5. *Sociotechnical systems design revisited at the end of the 20th century. STS 2.0* [1]

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Abstract and content

At the end of the ’90s, digital technologies took command changing global value chains, business models, services, organisational functioning, work. Business Process Reengineering, Lean Production, CSCW (Computer Supported Cooperative Work) became very popular approaches among managers overshadowing the STS (Sociotechnical Approach). In this chapter, a reconsideration of sociotechnical approach is proposed in line with the digital revolution and the new needs for rapid and radical changes. The positive aspect of those approaches are partly incorporated in the proposal of a Sociotechnical Approach 2.0: going back to the basic as process centred organization, quality of working life, process of design and change.

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[1] A former and radically different version of this chapter was originally written by Federico Butera in 1998, now revisited and excerpted from the *Final Report of Qualit Project* and from Butera F., Shael T. (1998). The Renaissance of Sociotechnical System. In: Mambrey P., Paetau W. (eds.). *Self-organization: A Challenge to CSCW*. London: Springer.

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1. Overcoming the bureaucratic and taylor-fordist organization. From functional to process centred organisation as the core step

Organisation is to *bring dispersed elements into unity* (Bittner, 1973). In large companies and Public Administration, in the past this was obtained through two basic devices in a large variety of concrete applications:

- *formal organisational structures* which set boundaries and authority to execute coordination and control;
- *tasks and jobs* taken as basic bricks for describing and prescribing an intense division of labour.

Two predominant ideas led the models of formal organisational structures and division of labour in the taylor-fordist model of industrialisation. The first was the predominance of *forms of coordination and control based upon hierarchy and procedures*. This was practiced both for formalised and structured processes (e.g., manufacturing, distribution, administration, information processing), and unfortunately also as for scarcely analysable and unstructured processes (e.g., providing services, developing research and development, managing human resources and so on): the model was applied also to less formalized processes for the sake of the social preferences for the hierarchical culture mutuated by the bureaucratic model perfectly described by Max Weber. This culture was to give authority to hierarchical positions which should take care of and respond for what happens in the processes with the help of some rational planning and control system. Therefore, problems and variances, needs for adaptation and opportunity for innovation became matter for managers, instead of being dealt with by working teams or individual worker. As a matter of fact, in the common language *function* indicates indifferently either the formal structure or the process: for instance the word *manufacturing* indicates both, the manufacturing management function and the much more composite manufacturing process.

The second fundamental idea, set forth by Adam Smith and Charles Babbage and fully developed by Frederick Winslow Taylor and Henry Ford, was related to the division of labour. The search for the maximum fragmentation of tasks and jobs and the careful description and strict prescription was intended to raise productivity of labour through simplification and repetition of work. Labour in manufacturing was reduced to the pure execution of movements, in offices to strict procedures. Unpredictable events, e.g. problems, trouble, disruptions, variances etc., be

left out of the premises of the process running and moreover out of the process control capacity from the part of the operators.

Extrinsic cooperation was the basis of the organisational model successful for more than a century. Butera (1977) named *extrinsic cooperation* that type of cooperation imposed from above and given by the combination and the synchronisation of prescribed work tasks within the same hierarchical plan and control. According to Karl Marx, this gave the collective work an unprecedented power and productivity even though it made the processes very rigid and worsened the workers motivation and participation. In contrast, Barnard (1938) early identified the organisation as a *system of cooperation*: he indicated the existence of conscious and free cooperation as the basis for a very good functioning of the organisations, but this was not the prevailing model in factories and offices until the ’70s.

In the plant and office rigidity in the workforce utilisation, lack of workers responsibility on quality and costs, excess of coordination and control overheads, worker dissatisfaction seemed the main reasons for the decline of the traditional organisation based upon the taylor-fordism model in the ’70s. In addition to these shortcomings, lack of operational and strategic flexibility, costs of bureaucratic and risk avoiding behaviour from managers, lack of general orientation to quality, long time-to-market, functional barriers, segregation of the innovation activities and many other factors seemed to indicate that the triumphal model of taylor-fordism slowly was becoming an obstacle to economic and social development (Butera, 1972).The crisis of taylor-fordism started first orienting scholars, innovative managers and practitioners to look for organisational alternatives coping with vested interests. Only in the ’80s this crisis became fully evident all over the world. Moreover, the increase of knowledge workers during the ’90s revealed how unsuitable this model was for the work in the growing world of services (Butera *et al.*, 1998).

