UNIVERSITÀ DEGLI STUDI DI SALERNO

ASVSA
Associazione per la ricerca sui Sistemi Vitali

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SISTEMI PER L'INNOVAZIONE E MANAGEMENT SANITARIO

The Viable Systems Approach (*VSA*)

and its potential contribution to decision making in uncertain conditions

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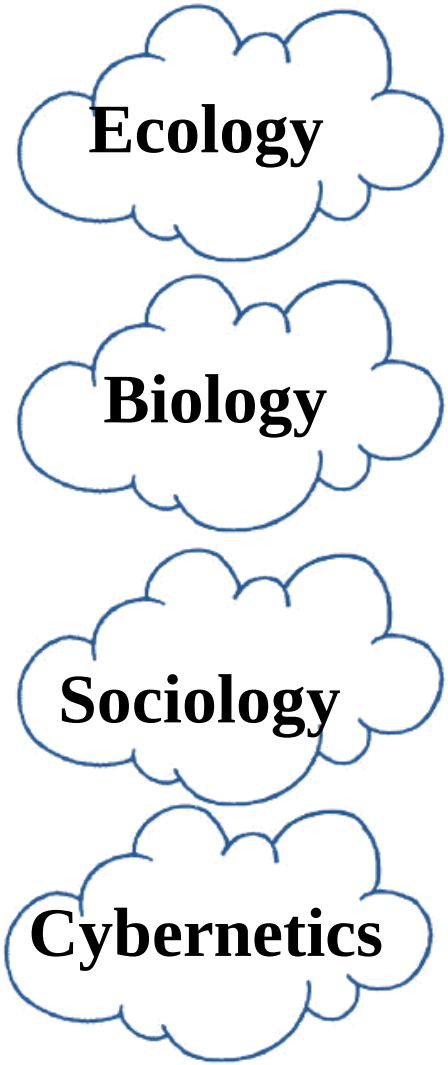
Agenda

- *VSA* Definition
- ” Interdisciplinary Roots and theoretical Framework
- ” Research Focus
- ” Fundamental Concepts
- ” Insights deriving from *vSa*

VSA® Interdisciplinary **Roots**



*Interesting to note the interaction between systems operating on our planet, the ground was laid for a theory of the earth as an integrated whole and living thing, in contrast with the mechanicistic vision of the universe. Particularly interesting are the organic aspects of homeostasis and equifinality (**Hannan and Freeman, 1977**).*

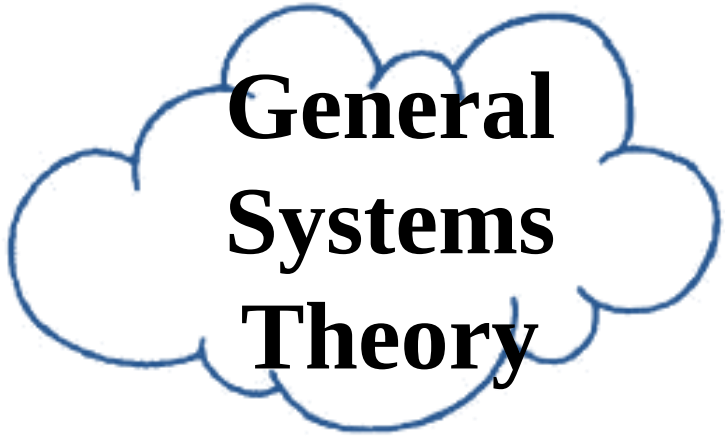
*Within their own environment (full of knowledge, resources and activities), systems are encouraged to selective mechanisms focused to the increase of their complexity in the attempt to allign it to the external complexity; living systems are characterized by autopoiesis, (**Maturana and Varela, 1975**)*

*Cognitivists suggest that the main source of value creation lies in knowledge and stress the importance of learning mechanisms (**Clark, 1993**)*

*From cybernetics comes the idea to interpret the firm as a viable system capable of homeostatic self control and self-regulation (**Beer, 1975**)*

***Prof. Ing. Francesco Polese** - fpolese@unisa.it* - August, 2016

VSA® Theoretical Framework



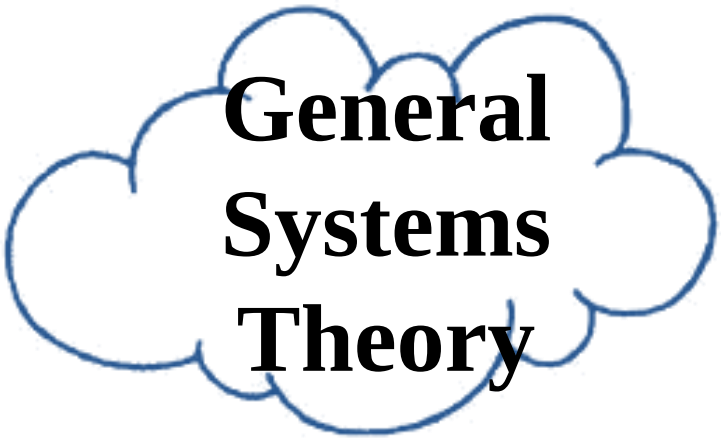
The General Systems Theory (GST) is a logical-mathematical discipline, in itself purely formal but applicable to the various empirical sciences.

For sciences concerned with "organized wholes", it would be of similar significance to that which probability theory has for sciences concerned with "changing events" (**von Bertalanffy, 1968**). We could even go back to the earliest work by **Bogdanov 1910**.

