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Business and non-Business Value Creating Organizations in the "Information and Internet Age".

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Abstract

This study seeks to present a theoretical framework to analyse the influence of *Web-Based Information Technologies* (WBITs) on the efficiency of the production organization, as revealed by the latter's economic and financial performance.
Accepting the assumption that the activity for the production of value is carried out by permanent organizations, I propose several basic definitions to show how production organizations can be considered as autopoietic systems which are coupled to the environment, as well as teleonomic systems that can continue to exist only as long as their performance as systems for the production of value is appreciated by the environment.
The preceding definitions and models permit us to examine how the Web-Based Information Technologies (WBITs) can integrate the structure of the *production-oriented organizations*, considered as *cognitive systems*, by strengthening the forms by which they realize their structural coupling with the environment by developing their Learning Management Capabilities and their autopoiesis.
In particular, the WBITs influence the structural coupling of the organization as well as its cognitive activity. To develop knowledge, the organization and its management – with the use of groupware technologies, business intelligence and analytical applications – must undertake a process of collective learning, thereby transforming itself into a learning organization and a learning management.
On the basis of the previous considerations we can make some general comments about the process of change that is so vast and sudden as that produced by the spread of the WBITs.

1. Organizations as autopoietic systems

Definition 1 - *An organization is a social system that forms when several individuals choose, for their own particular reasons, to be (or be part of) typical organs in terms of functioning, role, functionality and topology, which are linked by organizational relationships and structural ties that force them to carry out specialized, coordinated and cooperative behaviour – thus accepting certain objectives, programmes, rules and responsibilities – in order to undertake long-lasting processes aimed at a common end.*

Organizations carry out three types of interconnected processes (figure 1):

a) *cognitive*, through which representations of the external environment are formed through a system of data gathering that obtains data and transforms it into information and decisions; in this sense organizations are organizationally-closed *cognitive systems*, since the cognitive activity derives from the entire network of cognitive connections of the individuals that form it (Maturana and Varela, 1980);
b) *metabolic*, through which the structure maintains, strengthens and improves over time the network of internal processes, conserving the organizational relationships among organs despite changes in the individuals that make

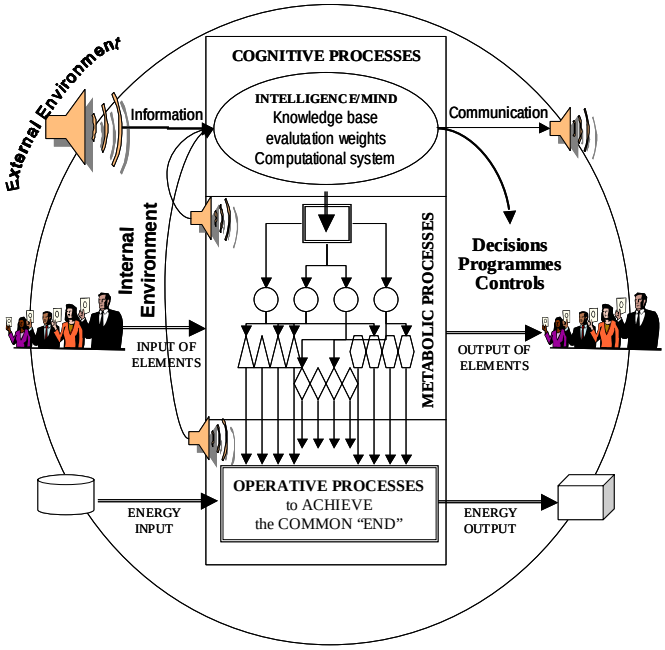
up the latter; in this sense organizations are *autopoietic systems* (Varela, 1979; 1981: 38; Uribe, 1981: p. 61; Vicari, 1991), in that they continually reproduce themselves – regenerating the network of processes and processors – in order to extend the length of the collective life for periods that go beyond the "life" of the components .". (Maturana-Varela, 1980: 82; Zeleny, 1981: 2).);

c) *operational*, through which they pursue the institutional aims that justify their autopoiesis; in this sense organizations can be viewed as instrumental, open transformation systems, since they transform input from the environment into output of some type required and valued by the environment .

As an *autopoietic system* (Bednarz, 1988; Luhmann, 1995)the organization *produces itself* by searching for the metabolic and energy inputs in the environment which are useful for *autopoiesis* and fleeing from those which are damaging (Zeleny and Hufford, 1992; Mingers, 1994).

In this sense the *cognition* activity is necessary for existential success.

Fig. 1 – The organization, its processes and flows



2. Organizations as teleonomic systems

Definition 2 - *An organization is a teleonomic system in that it maintains its own autopoiesis by carrying out cognitive processes to search for the conditions that allow individuals to benefit, directly or indirectly, from the achievement of a common end that defines its teleology.*

The *aims* that individuals, through organizations, can pursue are fourfold[1]:

1) *individual internal*, for which individuals are willing to participate in the organization, accepting its constraints and rules (for example: altruism, retribution, job interest, socialization, etc.);
2) *common internal*, or *institutive*; that is, the common aims for which the organization is created (for example: realizing a project, carrying out a production process for goods or services, etc.);

[1] *Goal setting theory* asserts that all living organisms - plants, human beings and production oriented organizations – are characterized by goal directedness (Binswanger, 1991); in particular, human action is purposeful, directed at a conscious goal and consequently, individuals engage in continuous learning in order to maintain their autopoiesis (Bandura and Cervone, 1986) and the believe that a rationale behavior is more effective than the behavior they consider no rationale (Locke & Latham, 1990). The term self-efficacy describes the confidence individuals feel about doing a particular task. Self-efficacy is influenced by ability, experience, training, past successes, internal attributions, and information about task strategies ((Bandura, 1982; Hollenbeck, Williams & Klein, 1989).

3) *individual external;* that is, the advantages individuals gain from the operating organization (for example: fruition of the results of the instrumental processes, awarding of goods or services, etc.);
4) *common external,* or *social;* that is, the advantages that the environment receives from the behaviour of the organization (for example: reduction of needs, spread of welfare, increase in the quality of life, etc.).

If we define *teleonomy* as the attitude of the organization to maintain its existence by regenerating its autopoietic processes, then we can distinguish between (Monod, 1970: 124; contra, Maturana-Varela 1980; 1988; Brooks and Wiley, 1986, Mayr, 1989)[2]:

a) *endogenous* teleonomy, which depends on the ability to pursue internal goals, that is to develop a teleology[3] (Dennet, 1988, Van de Ven and Pool, 1995); that is, to achieve a common aim and satisfy the individual internal motivations;
b) *exogenous* teleonomy, which depends on the organization being appreciated by individuals not belonging to it but who gain external advantages, individual or social, from its existence;

While *endogenous* teleonomy characterizes the internal structural dynamics, *exogenous* teleonomy characterizes the environmental dynamics of the organization; the organization has a high endogenous teleonomy if it continues to exist despite the unfavourable structural disturbances from the environment, by developing processes of *adaptation*; it is characterized by a high exogenous teleonomy if the environment itself sets the conditions that favour its autopoiesis, and thus a lasting existence, as a unit as well as an organizational type (Toffler, 1985).

Fig. 2 – Teleonomy of permanent organizations

	Individual goals: - very intense - judged positive	*Individual goals:* - not very intense - judged negative
Social goals: - very intense - judged positive	I – *permanent organizations* High exogenous and endogenous teleonomy Permanent autopoiesis Renewal of components slow or absent Examples: churches, states, professional armies, families	II - *permanent organizations* High exogenous but low endogenous teleonomy Difficult autopoiesis Renewal of components high Examples: armies, service associations
Social goals: - not very intense - judged negative	III – organizations for projects Low exogenous but high endogenous teleonomy Low renewal of components Difficult autopoiesis Examples: criminal organizations, useless organizations, sports associations	IV – *occasional organizations* Low exogenous and endogenous teleonomy Renewal of components unfeasible Autopoiesis impossible Examples: volunteers firemen, a pick-up game of football

With regard to the *length of life* we can distinguish among (figure 2):

A. *occasional organizations:* these are created for the pursuit of common institutive goals and often individual goals are not stressed; their genesis is predominantly spontaneous and non-programmed and operate by establishing *ad hoc* operative programmes; they have no social aim, and are characterized by low teleonomy, both endogenous as well as exogenous;
B. *organizations with a limited life or organizations for individual projects:* these are created for the pursuit of individual goals that give rise to the institutive plan for the achievement of the common end; because of their limited, predefined life there is no stress on the social end; they are above all characterized by endogenous teleonomy;
C. *permanent* or *autopoietic organizations,* or those having a *non-predefined* (unlimited) *life:* the common end is joined to the individual goals; the lengthy life also assumes the satisfaction of social interests or ends, as well as

[2] We can show the relationships between teleonomy and autopoiesis. In this sense teleonomy -- understood as a species' self-preservation -- can be considered the phenomenology, with respect to the species, that corresponds to autopoiesis -- understood as self-production -- which refers to each individual (Mella, 1997); "In effect, teleonomy is teleology made respectable by Darwin" (Dawkins, 1982).

