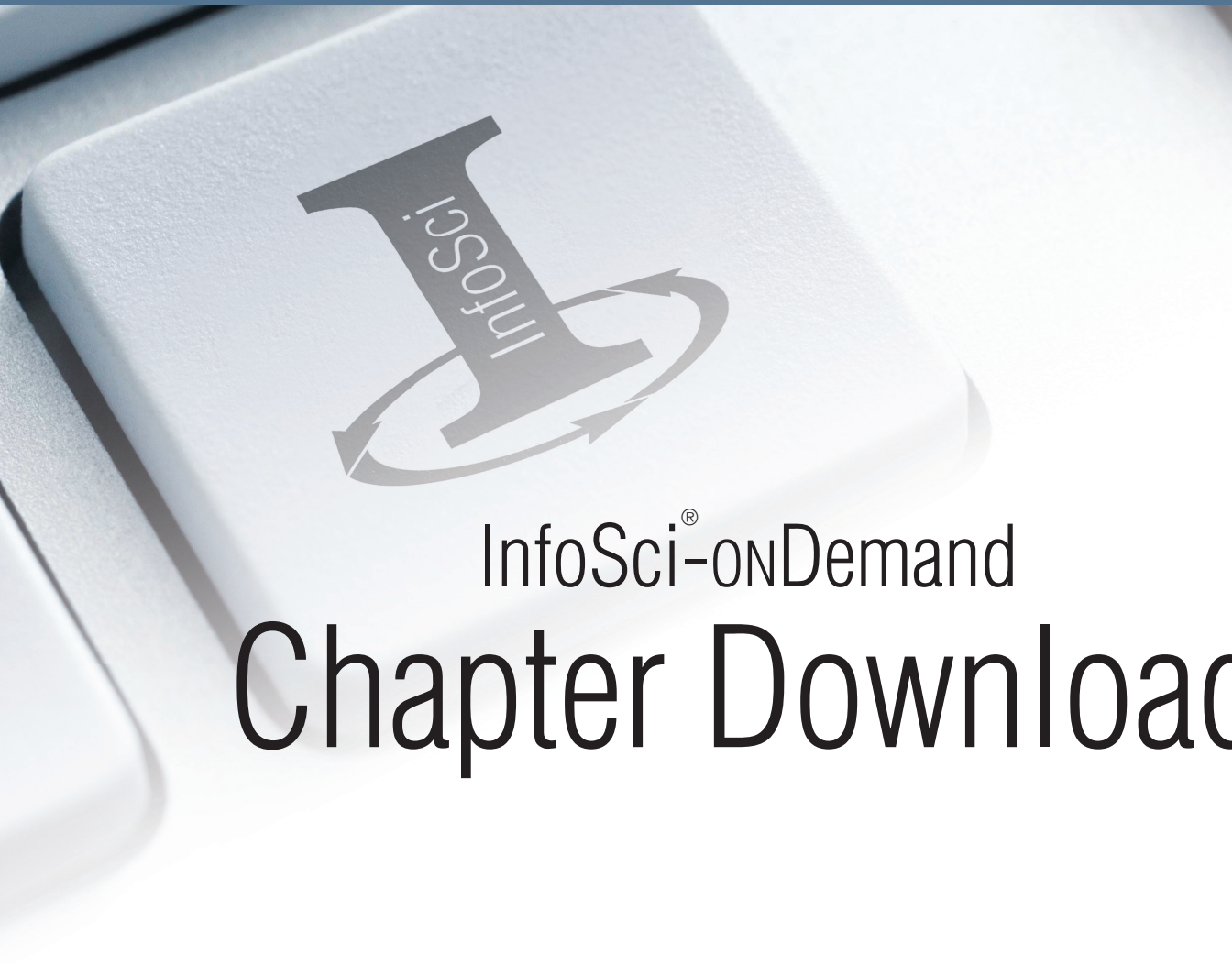

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Chapter 9
Cybernetics Principles in the Management of Intelligent Organizations

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ABSTRACT

Against the background that mechanical principles were applied in management leading to bureaucracy, an application of cybernetics principles in management would imply (1) a behaviouralist approach to organisations, (2) teleology: reintroducing the notion of purpose, (3) managing complexity, (4) systems thinking, (5) managing as building intelligence, (6) managing as integrating knowledge domains. This overcomes the rigidity embedded in bureaucracy where organizations sought stability and equilibrium and operated in a relatively stable environment for a dynamic and integrative approach to organisations which are not closed stable entities but dynamic open systems. Organisations built on cybernetics principles are agile and continuously respond to their environment through information processing and feedback loops. In this context, there is a paradigm shift from top down management processes linked with hierarchy to cross-functional, flexible, adaptable, and open to learning management principles based on knowledge networks. Alternatives to bureaucracy can be suggested in terms of flat, inverted pyramids, matrix, networked and virtual organisational structures which may stipulate a change from Michael Porter's normative approach to strategic management to Mintzberg's descriptive approach. Organisational structures are not cast in stone but respond to changes in the environment, and there is a paradigm shift in corporate culture from organisations as closed stable entities to organisations as open dynamic systems, from competition to trust and collaboration including outsourcing, consortia, joint venture, and conglomerates become better ways of satisfying customer needs. From a corporate culture there is also a change from focusing on power and ownership in decision-making to focusing on knowledge and an increased use of information and communication technologies leading to virtualisation.
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1. INTRODUCTION

Paradigms shifts in management, engineering and science in general are most of the time associated with disruptive technological innovations. A paradigm has been defined by Kuhn (1962) as "universally recognized achievements that for a time provide model problems and solutions to a community of practitioners". A disruptive innovation is an innovation that creates a new market and value network and eventually disrupts an existing market and value network, displacing established market leaders and alliance (Bower & Christensen 1995). Other authors add significant social impact as part of disruptive innovations (Marnix 2006). The link between disruptive technological innovation and unprecedented societal changes is not a new phenomenon. As Wiener (1961) has pointed out:

The thought of every age is reflected in its technique. The civil engineers of ancient days were land surveyors, astronomers and navigators; those of the seventeenth and early eighteenth centuries were clockmakers and grinders of lenses. As in ancient times, the craftsmen made their tools in the image of the heavens. A watch is nothing but a pocket orrery, moving by necessity as do the celestial spheres; and if friction and the dissipation of energy play a role in it, they are effects to be overcome, so that the resulting motion of the hands may be as periodic and regular as possible. The chief technical result of this engineering after the model of Huyghens and Newton was the age of navigation, in which for the first time it was possible to compute longitudes with a respectable precision, and to convert the commerce of the great oceans from a thing of chance and adventure to a regular understood business. It is the engineering of the mercantilists.

Wiener (1961) continues his exemplification of how paradigms have been changing within the area of physics and engineering by noting that:

To the merchant succeeded the manufacturer, and to the chronometer, the steam engine. From the Newcomen engine almost to the present time, the central field of engineering has been the study of prime movers. Heat has been converted into usable energy of rotation and translation, and the physics of Newton has been supplemented by that of Rumford, Carnot, and Joule. Thermodynamics makes its appearance, a science in which time is eminently irreversible; and although the earlier stages of this science seem to represent a region of thought almost without contact with the Newtonian dynamics, the theory of the conservation of energy and the later statistical explanation of the Carnot principle or second law of thermodynamics or principle of the degeneration of energy – that principle that makes the maximum efficiency obtainable by a steam engine depend on the working temperatures of the boiler and

the condenser – all these have fused thermodynamics and the Newtonian dynamics into the statistical and the non-statistical aspects of the same science.

As a conclusion Wiener (1961) sets as a contemporary challenge the fact that, "[i]f the seventeenth and the eighteenth centuries are the age of clocks, and the later eighteenth century the age of steam engines, the present age is the age of communication and control". Cybernetics was defined by Wiener (1948) as the science of control and communication in the animal and the machine. Although the concept originated from engineering it was successfully introduced in management by Stafford Beer (Beer, 1959, Beer, 1960, Beer, 1965, Beer, 1966, Beer, 1972, Beer, 1975, Beer, 1979, Beer, 1981) creating the discipline of "management cybernetics" (Rosenhead, 2006). Management cybernetics implies approaching organisations as wholes through "systems thinking" (Espejo, 2006, Jackson 2000,, Jackson, 1991). Systems thinking implies understanding how systems influence one another within a complete entity, or larger system. Therefore, the best way to understand the Viable System Model (VSM) as both a conceptual, diagnosis, design and management tool is to link the VSM with its corollary concepts such as cybernetics and systems thinking.

2. THE NOTION OF CYBERNETICS

The late 1980s and early 1990s a paradigm shift was being pointed by various academic disciplines. For instance, Prigogine and Stengers (1984) pointed out that "interest is shifting from substance to relation, to communication, to time." At the same time, Drucker (1989) postulated a multidimensional change characterized by *The New Realities in Government and Politics, in Economics and Business in Society and World View*. Another voice that begged for a paradigm change was Bernstein (1991)'s calling for a *New Constellation.* However, it is Henry C. Mishkoff who gave the concept of cybernetics its status as a new *weltanschauung* in his book on artificial intelligence. According to Mishkoff (1986):

Norbert Wiener is best known for developing a new approach to understanding the workings of the universe. Since the time of Newton, scientists have concentrated on an energy model, explaining events and processes in terms of the transfer of energy. Wiener suggested a model that has proven to be extremely valuable in understanding computers as well as people – he suggested that the transfer of information rather than energy is the best way to model different kinds of scientific phenomena. Cybernetics was the name Wiener used both to describe his informational approach and to entitle his 1948 book on the subject.