GST contributes in a significant manner to the creation of a new conception of phenomenological reality, as a synthesis of philosophical, sociological, mathematical, physical and biological approaches, influencing culture and its prevalent values founded on the axiomatic corpus of Cartesian thought.

Open systems – nonrandom elements organized into interacting, interrelated components - that seek to survive through interactions with environment .
Each system level nested in higher level: cells, organisms, families, organizations, communities, societies: (**Beer, 1972, 1975, 1979, 1985**)

VSA® Theoretical **Framework**



System theory is basically concerned with problems of relationships, of structures, and of interdependence, rather than with the constant attributes of object (**Katz and Kahn, 1966**).

GST implies a perception of reality as an integrated and interacting unicuum of phenomena, where the individual properties of the single parts become indistinct, while the relationships between the parts themselves and the events they produce through their interaction, become more important ("system elements are rationally connected"; **Luhmann, 1990**).

The fundamental unit of analysis is a system made up of many parts or structures (**Parsons, 1971**). In this sense, every entity (a firm, or simply an individual, a consumer, or a community) as a system can be considered a micro-environment, made up of a group of interlinked sub-components which aim towards a common goal (this is the condition, for the aggregate, to be qualified as a system).

Scientific **Framework**

From Systems Theories we ay observe:

•"a system as a complex of *interacting elements*" (Von Bertalaffy, 1956);
•"a system as an entity that is *adaptable* for the purpose of surviving in its changing environment" (Beer, 1975);
•"system elements are rationally connected" (Luhmann, 1990);
•concepts of many part compositions (Parsons, 1965), boundaries, connections and different relationship levels show certain signs of system relevance and allow an interpretation of its own capabilities as being critical and influential and its relations with correspondent supra-systems and sub-systems.
•"sub-systems focus on the analysis of relationships among its own internal components while supra-systems focus on the connections between the analysis unit and other influencing systemic entities in their context" (Golinelli, 2005);
•"a structure can be studied (what it is? How it is made?), a system should only be interpreted (how does it works? What logics does it follow?)" (Barile, 2008);
•"a system can be defined as an entity which is a *coherent* whole" (Ng, Maull, Yip, 2009).

vSA Definition

*"The **viable Systems approach (vSa)** represent a scientific proposal rooted in systems thinking, that valorize multidisciplinary contributes in a management perspective, in the attempt to better understand business behavior"*

***vSa** can be profitably adopted when observing reality (complex situation in which decision makers have to decide in uncertain conditions).*

***vSa** is a simplification attempt (a methodological approach, a meta-model) to deal with complex scenarios (service exchange).*

***vSa** does not provide solutions/answers! It is a meta-model.*

VSA® Research FoCUS

- The VSA has gathered several multidisciplinary contributions finalizing them to the observation of complex phenomena.

- VSA stimulates and enables an analysis of the relationships that exist among an enterprise's internal components, as well as an analysis of the relationships between the enterprise and other systemic entities in its context.

- VSA proposes a deep analysis of the Structure - Systems dualism when introducing that every *system* represents a recognisable entity emerging from a specific changing *structure* (set of individual elements with assigned roles, activities and tasks performed in compliance with rules and constraints).

VSA® Research Focus

- System origins from its own structure: this kind of evolution derives from the dynamic interactive activation of static existing basic relationships. A structure can be studied (what is it? How is it made?), whereas system should only be interpreted (how does it works? What logics does it follows?)".

- According to VSA, a firm develops as an open system characterised by:
  - many components (both tangible and intangible);
  - interdependence and communication among its components;
  - activation of these relationships in order to pursue the system's goal.

VSA® Research FoCUS

Enterprise as an open system, immersed in the environment, with which it interacts exchanging information, matter and energy.

It is a complex system of interacting elements rationally connected

The firm is a system with its purpose: it looks for survival.

The enterprise is an open system, aimed, organic, autopoiethic, cognitive, cybernetic

It is characterized by a life cycle similar to that of living organisms, which pursues its own survival in a selective environment

Biology: the environment is complex (full of knowledge, resources and activities). In it the enterprise is encouraged to selective mechanisms to increase its complexity and align it with external complexity

The cognitive approach suggests that the main source of value creation lies in knowledge and stresses the importance of learning mechanisms

From cybernetics it comes the idea to interprete the enterprise as a system capable of homeostatic self-control

…complexity…

Definitions

Decision makers are increasingly facing new situations and behave in contexts characterized by an elevated degree of dynamism

their existing interpretation schemes, based on predefined and standardized solutions, are often inadequate…

…complexity…

Definitions

Phenomena with respect to which there seem to be no potential solution, in the realm of problem solving approach are ever more widespread and complex.

Should a phenomenon in itself be considered complex? Or is complexity attributed by the observer?

The same phenomenon can be perceived as complex by one subject and even simple by another observer!

What defines a phenomenon as “complex”?

…complexity…

Definitions

Definitions on complexity have to take into account the traditional distinction between *quantitative* and *qualitative* elements.

In quantitative terms complexity is related to :

- size/articulation of a operating context (service eco-system);
- number and parts;
- variety of specialized social roles incorporated, the number of social actors;
- variety of mechanisms for organizing elements into a coherent, functioning whole.