[3] Teleology is considered in the traditional Hegelian meaning of purposeful activity directed towards an "End".

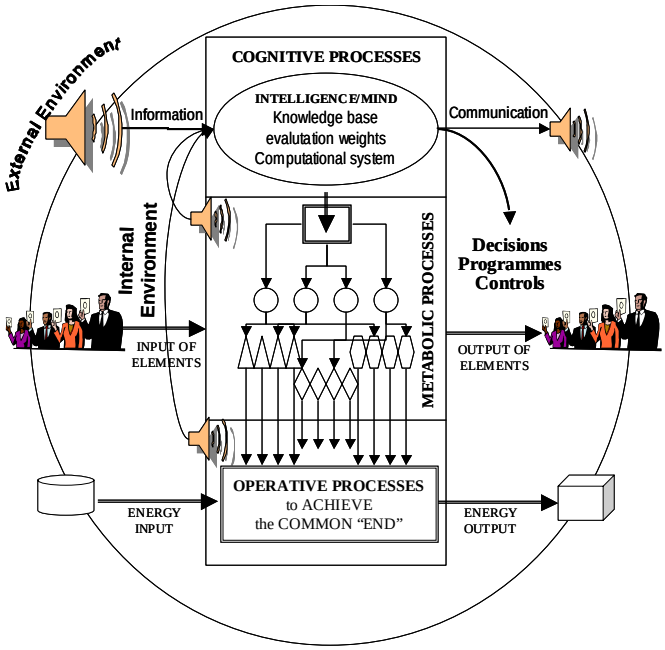
a system of operative objectives; they are also characterized by their exogenous teleonomy, as well as their endogenous one (Paetau, 1997).

3. Business and non-business, profit and non-profit organizations

Definition 3 – *A permanent organization whose common goal is the production of goods and services through instrumental transformation processes of factors into products is a* production-oriented organization (figure 3).

To carry out the productive transformation and obtain the quantity of goods QP_θ, at a given level of quality θ, Material and Services (M) and Labour (L) (these are the operative factors) together with Machines and other structural factors (S) (that is, production capacity factors), must be obtained from the environment at a cost equal to $CF_{M, L, S}$, whose sum is the full production cost for QP_θ[4]: CP_θ, = $CP = \Sigma_{M, L, S}\ CF_{M, L, S}$ (Mella, 2002)

Fig. 3 – Production oriented organization



Autopoiesis derives from the capacity to produce useful goods and services and to continually renew their demand by users, so that it is possible to hold back labour (metabolism) and reacquire the other factors. Since the production is consumed by the individuals that make up the organization, the latter enjoys a prevalently endogenous teleonomy. If the production is destined for the environment, then the exogenous teleonomy depends on the capacity to produce customer satisfaction so as to cover production costs and to reacquire from the environment the resources necessary for autopoiesis by renewing the productive processes. This implies the capacity to offer users products and services considered to be useful by feeding their desire to maintain the production organization alive, thereby reintegrating the production costs with contributions of various kinds (taxes, associative shares, sunk capital contributions, etc.).

Definition 4 – *A production-oriented organization which is preordained to sell its production in markets at prices at least equal to the unit cost of production is a* business organization. *If preordained to give up its production without a price, or recovering only a share of the production cost, it is a* non-business organization (figure 4).

[4] From now on we will use the notation $F_{M, L, S}$ to indicate F = M, L, S. In general, we will use capital letters (Q, T, P, etc.) to symbolize overall volumes or periods, and lower case letters (q, t, c, etc.) to indicate unitary or instant quantities. Capital letters are also used to designate the names of the variables (M, L, S).

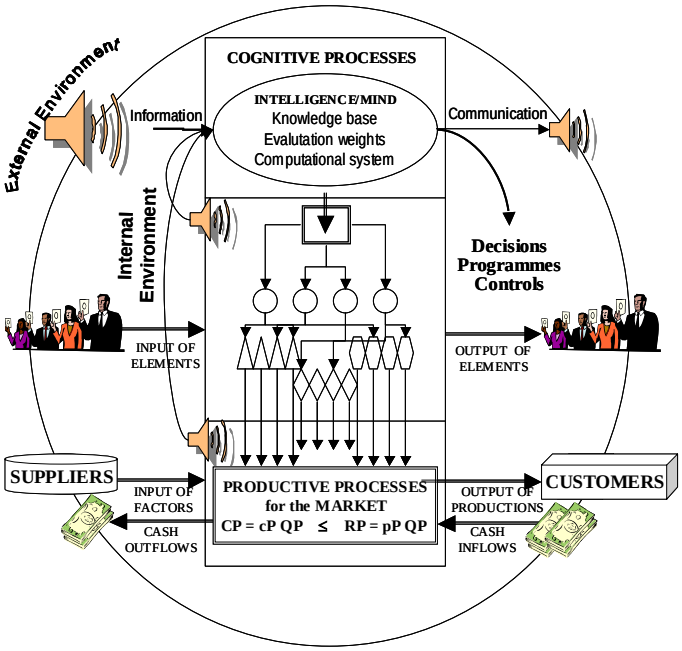
The business organization whose operative programme leads it to pursue the maximum economic efficiency by seeking the maximum gap between average unit production costs (to be minimized) and average selling prices (to maximize) is a for-profit organization; *otherwise it is a* not-(for-) profit organization.

If we let cP_θ, = CP/QP_θ be the average unit production cost, then the business organization reintegrates the cost $CP = cP\ QP_\theta$ by selling its production at price $pP \geq cP$, thereby gaining revenues of $RP = pP\ QP_\theta$.

The business organization's autopoiesis is based on economic *efficiency*, that is on the possibility of covering costs through revenues or containing costs within the limits of its revenue, so that in any event: $CP \leq RP$.

Exogenous teleonomy is connected to the capacity to create value for the environment; on the one hand by limiting or reducing the costs of production, and on the other by obtaining production with a value at least equal to the value of the factors used to produce it, so that customers are willing to pay a price at least equal to the unit production costs. This is equivalent to stating that these organizations are preordained to achieve a non-negative operational income, that is: $OI = RP - CP = QP_\theta\ (pP - cP) \geq 0$.

Fig. 4 – Business oriented organization



If the operating logic of the business organization is to achieve {[max] $(pP - cP) > 0$} then it becomes a *profit organization*; if, instead, the operating logic of its processes is to achieve {[min] $(pP - cP) > 0$}, then it becomes a *non-profit organization*.

If we assume we want to establish a fair pP* and a fair cP* - that is, production and sales values compatible with normal supply and sales conditions – then we can determine the fair Operating Income (OI*) produced by the organization: $OI^* = QP\ (pP^* - cP^*)$ that physiologically is zero in non-profit organizations and positive in profit ones.

The difference: *TEVA* = [OI – OI*] represents the *Total Economic Value Added* by the organization compared to the fair return that the environment could have (fairly) expect from the organization.

If the business organization has a productive efficiency higher than the fair one – so that $cP < cP^*$ – then $OI > OI^*$ and the difference [OI – OI*] represents the *Total Economic Value Added of Production; TEVAP* = QP [cP* - cP] with product qualities being equal.

If $cP = cP^*$ but market efficiency is higher than the fair one, so that $pP > pP^*$, then the *TEVAM* = QP [pP – pP*] represents the *Total Economic Value Added by the Market*, which is obtained from the price side, with sales volumes being equal.

If cP < cP* and pP > pP*, then RO > FR and RO – FR = *TEVAP* + *TEVAM* = *TEVA.*

In the non-profit organization, OI must tend toward zero by definition; thus, the TEVAM must tend toward zero (no increase in prices), with the *TEVAP* obtained from the production side and tending toward zero by a reduction in pP*; the entire *TEVAP* benefits the user of the products and services; thus in the non-profit organization the exogenous teleonomy depends on the capacity to produce values from the increase in the productive efficiency, since with each reduction in cP with respect to cP* there is a corresponding reduction in pP with respect to pP*. Since it cannot produce value by increasing pP but only by trying to reduce cP, we can see immediately that the operating logic of the non-profit organization must be based on the standardization of production over time and the constancy in its quality and process.