Emerging organisational alternatives to hierarchy and to the extreme division of labour indicated by organisational scholars since the ’50s (Trist 1963, 1990; Herbst, 1974) are in the ’90s changing the landscape of the organisational culture and practice. Such alternatives include work group autonomy (Gulowsen, 1972), job recomposition and responsibility of professional roles (Davis and Cherns, 1975; Butera, 1972, 1984), flattening out, decentralisation and flexibilisation of organisations (Davis, 1970; Galbraith, 1977; Mintzberg, 1979;), continuous education of employees (Argyris & Schön, 1978; Shrivastava, 1983; Senge, 1990; Huber, 1991; Simon, 1991; Nonaka and Takeuchi, 1995), use of technology for supporting cooperation (Zuboff, 1988; Ciborra, 1993, 1996; De Michelis,

1996a; Schael, 1996c), industrial districts (Piore and Sabel, 1984), network of enterprises and network enterprises (Butera, 1990; Eccles and Nohria, 1992) and so on. Those scholarly contributions report a large number of cases of organizations that afforded deep changes and developed new paradigms. Managerial literature rapidly picked up most of the pioneering concepts of the last decades as hypes and buzzwords.

Most of these changes and concepts march far away from the taylor-fordist tradition and have one element in common: they are the result of «focusing the functioning and the structure of the organisation upon processes» rather than on functional responsibilities (Butera 1994).

There are three main breakthroughs in the organisation of the '90s

- processes take command upon crystallised formal structures and work organisations;
- increasing orientation to process performances (output, quality, costs, flexibility, innovation) and to process control (avoidance and absorption of uncertainty, assurance of results in front of different degrees of indeterminacy, goal driven behaviour etc.) tend to reshape organisational structures, tasks and work rules;
- the change processes, i.e. continuous improvement and redesign processes, move far away from industrial engineering top-down methodologies.

In most cases in manufacturing, human activities are re-oriented toward goals, processes for achieving goals, variance absorption, communication and cooperation beyond functions and job domains. Processes become again visible in the mind of people (process work). There is a clear shift from *mechanistic cooperation* to *intrinsic cooperation* (Butera, 1977). Great part of synchronisation, coordination, collaboration and decision is performed by mutual adjustment rather than following the hierarchy or programs (Thompson, 1967). In most cases team autonomy is extended not only to the where, how, when, if to perform the task (Gulowsen, 1972), but also to invent new products and services. Coordination for problem solving, maintenance, continuous improvement and also generation of ideas for innovation become part of the responsibility and jurisdiction of individuals and groups. Participation at the shop floor is established not as a form of industrial relations, but as a true form of highly socialised work organisation (Trist *et al.*, 1963; Trist and Murray, 1990; Emery and Thorsrud, 1969). Multiple leadership is put into reality (Herbst, 1974). Competencies and continuous learning become more important than job and vocational training (Argyris and Schön, 1978; Senge, 1990). The workplace within (Hirschhorn, 1988) emerges in front of the formal job

description. The hierarchy looses its importance in relation to interfunctional links (Galbraith, 1977), adhocratic links (Mintzberg, 1979), weak ties (Weick, 1969) etc. Different denominations are indicated for such kind of work organisation of the micro-structures as shops, offices, laboratories etc. Such denominations include self-regulated teams, high-commitment organisation, participative organisations, process-centred organisation and many others. The author incline to use the last denomination: *process-centred organisation.*

Process is the most concrete dimension of complex organisations and sociotechnical systems Process represents the less influenced element by the social dimensions in the organisation (Udy, 1970); power (Pfeffer, 1981); organisational conflict (Crozier, 1990); belonging to a community (Bion, 1961; Jacques, 1951); symbols (Alvesson and Berg, 1992); images (Morgan, 1986) etc. Process is the *principle of reality* in an organisation. Process-centred organisations focus the work and the social interaction upon the work to be done and upon the goals, rather than upon power, people control and social stratification. Small societies in process-centred organisations are collaborative performing communities. Miller and Rice (1967) described wonderfully a number of organisation without producing a single organisational chart, but describing processes and the work around them.