…complexity…

Dimensions

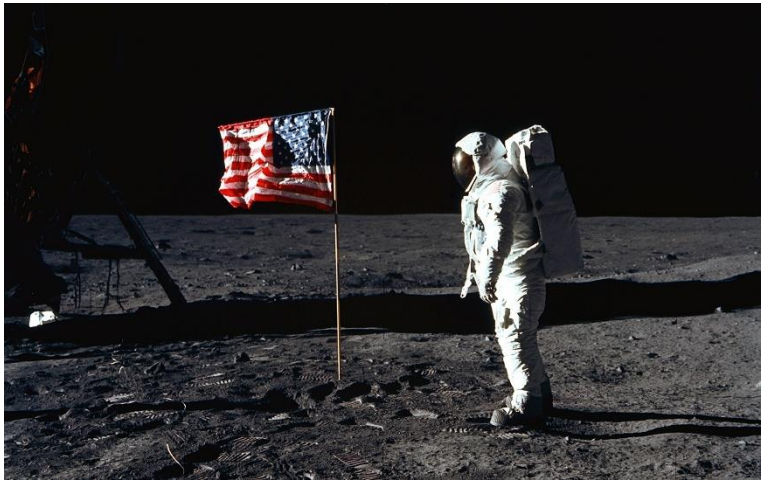
In qualitative terms:

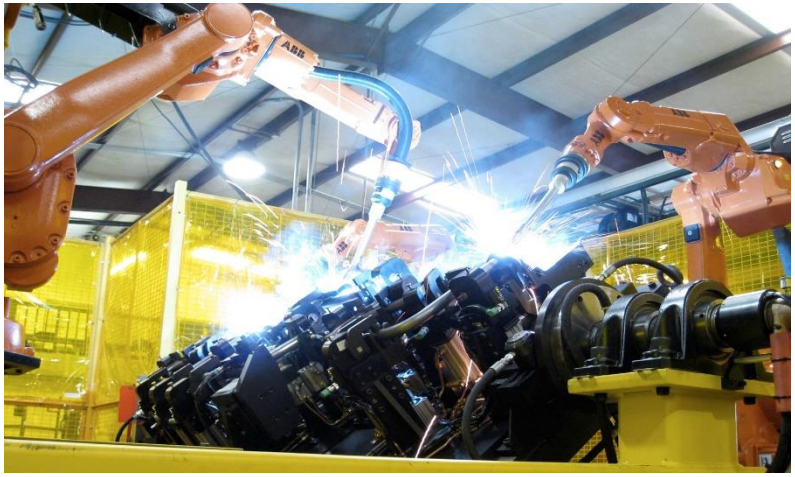
- complexity is characterized by a large number of parts that are linked in various interacting ways;
- complexity is an emerging phenomenon whose exact form cannot be predicted;
- processes that operate in live organisms produce an evolution that seems oriented towards entropy, towards a greater complexity.

…complexity…

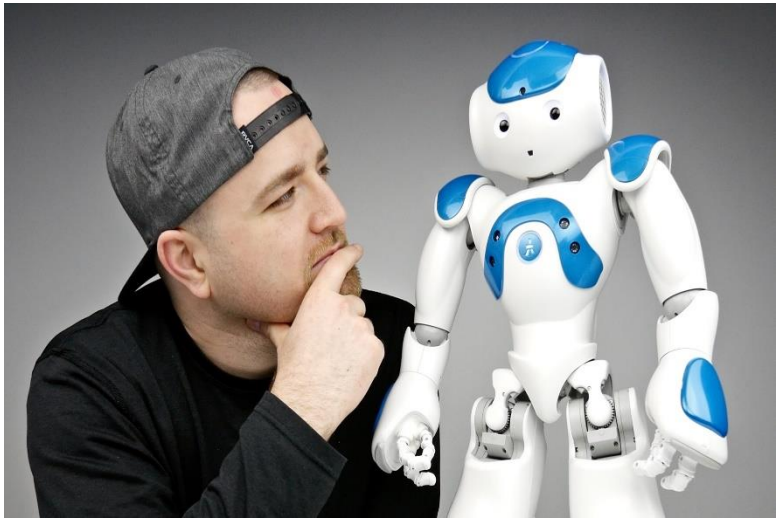
Do we share the same interpretation of complexity?

complication *versus* complexity





…complexity…



…complexity…

Perspective of Analysis

Complexity within the realm of social sciences, and therefore in business organizations, intervenes when observers are forced to abandon the structural perspective and need to evaluate "objects", both tangible or intangible, not enumerable on the basis of known calculation criteria.

Rather observers are forced to analyze objects characterized by:
-indistinct relational boundaries,
-changing and evolving relationships (in time and space),
-discontinuous and emergent behavior,
-extant social interactions.

Complexity – a *vSa* perspective

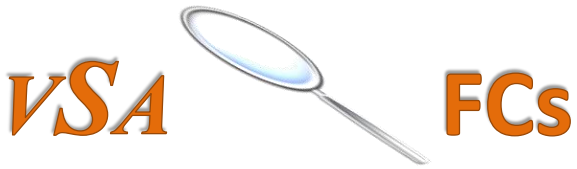
- ***Complexity*** *does not characterize the system in itself, but* ***emerges subjectively,*** *charactering the interpretation of the context made by the decision maker.*
- *A phenomenon can generate* ***chaos***, ***complexity*** *or simply* ***complication***. *It depends on the* ***interpretative capacity of the decision maker***, *not on the characteristics of the phenomenon (huge variety, variability, etc.).*
- *Complexity manifests itself when the* ***interaction*** *emerging from relations in a specific process* ***does not respond to clear cut criteria of behavioral rules***.

vSa Foundational concepts

vSa is based upon 10 foundational concepts (FCs) synthesizing its main assumptions; most of them appear to be helpful ways to better understand the observed phenomenon. The adoption of the proposed view supports a better understanding of the desing and management of complex issues (i.e, service systems), in which each observer/actor (i.e. modelist, designer, director, developer, manager, analist, etc.) is not fully under control of the outcome, which indeed is affected by not linear and qualitative inferences deriving from interactions in the socio-economic context.