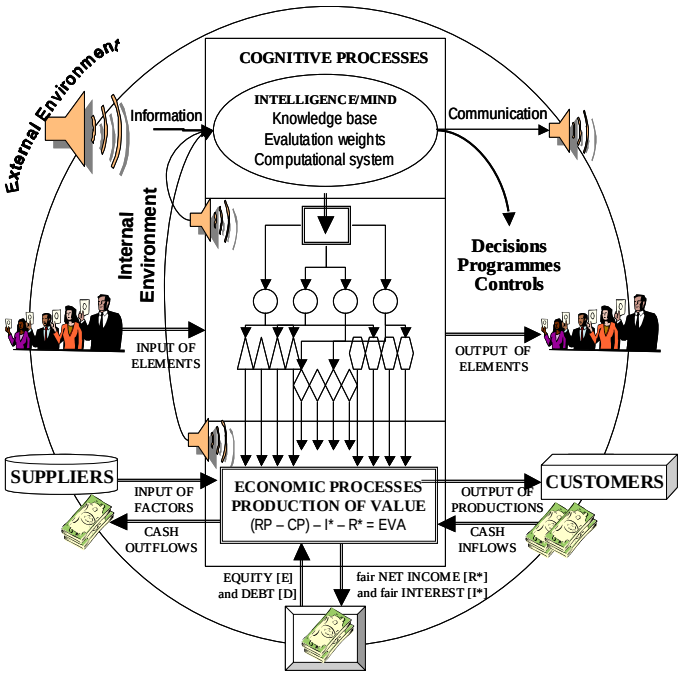
In the profit organization the TEVA is obtained by increasing both the productive as well as the business efficiency. Its exogenous teleonomy is linked to the capacity to produce the maximum TEVA, whose use for the *capitalist firm* will be examined in detail in the subsequent definition.

Definition 5 – *A profit organization that finances its economic processes with external capital in the form of* Equity [E] *and* Debt [D] *is a* capitalist firm. *The capitalist firm must produce an OI at least equal to the fair return which capital suppliers require (*fair cost of capital for the organization) *if they are to keep their capital invested; that is:* fair return [R*] *to remunerate* E *and fair interest payment* [I*] *to remunerate* D (figure 5).

The capitalist firm bases its autopoiesis on its capacity to regenerate its financial and economic circuits, or loops.

The financial circuit is renewed if the capitalist firm succeeds in acquiring and preserving its invested capital [IC] – necessary for structural investments – by means of an adequate financial leverage (Debt/Equity ratio, or *der*); but this requires that the suppliers of both *Debt* and *Equity* financial capital – D and E – receive a *fair remuneration*, defined as a remuneration at least equal to their *opportunity cost.* If we let R* and I* represent the remuneration judged to be fair by capital providers, then the financial circuit is renewed if the following economic condition holds: OI ≥ R* + I*. In particular, the difference [OI – (R* + I*)] = EVA represents the Economic Value Added, that is the surplus value produced in terms of the full cost plus financial charges, which is composed of the operating costs CP (necessary to produce) as well as the financial costs (necessary to obtain and hold the capital E and D. Since the profit organization is preordained so that {[max] (pP – cP) > 0}, then it follows that EVA = [max] as well.

Fig. 5 – Capitalistic firm



We can easily prove that if EVA > 0, then the firm's economic value EVF is greater than E, with the difference representing the value of knowledge (human capital) as well as the value of goodwill (Mella, 2002).

Having demonstrated that OI = OI* + TEVAP + TEVAM = OI* + TEVA, it follows that:

EVA = [OI* + TEVA – (R* + I*)].

The capitalist firm produces an EVA only if it succeeds in producing a TEVA which is sufficient to provide a fair return for the capital necessary for the productive processes.

Thus, the first condition for autopoiesis is that the capitalist firm produce values in terms of TEVA – and thus in terms of EVA and EVF – since only by producing in an efficient manner can it maintain its Equity and Debt while at the same time remunerating its shareholders and financers.

In fact, if the TEVA were insufficient to remunerate (I* + R*) then the capital would go toward other investments and the organization would break up.

Nevertheless, autopoiesis depends on the organization's capacity to develop economic processes capable of achieving an OI above the fair cost of capital [I* + R*]; but this implies that economic efficiency must be sufficient to permit an ROI greater than the fair ROD*, so that, by taking advantage of the financial leverage, ROE > fair ROE*

Since OI = QP (pP – cP), autopoiesis is achieved if the *economic circuit* is continually renewed: sufficient sales volumes and at adequate prices to cover the factor costs under fair conditions, so as to continually reintegrate the factors necessary for a new production cycle.

We observe then that in order for there to be teleonomy the search for TEVA and EVA by the organization must be perceived as positive by the environment. In particular, the TEVAP must be obtained under fair conditions of use of the factors of production and by maintaining the volumes of supply and the fair remuneration for the suppliers and workers; in the opposite case the contraction in the costs of production would be considered as unfavourable for the organization's teleonomy.

Similarly the TEVAM must be viewed as the consequence of an increase in the quality of the product and not only as the consequence of price control policies (monopolies, trusts, etc.). In the opposite case the consumers would perceive the price surcharge as unjustified with regard to the fair measure, and this would lead to a reduction in the market shares.

The capitalist firm maintains the conditions for *exogenous teleonomy* only if it tries to maintain prices as close as possible to the fair price, or even by lowering the latter through price reductions justified by cost reductions. On the other hand, it must try to reduce the cost of production below the fair cost, so as to reduce the latter as well.

Maintaining the conditions for teleonomy thus implies:

- searching for the maximum exploitation of the present market and enlargement toward new markets;
- the continual improvement in the quality of production θ in order to increase QP_{θ} and pP;
- the continual enlargement of the variety of products in order to reach new consumers;
- an increase in the *productivity* of the processes in order to reduce the unitary factor requirements qF, on which depend the purchased volumes: $QF_{M, L, S} = qF_{M, L, S}\, QP$;
- in particular, the increase in the productivity of labour πL through an increase in the quality of the human factor of the organization (skill, motivation, incentives) and its work efficacy (fertility, equipment, software);
- the search for supply markets where the factors have a higher quality θF, but above all lower purchase prices, since the level of factor costs depends on prices and, as a result, the cost of production, with: $CP = QF_{M, L, S}\, pF_{M, L, S}$.

Autopoiesis thus implies both attaining a high degree of *endogenous teleonomy* – with the search for internal conditions for survival through an optimal mix of creativity, productivity and incentive system – and a high degree of *exogenous teleonomy*, which guarantee the external conditions for survival, with an increase in customer satisfaction – obtained from the optimal mix of quantity, quality, variety and price of production – as well as social satisfaction, deriving from a valued social impact of the organization (spread of employment, rise in average income, payment of taxes, environmental care, etc.).

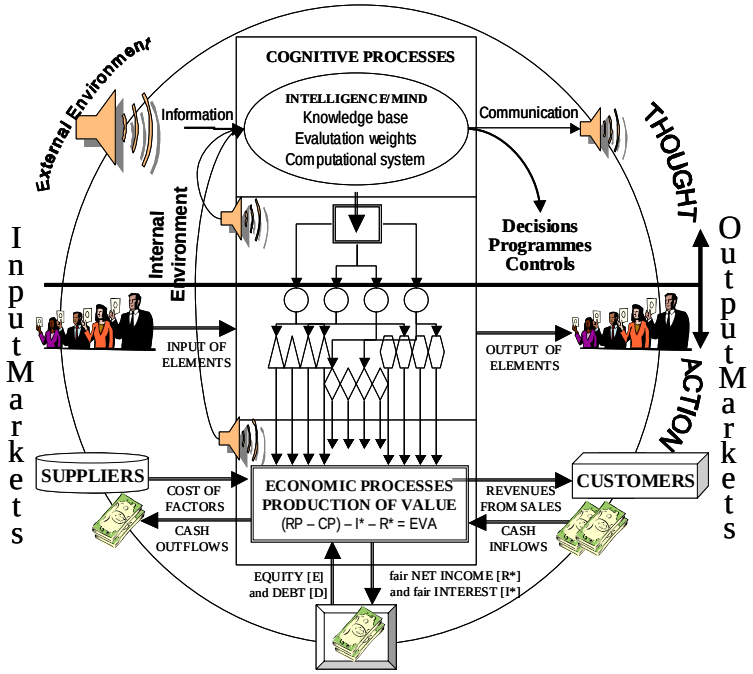
4. The permanent organization as cognitive system. Structural coupling

Definition 6 – *A permanent organization, profit or non-profit, may be viewed as a "conscious cognitive system" because it must develop processes capable of both perceiving stimuli and giving them a significance as "external" or*

"internal", "favourable" or "unfavourable", and of transforming them into dynamic representations of the internal or external environment on the basis of which decisions are made and programs built, in order to develop behaviour which is *reactive* (based on causes) and pro-active (based on objectives) *with regard to environmental changes for the purpose of maintaining its autopoiesis* (figure 6).