Many definitions of process have been formulated as: Conversion of input into output; Information and communication flow in view of goals; Sequence of decisions in the path to achieving results; Mutual commitment in performing a task and many others.

The author (Butera, 1994) suggested the following definition of a process – in its core – inspired by Miller and Rice:

> «[…] the connected events purposively conceived, implemented and controlled in a sociotechnical system which allow to change the throughput (material, information, communication or other) in such a way it may change, nature, shape, position, function, value or other in order to achieve a definite class of goals of the organization, within the parameters of the business performances of the organization (value, quality, customer satisfaction etc.) and the social performances (organisational effectiveness, quality of working life etc.).»

This definition applies both to *primary (or fundamental) processes* and to *operational processes*.

Primary processes are intended to realise the primary goals and mission of an organisation. They cross the entire organisation irrespectively of hierarchical or functional responsibilities and relations. *Primary processes*

include business processes, main coordination and control processes, main support processes. To redefine *primary processes* is necessary in two cases:

- in green field situations before designing technology, organisation, management etc.;
- dramatic problems or unfulfillment of organisational goals and of the related business and social performances.

In both cases, the *primary processes* are redesigned (re-engineered) together with the architecture of macro-organisational structures and the technology.

Primary processes are composed of many *operational processes*. *Operational processes* are not only management partitions of the primary process within defined boundaries and resources, but mainly processes which allow to *get the things actually done*. Micro-structures, e.g. shops, offices, work groups, teams, professionals, case managers, take care of the achievement of goals within *operational processes.*

Operational processes designed with sociotechnical approach are run upon the principles of commitment, cooperation, communication, variances avoidance or absorption. Their results are usually tangible, in business and social terms.

All processes are always challenged by dramatic changes within the general setting (competition, new technologies, new public regulations etc.) as well as by local breakdowns (accidents, disturbances, variances etc.). In order to control and manage those changes, *real persons* in the organisation should have the duty to detect, avoid and absorb changes and breakdowns and to re-design or reassess the process and the way to deal with change and breakdowns. Re-design and control of a process is possible only if people have enough knowledge of the process. People working in processes must have the process in their mind to guarantee the achievement of its goals.

The challenge of *process management* and *process-centred organisation* is that they are at same time a recent organisational innovation and a very old phenomenon. *Process management* and *process-centred organisation* existed prior to Taylor and Fayol as the main form of craft organisation. Then they developed as forms of *natural organisations* or *real organisations* and existed tacitly aside to the *formal bureaucratic organisation*. This happened when the nature of process required that members of the organisation should adopt forms of cooperation based on mutual adjustment, communication, goal sharing, sense of work community etc. In most industries, workers have been caring about results even when this was not their formal responsibility (Gouldner, 1954;

Thompson, 1967; Perrow, 1972). It has been found that workers go beyond their responsibility in agreement with management. This phenomenon has been misinterpreted as an informal organisation or as a furtive adjunction to the formal one. The coexistence of *natural* and *rational organisation* in the same setting has been theorised by Scott (1981) as a constant feature of organisational history.