VSA®

Fundamental Concepts



	vSa **Fundamental Concept**	**Comment**
Fc1	Individuals, organisations, and social institutions are systems that consist of elements directed towards a specific goal.	People, families, networks, enterprises, public and private organisations are complex entities, all of which can be understood as systems.
Fc2	Every system (of level L) identifies several supra-systems, positioned at a higher level (L+1), and several sub-systems, located at a lower level (L-1).	Every hierarchy of systems is determined by observation from a specific perspective. The designation of a 'supra-system' or a 'sub-systems' is thus subjective.

vSa Fundamental Concept

Comment

Fc3

The interpretation of complex phenomena requires interdisciplinary approaches, and should synthesize both a reductionistic view (analysing elements and their relations) and an holistic view (capable of observing the whole).

The contribution of relationships (static, structural) and interactions (dynamic, systemic) is fundamental to the observed phenomenon (reality).

Fc4

Systems are open to connection with other systems for the exchange of resources. A system boundary is a changing concept within which all the activities and resources needed for the system's evolutionary dynamic are included.

Nothing happens in isolation. The exchange of information and service of open systems is fundamental within every system dynamic.
Within systems boundaries not only property resources are valorized, but many available, thus accessible resources (even though these are owned by other systems).

	vSa Fundamental Concept	Comment
Fc5	Viable systems are autopoietic and self-organising; that is, they are capable of self-generating internal conditions, which through self regulation, support the reach of equilibrated conditions, thus synthesising internal possibilities and external constraints.	Every system is autopoietic, and is thus able to generate new internal conditions. Every system is also self-organising as it continuously aligns internal and external complexity. These two characteristics are the basis for sustainable behaviour in the face of opportunities and threats.
Fc6	Every organisation is constituted by components that have specific roles, activities, and objectives, which are undertaken within constraints, norms, and rules. From a structure emerges a system through the activation of relations into dynamic interactions with sub-systems and supra-systems.	The passage from structure to system involves a passage from a static view to a dynamic view, and focus shifts from individual components and relations to an holistic view of the observed reality. From the same structure, many systems can emerge as a consequence of the various combinations of internal and external components designed to pursue various objectives.

	vSa Fundamental Concept	Comment
Fc7	Systems are consonant when there is a potential compatibility among the system's components. Systems are resonant when there is effective harmonic interaction among components.	Consonant relationships refer to the static view (structure) where you could just evaluate the chances of a positive and harmonic relation. Resonant relations are referred to a dynamic view (systemic) where you could evaluate concrete and effective positive and harmonic interactions.
Fc8	A system's viability is determined by its capability, over time, to develop harmonic behavior in sub-systems and supra-systems through consonant and resonant relationships.	Viability is related to the system's competitiveness and to the systems co-creation capability.

	vSa Fundamental Concept	Comment
Fc9	Business dynamic and viability require continuous structural and systemic changes focused to the alignment of internal structural potentialities with external systemic demands.	The evolutionary dynamics of viable systems demonstrate continuous alignment between internal potentials and external expectations.
Fc10	Viable systems continuously align internal complexity with external complexity in order to better manage changes affecting its viable behaviour. Decision-makers within these cognitive processes are influenced by strong believes, his/her interpretational schemes, and information.	Internal and external alignment is achievable through a cognitive alignment, a knowledge process that includes chaos, complexity, complication, and certainty (through processes of abduction, induction and deduction).