Like any new concept, the concept of cybernetics may be new but the phenomenon it describes is not. Cybernetics did not get immediate acceptance in the scientific

community. At the beginning, cybernetics was considered as belonging to the esoteric jargon of highly skilled mathematicians given its origins at the Massachusetts Institute of Technology (Ashby 1956). Syre (1967) warns that the concept of cybernetics came a long way. Before its general acceptance, it had some competing or substituting concepts which instead of overcrowding it revealed its intrinsic link with information science and its richness. In Syre (1967) own words:

The term "cybernetics" has not been universally accepted by mathematicians and engineers who often prefer to speak instead of information theory or of the theory of feedback and control. Use of the term here does not reflect a decision one way or another regarding those issues which incline many specialists from adopting "cybernetics" as a technical term.

The concept of cybernetics like any other encompassing concept refers to such wide and different areas of reality that it is not easy to define. For example, its mechanical counterpart defines reality as "matter in motion" and hence insists on the transmission of energy. We can also describe how mechanical principles apply in machinery, in body functions such as the understanding of speech as the movement of the tongue in the mouth, dying as the impossibility of motion which include the motion of blood in vessels, the motion of air in the lungs, or economics as the motion of goods and services between sellers and buyers (the notion of "financial flow" attests to this). The same wide areas of application are available for the concept of cybernetics. According to Norbert Wiener (1948) the inventor of the concept himself:

Since the end of World War II, I have been working on the many ramifications of the theory of messages. Besides the electrical engineering theory of transmission of messages, there is a larger field which includes not only the study of language but the study of messages as a means of controlling machinery and society, the development of computing machines and other such automata, certain reflections upon psychology and the nervous system, and a tentative theory of scientific method. This larger theory is a probabilistic theory … Until recently, there was no existing word for this complex of ideas, and in order to embrace the whole field by a single term, I felt constrained to invent one. Hence "Cybernetics", which I derived from the Greek word *kubernetes*, for "steersman," the same Greek word from which we eventually derive our word "governor".

Hence from the subtitle of the book where the founder of cybernetics has systematically exposed this concept, we can define cybernetics as the science of "control and communication, in the machine and the animal" (Wiener 1948). The encompassing character of the concept of cybernetics creates a situation where, as Syre (1967) warns "there is no recognized philosophic theory or school that could properly be termed cybernetics." This is because, "cybernetics stands to the real machine – electronic, mechanical, neural, or economic – much as geometry stands to a real object in our terrestrial space" (Ashby, 1956). In other words, cybernetics

is not a form of description or a separate theory but a framework through which the functioning of both natural and artificial machines can be understood. According to Ashby (1956):

It (cybernetics) treats, not things, but ways of behaving. It does not ask "what is this thing" but "what does it do?" Thus it is very interested in such a statement as "this variable is undergoing simple harmonic oscillation", and is much less concerned with whether the variable is the position of a point on a wheel, or a potential in an electric circuit. It is thus essentially functional and behaviouristic.

This clarification by Ashby confirms Moray (1963)'s definition of cybernetics as the study of the behavior of systems of all kinds. It is the science of "input" and "output". This shift introduces a double dynamism. On the one hand, it requires us to study and understand not the invariant characteristics of systems associated with structure but the variable ones that are associated with behavior. That is why while mechanical models focus on identifying simple immutable laws that can be formulated into simple mathematical relations, cybernetic model focus in how systems respond to changes in their environment either by transforming themselves or by activating feedback processes. That is why Ashby (1956) points out that:

The most fundamental concept in cybernetics is that of "difference", either that two things are recognizably different or that one thing has changed with time … All the changes that may occur with time are naturally included, for when plants grow and planets age and machines move some change from one state to another is implicit. So our first task will be to develop this concept of "change", not only making it more precise but making it richer, converting it to a form that experience has shown to be necessary if significant developments are to be made.

Change effected at one end of the behaving system is transmitted to other parts of the system or to its environment. In other words, change does not occur merely within the system but the system is both an object and an agent of change. In other words, cybernetics is interested not only in the way both internal and external factors change a given system but also in how this system transmits this change to its environment. This double dynamism points to another aspect of cybernetics, namely, the study of "input" and "output" (Moray 1963) because not only the system is acted upon by its environment but it also acts on its environment. This capacity to be acted on or to receive inputs and the capacity to generate an output create a situation where the system loses its invariant character and is subject to complex processes of change that are triggered by both internal and external factors. Hence, "a system is a set of attributes and the history of the changes of that set of attributes" (Moray, 1963)

3. CYBERNETICS IMPLICATIONS FOR MANAGEMENT

3.1 A Behaviouralist Approach to Organisations

Cybernetics implies a behaviouristic approach to machines and organisms. Rosenblueth, Wiener and Bigelow (1943) defined the behaviouristic approach as "the examination of the output of the object and of the relationship of this output to input" (Rosenblueth et al., 1943). Output is defined as "change produced in the surroundings of the object" (Rosenblueth et al., 1943) while input is "any external event to the object that modifies this object in any manner" (Rosenblueth et al. 1943). This definition of the behavioural approach to systems and organisms follows Moray (1963) definition of cybernetics as the the study of "input" and "output." The behaviouristic approach is contrasted with the functional approach which focuses on the intrinsic organization of the entity studied, its structures and its properties. The relationship between the entity and its surroundings are relatively incidental (Rosenblueth et al. 1943).

A functional approach to business organisations would imply conceiving organisations as stable closed entities while a behavioural approach implies understanding business as dynamic open systems (Bigirimana 2004). Organisations have been traditionally conceived as stable and closed entities aiming at equilibrium (balancing books or avoiding crises). This view exemplifies the way of proceeding of the pyramidal model where the preservation of the structural makeup of organisations made organisations self-serving rather than customer focused. In many instances, the fear of competition or sabotage by ill willed people covered them with secrecy and led to the creation of deep rooted routines borrowed either natural sciences or from other human organisations such as armies. In computer mediated environments, it becomes difficult even impossible to avoid interacting with others. The idea of the corporation (an autonomous body) invites some degree of heteronomy given the fact "interorganisational metabolism" (Lloyd and Boyle 1998) rather than "intraorganisational" metabolism is the norm of the day.

While the bureaucratic model conceives organisations as machines (Morgan, 2006) with laid down principles and processes that makes decisions independent of the bureaucrat, the idea of a corporation (from *corpus* in Latin that means body) implies an organic model with internal dynamics that are as stable as the biological laws of metabolism. From an organisational point of view, while the mechanical model implies a physical metaphor, the cybernetic model implies a biological metaphor. The biological metaphor presents organisations as living organisms hence their capacity to have "life" or viability. Organisations (from Greek *Organon* that means instrument) are not created for their own sake but for fulfilling pre-established goals,

hence, the importance of the notion of purpose or teleology in both organizational design and management.

3.2 Teleology: Reintroducing the Notion of Purpose

One of the merits of cybernetics, is the introduction of the notions of purpose and teleology in the description of the behavior of machines and organisations (Rosenblueth et al., 1943). Scientific accounts of the behavior of machines and organisms had discarded this notion mainly because of its link to intentionality, a notion which is considered as inherently subjective but also because of its relation which religion through the definition of God by Aristotle and Thomas Aquinas as "the final cause" or the "immovable mover". In the context of cybernetics, the term purposeful is meant to denote that the act or behavior may be interpreted as directed to the attainment of a goal (Rosenblueth et al., 1943) i.e. a final condition in which the behaving object reaches a definite correlation in time or in space with respect to another object or event (Rosenblueth et al., 1943).

This is because there are actually two types of bahaviour: active behavior and passive behavior. Active behavior is that in which the object is the source of the output energy involved in a given specific reaction (Rosenblueth et al., 1943) while in passive behavior the object is not a sources of energy, all the energy in output can be traced to the immediate input (Rosenblueth et al. 1943). Active behavior may be subdivided in two classes: purposeless (random) and purposeful. That is why Umpleby (1987) have described cybernetics as a "science of goal formulation." This emphasis of goal formulation has been brought into focus by other cybernetics scholars such as Ackoff and Emery (1972), Ackoff (1981), Ackoff, Finnel and Gharajedaghi (1984), Ackoff (1994).

This emphasis on purpose implies that organisations should be geared towards shaping their future rather than preserving current structures and and practices. While the metaphor of the organization as an organism (Morgan 2006) is perceived as a improvement to its mechanical and bureaucratic counterparts (Morgan 2006), the idea of purpose justify the very nature of organisations (from Greek *Organon* that means instrument). Organisations are in their very essence, instruments for fulfilling pre-determined goals. This implies not only putting into place structures and systems i.e. not only putting parts together in a certain pattern of relationships and functions (creating a structure) but also determining the principles, values, procedures, and rules of interaction (creating a culture) (Bigirimana 2004).

3.3 Managing Complexity

Another aspect of organisations which is brought into focus by cybernetics is the idea of complexity. Moray (1963) has noted that "a system is a set of attributes and the history of the changes of that set of attributes." Being a set of attributes and the history of that set of attributes, any system presupposes basically some complexity. This complexity is brought by the fact that on the one hand in order to make a system one must bring many entities or attributes together, and on the other hand, not only these entities but also their various relations are subject to change over time. Hence, adopting cybernetics as a *weltanschauung* implies what Rescher (1998) calls "the complexity of the real." This idea of complexity has been studied in detail by scholars such as Mainzer (2007), Heylighen, Bollen and Riegler (1999), Sandra Mitchell (Mitchell, 2003, Mitchell, 2008, Mitchell, 2009) and Melanie Mitchell (2009).