Studying and re-designing chemical and steel plants, offices and R&D laboratories, Butera (1979, 1984) proposed the concept of *real organisation* for getting the process accomplished. *Intrinsic cooperation* is activated. According to the author, any *real organisation* is composed of different layers of coexisting organisations: formal, which is the type of the organisational iceberg, and under the technical, professional, *de facto*, community of practices, perceived, informal ones. The overall organisation is the combination of all of these layers. In a certain sense a new *overall organisation* is emerging combining natural, rational and open system organisation. In the taylor-fordist model the formal and technical organisation were predominant. In the new and emerging organisational models the unwritten and bottom-up parts of the real organisation become the source of new lively norms and structure. In fact, the real organisation in the ’80s and ’90s has been indicated as the model of process work and organisation upon which to develop new rules, technologies, training, participation etc. The model of *process-centred organisation* is conducive to identify and to manage the *real organisations*. The organisational development which neglects the already existing real organisation does not meet success, while participation and consideration of the *trajectories of evolution* (Nelson and Winter, 1982) yield successful and long lasting innovations.

The sociotechnical school did not restrain to observe this phenomenon but was more focused on “what should be” through the joint optimisation of the technical demands (e.g., nature of processes, technology, physical layout) and the social demands (e.g., cooperation, motivation, growth).

New patterns of process-centred microstructures are now largely adopted by most industrial and service organisations (Butera, 1996b). Group technology units and production islands (Butera, 1977), computer and human integrated manufacturing units and many other micro-structures are diffused in manufacturing today. A large variety of *t*eams (face-to-face teams and remote, permanent and ad-hoc) are now the backbone of industrial and service organisations. *Competence* and *creativity* of individuals are the key variables of *process-centred organisations*. *Open*

roles, new professions and roles, new professional systems are emerging as new flexible and evolving structures.

Management structures and process innovation (process management structures) are becoming important. Process owners, project team, continuous improvement teams, quality teams and others are examples of these tendencies. Meaningful business process are often run by new patters of macrostructure moving away from the traditional hierarchical-functional structures (Galbraith, 1973; Mintzberg, 1996): project structures divisional structures, brand organisations, matrix organisations etc.

Sometimes business process crosses many firms and institutions as in the network of enterprieses as the solar system enterprises (Miles and Snow, 1978), the regional systems of flexible specialisation (Piore and Sabel, 1984), the industrial districts (Becattini, 1979; Brusco, 1990) and many other cases. A new pattern of firm moving away from the traditional *castle-firm* is the *network enterprise* (Imai, Butera, Dioguardi *et al.*, in Camogli Conference, 1988[2]). In all cases, boundaries of the main or business process and legal and organisation boundaries of the firms are disentangled.

2. Business process re-engineering

Business process re-engineering (BPR) takes the *primary processes* of an organisation (the *business processes* as it has been re-named) as a subject to be firstly re-designed (re-engineered) and then accordingly organisation and technology to be adjusted, aiming at dramatic improvements. BPR in its different meaning and understanding (Hammer, 1990, 1996; Hammer and Champy, 1993; Davenport, 1993) has been one of the most diffused approaches to change in the last decade of the '90s. The BPR movement started with very high claims for great business results for companies doing BPR. Hammer and Champy (1993) introduced re-engineering to millions of managers and consultants. According to Hammer, re-engineering is «the fundamental rethinking and *radical redesign* of business *processes* to bring about *dramatic* improvements in performance». Michael Hammer (1990) had a very determined way of arguing for the way of doing re-engineering and its results: «radical change

[2] Convegno Irso "Impresa-rete", Camogli, 1988: https://irso.it/7-luglio-un-ricordo-di-oliver-williamson-premio-nobel-per-l-economia-la-sua-keynote-lecture-e-il-video-integrale-del-convegno-sull-impresa-rete-dell-irso-del-1988-a-camogli/.

yields radical results». Reengineering for him did not mean to tinker with what already exists or to make incremental changes which leave basic structures intact, but to start over again. Re-engineering took nothing for granted. It ignored the existing and concentrated on what should be.