Focus: **VALUE/COMPETITIVENESS**

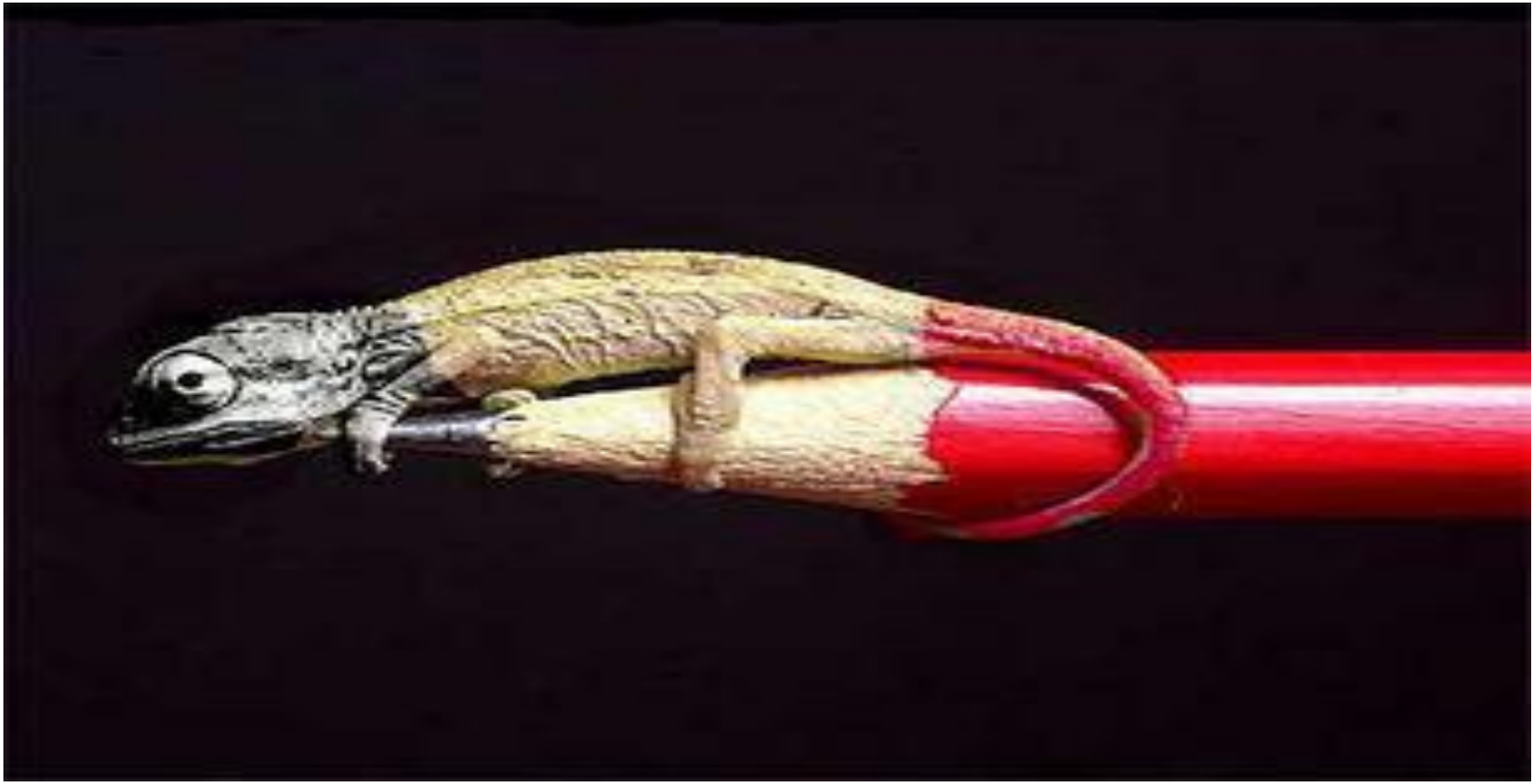
Focus: **RELATIONS**

Focus: **RESOURCES**

vSa FC9: Resources are determinant to supra-systems qualification

Resources are non proprietary, but disposable upon consonant and resonant behavior (this imply an active role of government): since viable systems need resources to perform sustainable behavior, critical resources are needed, and therefore determine the external systems' importance and relevance for viability.

Focus: **ADAPTATION**



RESOURCES

Do we share the same idea of critical resources?

Main concerns

Structural compatibility means that involved actors reciprocally posses the resources that the other actor needs, show reciprocal empathy, common values, etc. This is a potential condition for resource integration.

If actors do not share the same purpose their interaction would not be resonant (viable), and this would inhibit successful value co-creation, and thus actors engagement.

Structural incompatibility		
Structural compatibility = consonance		
Systemic harmonic interactions = resonance		

Not shared purposes	

You may have structural compatibility (presence of needed resources, of reciprocal empathy, of common values), but if the **purpose** of actors within the service exchange are different then there will not be resource integration (of critical resources) hence there will never be engagement!

vSA Key Scientific Outcomes

- **a viable system lives**, its aim is to survive within a context which is populated by other (viable) systems;
- **every context is subjectively perceived** by a viable system's top management (the decision-maker) through the analysis of its environment (a macro-system in which the decision maker is immerged) distinguishing and identifying its relevant supra-systems (resources owners) in relation with its objective;
- **context is the synthesis of a reticulum of viable systems**, within which it is possible to distinguish a certain number of systems (relevant supra-systems), which are able to influence the system's behaviour (the eco-system);
- **the system's structural definition and the level of consonance between its evolved components** (interacting supra and sub systems), define viability capacities;
- **a viable system has the capability of dynamic adjusting** (self-regulation) its structure: hence we may refer consonance to the system's attempt to correctly interpret contextual signals, and resonance to the concretization of the consequent competitive behaviour in order to maintain stability (when the system satisfies external expectations and needs displayed by relevant supra-systems).

VSA® ...some comments

- **a viable system lives**, its aim is to survive within a context which is populated by other (viable) systems;
- **every context is subjectively perceived** by a viable system's top management (the decision-maker) from analyzing its environment (a macro-system in which the decision maker is immerged) distinguishing and identifying its relevant supra-systems (resources owners) in relation with its objective;
- **a viable system has the capability of dynamic adjusting** (auto-regulation) its structure: hence we may refer consonance to the system's attempt to correctly interpret contextual signals, and resonance to the concretization of the consequent competitive behavior in order to maintain stability (if the system satisfies external expectations and needs displayed by relevant supra-systems).

VSA® ...some comments

Viability

VSA proposes that viable systems are able to survive in a particular context as a result of dynamic processes of adaptation, transformation, restructuring, and so on.

This continuous **learning process** requires constant monitoring and evaluation of accumulated technological knowledge and innovation to re-orient the tasks and objectives of the system.

Thus viability describes the evolution of the system since it can capture the **dynamic** of its components especially with reference with the variation of system's traits due to internal characteristics and external opportunities.

Indeed, VSA goes beyond that, in the attempt to: **classify** the external supra-systems (in order to understand which of them are more critical and influential for business behaviour); establish a qualitative method to measure the system capability to satisfactory behaviours (based upon affinity of culture, knowledge, value and other dimensions).