A *conscious cognitive system* - to an outside observer - is a system with internal organs with memory and the capacity to compare, capable of computing *information*, structuring the system with *cognizance* and *preferences* in order to successfully link up *with and within the environment* in order to survive by maintaining its own *identity* (that is, the organization of the autopoietic processes), even while it modifies its own structure (Von Krogh and Roos, 1995; Lewin et al., 1999)[5].

Fig. 6 – Structural coupling



A *conscious cognitive system* links itself to the environment through a system of processed, up-dated, and evaluated information which we can define as the *representation of the external world* (Terreberry, 1968).

It follows from the definitions that a permanent organization must be structurally coupled with the environment, and its structure must at least include[6]:

- *sensory interface* organs, by which the system links itself to the environment in order to perceive *environmental stimuli*; that is, the *data* (signs, signals);
- *internal sensory* organs to perceive the *vital* parameters; that is, the disequilibrium stimuli in the autopoietic network (pain, disease, weariness, needs, etc.);
- organs to select and memorize the stimuli and transform these into meaningful *information*;
- computational organs (computational system) to systemize the information and create *representations* of the environment;
- organs for the *comparison* and *evaluation* (weights) of the information and the representations;

[5] Maturana and Varela distinguish between two forms of System Coupling: one with the Environment and one with another system (Maturana, 1975; Varela, 1979).

[6] *"A cognitive system is a system whose organization defines a domain of interactions in which it can act with relevance to the maintenance of itself, and the process of cognition is the actual (inductive) acting or behaving in this domain."* (Maturana and Varela, 1980: 13).

- *effector* organs to intervene in the environment (or in the niche), searching for adaptation and producing ordered actions as part of activities that make up the processes.

In the permanent production organizations, be these profit or non-profit oriented, the structural coupling is achieved through (figure 6):

- data gathering organs (*sensory interface*), whose function is to perceive the data from the external environment (purchase orders and sales potential; supply of provisions; legislation) and the internal one (production and personnel trends, state of the processes, etc.) used by the mind of the organization;
- organs that connect the production with the markets: supplies, finance and marketing
- agency organs (legal entities)

The internal organs are:

- the mind of the organization, which we define in general as the management that transforms the data into information from which the representations are constituted (market and sectoral structures; threats, opportunities, strong and weak points), on which the economic-financial calculations used to make decisions, arrange programmes and achieve the organizational activity are based, thereby ensuring it conforms with the programmes and decisions (Beer, 1981);
- the process organs, which we define as executive, which transform the programmes into actions, carrying out the provisioning and productive transformations, and the sales and the financial operations (cash-flow management).

However cognition is formed, each action carried out by a permanent organization can be provoked by both *causes* and *objectives*, and can be conditioned by *constraints*.

The behaviour that is *caused* is typically *reactive*; that which has an *aim* is *proactive.*

5. The behaviour of the cognitively efficient organization

Definition 7 –*The permanent production-oriented organization – profit or non-profit – can be conceived of as an efficient transformer of* representations *from the environment (cognitive base) into* decisions *and* programmes, *producing a recursive dynamics (the behaviour of the organization) by means of a continual feedback between acts of thought (mental activity) and actions directed at the environment (institutional activity), which leads the organization toward the continual change of its perceived position in the environment and the gradual widening of its cognitive base from which its subsequent actions depend.*

Mental activity uses *cognitive resources* to produce *cognitive processes* that allow the organization to construct representations of the environment on which to base its own actions (Hejl 1984).

The *cognitive resources* are represented by an *information* (data gathering) system, by a system of *weights* – that is, preferences (evaluations) – and by a *computational system*, in order to process the information while taking into account the weights (decisions) (Mella, 1991).

The *weights*, or preferences, represent the intensity by which thought influences action and constitute the basis for the formation of judgements, and they make the cognitive system capable of evaluating the stimuli, and classify them into positive or negative as a function of its own survival; thus, every observation can be transformed into a judgement if it is joined to a preference. The weights condition the actions, since they select (classify according to a value) the information that the cognitive system holds to be useful for survival. The system of weights is dynamic and usually structured into levels.

The highest level of the system of weights in the organization, from which the system of weights at the lower levels derives, is defined as the system of values, or *ethical system*; a system of knowledge and representations to which a system of weights is associated is defined as a *cultural system* (Hampden-Turner, 1990).

The *computational system* is the cognitive resource needed to transform the stimuli into *symbols* and these into information and the latter into representations (models), taking into account the weights.

In terms of behaviour, a *cognitive* system can thus be represented (figure 6) as a *system of transformation* of *symbols* into *action* (interaction with the environment) through a knowledge base that is continually adapted, for the purpose of maintaining its own identity in a changing environment.

The knowledge base is arranged in preferences by the *system of weights*, and its formation, as its subsequent dynamics, is a function of the power of the *computational system.*

Learning from experience is the process of the (i) formation, (ii) preservation, and (iii) evolution of the *cognitive base* (representations, decisions) and the cognitive resources (concepts, weights, computational capacity) through

behaviour: that is, successions of cycles of thought/action. Thus the *cognitive resources and the knowledge base are conditioned by the experience of the cognitive system; that is, by its behaviour* (Weick, 1990)

The efficient behaviour of the permanent organization depends on both the capacity to perceive and significantly represent the environmental stimuli and the quality and quantity of the accumulated experience (internal cognitive state), and thus on the learning capacity of the system.[11]

The cognitively efficient organization is thus one that:

a) develops the *sensory* organs in order to increase the spectrum of perceived *stimuli;*
b) develops the *attention* organs in order to improve the *representation* of the environment;
c) favours the sharing of the representations (formation and use);
d) improves the perception of the internal *vital* parameters, by broadening the range of the *internal performance* indicators;
e) refines the *system of weights*; that is, the criteria for evaluating risk and trust (decision criteria);
f) develops the *computational system* (potency, speed and quality of processing);
g) widens the range of *external performance* indicators in order to make the *effector* organs more efficient;
h) strengthens the effector organs in order to improve the pursuit of institutional aims

6. Intellegence, learning, experience

Definition 8 –*In order for the permanent organization to maintain its autopoiesis it must produce an intelligent behaviour based on a continual learning and experience-forming process. The permanent organization where there is the maximum degree of "pooling" of individual intelligence so that all the individuals collaborate to learn together and, above all, to learn to develop a common learning process becomes a learning organization.*

The intelligence of the organization is the capacity of the cognitive system to acquire and utilize *knowledge* in order to make rational decisions, develop programmes that are compatible with the structure and adequate in terms of the available resources, act in a manner coherent with the programmes, and carry out effective performance controls, all the while tending to achieve the maximum existential success without reducing the options for survival (Drucker 1989; Gephart at al., 1996). On the other hand, the intelligence of the organization is the capability of its components to build on a common experience (Kock, McQueen and Baker, 1996; 1997).

In order to maintain its autopoiesis and renew the financial and economic cycles it is vital for the intelligent autopoietic organization to produce a continual *learning process*; that is, one with formation, accumulation, structuring and self-confirmation of *knowledge* in order to broaden the *experience* (formation) and use it (utilization) to modify the evaluation criteria for the purpose of improving the decision-making and planning process and the control procedures (Boland and Tenkasi, 1995; 33. Argyris, 1977; 1992; Walsh, 1995).

The fundamental learning processes are:

1) *observational or indirect learning:* here *thought* is mainly involved; action is limited to directing the sensor organs;
2) *operational* or *direct learning: action* is also involved here
3) *cooperative learning*: the organization learns because its structural elements collaborate to learn together, to share information or to *work as part of a network* (Grandi, Marzotti and Zanoni, 1994; Child, 1989) or to build *virtual operating units*, or virtual organizations (Tonchia, 1996).