The complexity of the real becomes more evident with the various patterns of organization and interaction of elements and entities which can be aggregated to form complex beings or which are involved in various relations be they spatio-temporal, exchange of various forms of energy or various possibilities of transformation given both external and internal factors. The degree of complexity can be so high to the extent that the ideas of simplicity, order, and regularity that founded Newton's mechanical model and Descartes' rational model can be called into question. There is increasing literature that claims that reality, at least in some of its aspects, is chaotic. This chaotic aspect has been so well studied to the extent that some scientists have attempted to find its mathematical formulation especially by pushing beyond certain limits the variables of functions which are otherwise simple when their computation are kept in 'normal' limits. It is worth noting the distinction that Toffler (1984) makes when he assesses Progogine and Stengers' ways of thinking. In their view,

Summed and amplified, they hold that while some parts of the universe may operate like machines, these are closed systems, at best form only a small part of the physical universe. Most phenomena of interest to us are, in fact, open systems, exchanging energy or matter [one may add information] with their environment. Surely biological and social systems are open, which means that the attempt to understand them in mechanistic terms is doomed to failure. This suggests, moreover, that most of reality instead of being orderly, stable, and equilibrial, is seething and bubbling with change, disorder, process.

3.4 Systems Thinking

Management cybernetics implies approaching organisations as wholes through "systems thinking" (Espejo, 2006, Jackson, 2000, Jackson, 1991). Systems thinking implies understanding how systems influence one another within a complete entity, or

larger system. Systems thinking has been defined as an approach to problem solving that attempts to balance holistic thinking and reductionist thinking. Reductionist thinking implies analysing complex systems by separating their parts. However, Bertalanffy (1968) pointed out that:

Application of the analytical procedure depends on two conditions. The first is that interactions between "parts" be non-existent or weak enough to be neglected for certain research purposes. Only under this condition, can parts be "worked out," actually, logically, mathematically, and then be "put together." The second condition is that the relations describing the behavior of parts be linear; only then is the condition of summativity given, i.e., an equation describing the behavior of the parts; partial processes can be superimposed to obtain the total process, etc., but as by cutting them into their parts.

In other words, we can only analyse systems which are analysable. Systems thinking is a response to Cartesianism i.e. the habit to "break apart problems, to fragment the world" (Drucker 1989). The semi-skilled worker was precious in the industrial society because at that time the industrialist "analyzed tasks and broke them down into individual, unskilled tasks that could be learned quickly" (Drucker 1989). However, this situation is changing radically since the post-industrial society is dominated by the scientists and experts that hold technical and professional positions. Drucker has noted that the "knowledge worker", an expert is replacing the semi-skilled worker of the massive production of the industrial society (Drucker 1989).

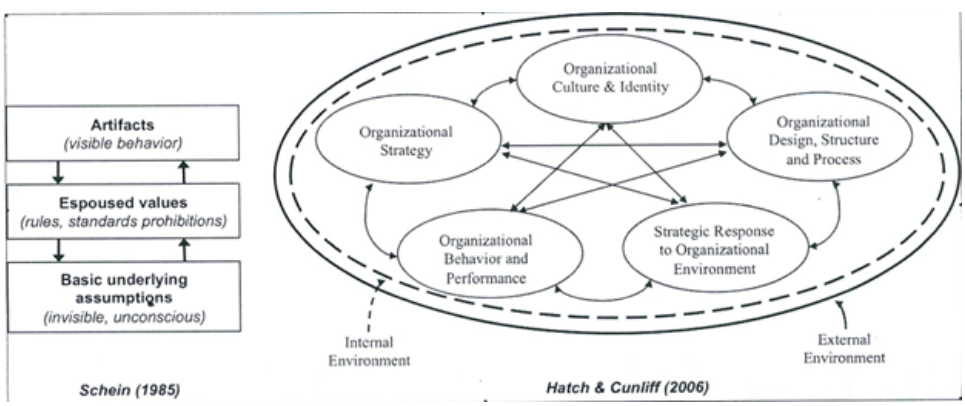
Cabrera (2008) has noted that systems thinking itself is the emergent property of complex adaptive system behavior that results from four simple rules of thought. These rules also known as DSRP imply that a system thinker has to display four types of ability namely: (1) making Distinctions i.e. among various objects in a system the system thinker should be able to know which consist of an *identity* and an *other; (2)* Organizing Systems – which consist of *part* and *whole, (3)* recognizing Relationships – which consist of *action* and *reaction* and (4) taking Perspectives – which consist of *point* and *view.* According to Jackson (1986) cybernetics offers an extremely sophisticated account of the nature of organisations. In spite of its strengths, the cybernetic model is not widely known or used in organisation and management theory. One reason might be that perceived weaknesses in the model are seen to outweigh the strengths (Jackson 1986). Jackson (1986) corroborated Clemson (1968)'s view who earlier pointed out that that cybernetics is a new management tool. Espejo (2013) actually is of the view that a cybernetic model would have averted the 2008 financial crisis by weaving financial and economic activities into one organisational system constituted by cohesive and inclusive autonomous systems. The origin of the crisis, according to Espejo (2013) is that financial services as wealth extracting

activities [are] detached from the economies they were supposed to serve. Likewise, applying cybernetic principles to the management of institutions of higher education would imply considering universities as complex systems which are in continuous interaction with the communities in which they serve.

3.5 Managing as Integrating Knowledge Domains

A cybernetic model of organization has the advantages of integrating aspects of business which are traditionally considered as separate. Furthermore, a cybernetic model goes beyond academic disciplines and research programmes. For instance, The Organization Orientation Group (OOG) (2011) have showed how a cybernetic model of organisations integrates organization theory ad culture theory through knowledge cybernetics. In their view, every organization is characterised by four domains (culture, strategy, structure, operations) and six processes (cultural guidance, strategy implementation, structural guidance, performance assessment, single- and double-loop learning (OOG, 2011). The cybernetic model that they suggest integrates Schein (1985)'s theory of culture and Hatch and Cunliffe (2006)'s organizational theory. Schein (1985)'s theory of culture comprises 'underlying values' (invisible, unconscious assumptions), 'espoused values'(rules, standard prohibitions) and 'artifacts'(visible behavior). Hatch and Cunliffe (2006)'s organizational theory on the other hand identifies five major fields in organizational theory namely organizational culture and identity, organizational strategy, organizational design and structure, organizational behavior and performance, and strategic response to organizational environment. Taken in isolation, Schein (1985) and Hatch and Cunliffe (2006) models can be represented as shown in Figure 1.

Figure 1.
Source: OOG (2011: 3)



However these models taken in isolation have some limitations. While these model suggests which domains seem to be of utmost importance when analyzing organizations, it does not extend our knowledge about how these domains are related to each other and how they may change over time (OOG, 2011). The same limitation is observed with Schein (1985)'s theory of culture. Schein (1985) still lacks a precise definition of relationships among domains is not provided, which reaches beyond what is commonly defined as 'organizational mechanisms' (Pajunen, 2008). In other words, there is a need to integrate the two theories in order to introduce an element of dynamism which accounts not only for the relationships between various domains but also their possible changes over time. This process of integration was achieved by the OOG (2011) by noticing a relationship of equivalence between knowledge cybernetics, Hatch and Cunliffe (2006)'s organizational theory and Schein (1985)'s theory of culture. Equivalences in these domains has been represented as Table 1.

Following these relationships of equivalence any organization can be defined from the point of view of knowledge cybernetics as having a phenomenal domain, an epistemic domain and an existential domain (OOG 2011). The phenomenal domain of an organization can be understood as a structural coupling between two domains, namely, structures and operations (OOG 2011). Operations make an organization visible as a member of society because they become manifest through action/behavior (OOG 2011). Structures on the other hand, are responsible for the 'internal allocation of tasks, decisions, rules, and procedures for appraisal and reward, selected for the best pursuit of […] [a] strategy' (Caves, 1980). Changes in the phenomenal domain are triggered by performance feedback of other social systems, i.e. institutions, organizations, interest groups and individuals, which can be subsumed as stakeholders of an organization (Freeman, 1984). According to Yolles (2017), the OOG (2011), (Piaget 1950) the coupling between the distinct domains is cybernetic in nature, with feed-forward and feedback "loops" that are most simply described in terms of operative and figurative intelligence.

The epistemic domain of the organization comprises the strategic orientation of the organization and mechanisms of implementing strategy. A strategic process comprises three stages namely strategy formulation, strategy implementation and strategy evaluation. Strategy itself comprises a vision, a mission, long term goals,

Domains of the Cybernetic Model	Equivalents in Organisational Theory (Hatch & Cunliffe, 2006)	Equivalents in Culture Theory (Schein, 1985)
Existential domain	*Organisational Culture*	*Underlying Values*
Epistemic domain	*Strategy*	*Espoused values*
Phenomenal domain	*Structure, Operations*	*Artifacts*

Source: OOG (2011)

systems and structures and a corporate culture. Menguc and Auh (2005) have noted that strategic orientation formation and strategic orientation implementation are different. Strategic orientation includes "the strategic directions implemented by a firm to create the proper behaviors for the continuous superior performance of the business" (Gatignon and Xuereb 1997: 78). Strategic orientation comprises the organization wide and collective action of firms that is supported by successful communication, interpretation, adoption, and enactment of information (Menguc and Auh 2005). The formation stage includes three activities, namely, the the adoption, interpretation, and communication of information (Menguc and Auh 2005) while enactment, implementation, or execution of such information belongs to the strategic orientation implementation stage (Menguc and Auh 2005). Implementation can be defined as the application of resources to strategy (Day and Wensley 1983) or the "how-to-do-it" aspects (Céspedes 1991). In other words, implementation involves "the organization's competence in executing, controlling, and evaluating its marketing strategy (White et al. 2003).

