 1: The conventional wisdom of organization theory.

Organizational engineering has to be carried out with an understanding of organization as complex systems made up of a wide variety of elements. These elements may be subsumed into two major categories: the natural and the intentional (McKelvey, 1997). The natural are the human, behavioral, action-oriented, and mostly intangible elements that are often problematic to model formally but that cannot be ignored in any attempt to model an organization. The intentional elements that interact with the natural elements in an organization.

In line with advances in many of the sciences, McKelvey (1999) argues for a "model-centered" organization science in which research would be bifurcated into two types of activity. On one hand, idealized models of organized or organizing activity would be devised and tested and, on the other hand, descriptive analyses and case studies would be carried out in order to compare "the isomorphism of the model's idealized processes/structures with that portion of real-world phenomena" (ibid, p. 18). Models do not attempt to explain real-world behavior; they only attempt to explain "model" behavior. In order to make models meaningful and useful to real-world organizations, idealized models must be validated against real-world phenomena. This, in turn, requires a transdisciplinary research disposition. Can autopoietic epistemology inspire and frame a transdisciplinary research disposition? Can it provide the much needed bridge between the hard and the soft sides of the organization sciences?

3.2.4 The Networked Nature of Organizations and Organizing. Increasingly, organizations are being conceptualized as networks with no substance except a system defined by its knowledge (Von Krogh & Roos, 1995b). The knowledge of the organization can also be conceptualized as a network, put together in the following manner (Hanseth, 2004):

- (1) Individual "pieces" of knowledge are related and interdependent.
- (2) Different individuals (or actors) adopt the same "piece" of knowledge and that "piece" becomes embedded into organizational routines.
- (3) As individuals (or actors) and routines are linked together, they become interdependent, and thus begin forming the network.

One of the key characteristics of the networking perspective is the interactions that organizational members design and develop in seeking to communicate with other organizational members. Through interactions, organizational members perform socially embedded (i.e., role-based) actions and build relationships at a variety of levels (local, group, intergroup, organization, and interorganization). The relational nature of organizational life and the conception of an organizational member as a social actor are also features of actor-network theory (ANT), an important landmark in contemporary organization theory. As tool for understanding crucial organizational concepts, the network concept can be explained as follows:

[the network] has the same relationship with the topic at hand as a perspective grid to a traditional single point perspective painting: drawn first, the lines might allow one to project a three-dimensional object onto a flat piece of linen; but they are *not* what is to be painted, only what has allowed the painter to give the impression of depth before they are erased. (Latour, 2005, p. 131)

ANT can be seen as a systematic way to bring out the network infrastructure that is usually omitted in "heroic" accounts of scientific and technological achievements (Ryder, 2008). ANT views social change as an emergent process that is initiated and guided by actors with specific interests and strategies and describes the progressive constitution of a network in which both human and nonhuman actors assume identities according to prevailing strategies of interaction. In this sense, organizational life is *heterogeneously engineered*, after an expression coined by Law (1987). Instead of characterizing the technological world as a neat set of homogenously engineered, cause-and-effect relationships, Law describes it as the result of the activity of myriad dynamic networks, comprised of multiple actors possessing many different attributes, interests, and goals.

Besides ANT, other approaches have been put forward that are consistent with the networked view of organizational life. Another relevant example is social capital (Burt, 1997; Nahapiet & Ghoshal, 1998; Adler & Kwon, 2002) which holds that the source of the organizational capacity to create value is the interactions between individuals or between firms, rather than the individuals themselves. According to this view, knowledge about what products systems produce is becoming less important than knowledge about how systems produce themselves — i.e., how systems renew their own ability and capacity to produce (Zeleny, 2003). Given the considerable degree of convergence between the networked approaches to organization and the tenets of autopoietic theory, can autopoiesis become a more encompassing organizational theory of networks?

3.2.5 The Integration of Social and Technological Architectures in Organizations. Ever since the 1960s, increasing volumes of data have been reduced to text and stored in computers' memories, making it possible to retrieve, combine, recombine, condense, and transmit data with the greatest of ease. The maturity and pervasiveness of this IT-supported capability raises the issue of the impact of information technologies on organizations to a new level of debate. Managing data has given way to managing information, and the increasing availability of information in organizations is now leading to increasing interest in managing knowledge.

Data, information, and knowledge are all concepts relevant to information systems (IS). So, what is an IS? Symons (1991, p. 186/187, emphases added) has suggested the following definition:

a complex social object which results from the *embedding* of computer systems into an organization (...) where it is *not* possible to separate the technical from the social factors given the variety of human judgments and actions, influenced by cultural values, political interests and participants' particular definitions of their situations intervening in the implementation of such a system.