Operative learning by *cause and effect* (Argyris 1991) and by *objectives, which until yesterday was considered* the most powerful way to develop accumulative experience, by gathering information on the successes and failures (errors) of actions directed at removing causes or achieving objectives, has today become the least efficient; it must transform itself into a shared learning in which causes and objectives exchange roles among individuals that operate from opposing points of view and at times that do not coincide.

The intelligent *behaviour* of the permanent organization is principally manifested in four ways:

a) automatic behaviour: this is a non-conscious behaviour that depends *totally* on operational, behavioural experience, and is directly accumulated in the past history of the system;

b) adaptive, conscious behaviour: this is achieved through a constant recourse to conscious care and attention and depends on the *behavioural experience* in addition to the *operational experience;*

[11] If we consider experience as the *internal state* of the cognitive system, then from this perspective the organization can be conceived of as an open, dynamic system having a memory, according to a typical vision of the general theory of systems.

c) explorative behaviour: this cannot count on direct operational experience and is typically *feed forward*, trying to foresee errors and avoid them;

d).generative (or innovative-creative) behaviour: this is typically *feed-forward*, trying to "create" errors that can turn into advantages, to break free from memorized models and form representations on the basis of elements generated by the same cognitive base (ideation, invention)

In a highly dynamic environment, where the past experience has an increasingly smaller role and an explorative and innovative-creative behaviour becomes essential, the organizations with a higher *endogenous teleonomy* will be those which are transformed into a *learning organization*, providing themselves with organs, procedures and awards to learn more quickly, react promptly, avoid repeating the same errors, and create innovation. The permanent organization, being a unitary cognitive system, has its own emerging intelligence which derives from the "pooled" intelligence of the individuals that make up its structure (Hejl, 1981).

7. Managerial qualities and entrepreunership in business organizations

Definition 9 –*In business organizations the construction of representations of the internal and external world, and the other cognition processes are carried out by the* management, *which produces the thought of the organization (rational calculations for decision-making, programmes and controls) from which the organization's actions derive; the production and financial processes, which are instrumental for achieving a common end, are carried out by the effector organs that produce the action of the system.*

Management must formalize its mental representations by constructing formal, verifiable, transmittable and utilizable models:

a) *market and sector models*, to know the competitive structure of the external environment the organization operates in (present sector, present and potential competition, markets, profile of potential consumers, profile of customers, etc.);
b) *organization models*, through which the internal organic structure is known (formal and informal structure, information flows, internal competition, incentive system, etc.);
c) *balance sheet models*, which represent a summary of the past trends in the economic and financial processes, and of the organization's impact on its environment; these models determine the economic output, the capital, and the overall surplus;
d) *programme models*, which represent the future trends that result from the forecasts and decisions;
e) *control models*, such as analytical accounting and the *tableau de bord*, which monitors the performance variables judged to be significant indicators of the organization's vital parameters (efficiency, efficacy, quality and, in particular, economic efficiency, profitability, length of processes, potency of the organs, etc.), since the organization can maintain its identity only if it remains vital: that is, manages to maintain the vital parameters at levels that impede its break-up.

We can distinguish between two types of management behaviour:

1) *procedural* or *conservative behaviour*, typically automatic or adaptive; managerial thinking is typically directed at determining objectives, making plans to achieve these, and controlling for any problems by identifying errors or deviations to be corrected in the spirit of *carrying out only successful actions and never repeating the same error twice*);
2) *entrepreneurial* or *creative behaviour*, typically explorative or generating innovation; actions attempt to avoid known types of behaviour in order to produce new ones; in this case managerial thinking is typically *creative*, in the spirit of *never repeating successful actions* but purposely producing errors in order to break free from known schema.

In non-business and non-profit organizations a conservative managerial behaviour prevails, since the exogenous teleonomy implies that the organization must maintain the efficiency of its processes and seek to produce value from the cost side. Product innovation is not possible, or in any case is rare; the constancy of production quality that continues on unchanged through time is rewarded.

Control appears to be the crucial cognitive activity, in order to maintain quality and reduce production costs; conservativeness is the crucial cognitive resource.

In profit organizations, especially capitalist firms, the achievement of exogenous teleonomy is based on customer satisfaction, and the conditions of autopoiesis impose an innovative business behaviour that supplements the conservative behaviour.

The crucial cognitive activity appears to be innovative decision-making and the crucial resources creativity and motivation; the former is necessary to produce diversification and innovation, the latter to reduce production costs.

8. The Web-Based Information Technologies and the structural coupling of production organizations in the Information and Internet Age. The sensory organs

The preceding definitions and models permit us to examine how the Web-Based Information Technologies (WBITs) can integrate the structure of the *production-oriented organizations*, considered as *cognitive systems*, by strengthening the forms by which they realize their structural coupling with the environment by developing their Learning Management Capabilities and their autopoiesis (Hammer and Champy, 1993; Boland et al., 1994; Nonaka and Konno, 1998).

WBITs modify the structural coupling by strengthening all the system's organs.

A) Connector Sensory Organs. It is fundamental that organizations are able to develop efficient data gathering processes to transform data into information and representations (Definition 7). The sensory organs have the role of perceiving the *data* from the environment that the internal computational system processes and inserts into information flows that allow the external and internal environment to be represented.

Historically the sensory organs were represented by the same effector organs supplemented by *ad hoc* sensory organs (research offices, Research and Methodology, market research, etc.) that tried to monitor the environment and gather the strong and weak signals that indicated the trends in science, technology, and in social, political and juridical phenomena; and that identified present and potential constraints on the actions of the organization; and above all allowed the organization to understand the structure of the sales market and the needs, aspirations, tastes and preferences of consumers, the price elasticity of demand and of product quality, the structure of supply markets and the presence of potential suppliers, and so on.

The spread of WBITs, as we can easily imagine, has led to both the strengthening of the sensory capacity of the organization and the refinement of monitoring techniques. In fact, the use of the web techniques – and in particular building usable websites and efficient search engines and devoting sufficient time daily to attracting visitors to the website – permits the organization to receive a much higher number of external stimuli (passive contacts and received data) or to enter into contact with a much higher number of data sources (active contacts and researched data), and to broaden the spectrum of obtained and transmitted data.

The advent of mobile and wireless technologies provides the ability to extend data gathering and compilation processes. Powerful, rugged and easy to use devices enable automated and semi-automated data gathering for any type of application.

Organizational or external research engines (such as the Yellow Pages) increase such possibilities even more, allowing, as we shall see, the cognitive organs to perfect their own representations. The growing spread of virtual communities, of the practice of link exchange, and the formation of networks of organizations and firms with similar activities or complementary products favours the community buzzword and the pre-commerce that leads to an increase in contacts and the gathering of useful information regarding potential clients as well as potential suppliers. (Hagel and Armstrong, 1997).

Even though guaranteeing the anonymity of the visitor, the by now widespread techniques of web design also make it possible to come up with profiles of potential clients and identify their social position, preferences and potentialities through an analysis of contacts and of the pages visited.

9. The connector effector organs and the processors

B) Connector Effector Organs. Business organizations are created for the purpose of producing goods and services for output markets. To carry out the production processes they use effector organs, which can be external (connection with the markets) or internal (transformation).

Due to the conditions of autopoiesis and exogenous teleonomy (Definition 2), business organizations with their own connector effector organs must operate in input markets to re-supply themselves with factors under the best

conditions and in output markets to distribute (non-business) or sell (business, profit or non-profit) under the best conditions by increasing the value of production.

The use of WBITs facilitates the *two-way* connections between the agents in the input and output markets, on the one hand, and the organization on the other, both from the active as well as passive side, in order to reach a true mobile environment that concentrates on visual mobile messaging (Pallot and Sandoval, 1998).

From the active side the organization broadens the possibilities of connecting with the external agents, whether these are active or potential clients or suppliers; and vice-versa, on the passive side, facilitates the connection of the active or potential agents with the organization without the intervention of effector organs. Thus the traditional logic of connecting with the markets and the environment is modified and integrated in general.

This leads to an enlargement of the geographic areas that can be reached by the organization and a reduction in the connection times, with the possibility of modifying the sales and supply mix in order to attain a true web-based *Customer Relationship Management* (CRM) through technologies and software that seek to satisfy the need for collaboration in order to construct a true e-commerce system.