All in all, the epistemic domain of an organization has both a theoretical and practical dimension. The implementation stage is a key mediator between strategy development styles and firm performance (White et al. 2003). Menguc and Auh (2005) have emphasized the the need of TMT (top management team) diversity and interfunctional coordination in successful strategy orientation formulation while they noted that this diversity may be detrimental to strategy orientation implementation. From a cybernetic point of view, the epistemic domain integrates normative aspects of the value chain (Porter 1998) and emerging properties linked with the multifaceted nature of managerial roles (Mintzberg 1975).

The existential domain is the values and principles which underlying the daily management of the organization. Porter (1998) pointed out that culture is difficult to define. However, he acknowledges different cultures are implied by different generic strategies. Porter (1998) has identified three generic strategies cost leadership, differentiation, and cost focus. For Mintzberg (1973) corporate culture is linked to the strategy making mode and to the context. Mintzberg (1973) distinguished three strategy modes namely the entrepreneurial, the adaptive and the planning mode and five contexts namely the entrepreneurial, the mature, the diversified, the innovation and the professional context (Mintzberg 1983). These contexts invite according to Mintzberg (1983) not only different cultures but also different organizational structures ranging from the simple structure where an entrepreneur has pervasive influence on the environment, the machine bureaucracy, the divisionalised form, adhocracy, or a professional bureaucracy. A comparison of Porter and Mintzberg approaches to strategy can be represented in Table 2.

Table 2.

	PORTER	MINTZERBERG
Approach	Normative	Descriptive
Definition	Plan	• Pattern; • Ploy; • Position; • Perspective • Plan
Process	Top-down Linear (Formulate-Implement-Evaluate)	Vertical and Horizontal Integration Complex and dynamic (Craft through the interaction between the strategic and a context
Context	Mature	Variable (look at the various possible contexts)
Structure	Machine Bureaucracy	Variable (look at different possible configurations)
Culture	Command and Control Employee compliance	Dynamic and Integrative and Interactive (look at the different coordination mechanisms)
Outcomes	Conformity to pre-determined goals	Planning; Entrepreneurial; Adaptive depending on the context, the size of the organisation etc

3.6 Managing as Building Intelligence

Intelligence has been often presented as human prerogative. According to Sternberg (1988) intelligence implies the capability to do two things: (1) to transform or change oneself by adapting, developing and learning, (2) to influence or change the environment if necessary. For Schwaninger (2000) in order to make the concept of an intelligent enterprise operational there is a need to class an enterprise that effectively combines adaptation, learning and development as 'intelligent'. Schwaninger (2000) has defined adaptation as self-transformation in order to meet requirements from outside. Learning signifies an increase in the ability to take effective action (Kim 1993) while creation signifies the growing ability of an organization to meet its own and others' needs (Ackoff 1981). The paternity of the concept of "organizational intelligence" is attributed to Wilensky (1967)'s book on Organizational Intelligence: Knowledge and Policy in Government and Industry. March and Olsen (1975) explored the concept of organizational learning while Quinn (1992) popularized the concept in his book *Intelligent Enterprise.* In addition to Quinn (1992), Thannhuber (2004) and Gupta and Sharma (2004) explored the ins and outs of the concept outside the United States. Contrary to the dominat supportive trend, Palmer (2007) pointed to the limitations of the concept.

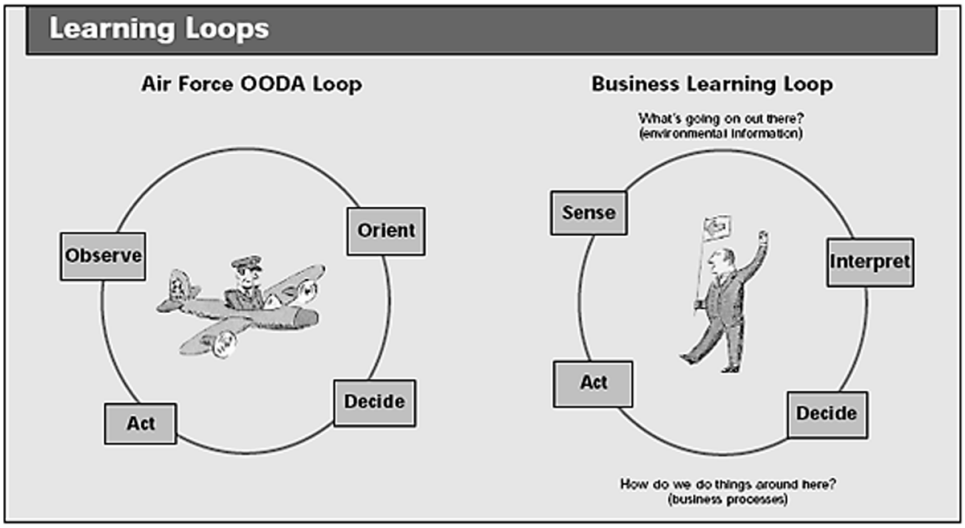
Yolles (2005) argued that the concept of intelligence can be applied to organization at least metaphorically. In Yolles (2005)'s terms the notion of organisational intelligence requires a metaphorically defined psychological frame of reference. In trying to formulate this metaphor, there has been a need to explore the collective from a psychological perspective (Yolles, 2005). Applications of the notion of organisational intelligence operate in a variety of areas, and two of these are in organisational learning and managerial cybernetics (Yolles, 2005). Other authors who explored the possible extension of individual cognitive processes to organization include Morgan (2006) who presented organisations as "brains". Presenting organisations as brains implies emphasizing organisations's ability for learning and self-organisation (Morgan 2006) but also organisations that are able to "learn to learn" (Morgan 2006). It is through this ability that Morgan (2006) links the image of the learning organization to cybernetics.

The idea that organization are able to learn was brought to public earlier by Senge (1990) who is perceived as the pioneer of the concept of a "learning organization" but Haeckel and Nolan (1993) have defined organizational intelligence as the institutional ability to deal with complexity, that is, its ability to capture, share, and extract meaning from marketplace signals. This implies that managing intelligent organisations includes integrating knowledge domains but also adequate information management (Choo 1995), knowledge management (Wiig, 2007) and intelligent behavior. This integrative dimension is highlighted by Liebowitz and Wilcox (1997). Haeckel and Nolan (1993) suggest a transfer of the OODA model used by the United States Air Force to management. According to Haeckel and Nolan (1993) the United States Air Force assesses a pilot's ability to learn with the OODA Loop, a model for the mental processes of a fighter pilot. OODA stands for:

- *Observation:* sensing environmental signals;
- *Orientation:* interpreting those signals;
- *Decision:* selecting from a repertoire of available responses;
- *Action:* executing the response selected.

Fighter pilots with faster OODA Loops tend to win dogfights, while those with slower ones get more parachute practice (Haeckel and Nolan, 1993). Haeckel and Nolan (1993) indicate that the loop is iterative: a continuous cycle in which an action leads to the observation of the results of that action that in turn requires a new orientation, decision, and action. This iterative sequence constitutes a *learning loop*. It contains the four functions essential to any adaptive organism: sensing, interpreting, deciding, and acting. By analogy, an enterprise model for a business that incorporates learning is one that systematically creates and links learning loops.

Figure 2.
Source: Haeckel and Nolan (1993)



Haeckel and Nolan (1993) have represented the OODA model and its managerial equivalent as Figure 2.

4. CHANGES IN ORGANISATIONAL STRUCTURES

The 1990's saw a wave of organisational changes that included Total Quality Management (TQM), Business Process Reengineering (BPR), Customer Relations Management (CRM) and the Learning Organisation. The whole process started when icons of American wealth such as General Electric, Ford and General motors were finding difficult to face the competition brought by young, swift Japanese competitors with less resources and experience. In a process of self-examination, the American business practices were recounted as follows:

Because of the voracious appetite for cars in America, GM grew rapidly after World War II. Symbolising America's wealth, companies likes GM wrote the marketplace rules while the rest of the world was rebuilding. These rules emphasized finance, size, low cost production, and marketing power. Finance began to dominate GM's corporate decision making during the late 1950s. The Board of Directors' Financial Committee approved all significant strategic decisions. Financial influence proliferated throughout the organisation. This success, coupled with the power that the company had, made GM arrogant. This story however, was repeated in nearly every industry in America. Post-war America was a heady time for business. "From

sea to sea" symbolised a relatively closed system for American business. No foreign organisations came close to threatening American business. Business adapted to this system a set of strategies that maintained the equilibrium of marketplaces. Those companies that dominated their industry could easily defend their market share. The nation's antitrust laws kept the largest firms from exploiting their economies of scale and marketing power. The Sloan-type bureaucracy was the appropriate design for this period of time (Vroman & Luchsigner, 1994).

In such a context, it was paradoxical that the Japanese who lacked both the financial and the marketing arm managed to succeed in the American business environment and to push some giants on the wall. Their success was based on "a unique design and effective strategies" (Vroman and Luchsinger 1994). It came to light that "the Sloan bureaucracy was unable to respond to new quality standards in the marketplace. The whole processes and paradigms of changes can therefore be summed up to a process of "debureaucratisation".