THANKS FOR YOUR ATTENTION

…AND CURIOSITY…

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Back up Charts (*roots*)

Later on, with the development of ecology, the science which studies the **interaction between systems** operating on our planet, the ground was laid for a theory of the earth **as an integrated whole** and living thing, in contrast with the then mechanistic vision of the universe.

Developments in the field of ecology have recently led to a new vision of reality, defined as a deep ecological vision, which interprets **reality as a network of interconnected and interdependent phenomena**, thus opening up new scenarios, producing significant effects also upon how we understand entrepreneurial behaviour.

This vision, also known as deep ecology, places the Earth and Nature at the centre and holds that human beings and all other things are part of the natural environment. Furthermore, it "recognizes the intrinsic value of all living beings and views humans as just one particular strand in the web of life" (Capra, 1996: 7).

Back up Charts (*roots*)

Cybernetics was defined by **Norbert Wiener**, in his book of that title, as the study of control and communication in the animal and the machine (**Wiener 1948, 1950**). **Stafford Beer** called it the science of effective organization (**Beer, 1972, 1975, 1979, 1985**).
Cybernetics is the interdisciplinary study of the structure of complex systems, especially communication processes, control mechanisms and feedback principles.
Cybernetics is closely related to control theory and systems theory (**Ashby, 1952, 1956**).

Cyberneticians arrive at the important conclusion that these cycles describe organisation designs, or patterns of relationships within physical structures, thus making the first important **distinction between the organisation design and the structure of a system**.

The concept of organisation design is applied to the theory of information and then to that of control. **Communication, control and retro-action mechanisms are based on the transmission and reception of information**. The organisation design is first and foremost conceived as a model of communication, and in second place, as a control model, becoming, in cybernetics, the chief characteristic of life.

The concept of organisation design, as we shall see, has a fundamental role in bringing out systems characteristics. These are not, in reality, connected to structural components, or at least not exclusively so, but to the **configuration of organised relationships**. It follows that systems properties are connected with the organisation design.

Back up Charts (*roots*)

Theoreticians in the economics and management fields have been seeking to apply, with various degrees of success, knowledge, concepts and theoretical models from other scientific contexts (physics, sociology, cognitive psychology, IT, etc.) in **an attempt to gain a better understanding of the principles regulating the way firms work**, and in particular, the activity of their governments.

The embeddedness of entrepreneurial phenomena in modern society, and the influence they have on the existential conditions of human beings, from the macroscopic effects, such as atmospheric and climatic change, to the microscopic, such as their effect on the economic, psycho-sociological and cultural dynamics of individuals and social groups, may lead to the idea that the study of a reality such as the firm with all its activities and the processes governing its dynamics, **cannot be undertaken without a deep understanding of its broader social**, cultural, and economic context, home to fundamental elements which condition and permit its evolution.

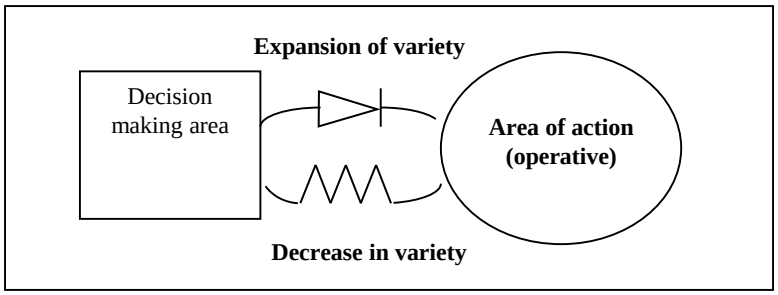
Back up Charts (*for comparison*)

VSA

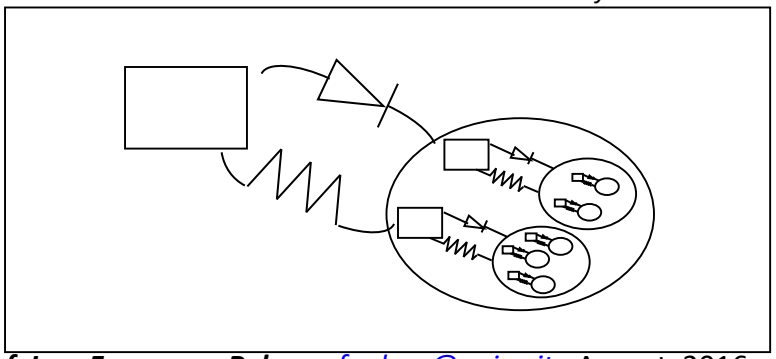
Viable systems can however, considering isotropic properties, present themselves differently from their various actual structures without denying their own identity. These systems can be represented as a unique category based on this identity as shown in the diagram below:

•a decision area
•an action area

The representation of the identity of viable systems.