By means of CRM organizations can learn more about customers' needs and behaviours in order to develop stronger relationships with them, bringing together a great amount of information about customers, sales, marketing effectiveness, responsiveness and market trends (Newell, 2000).

Costumer and user service improves both in terms of timeliness as well as flexibility, with the possibility of rationalizing production and logistics, with a consequent saving of time and delivery costs.

In particular the link with clients can benefit from the Internet Business Infrastructure at various levels: from simply capturing a fair share of new customers to managing and capitalizing on existing customers and setting and enforcing acceptable usage policies (Adler, 1966).

Along with this initial advantage goes a better knowledge of the external agents, as will be discussed in the following section.

Of particular significance are several recent start-up phenomena, whose growth tendency seems clear-cut:

- advertisement on the web, which makes the connection more precise and facilitates the understanding of the needs of potential clients (Goldhaber, 1977);
- telematic work, which reduces the internal operating structure and makes production more flexible;
- the outsourcing and externalisation of functions, with a resultant rationalization of production costs;
- integrated logistics, that permit a more efficient connection between the organization and the market agents.

C) Internal Productive Process Organs. The function of WBITs is not only connection; they also represent a potent means for strengthening the internal effector organs: that is, the process organs: supply, storage, production, sales (Davenport, 1993, 1994).

The larger organizations are usually structured according to divisions that carry out particular functions (functional organization), pursue particular objectives (linear organization), or develop certain products (matrix organizations). One of the problems of such organizations is the coordination of activities, in order to avoid duplications or asynchronies and to strengthen the knowledge of the state and the dynamics of all the processes.

Although the possibilities for the use of WBITs can be intuited, they must be observed and planned in the context of organizational reality.

In particular I would mention (Kock and McQueen, 1996):

- the synchronization of logistical and financial processes carried out in different sites through web-based information and GPS-based technologies;
- reduced waiting times for clients and users through the redistribution of user requests among the service centers; the real-time control of many production and distribution processes.

In addition to what has just been discussed, WBITs also offer a new and potent opportunity for production organizations: creating a network to reorganize and strengthen the processes for the production of value and give rise to true *value-creating systems* where the cognitive organs of the various businesses (enterprises, firms, concerns) are interconnected in such a way as to represent a collective mind able to globally improve the processes while acting and deciding locally.

10. The internal organs of cognition. Business intelligence and Analytical applications

D) Internal Organs Of Cognition And Communication. It is above all the internal organs of cognition and communication that gain the greatest advantages from the use of WBITs that can transform the Internet into a semantic Web which will permit the automated use of disparate, distributed Internet information sources and services as well as favor cooperative learning.

Since the function of cognitive processes is to construct quantitative models that provide the knowledge for decisions and control, it seems clear that the first important cognitive advantage is the strengthening of the processes for understanding the external and internal environments. Through the connector organs, both sensory and effector organs, the organizational intelligence is enriched by data flows which, in terms of quantity and quality, were unthinkable before. Management can construct more complete, timely, and significant models of the supply markets by identifying the potential suppliers, rationalizing their requests, comparing the offers and segmenting the orders. On the output market side, increasing the knowledge of consumers whose tastes and preferences are more easily identifiable even through the simple use of data-mining techniques on the data gathered from contacts on the internet.

The refining of the existing models and the construction of new ones allows management to be more aware when deciding the range of offers and the characteristics of the products, making these more uniform or diversified based on the perceived preferences.

Even the construction of sector and competitor models can be made more effective. The study of sites of producers of similar or substitute goods allows management to identify possible threats as well as concentrate on opportunities.

The greatest potential for WBITs today are probably linked to the development of models regarding the knowledge of internal, production and organizational models as well as the emergence of strong and weak points in the structure, as has occurred, for example, with the new means of Performance Management, including the balanced scorecard.

Management control as a whole benefits from WBITs, since such technologies allow for a continual monitoring of the processes of supply, logistics, and factor consumption by also constructing analytical accounting systems with continual updating, together with systems for the determination of costs based on cost driver dynamics which are capable of modifying the process mix while the latter is being carried out, in order to take into account demand trends. In particular, we can refine models for the determination of the parameters of factor use and cost, and of those for the internal transference of resources, as well as models of efficiency and quality with regard to resource use.

The cognitive processes produce knowledge and also decisions and controls. Both the decision-making process and the planning and control process gain important advantages from the use of WBITs. The strengthening of the data gathering organs not only develops the computational capacity, but spreads this to all the levels of the organization. Decisions can be decentralized even to peripheral and operative levels, and the controls brought to the rank and file of users of the productive structure. A system of control, planning and analytical reporting can be implemented, with various levels of subsequent synthesis.

A specific application made possible in fact by the use of WBITs is the creation of a *tableau di bord* to keep under control the variables management considers fundamental for monitoring the state of the autopoietic processes of the organization.

The *Tableau de bord* (performance measures, balanced scorecard, pilotage, organizational cockpit) in addition to being an information instrument for short-term decisions, also represents a fundamental self-coordinating instrument, since its information can permit the development of a *combinatory system of improvement* and progress (Mella, 2001), on condition that an internal system of communication is created that allows all the members of the organization to perceive positive and negative gaps in their performance measures with respect to those indicated in the *tableau di bord*.

The best practices are communicated and shared by producing progress in the operating efficiency of the entire structure.

More generally, WBITs permit the creation of a system of *business intelligence* tools (such as online analytical processing[7], or OLAP, query/reporting and data mining) in order to enable organizations at any level to acquire and process information in order to measure, analyse and optimise business performance (Harrington, 1991).

Business Intelligence (or Decision Support Systems) includes software applications, technologies and analytical methodologies that perform data analysis, and includes data mining, web mining, text mining, reporting and querying, OLAP, and data visualization.

Business Intelligence usually assumes an efficient Data Warehouse system (DW); this is a way of storing data and creating information through leveraging data marts, defined as segments or categories of information and/or data that are grouped together to provide *information* to that segment or category. Data warehousing does not require Business Intelligence to work. Reporting tools can generate reports from the DW.

A system of Business Intelligence – supported by an efficient data warehouse system along with statistical analysis tools and data mining tools – can be integrated with a system of *analytic applications* that include instruments capable of strengthening the decision-making process through information and data rule engines that make it easier to gather useful data for processes and projects and enable the management to use all firm information to manage and analyze every single aspect of business, from beginning to end.

While *business intelligence* tools can be segmented by technology (such as data mining or OLAP), *analytic applications* can be segmented by business function (such as finance or marketing) and structure, and can coordinate business activities to achieve a particular result (such as producing a budget or assessing the performance of key suppliers).

The two systems are complementary, since the organizations need to develop cognitive processes both in general as well as for specific business processes or functions.

Even the processes for the formation of strategy can benefit from Business Intelligence and Performance Management.

More generally, it is apparent that WBITs play a fundamental role in internal communication processes, given that the external communication processes are strengthened by the same sensory and connector organs.

The internal communication processes are vital for the organization, since not only do the coordinating capabilities depend on these, but also those vital capacities of shared decision-making and learning.

11. Learning organizations and learning management. Business intelligence

In a competitive environment the organization's capacity to survive and its autopoietic success depend not so much on the quantity and quality of the information possessed and managed by the business intelligence, in order to build a knowledge base, but above all on the growth rate of the learning capabilities of all the components of the organization that must learn to acquire knowledge in a coordinated way and share it in a cooperative manner.

Garvin clearly stated: "Without accompanying changes in the way that work gets done, only the potential for improvement exists" (Garvin, 1993: 80) and he suggests that Learning Organization must be capable of systematic problem-solving, experimentation with novel approaches, learning from experience and benchmarking, and transferring knowledge rapidly and efficiently to all parts of the organization.

In this sense, WBITs play a fundamental role for the formation of *Computer Supported Cooperative Work* (CSCW) (Greenberg, 1991), *Work Group Computing Systems*, and, in general *Groupware*; that is, as a system of WBIT instruments that supports the activity of persons who work toward a common objective, facilitating their cooperation, interaction and coordination, and providing them with different means for communicating and allowing them to share the operational and informational context (Whitaker, 1995).

To ensure such growth the organization must transform itself into a learning organization that trains and coaches people to achieve greater responsibilities, and do so sooner, with the maximum understanding.