4.1 The Networked Organisation

Another problem that the American giants mentioned above faced with bureaucracy was that of coordination. There were many bottlenecks in resource and information circulation not only within departments (from the bottom to the top) but also between departments (from one functional speciality to another). Processes of decision making are often fragmented and levels of the value chain that produce inputs for other levels sometimes provided substandard products, information and services. As a remedy to this state of affair, the networked organisation emerged. As Quinn et al. (1996) have noted, "in the network organization, lateral relations are more important than vertical relations, and hierarchies are either flat or disappear altogether. The network organization appears in different forms such as the infinitely flat organization, the inverted organization, the spider's web organization, the cluster and the starburst. However, in practice the network model appears in many forms. In fact, the fundamental difference between these forms is that they represent different models of deploying intellect, the key to hypercompetitive survival. This implies a change in paradigm, since from the inception of administrative theory, organizational structure has been defined primarily by functional specialization, power relationships, and hierarchy. However, today's managers must focus instead upon how the enterprise develops and deploys intellect (Quinn et al. 1996).

For instance, the models of networked organisations mentioned above deploy the intellect differently. The infinitely flat organization locates the intellect at the center and locates novelty at the nodes. This mode of linkage consists of linking the center to the nodes and its source of leverage is multiplicative. The management problems and challenges that it raises are that there is no career path, the pay depends on individual

performance, professional management is isolated, and there is a permanent need to maintain system flexibility. The typical example of an infinitely flat organization is a brokerage firm. The inverted organization locates the intellect and linkage at the nodes and its source of leverage is distributive. The managerial problems and challenges it raises are the loss of formal authority for line managers, the need to simultaneously empower and control the people at nodes. The best illustrations of the inverted organizations are hospitals. The spider's web organization locates the intellect at the nodes and novelty in the project. The linkage occurs from node to node and the source of leverage is exponential.

The managerial problem it raises is the need to foster communication without overloading the system and the management of competition over the nodes. The most common example of a spider's web organization is the internet. The cluster organization, as the name indicates, locates the intellect in the whole cluster and novelty in project. The mode of linkage is from cluster to project and the source of leverage is additive. The problems and challenges it raises are the facts that individuals face pressures from clusters and cross-cluster teams. The whole organization depends on the quality of leadership, breadth of training, and motivation of participants. An example of a cluster organization is the corporate staff. The starburst organization locates the intellects at the center and at the nodes while novelty is located at the nodes. The mode of linkage is from center to nodes and the source of leverage is synthetic. There is a need to balance autonomy and control and to generate significant resources (Quinn et al. 1996).

However, it is worth noticing that: these new forms seldom occur in pure form across the entire entity, integrating all aspects of a major enterprise, and their evolution is not being driven by the emergence of new enterprises. Rather they are forms of organizing, not forms of organization, and they are typically embedded in large organizational structures that are still at least partly bureaucratic. Because these forms are building blocks, with several typically co-existing inside larger organizations, a key challenge for top management in integrating these different forms of organizing into a coherent whole. The organization of the future will not be a hybrid, but will be polymorphic, containing within itself subunits whose fundamental ways of bringing intellect to bear upon problems vastly different from one another (Quinn et al. 1996).

4.2 The Flat Organisation

With the growing awareness the bureaucracy as an organisational design was not only inefficient but also time and resources consumer, many anti-bureaucracy movement emerged. Jack Welch, the CEO of General Electric called bureaucracy a sin (Bower et al. 1995). This was a revolution preceded that has been occurring through human

history. While in the pre-industrial society, work was based mainly on physical labour be it of humans or animals, in the industrial society work was massively organized in giant plants around automatic machinery. The new demands of work and life in the modern times introduced new paradigms of work and organisation design such as the division of labour spearheaded by Max Weber. As a paradigm of organisational design, the division of labor fosters a pyramidal organisational model where levels of hierarchy are clearly delineated and where channels of command and control from the top to the bottom of the pyramid are clear and well codified in legal and juridical instruments.

However, with the "debureacratisation" movement, this model of organisational design was brought into disrepute because of many changes in demographics and psychodynamics. For instance, skilled labour emerged with "knowledge workers" who most of the time knows better than their bosses in their area of expertise. These people did not want just to be told what to do but also to have a say not only in their specific areas but also to participate in decision making. This created a predilection for organisational designs that abrogate the hierarchy embedded in the pyramidal model. In this context the concept of the flat organisation emerged and shifts were made from command and control to information-based organization (Quinn et al. 1996). Some authors went as far as turning upside down the pyramid and advocating of an inverted pyramid model of organisation where the wide bottom would be at the top and the narrow pick at the bottom. All these were attempts to reduce inefficiencies due to the fact that in a rigid hierarchy viewpoints are valuable and taken into account in decision making according to the position of the person who express then and not his or her competence or their overall contribution to value creation. Moreover, the flat organisation avoids bottlenecks in resource and information circulation.

4.3 The Learning Organisation

Most of organisational designs assessed so far focused on their own internal workings. For instance, the pyramidal and hierarchical model considered organisations as autonomous (if not isolated) entities and focused on stabilising their internal channels of control and command in a way that these organisations lacked internal flexibility and external adaptability to cope with increasingly complex production systems and versatile markets. Moreover, the customer of the mass production area looked for products quality and service in addition to mere utility and this introduced new pressures especially with the entry of Japanese companies in the American market that brought philosophies such as continuous improvement (Kaizen) and types of loyalty that went beyond the legalistic and contractual understanding of work. The

mechanistic model (a search for universal and immutable laws similar to Newton's laws of motion) that has led to rigid bureaucracies and to stagnation both in management thought and practice and big companies could not anymore face the challenges of increasing competition, customers oriented production methods and services and a new labour that is educated and willing to participate in the running of the business. This mechanistic and rigid system was more and more replaced by a more flexible (even somehow amorphous) model that included in organisational design the notion that businesses are not isolated entities but they are complex and integrative process that are in continuous interaction with their environment. The mechanistic model was replaced by an organic model in attempt to integrate elements of complexity and dynamism and in the academic jargon there was a shift from business systems (internally focused) to business ecosystems (environment minded).

The notion of a business ecosystem has been applied to electronic commerce in a way that some scholars have talked about the Internet ecosystem. As Turban et al. (2004) have noted, the Internet ecosystem is the business of the online economy. The prevailing model of competition in the Internet economy is more like web interrelationships than the hierarchical, command-and-control model of the industrial economy, Unlike the value chain, which rewarded exclusivity, the Internet economy is inclusive and has low barrier entry. Just like an ecosystem in nature, activity in the Internet economy is self-organising. The process of natural selection take place around company profits and value to customers. As the Internet ecosystem evolves both technologically and in population, it will be even easier and likelier for countries/companies/individuals to participate in the Internet economy. (Turban et al. 2004).

Linked to this idea of a self-organising economic ecosystem is the notion of the learning organisation. To survive the turbulence of the electronic marketplace organisation must be flexible and adaptable enough to face the challenges of their own complexities and changes in the environment. The notion of the learning organisation was coined by Peter Senge (1990) and he defines this type of organisation as "an organisation that is continually expanding its capacity to create its future. For such an organisation, it is not enough merely to survive. "Survival learning" or what is more often termed "adaptive learning" is important – indeed is necessary. But for a learning organisation, "adaptive learning" must be joined by "generative learning", learning that enhances our capacity to create (Senge 1990). The learning organisation therefore does not emphasize its own processes and systems but it is alert and ready to make necessary changes to face challenges an to seize opportunities. It is not merely reactive to its context but it is proactive and ready to undergo processes of radical change equated to the Geek word for conversion to Christianity – *metanoia* – that Senge (1990) defines as a "shift of mind". In this context, the capacity to learn becomes a strategic asset at the same level as capital and labour.

4.4 The Virtual Organization

There is no agreed definition of what a virtual organisation is. This is due to the fact that virtual in the business ecosystem is a complex notion and many people tend to define the virtual organisation by contrasting it to the traditional brick-and-mortar organisation. Therefore, from the point of view of physical location, people define the virtual organisation as "placeless", located in the Cyberspace. This implies that the virtual organisation is purely an electronic entity made of "bits rather than atoms" (Negroponte 1995). This notion equates the virtual organisation to any online organisations. The different dot.coms that dominated the market in the early 1990's then can be considered as the only virtual organisations. However, a wider view considers the virtual organisation from the point of view of the way resources, people, information and skills are put together in view of creating value for the customer. This leads to defining the virtual organisation from the point of view of business practice and not of essence. The question shifts from "what is a virtual organisation?" to "what does a virtual organisation do?". This second approach brings into focus definitions such as that of Burn et al. (2002) that the virtual organisation is "an entity which comprises a combination of different companies and individuals that have combined to complete projects or business propositions and developments". From this second perspective it seems that the virtual organisation extends the formation of cross-functional teams beyond the traditional boundaries of any single organisation. This aspect underlines another important characteristic of the virtual organisation: inter-organisational systems. For the virtual organisation to operate successfully in the internetworked markets it must be aware that "no organisation is an island". The different aspects will be assessed in details in the next sub-sections.