This understanding of "information system" opens up a host of new possibilities for the deployment, use, and management of IT in organizations. In the world of business strategy, there is a general recognition that the "positions" of companies in a competitive market do not assure that they can maintain sustainable advantage. In the "knowledge economy," both manufacturing and service organizations require an ongoing stream of new capabilities to sustain competitive success. The ability of a company to mobilize and exploit its intangible assets has become far more important than investing in and managing physical, tangible assets (Wernerfelt, 1984, 1995; Conner, 1991; Barney, 1991; Grant, 1991; Mahoney, 1995; Conner & Prahalad, 1996). Intangible assets enable organizations to develop customer relationships, retain the loyalty of existing customers, serve new segments more effectively and efficiently, introduce innovative products and services, produce customized products with high quality, low cost, and short lead times, and mobilize employee skills and motivation for continuous improvement.

However, following the trend of fragmentation among the sciences in general, organization, information, and systems are commonly treated as independent aspects of organizations that are divorced from each other both in theory and practice. As a result, IS/IT development, implementation, and management are often presented as separate issues from strategic analysis, organizational development, or change management. This discrete treatment of interdependent phenomena places severe limitations not only on the development of multidisciplinary approaches in organization theory, but also on the search for solutions to the practical problems that both management and IS specialists face on a daily basis.

In order to move forward, we have to abandon the "either–or" mindset. The problem of integrating IS/IT and the organization cannot be solved by either organization theory or computer science working alone. Similarly, it is pointless to argue about whether organizations are socially engineered or socially constructed. Organizations have to be seen, studied, and managed from both perspectives. We believe that an "either–or" mentality has been a major obstacle to the development of organizational thinking in the 20th and 21st centuries. Magalhães (2004) proposes that the problem can only be solved through the adoption of a *holistic perspective*, founded upon the following assumptions:

- (1) Organizations are complex adaptive systems where efficient, effective, and sustainable growth and development depends upon the constant production of new internal knowledge.
- (2) As in complex adaptive systems, the transformation of organizations often starts from small innovations found at the fringes of the system's central core of activity.
- (3) Innovations and new knowledge are partly associated with the implementation and management of IS/IT.
- (4) IS/IT-related innovations and new knowledge creation are often found at the fringes of the organization's central core of activity.
- (5) Organizations need to adopt new managerial theories and practices in order to discover and benefit from the knowledge assets found at their fringes, including new IS/IT-related knowledge (ibid, p. 225).

In effect, new knowledge assets are to be found in an organization's *social architecture* (management systems, structures, performance measures, processes, and culture) as well as in its *technical architecture* (information and communication infrastructure and applications). These two types of architecture are often considered the pillars of the competitive advantage of companies (Prahalad & Krishnan, 2008), and together these two architectural perspectives are redefining the principles and rules of organizational design and engineering. Hence, the challenge is for new integrated research approaches to be launched in which there is an equal contribution from organization and IT theorists. An appropriate context for such research can be found in the holistic approaches proposed by the complexity framework, including autopoiesis theory and enacted cognition.

4 Conclusion

In spite of the growing interest in autopoiesis and autopoietic systems in organizations over the last 10 or 15 years, such interest has not made its way into the textbook domain. In the 1960s, open systems theory, a breakthrough in the biological sciences (Von Bertalanffy, 1950), made its way into the organization sciences through the seminal work of Katz & Kahn (1966) and has held a dominant position ever since. Many of the tenets of open systems now need to be revisited, but so far there has not been an alternative perspective as powerful or influential in organization theory. Although autopoiesis has been heralded by many as a new systems theory, it has not yet achieved the same kind of impact as open systems thinking, in large part because there is no clear-cut agreement among organization science.

Nevertheless, there has been a considerable amount of literature on autopoiesis in organization studies, a selective summary of which has been presented in this chapter. While some authors have adhered to the qualified approach of Luhmann, others have taken autopoiesis straight from the realm of the biological sciences to organization studies, and have even combined it with other approaches. The result has been a number of proposals, some cautioning observation and interpretation, others supporting analysis and direct intervention, but none attempting to elaborate an integrated or comprehensive approach. In this volume, we have set ourselves the challenge of moving the possibilities for theoretical integration forward and of *placing autopoiesis alongside other mainstream approaches in organizational thinking*.

To this end, five questions encapsulating the trends at the forefront of contemporary organizational thinking were posed to the authors included in this volume:

- (1) Can autopoiesis provide the backdrop for a new organizational paradigm?
- (2) Framed within the complexity paradigm, can autopoiesis provide the metalanguage for a new theory of organization and management?

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- (3) What might be the role of autopoiesis in the turn toward a focus on practice and transdisciplinarity in organizational thinking?
- (4) How might autopoiesis theory lend further support to the views supporting the networked nature of organizations and organizing?
- (5) Given its holistic nature, can autopoiesis provide a suitable framework for the integration of IT/IS into social organizations?

The invited authors responded in a variety of ways to these questions, and the result is the present volume of original and peer-reviewed papers. The editors hope that the ideas presented here will provide the basis for establishing autopoiesis as an innovative intellectual lever for the study of organizations.

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