If we define a Learning Organization as an organization in which people at all levels, individually and collectively, are continually increasing their capacity to produce better results (Garvin, 2000; Greenberg, 1991; Rheem, 1995), and if we define E-learning as any form of learning that utilizes a network for delivery, interaction or facilitation, then we can easily imagine how WBITs can represent the indispensable means for creating a system of

[7] Systems designed to handle the queries required to discover trends and critical factors are called online analytical processing (OLAP) systems.

E-learning to allow all the members of the organization to invest in their own cognitive growth and learning capacity[8].

Learning must be spread to all levels,and an E-learning system can permit the development of both in-house as well as outbound training (Lepperhoff, 2002).

The use of WBITs has revealed itself to be fundamental for the construction of a system of Education with New Technologies (ENT) (Wiske, 1998; Blythe, 1997): utilitzing the Internet and the Intranet allows for the formation of a networked community which develops powerful learning experiences for the components of the organization at any level through the effective integration of new technologies.

Internet offers the tools for significant improvements in teaching and learning because, through ENT websites, people can connect to thoughtful colleagues, interactive tools, detailed examples of technology-enhanced education, and a valuable collection of on-line resources, in particular: qualified online libraries containing annotated links to high-quality resources (web, print, and other media) that address issues related to the integration of technology for education.

The learning activity must concern not only specific functions but must also be capable of achieving the same capacity to perceive the direction and speed of changes in the environment and understand the systemic interconnections between external and internal phenomena.

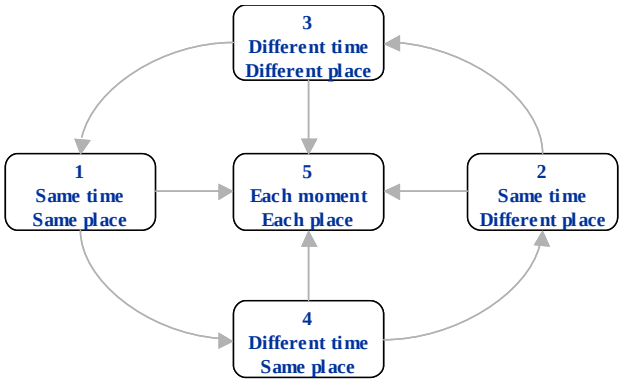
However, this obliges the organization to motivate its members at all levels to attain higher technical skills through collective learning processes in which not only are others' experiences learned, but one's own successful experiences pooled in order to share the best solutions to problems and the best practices.

Here then are the three processes produced in a learning organization: 1) knowledge acquisition (theoretical and practical); 2) learning to learn; 3) learner engagement and motivation.

For this reason, to be successful a learning organization must develop efficient internal and external communication processes based on networking and the wide use of WBITs, in order to permit the formation of learning groups and online learning communities by means of groupware instruments, where efficient use is made of group learning around a particular topic (context) which is able to add people and resources (web pages, documents, etc.), set up group tasks, and then engage in group and personal *conversations* about the topic.

We can propose as a method for classifying the groupware products (Gantt 1992; Hsu and Lockwood, 1993) that used by the Institute for the Future, in Menlow Park, which uses temporal-space parameters (figure 7).

Fig. 7 The diamond of Groupware (Source : Iftf/Reseau)



[8] Senge identifies three conditions that are necessary for dialogue to occur: All participants must "suspend their assumptions;" all participants must "regard one another as colleagues;" and there must be a facilitator (at least until teams develop these skills) "who holds the context of the dialogue." Bohm asserts that "hierarchy is antithetical to dialogue, and it is difficult to escape hierarchy in organizations." (Senge, 1990, p. 245) Suspending all assumptions is also difficult, but is necessary to reshape thinking about reality.
Before a team can learn, it must become a team.
Tuckman (1965) identified four stages that teams had to go through to be successful (Tuckman and Jenson, 1977):

1. *Forming*: When a group is just learning to deal with one another; a time when minimal work gets accomplished.
2. *Storming*: A time of stressful negotiation of the terms under which the team will work together; a trial by fire.
3. *Norming*: A time in which roles are accepted, team feeling develops, and information is freely shared.
4. *Performing*: When optimal levels are finally realized—in productivity, quality, decision making, allocation of resources, and interpersonal interdependence.

Tuckman asserts that no team goes straight from forming to performing (Robbins and Finley, 1995).

In the first case the technologies are used at the same time and in the same place; for example, products for use at meetings, such as overhead projectors and electronic blackboards, conference systems and equipped meeting rooms.

In the second case, products such as the conference video (Desktop Video Conferencing, DVC), and Electronic Meeting Systems (EMS), equipped meeting rooms and video telephones can be adopted by users contemporaneously and in different sites.

The binomial different time/same place includes products that range from electronic mail (E-Mail) to more complex Office Systems, which can be used in an asynchronous manner.

Finally, the category different time/different place includes, in addition to all the instruments already mentioned, planning systems that manage the work flow (Work Management Systems, WMS), project management and others.

Consider in this regard the telematic networks, and the local and geographic ones of the personal computer, which permit the transmission of endless information in very distant countries; or to multitask operational systems, which allow us to use several programmes contemporaneously, with the possibility of a dynamic exchange of data.

Consider also that a work force that can be distributed all over, the overabundance of information and the need to bring products to market as quick as possible are only some of the reasons that justify the growing request for means to support collaboration.

Moreover, academics, organizational experts and software producers linked to the creation and development of *Groupware* maintain that, thanks to the latter, information technologies will play a role in the near future, which just a short time ago was unthinkable, in the production of goods and services; they are also convinced that organizations that are able to redesign their organizations, productive or hierarchical, by means of group work and workgroup computing, will be able to overcome the new challenges from the market..

To support this way of working, users can continually build a library of resources which can be used in different contexts, as well as have access to detailed information about the people they are working with. These are "dragged and dropped" into new contexts.

Contexts can have sub-contexts, which can be set up by any participating member and contain sub-groups of members, additional resources and new tasks. Contexts and sub-contexts are only seen by their members.

The role envisaged for Corporate Communication is that of managing both the external and the internal communications and networks. The former involves media relations, relations with all external stakeholders, and managing our websites. The latter involves employee communication, intranet, in-house magazines and communiques.

The learning process concerns all the structural levels of the organization, but is particularly necessary for management.

A *learning management* system means that both distributed teamwork on projects using synchronous and asynchronous communications and shared-knowledge management systems (Iacono, 2001) must be created[9] in order to develop with the greatest degree of cooperation possible the cognitive capacities of the organization, in order to permit management to have, find or create the knowledge necessary for solving problems, planning the achievement of objectives, or controlling the performance of its businesses.

12. The three wheels of change in the organization

The transformation of long-lasting organizations into cognitively efficient organizations through the formation of learning organizations – in which management, by making wide use of WBIT systems and implementing business intelligence systems, maintains the conditions for autopoiesis – is urgent for business as well as non-business organizations.

The driving forces for change identified above, whether "emerging" or "constructed", lead private and public sector organizations to develop new forms and new management logic (Whittington *et al*, 1999) regarding the explorative or exploitational adaptation of organizations to changing conditions (March, 1991; Lewin *et al*, 1999).

The visible features of environmental change are:

a) the ever greater speed of the production of "novel" goods;
b) the ever wider territorial context in which interactions among the various organizations occur;

9 "Knowledge Management caters to the critical issues of organizational adaption, survival and competence in face of increasingly discontinuous environmental change.... Essentially, it embodies organizational processes that seek synergistic combination of data and information processing capacity of information technologies, and the creative and innovative capacity of human beings."(Malhotra, 1998).

c) the thickening of networks for interorganizational and intraorganizational interactions, which makes it more difficult to interpret the overall behaviour of each system;

The ability to survive for a long time, to develop teleonomy, depends on the capacity of organizations and their managers to understand change and to regenerate the cognitive processes, thereby achieving a lasting autopoietic behaviour.

There are three ways to achieve change in the *cognitive processes* of the organization:

a) a change in *programs*, understood also as norms, regulations, training, etc;
b) a change in the *structures*: organization, organs and personnel;
c) a change in the *culture*: that is, the cognitive and behavioural models of the individuals or groups that participate in the organized structure.

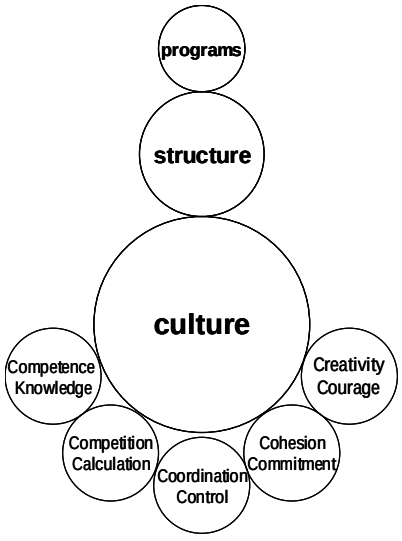
The three ways for change are interconnected, like the wheels of an unceasing process of change (figure 8).