4.4.1 The Online Organisation

The most known aspect of e-commerce is the fact that it is technology-enabled, technology-mediated, and includes intra- and interorganisational activities to support the exchange (Rayport et al. 2003). This creates the image that the virtual organisation operates solely in computer mediated environments (CME), a phenomenon that may in a near future put an end to brick-and-mortar types of business that the industrial society has created and develop into a cashless society. The role of technology is so important that Barnatt (1995) has coined the concept of "management by wire" Management by wire is possible because the Internet and related technologies allow "near-instantaneous global connectivity" (Barnatt 1995). Therefore, the virtual organisation is not fiction since computer mediated environments creates infrastructures such as computer virtual workplace (CVW), personal virtual workplace (PVW) and computer supported cooperative work

(CSCW). Other infrastructures are computer telephone integration (CTI) and this goes beyond organisational and country boundaries allowing large scale integration (LSI) and very large scale integration (VLSI) communication systems. In this arena, the notion of virtual reality emerges. According to Barnatt (1995), virtual reality is "any structured representation or metaphor of the physical world, encoded in computer software with which human beings may interact". Therefore, "the concept of the virtual organisation is encapsulated in a desire to use information technology to enable relaxation of the traditional physical constraints of organisational formation and adaptation" (Barnatt 1995).

The understanding of the virtual organisation from the point of view of technology brings into focus a wide range of application including simple electronic versions of traditional paper based activity such as record keeping, invoicing, billing, and other innovations such as automated teller machines (ATMs), electronic checks and electronic cash. There are options such as homeworking also called telecommuting since through computer network people can work together without being located at the same place. This creates the possibility of the paperless office since there are ways of carrying all the informational, communicational, distributional and transactional activities through computer networks. A partial solution to the virtual workplace is hot-desks. According to Barnatt (1995), "hot-desk environments abandon the notion of having individual desks for individual employees. Instead, with these re-engineered workplaces, many communal desks or consoles with networked IT facilities are provided. In Digital Equipment Corporations's Stockholm headquarters, such "office of the future" has already been created. With permanent offices and desks scrapped, employees are presented with an open-plan area with terminals that drop down on flexibars. When an employee needs computer access they simply pull down a free terminal, and when they're finished they let it sail back up to the ceiling. Any personal space in the office is confined to the capacity of one's individual drawer in a communal filing cabinet".

Other ways online transactions are transfiguring the workplace is through hotelling and the use of groupeware and virtual teams. As Barnatt (1995), "closely related to hot-desk development, where enough desks will only be provided to accommodate the number of staff likely to be in the office at any one point in time, are *hotelling* arrangements. This system of working, as adopted by consultants Ernst & Young, relies on the notion that many consultants, accountants and so forth spend the majority of their working lives out with clients. They therefore have no need for permanent desks or office back at base. Hotelling employees are instead provided with portable, start-of-the-art computers, and rely on their clients to provide them with a desk from which they stay in touch with base via computer network links and voice-mail. When hotelling employees need to work at base, they simply call on a 'concierge', letting them know when they will be arriving and for how long. A

cubicle is then allocated for the duration of the employees's 'visit', on which their nameplate will be displayed by the time they arrive. Like its sister hot-desk, the hotelling concept relies on organisation-wide communications networks and high specification computer hardware through which all work is directed." Telecommuters do not work in isolation although they do not converge at one physical location. Specific software known as groupeware allow them to work into virtual teams. Groupeware as noted earlier is a genre label for the many types of computer software which are designed to enable group rather than individual computer usage (Barnatt 1995). In other instances, some human functions have been replaced by software agents. A software agent is "a 'smart' computer program (or *infomachine*) that will 'serve' its human master in cyberspace. Software agents protect their users from complexity of computer and network operations, and may engage is database searches and transactions based on knowledge of their user's "profile".

Authors such as Barnatt (1995) have defined the virtual organisation from the point of view of technology. In their view, the virtual organisation has three main characteristics:

- A reliance for their functioning and survival on the medium of cyberspace across a wide system of organisational infrastructures.
- No identifiable physical form, and only transient patterns of agent-broker (employee-employer) connectivity.
- Boundaries defined and limited only by the available information technology, rather than bureaucratic rules or cumbersome contractual arrangements.

However, complementary to this view, are views that define the virtual organisation form the point of view of business practice and insist that in addition to being an online organisation the virtual organisation is a collaborative organisation.

4.4.2 The Collaborative Organisation

Gammack and Poon (2013) have ranked the levels of a virtual organisation in the following decreasing order collaboration, conversation, communication and connection. This implies that Internet connectivity is just the first step in an organisation that is moving from brick-and-mortar or virtual organisation. This implies that in addition to technological aspect (going online) there are not only new organisational structures that take place but also a supporting culture that permeates business practices. As Marshall et al. (2001) note, "the virtual organisation may provide the much needed after flexible and synergistic model of this Millenium". Collaboration in virtual organisations have occurred under two main strategies: partnering and outsourcing. In fact, some authors such as Burn (2002) have defined

virtual organisations as "partnership networks". This implies that to succeed, virtual organisation either enter into strategic alliances with other organisations or they stick to what they do the best and outsource what they are not best at. As proponents of virtual organisations such as Hedberg (1997) have noted, "Back to basics" and "focusing" have become watch words in efforts to limit a company to activities of vital strategic importance and to areas in which it can be a winner or at least operate efficiently. Accordingly it would be better to subcontract activities not part of this core (outsourcing), or even to discontinue then entirely and buy them from completing suppliers when necessary. For instance, CACC Learning, a distance education college focuses on its core (providing study material, collecting fees, administering exams, and providing qualifications) and sub-contracts some of its activities such as exam invigilating and essay marking or hiring exam halls rather then building them.

In addition to outsourcing many business scholars have noted that companies need to collaborate rather than to compete. This leads to the creation of strategic alliances or establishing "knowledge links". Strategic alliances corroborate Marshall's view of the virtual organisation as an organisational structure based primarily on the notion of collaborating entities. As Marshall (2001) elaborates, "here, firms come together to share competencies, skills, knowledge and other resources for the purpose of producing a particular service or good, or of taking advantage of a particular opportunity." The demands of collaboration create an amorphous type of organisation that keeps changing according to the product or the services the alliance is being formed for. That is why "a key characteristic of the virtual organisation is its adaptability and flexibility in the face of turbulent business environments, a condition sometimes described as "agility" (Goldman et al. 1995 quoted in Marshall 2001).

Virtual organisations appear in various forms according to the type of their presence online and to the type of strategic alliance they are involved in. They range from virtual faces, co-alliances, star alliances, value alliances, market alliances and virtual space. The first model, virtual faces, is the online presence of brick-and-mortar organisations. For instance, the University of Zimbabwe may have a web presence (a virtual face) but that does not dispense this institution from using lecture rooms, libraries and other physical facilities. The second model is made of co-alliance virtual organisations. These are essentially shared partnerships. In this type of virtual organisation, "each partner makes approximately equal contribution to resources, competencies, skills and knowledge to the alliance, then forming consortium (Marshall et al. 2001). The composition and the structure of the consortium may change according to market opportunities and these types of alliance may appear or disappear either by mutual convenience or on a project-by-project basis. Unlike co-alliances that are partnerships between equals, there are other strategic alliances where a big organisation that occupies the centre stage is

surrounded by small organisations. This third type of alliance is called star-alliance. According to Marshall et al. (2001), "star-alliance models are co-ordinated networks of interconnected members representing a core surrounded by satellite organisations. The core comprises the leader who is a dominant player in the market. The leader tends to dominate and has the power to direct and dictate the supply of competence, expertise, knowledge and expertise to members." The fourth type, value alliance models, brings together range of interrelated products, services and facilities that are based on an industry value or supply chain" (Marshall et al. 2001) while the fifth type- the market alliance- is made of organisations that come together to coordinate manufacture, marketing, selling, and distribution of a diverse but coherent set of products and services. The market alliance is different from the value-alliance model in the sense that several value chains are likely to be involved (Marshall et al. 2001)

4.4.3 Inter-Organisational Systems

The shift from the brick-and-mortar organisation to the virtual organisation implies a change from the understanding of organisations as static autonomous entities to organisations as dynamic interdependent processes. The flow of resources, people and information in virtual organisations enhances complex and dynamic processes that are captured by computer networks. Whether an organisation is called virtual by the virtue of being online or whether the collaborating aspect is emphasised, or various combinations of the two models it is clear that traditional boundaries be they physical, structural and legal are being regularly modified for the only purpose of creating value for the customer. This implies technically that no organisation is an island and hence cross-functional teams are not enough as long as they are confined to one organisation. The weaknesses of self-centred organisations make then unable to complete since other organisations through outsourcing and strategic alliances can form all stars teams. The introduction of inter-organisational systems becomes not only a prerequisite and a strategic asset but sometimes it is a condition for survival. This subsection will focus on inter-organisational systems and their value-creating role in the context of computer mediated business environments.

Inter-organisational systems (IOS) have been defined by Li (2001) as "the computer and telecommunications infrastructure developed, operated and/or used by two or more firms for the purpose of exchanging information that supports a business operation process." The most known is Zimbabwe is the ZimSwitch function that links all the banks in Zimbabwe in a way that credit card holder can cash at any ATM regardless of which bank she banks with. A similar function exists in the UK's banking sector with LINK network of cash dispensing machines. Another

well known example of an IOS is the online seat reservation and ticket reservation network among major airlines in the USA, and less known such as Demepool in France, an information network created by a group of independent transportation firms for the exchange of jobs and for avoiding the running of empty vehicles on return delivery trips (Li et al. 2001). The role of inter-organisational systems is not limited to the service industries, as the examples above may seem to portray. In the manufacturing industry techniques such as just-in-time have been possible because of inter-organisational systems that have been called integrated core technology. According to Vroman and Luchsinger (1994), integrated core technologies refers to the use of information technology to reshape organisation's relationships with customers and supplier partners and with employee teams. It means redesigning the operations or service delivery to complement the power of these elements. Corollary to integrated technology are improved service quality and a holistic understanding of work and organisation that empowers the front-line employee.