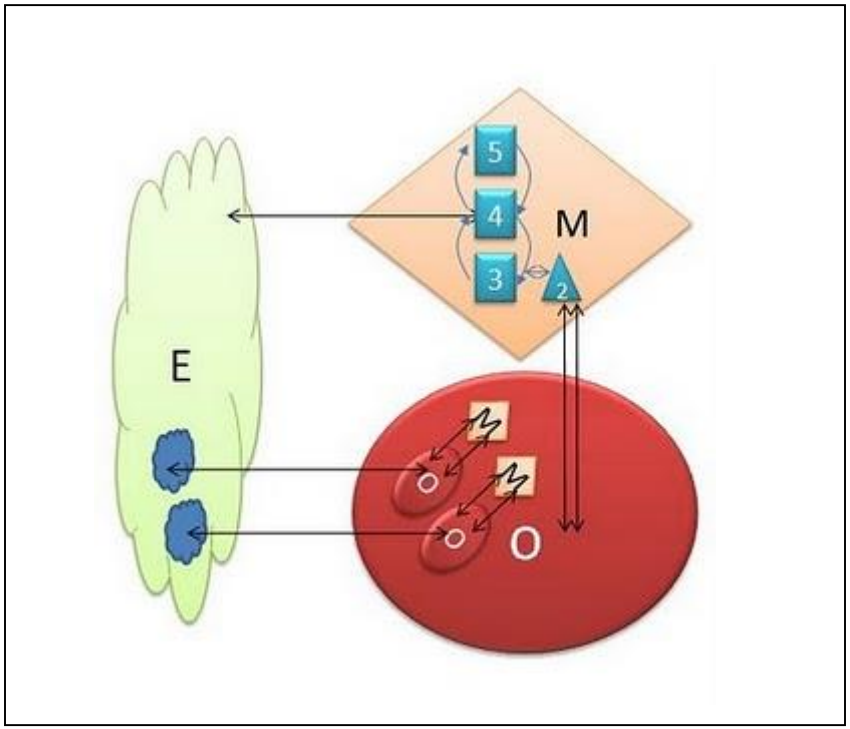


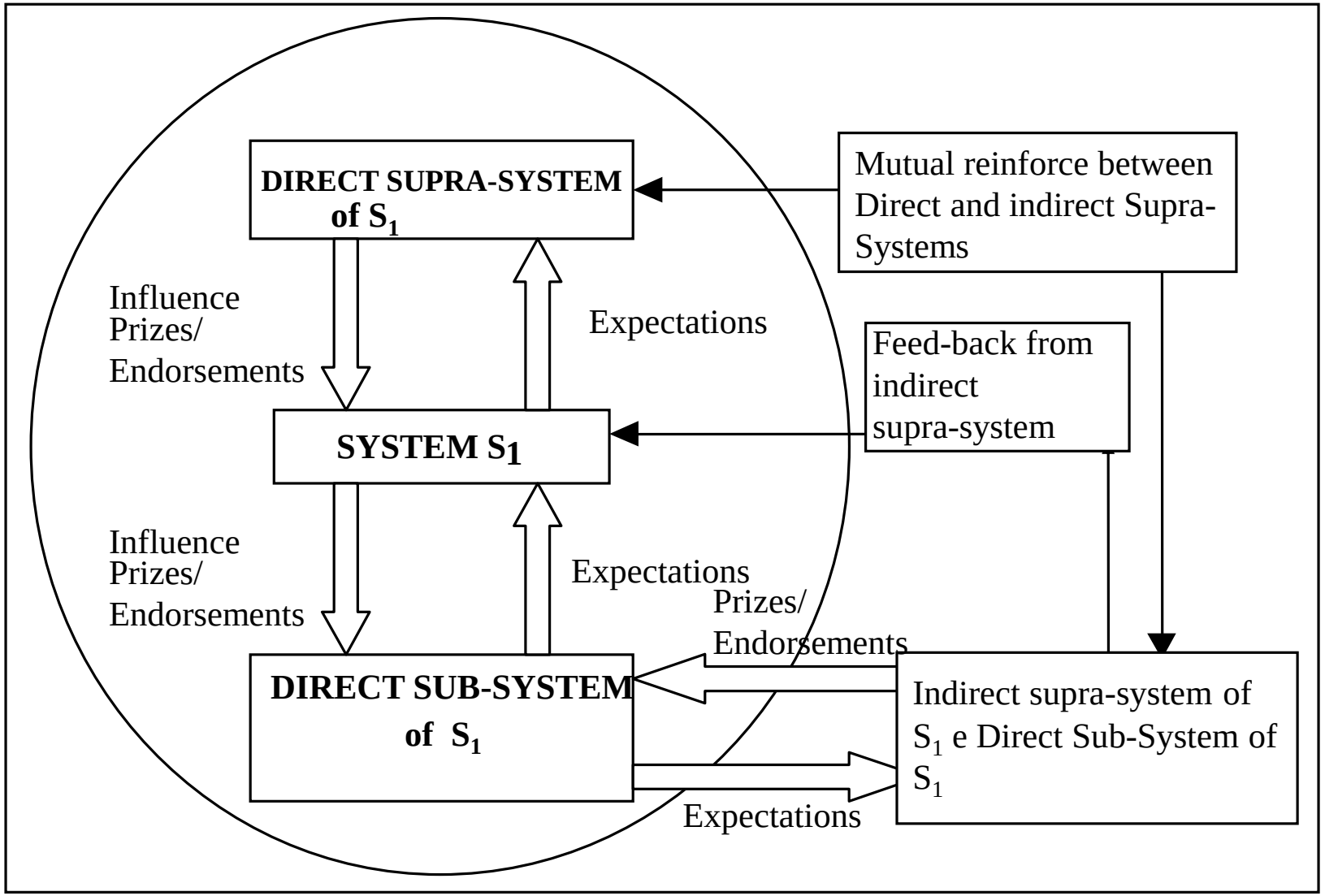
Connection between the identities of viable systems



VSM

In viable systems, there is an O for operations (which is where the CT sits), an M for the metasystem that governs O and an E for the environment. Together, they define what the boundaries are and most importantly where is the boundary for E as this defines the viability of the firm (ability to achieve homeostasis) as this boundary determines what is outside and what is inside. IF the CT changes, what was previously the environment could now be a resource and the metasystem could be managing something completely different.