These three paths can be pursued at different speeds; from a *top-down* perspective the change in the processes is the most rapid, but also the least effective. However, this leads the organization, though slowly, to a change in its structures which, in turn, and even more slowly, forces it to undertake a cultural innovation. From a *bottom-up* perspective, when there is success in effectively influencing the culture of the individuals that make up the organization, the new cognitive models lead to a speedy change in the structure that, in turn, implies an even faster adaptation of the programs and procedures.

Of the three paths to a change in social systems, the one that leads to a readjustment of the culture appears today to be the most necessary, precisely for its powerful influence over the other wheels of renewal, in a world that is changing ever more rapidly and in a more structurally complex way.

The process of change – with its path of renewal – becomes a unifying process that is common to each type of permanent organization, non-business as well as business, profit as well as non-profit.

Fig. 8 The wheels of change in social systems



13. The change in mental models

The behaviour of the individual in the organization is often guided by inadequate cognitive models, even if deep-rooted ones, of which we often have little awareness (first line of figure 9). Cultural change must "update" such models in light of complexity and transform them into "driving wheels" of cultural change.

To get the momentum going for the *cultural wheel* several fundamental factors of *cultural change* can be identified, which I feel it is useful to distinguish based on whether or not they act at the system (new cognitive models) or individual (individual factors) level.

Fig. 9 – The "10 driving weels of cultural change. The cultural changes that must be produced in cognitive models of individuals that act in an organized way

Cognitive models to update	Habit	Protection	Individualism	Selfishness	Conformity
New cognitive models	COMPETENCIES	COMPETITION	COORDINATION	COHESION	CREATIVITY
Individual factors	KNOWLEDGE	CALCULATIONS	CONTROL	COMMITMENT	COURAGE
The competent subsystems	*Cultural Educational system*	*Economic productive system*	*Territorial public system*	*Political and associational system*	*Family and collective system*

These factors are indicated in pairs in the five "driving wheels" at the base of figure 8, and in detail in figure 9, which highlights both the old mental models which must be updated by change as well as the social subsystems where those factors must be developed. A brief commentary follows for each.

COMPETENCIES AND KNOWLEDGE: in simple organizations that operate in static or slow-moving environments, the competencies necessary for the action of the individuals in the organized structure are elementary and often linked to the mechanical repetition of successful actions. Habit, even in the form of training, represents the prevalent mental model for rendering behaviour efficient; the more complex the organization is and the more it operates in dynamic environments the more necessary it is to pair up the development and diversification of specific *competencies*, above all the capacity to understand change and the flexibility of adaptation. *Competencies* require *knowledge*; all the members of an autopoietic organization must acquire a new cultural awareness: continual education, and a constant critical approach to one's culture. This change in attitude must be supported by the entire cultural system, and in the first place by the scholastic system. University and post-university education play a fundamental role in the diversification of cultural models and in the supply of education and the updating of knowledge and competencies for the individuals of the new organizations.

COMPETITION AND CALCULATION: People in organizations tend to be oriented to the preservation of the *status quo* by seeking protection and refuge from competition. In an organization able to acquire and manage ever greater physical and cultural resources, the *competitive* action model must necessarily flank the *competent* action model; it is necessary to learn and accept comparison, take initiatives, and accept risk and responsibility, fleeing from the convenient protection of the hierarchy. Nevertheless, competition must not be a pure "struggle" based on "force", however the latter is defined, but the result of innovative choices which are coherent with the other areas of cultural progress. At the personal level the cultural attitude of competition, of risk, of responsibility must develop alongside that of understanding, convenience, and rational calculations aimed at maximizing the efficiency and efficacy of actions. The spread of these cultural attitudes is correlated with change in the system of production, and, in organizations that operate in an non-monopolistic environment supported by some form of protection, this will be more rapid and widespread the more prevalent are the forms of production under free competition – and not necessarily in a business or market sense – which is linked to the freedom to make optimal choices based on calculations of convenience.

COORDINATION AND CONTROL: If, on the one hand, members of autopoietic organizations must act competently, with a competitive attitude, on the other they must accept the structural constraints. The mental model of *individualism* must make room for the conscious acceptance of *coordination;* every individual must, as with every organization or social system, become actively and passively involved in coordination. The mental model of coordination cannot be separated from the culture of *control*, understood as both the desire to control and the verification of responsibility. The culture of control has always been antithetical to individualistic action, to selfishness, but it must represent an important engine for cultural change in a competitive world where calculation and competence prevail. Only a social system hierarchically organized on a territorial base can favour the formation

and spread of these new cultural attitudes; local administrations play an important role in this and have a clear-cut responsibility.

COHESION AND COMMITMENT: In (and between) organizations selfish behaviour prevails based on the idea of acting in a hostile environment and with scarce resources. With a similar cultural attitude participation in organizational initiatives is focused more on individual advantages than on the pursuit of the common good. The mental model of selfishness that moves individuals to "use" the organization for their own ends and to "leave" the organization when it tries to impose objectives from above must make way for *cohesion*, even in the context of competition. Belonging to the organization must be viewed as the premise for a unified collective action; the "communion of intents" with regard to the common end must become a new cultural model. However, this behavioural logic assumes another mental model: the acceptance of *commitment* in the common intentions toward action and toward *shared values*. Without such commitment, common intentions and shared values cohesion is not possible, since disinterest arises toward "the affairs of others", and individualism, together with a competition without calculations, ends up by imposing selfishness. In the environmental context the responsibility of creating and spreading culture and commitment is the responsibility of the political and associational system. A political system that provides incentives to individualism and spreads the idea that association only means protection, and a system of associations in which participation is obligatory or forced, ends up by creating conflict and disinterest, justifying egoism and conformity in opposition to the driving wheel of cohesion and personal commitment.

CREATIVITY AND COURAGE: In a static environment with reduced competition and limited competencies, behaviour was inevitably repetitive and the mental model of habit was associated with that of conformity. This mental model must give way to *creativity*, to the desire to escape from uncritically accepted schema. Habits, rules and programs must always be critically examined, thereby creating or recreating the capacity to innovate. "Reactive" thinking, which looks to the past and leads to the elimination of errors and the avoidance of failures, must be joined by "proactive" thinking, which typically looks toward the future and leads to the planning of actions and the setting of objectives for success. However, above all the habit of creative thinking, of lateral paths, which get away from the schema triggered by history or predictable evolutionary scenarios, must take over. Unpredictability becomes a factor for success. Creativity must not mean only imagination; it must also translate into organized and social action, and for this reason it is necessary to accompany this new cognitive attitude with the necessary courage to get away from the consolidated schema and risk innovative behaviour. Only the system of family relationships – and the assimilable and substitutive ones of the school and aggregative institutions – can give rise to, if latent, or provide incentives for the birth of these two important motors of cultural change.

The five "driving wheels" of cultural change just described do not necessarily have to operate contemporaneously; change can be brought about by any one of these, but on the condition that the other wheels do not put up a resistance that is strong enough to nullify the effect. If there is no resistance to the movement by even a single "driving wheel", then, when the large wheel of culture starts slowly to turn in the sense of improvement, the other wheels of change will also be moved to produced positive effects.

Both the reform processes under way – at the world or European level as well as within the institutions of individual countries – and the attempts to block them can be "interpreted" in light of the model which has just been proposed. In particular, the following appear to be clear-cut engines of change: the reform of schools and universities aiming at a greater interaction between the educational and production systems and an equilibrium between public and private; reform of the competitive system, towards increasing privatisation and lower state assistance; reform of the system of territorial public autonomy, characterized by decentralization and the conscious coordination of territorial resources; reform of the political system toward bipolarism, in order to favour cohesion; the tendency to re-evaluate the family, both in the traditional sense as well as the wider sense of place, where security is provided, and courage and the desire for commitment is infused.

The following, on the other hand, are restraining factors: obstacles to the modernization of training programs; concentration processes that reduce competition in the name of efficiencies of scale; the processes of regionalization when their declared aim is to eliminate controls, as well as the processes that block the modernization of territorial authorities; the processes of political disaggregation that create selfish conflict.

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