Inter-organisational systems appear in many forms according to their degree of openness to external input. Three models have emerged: (1) the dedicated closed inter-organisational systems, (2) the semi-closed group networks based on value-added network services (VANs) and (3) completely open systems based on mediums such as the Internet. (Li 2001). Inter-organisational systems creates new types of organisations and a new management philosophy by fostering radical changes and introducing new business paradigms. Lloyd and Boyle (1998) have identified the way new technological infrastructures affect both value creation and organisational transformation. For instance, the "net" allows wealth creation and social development leading to internetworked business. Likewise, interenterprise computing allows the recasting of external relationships extending the traditional boundaries of corporations and thus creating "the extended enterprise". From the internal physiognomy of the enterprise, enterprise infrastructure fosters organisational transformation and creates "the integrated enterprise" as opposed to the hierarchical pyramidal model that creates boundaries between management and staff and fragments the enterprise into rigid functional specialities that sometimes lead to bottlenecks in the flow of resources, skills and information. Workgroup computing leads inevitably to business process and job redesign and this creates the high-performance team. From a personal point of view, personal multimedia technology gives the employee access and control over information in such as way that she becomes the effective individual. It is obvious that effective individual freed from the bottlenecks imposed by rigid hierarchies and inflexible functional specialties enter into collaborative relationships that go beyond the physical and legal bounds of their organisation in order to give the customer the best value.

5. CHANGES IN CORPORATE CULTURE

5.1 From Fragmentation to Integration

Traditionally organisations have been defined by their boundaries both physical and legal. However, Barnatt (1995) has noted that computer network facilities have already been noted to "supercharge" organisations, with hierarchical and functional boundaries often short-circuited as interdepartmental problem solving teams spontaneously emerge. In computer networked organisational environments, people with relevant knowledge get drawn into any kind of discussion, with employees forming into "virtual departments". This leads to vertical integration (removal of barriers between management and staff) and horizontal integration (removal of barriers between different functional specialities). This double integration requires from managers some technical know-how that not only help them to make efficient and effective decisions but also that allow them to solve complex problems linked with the sophistication, complexity and elusiveness of computer mediated business environments. These environments require organisations to pull together the best of their resources, skills and people in order to satisfy a more and more demanding customer who has limitless choices since Internet connectivity allows the customer cheap and real-time access to global markets. Moreover, online trade gives the customers the possibility of dictating the features of the products she can buy or the quality of the services that she requires. In this context, only the best can sell and the Biblical metaphor of a kingdom divided applies here. Fragmentation though watertight hierarchical levels and functional speciality is detrimental to the production of quality goods and the provision of quality services.

At the organisational level, this creates a need, not only for new structures but also new principles values and procedures that inevitably involves new skills. Each employee participates in the double process of integration described above though integrating at the personal level of technical and non-technical skills. Technical and non-technical skills at this level are not mutually exclusive; they are different but yet complementary. Companies need either to initiate integrated training programs but the overall school systems need to narrow the gaps between the two. These new training needs lead to what Barnatt (1995) calls convergence. In his own words, "traditionally, research scientists, systems analysts and computer programmers have been isolated from front-line company operations. They have had no contact with customers, and hence have not needed training in customer liaison. However, with many organisations now downsizing away from remote mainframes, and with cybertechnology being used by a greater and greater number of employees, this scenario is changing. Across many institutions, technical employees, and the computer systems and interfaces they create and maintain, are becoming the first point of

contact. Take banking as an example. Many customers now never go into a bank at all. They deal with the whole organisation totally via interaction with its hole-in-the-wall machines. Such a trend will explode as home banking, home shopping and other interactive television services become available. Just as companies now spend money training sales reps, marketing personnel and other customer representatives, so in future attention will need to be focused upon the non-technical capabilities of technicians, as their contribution to organizational success emerge from the backroom and into the harsh light of the front-line. All employees will require some degree of customer training. Similarly, future managers will require a high level of technical expertise if they are to reach for the top. A powerful ethos of the New Age is convergence in a myriad of guises. Across industry, demarcations are being decimated on all levels."

5.2 From Stable Closed Entities to Dynamic Open Systems

In addition to integrating technical and non-technical skills at employee level, integrating low and high levels of hierarchies through "debureaucratization", and achieving excellence through cross-functional teams that may go beyond the physical and legal boundaries of one organisation it is important to have a shift of focus. Organisations have been traditionally conceived as stable and closed entities. In many instances, the fear of competition or sabotage by ill willed people covered them with secrecy and led to the creation of deep rooted routines borrowed either natural sciences or from other human organisations such as armies. The idea of the corporation (from *corpus* in Latin that means body) implies an organic model with internal dynamics that are as stable as the biological laws of metabolism. Moreover, to remain healthy, a body needs some degree of autonomy that leads to strict ways of integrating elements from the external environment. There is no wonder that sickness is often conceptualised through the metaphor of attack (by germs, viruses and so forth). From this point of view, purity is equated to health and diversity or integration of external elements is either avoided or submitted to strict screening. From an organisational point of view, this view exemplifies the way of proceeding of the pyramidal model where the preservation of the structural makeup of organisations made self-serving rather than customer focused.

In computer mediated environments, it becomes difficult even impossible to avoid interacting with others. The idea of the corporation (an autonomous body) invites some degree of heteronomy given the fact "interorganisational metabolism" (Lloyd and Boyle 1998) rather than "intraorganisational" metabolism is the norm of the day. This new dynamism questions even the idea of an organisation (from Greek Organon that means body) since organising means putting into place structures and systems i.e. not only putting parts together in a certain pattern of relationships

and functions (creating a structure) but also determining the principles, values, procedures, and rules of interaction (creating a culture). However, doing business in the cyberspace seem to creates amorphous organisational patterns where paradoxically the only constant is change and where to survive organisations must respond to the requirements of en ever changing environment. This leads inevitably to an organisational culture characterized by paradoxes and a constant tension that amounts to the "entrepreneurial spirit". In this context, ambiguity and uncertainty seems to take the upper hand over planning and rigor, creativity opposes disciplined analysis while urgency (opportunistic proactive behaviour) overrules the patience and perseverance (that is embedded in building long lasting and bid physical structures such as the massive plants of the industrial revolution). The new context requires organisations to be flexible, adaptive and open to learning if they are to survive. In addition to flexibility, adaptability and openness to learning, organisation that operate in computer mediated environment must be innovative and responsive to external changes instead of abiding to deep rooted orthodoxies and practices that are only applicable in stable environments. Instead of avoiding risks these organisations brave the storm and seem to be interested in current profit rather than in long-term equity. These new ways of doing business make the Internet not only a technological innovation but also the heart of a cultural revolution.

5.3 From Power and Ownership to Knowledge

Unlike the industrial revolution where the transformation of energy was the dominant mode of production, the Internet and e-commerce make information processing the dominant mode of production. This change of focus creates subsequent changes in the attribution of value to different types of stakeholders be they from the point of view of the ownership and valuation of the means of production, or from the point of view of their relative contribution to the value chain. For instance, "across the economies of the world, information itself, rather than oil, land, minerals and industrial plant, has now become the key global resource" (Barnatt 1995). This brings in focus that the owner of information technology and information know-how is slowly replacing the owner of "natural resources" in dictating the rules of the world economy. The traditional economic theory of limiting resources to capital and labour can be questioned from many point of view unless different players accept that information technology, information itself and information know-how are strategic assets, a "digital capital" as Tapscott et al. (2000) point out.

This changes in the valuation of assets shifts the balances of power from owners and to the knowledge worker who, most of times, knows much more than the bosses in his or her specific area of expertise. The "knowledge worker" according to Drucker (1989) is replacing the semi-skilled worker of the massive production era

of the industrial society. The semi-skilled worker is in fact the fruit of Cartesianism i.e the habit to "break apart problems, to fragment the world" (Senge 1990). The semi-skilled worker was precious in the industrial society because at that time the industrialist "analyzed tasks and broke them down into individual, unskilled tasks that could be learned quite quickly" (Drucker 1989). In the information society things are different. The professional or the expert more and more replaces the semi-skilled worker and this puts an end to the command-and-control model of organising. This change leads to different patterns of empowerment and sharing of rewards. The distinction between management and staff becomes irrelevant because power is no more at the top of a pyramid but at different nods of complex networks where different members of a team share resources and information. This creates a flat, networked model of organisation that is ruled by equality rather than domination. Daily manifestations of power balance such as routine checks and controls and scheduling are minimized since the knowledge worker has the options of working from home or any other location she pleases and can access central databases twenty four hours a day. This shift in power balance creates also a similar shift in the sharing of rewards since people get rewarded according to their contribution rather than to their position in the organisational structure (in computer mediated environments there may be no structure at all since teams assemble and disassemble following the dictates of the market).