DIRECT SUPRA-SYSTEM of S_1
Mutual reinforce between Direct and indirect Supra-Systems
Influence Prizes/ Endorsements
Expectations
Feed-back from indirect supra-system
SYSTEM S_1
Influence Prizes/ Endorsements
Expectations
Prizes/ Endorsements
DIRECT SUB-SYSTEM of S_1
Indirect supra-system of S_1 e Direct Sub-System of S_1
Expectations

Back up Charts
(System Thinking to Reductionism revisited)

THE FIRST AND MORE CRUCIAL ASSUMPTION IS THE DIVISION OF COMPLEX PROBLEMS INTO SEPARATE PARTS

It has been argued that the traditional scientific approach is based on the 3 R's of reduction, repeatability and refutation. That is: *we reduce the world through the selection of variables and we repeat experiments till exceptions occur.*

Any parts, in service, are interconnected and their relationships are complex and non-linear. Implications for the performance of parts where there is a close relationships among them have been investigated as well .

- **System thinking core ideas**:
  - the set of interconnected elements forming a whole;
  - emergence: when new forms appear and causes of this appearance are incapable to explain the forms;
  - cybernetics;
  - open and close systems: complex and dynamic interaction between organization and context

SYSTEM VIEW DOES NOT CONFLICT WITH REDUCTIONISM, BUT IT SHOULD BE CONSIDERED AS COMPLEMENTARY

Service Science has to embrace the notion that, whatever reductionism taken, what is lost in reduction is not the understanding of the whole. Complex Engineering Service Systems involve tightly coupled parts and the change of one component affects the others.

Back up Charts
(System Thinking to Reductionism revisited)

Reductionism breaks a problem down into its component parts and seeking to optimise each part. At the core of such a reductionist approach are three fundamental assumptions :
1. The connections between the parts must be very weak;
2. The relationship between the parts must be linear so that the parts can be summed together to make the whole;
3. Optimising each part will optimise the whole.

Complex engineering service systems involve tightly coupled parts; changing one component (e.g. one of the core value transformations) affects many others, leading to unintended consequences.

- The interactions between them are often highly complex and non-linear.
- The effect of an event or a variable returns indirectly to influence the original event itself by way of one or more intermediate events or variables.
- Thus, **complex engineering service systems** research has to reject the linear perspective on causality for the richer insights that can be gained from the systems view. Yet, such a rejection does not imply the rejection of the analytical approach.
- However, it is important to understand that certain properties of the system (such as customer experience).
- In such cases, the design of the system should consider interventionistic approaches rather than believing that the system could be pre-determined.

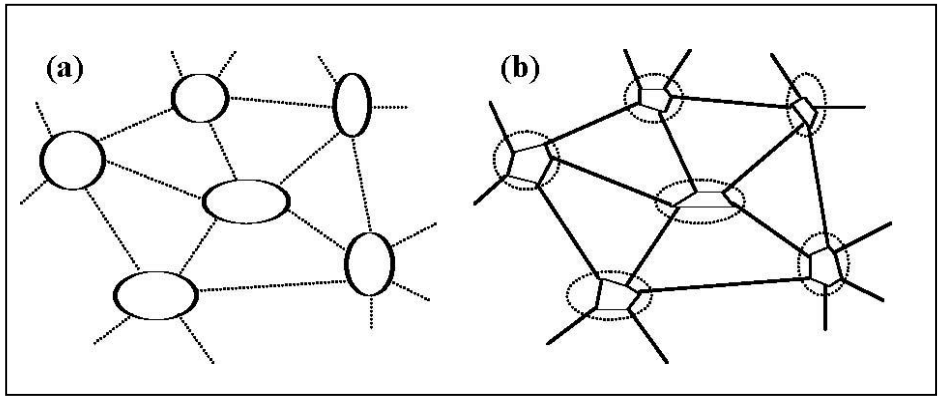
Back up Charts
(*VSA vs Reductionism and Holism*)

THE VSA, UNLIKE A THEORY, DOES NOT CONSTITUTE A STRUCTURED AND FORMAL DISCIPLINE

Within the theoretical studies which have contributed to the spread of systems thinking and the related new way of interpreting reality, it is important to note a shift from an analytical-reductionist approach to reality, to a holistic view of phenomena, associating systems thinking to this definition.
The most common interpretation of systems thinking, on the other hand, does not accept a reductionist view of reality, but embraces an overall view of phenomena, defined as holistic, which aims above all to show the link between the elements of a single phenomenon, the links between different phenomena, and the links between the elements concerned with different phenomena.

This kind of change comes from the shift in attention from the part to the whole, implying a perception of reality as an integrated and interacting *unicuum* of phenomena, where the individual properties of the single parts become indistinct, while the relationships between the parts themselves and the events they produce through their interaction, become more important.

Shifting from the observation of elements (a) to relationships (b).



VSA DOES NOT COINCIDE WITH THE HOLISTIC APPROACH AND IS NOT IN OPPOSITION TO THE ANALYTICAL-REDUCTIONIST APPROACH

Rather, as we have already shown, it is an approach which, placing itself within a *continuum* with reductionism and holism at its extremities, is able to reconcile the two.