5.4 From Competition to Collaboration

Theories of organisations that followed the industrial revolution were mainly inspired by the command-and-control model that guided armies and emphasized individual achievement and discipline as a way to achievement and greatness. The metaphor of the individual hero emerged and this way of approaching organisation emphasized competition as a core value. This model was later supported by evolutionary theories inspired by Charles Darwin that contended that natural selection and the survival of the fittest were the only ways for species to grow. From the two metaphors introduced previously the marketplace was considered as a battle from where one victory implies one's defeat. From an ethical point of view, theories such as ethical egoism emphasized the fact that in the marketplace every player should follow his or her self-interest and let the "invisible hand" supply and demand regulate the competition. This predilection for competition has been articulated clearly by some business leader such as James Lincoln the CEO of Lincoln Electric. For him:

Competition is the foundation of man's development. It has made the human race what it is. It is the spur that makes progress. Every nation that has eliminated it as the controlling force of its economy has disappeared, or will. We will do the same

if we eliminate it by trying to give security, and for the same reason. Competition means that there will be losers as well as winners in the game. Competition will mean the disappearance of the lazy and the incompetent, be they workers, industrialists, or distributors. Competition promotes progress. Competition determines who will be the leader. It is the only known way leadership and progress can be developed if history means anything. It is a hard taskmaster. It is completely necessary for anyone, be he worker, user, distributor, or boss, if he is to grow. If some way could be found to so that competition could be eliminated from life, the result would be disastrous. Any nation and any people disappearing from life becomes too easy. There is no danger from a hard life as all history shows. Danger is from a life that is made soft by lack of competition. (Bower et al. 1995)

However, doing business in the cyberspace portrays a different understanding of the relationships between different players. This crude individualistic understanding of competitions has been replaced by vertical integration (the suppression of hierarchical barriers) and horizontal integration (the formation of cross-functional teams). These patterns of integration lead to sharing resources and information in a way that within the organisation collaboration rather than competition is the order of the day. Barnatt (1995) has noted that interactive information technologies and computer connectivity allow real-time collaboration. These patterns of integration are not limited to isolated organisations. Collaboration between organisations and their customers and suppliers is not common while through outsourcing and strategic alliances competitors can work together in order to give the customer the best value.

This new way of doing business has been called by Burn et al. (2002) "coopetition". For them coopetition is the information and resource sharing strategies that are replacing naked aggression and competition in many business contexts. Collaboration is the way virtual organisations do business. With the global reach that many organisations enjoy the organisation that isolates itself is self-destructive. Burn et al. (2002) have noted the link between collaborating ways of managing and virtual organisations. In their view, "as soon as one mentions managing in a virtual organisation, or of adopting virtual organising as a deliberate strategy, then there is a sense in which one is almost talking about *interorganisational* management, and thus about the *coordinated* and cooperative behaviours and endeavours of acts/managers who originate in different organisations and who, after a period of time, may again actually be in different organisations."

5.5 From Warfare to Trust

The war metaphor is ingrained into popular beliefs that some electronic commerce scholars have entitled their book *Hyperwars* (Judson and Kelly 1999). This implies

that the marketplace conceived as a battleground is a dangerous place, where one must be very careful in order to brave the fury of the enemy and unveil the enemy's traps. This way of understanding business has created suspicion in the marketplace and one's operations are covered with secrecy. Otherwise, unscrupulous competitors may take advantage of loopholes in one production system either to destroy an organisation or to take an upper hand in the market. In contradistinction to this approach, virtual managing suggests another spirit i.e. trust. To be successful trust must be the order of the day both within and between organisations. Concerning trust within organisations, Jack Welch, the CEO of General Electric has noted that in the processes of "debureaucratization" a new type of loyalty is a must. In his own words, "my concept of loyalty is not "giving time" to some corporate entity and, in turn, being shielded and protected from the outside world. Loyalty is an affinity among people who want to grapple with the outside world and win. Their personal values, dreams, and ambitions cause them to gravitate towards each other and toward a company like GE which gives them resources and opportunities to flourish" (Bower et al. 1995).

Jack Welch calls this new type of loyalty the "psychological contract". Psychological contract, in addition to financial rewards give the employee the feeling that not only do they get from the company their pay check but also that their work goes beyond earning a living and satisfying their vegetative needs. The psychological contract gives job security and a sense of fulfilment and accomplishment. In addition to their financial and other material needs, the psychological contract help the employees to feel that there are not working for "someone else" but that there are "insiders" and that their participation is acknowledged and rewarded. That is why, as a way of implementing the psychological contract Jack Welch testifies: "we try to avoid barriers between management and workers. We're treated equally as much as possible. When I got to work this morning at 7:30, the parking lot was three-quarters full. I parked way out here like anyone would. In don't have a special reserved spot. The same principle holds true in our cafeteria. There is no executive dinning room. We eat with everyone else." (Bower et al. 1995). This way of proceeding fosters trust and other values such as independence, freedom, responsibility and autonomy (Bower et al. 1995). To be effective in real business practice the psychological contract must be supported by the employees' sharing in the financial rewards of the organisations and in their effective participation in decision-making and problem solving. Jack Welch finds that the main limitation of the psychological contract is that it "tends to focus people inward" (Bower et al. 1995). This creates the need for trust not only within organisations but also between organisations. Technically, inter-organisational systems that help the sharing of resources, information and skills exist.

Inter-organisational systems traditionally linked organisations to their customers and suppliers. For instance, in manufacturing the cost of inventory is significantly

reduced when the suppliers can access information about the needs of the producers in raw materials. This type of collaboration let at General Electric to "a new plant lay out". As Jack Welch explained, "raw materials entered one side of the plant and finished goods came out the other side. There was no central stock room for materials and or work in process. Instead, everything that entered the plant was transported directly to the work station where it would be used." (Bower et al. 1995). In the same organisation the approach to the customer is different. As Al Patnik, vice-president of sales at GE pointed out: "our approach to the customer is to go and learn what he is doing and show him how to do it better. For many companies our people become their experts in welding. They go in and talk to a foreman. They might say, 'Let me put on a headshield and show you what I am talking about" (Bower et al. 1995). This type of collaboration yield a lot of financial benefits. Electronic commerce however brings collaboration to a higher level the one of putting in place inter-organisational systems that links organisations to their competitors. Obviously, this type of arrangements requires, in addition to technical links and structural convergence, a supporting culture based on trust rather than on suspicion.

Linking organisations to their competitors is paradoxical but it helps both organisations to pull together the best of their resources, personnel, know-how and information to give the best value to the competitor. However, this may amount to the violation of basic business intelligence and to the loss of one intellectual property. In this context, it is difficult to assess whether the competitor really has the real intentions he or she is expressing. The solution to this suspicion is the acceptance by both partners to share the risks involved equally or proportionally to the potential benefits. When the partners know each other agreements in this matter can be worked out. However, the nature of electronic commerce makes some organisations time and space independent and electronic transactions can be impersonal and faceless. It is a fact of human experience that people have difficulties to trust people they have never seen especially when financial transactions are involved. Moreover, people do not like to purchase products and services they do not know. These difficulties can be overcome through product certification and authentication by trusted third party intermediaries or shared security features such as encrypted security messages that can be decoded by the purchaser.

6. CONCLUSION

The unprecedented development and diffusion of computer and related information and communication technologies (ICTs) brought unprecedented changes in the ways people do business, live and play. However, the information age cannot limited to replacing pen and pencils with computers but information and communication

Table 3. The process of debureaucratisation (from mechanics to cybernetics)

Type of Organisation	Bureaucratic	Informated
Structure	**Pyramid**	**Network**
Emphasis	**Internal Workings to achieve equilibrium**	**Internal and External environment to adapt to change**
Model	**Closed Entities**	**Open System**
Layers of Hierarchy	**Many**	**Few or None**
Management Method	**Command and Control**	**Interaction**
Workforce	**Uniform Semi-skilled**	**Diverse Knowledge workers**
Values	**Rigidity; Discipline; Compliance Competition Warfare**	**Flexibility Adaptability Openness to Learning Collaboration Trust**
Location	**Physical Place**	**Physical and Virtual**
Results Areas	**Functional Specialties (Departments)**	**Cross-Functional Teams**
Performance Criteria	**Outcomes**	**Processes**
Strategy	**Cost cutting; Competition**	**Adaptation to Change Collaboration (including outsourcing and strategic alliances)**
Inspiration	**Mechanics**	**Cybernetics**
Decision-Base	**Power and Ownership**	**Knowledge**
Organisational Principle	**Division of Labour**	**Integration/Networking**

technologies (ICTs) brought changes in business operations, organizational structures and corporate culture. This chapter endeavored to outline not only changes brought in organizational structure and corporate culture but also pointed to a paradigm shift from bureaucracy which is build on mechanical principles to informated organisations which are built on cybernetics. This is not just a shift for paper-based operation and learning or simply the replacement of paper by hardware and software but a change of mindset from bureaucratic to informated organization. This change of mindset implies not only a change in organizational structuers but also a change in corporate culture from organizations based on mechanical principles embedded in bureaucracy to dynamic, agile, and flexible organizations build on dynamic and integrative principles embedded in cybernetics. This implies the changes presented in the table below:

Debureaucratization is supported by a change in corporate culture:

(1) From hierarchies (pyramids) heterachies (networks)
(2) From organisations as stable closed entities to organisations as dynamic open systems;
(3) From competition to collaboration;
(4) From warfare to trust and mutual support;
(5) From focusing on ownership and power to focus on knoweldge.
(6) From universality (tendencies to standardize products and procedures) to transversality (creating value through temporal cross-functional teams)
(7) From making and selling products to sensing and responding to customer needs

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