The resulting productivity gains from BPR were the best known at its beginning. According to *Business Week* (1991), re-engineering may reduce costs by 80 per cent, improve time-to-market by 80 per cent, or double sales in other cases. One of the publicized example is Ford's accounts-payable procedure (Hammer, 1990; Hammer and Champy, 1993; Davenport, 1993). From the point of view of results, high claims and objectives of BPR have not been met by the projects, as already the very first experiences with BPR have shown (Hall *et al.*, 1993). Two thirds of business process re-engineering initiatives failed (Hall *et al.*, cit.; Davenport, 1996). Many reasons of these failures can be attributed to the lacking attention to social dimensions and to the management of the change process (e.g., missing participation, negation of people empowerment, stakeholders gain or lose power etc.) rather than to the technical dimension of methods and technologies used for creating or managing change. Davenport (1996:71) reports findings from the CSC Index report on the state of BPR:

> «[…] 50% of the companies that participated in the study reported that the most difficult part of reengineering is dealing with fear and anxiety in their organisations; 73% of the companies said that they were using reengineering to eliminate, on average, 21% of the jobs; and, of 99 completed reengineering initiatives, 67% were judged as producing mediocre, marginal, or failed results.»

Also Hammer and Champy (1993: 200) admit that: «[…] our unscientific estimate is that as many as 50% to 70% of the organisations that undertake a reengineering effort do not achieve the dramatic results they intended». The failure can be in a single project, but also for the entire business. McKinsey made a research into re-engineering projects in more than 100 companies with a detailed analysis of 20 of these projects (Hall *et al.*, 1993). The research reveals how difficult redesign actually is and, even more interesting, how often business process re-engineering projects with impressive results on the single process fail to achieve real and long-lasting business impact. BPR has become a word also standing for «too-often failed change programmes» (Davenport, 1996).

In the author's view, BPR, in spite of its failures, had the great virtue to raise courageously a key question to CEOs: when should our processes be

changed to win a bitter competition? How to overcome estabilished organisational structures justified mainly by power reasons? How to overcome BPR may be seen as a step forward to overcome hierarchies and tight division of labour and to re-address the organisation to goals, process reinvention and control, extended cooperation. But this would have required three basic conditions.

The first condition is to redesign (re-engineer) jointly processes, organisation, technology, roles and moreover competencies and attitudes at every level of the organisation's functioning: from *primary processes* to *operational processes*. The second condition is *to make the things really happen*. This implies to generate a change management program, which permits implementation, learning, participation, change in attitudes and behaviour. The third condition is the issue of *values*. Reducing costs is very important, but not less important are quality of products and services, flexibility, strategic readiness, innovation, conservation of economic and knowledge asset, capability of the organisation as being *built to last* (Collins and Porras, 1994) and many others business performances. The human and social performances of the firm are of paramount importance. Improving *organisational learning* and the *quality of working life* should be key drivers of organisational development initiatives for economic institutions. A narrow monetary focus (cost cutting) and a socially irresponsible attitude (squeezing out of people and widespread alienation) of most BPR exercises are attracting discontent among the business community, the workers, the government.

3. Computer Support Cooperative Work (CSCW)

Most of the companies following business process re-engineering projects have linked this to the use of information technology (Davenport, 1996; Schael, 1996 b; Zeller, 1996). Most of the organisational models necessary from BPR design could only be put into place thanks to the availability of information technology (e.g., for communication, information sharing, data warehousing, process simulation and so on).

Computer Supported Cooperative Work (CSCW) is «an identifiable research field focused on the understanding of nature and characteristics of co-operative work with the objective of designing adequate computer based technologies to support such co-operative work» (Schael, 1996b: 55).

CSCW technologies are intended to make process visible to workers and managers and to enlarge the human's and organisation's space of

possibility for variance control, continuous improvement, creative re-design etc. De Michelis (1996a) argues that CSCW systems augment the *sustainable complexity* of persons involved in cooperative work. This means, that people at work may manage more activities, processes, communications etc. within the working environment. This relates to make technology part of people empowerment, as an individual or a group. In this sense, CSCW is not only part of the technical dimension of sociotechnical systems, but can also be a means for achieving new forms of organisation, because constituent of cooperation and communication.

CSCW had produced marketable systems: groupware applications and workflow management systems are the best known. However, the opening towards the design of work and organisational development is still missing in the self-understanding of the CSCW community. CSCW has been concentrating upon supporting existing cooperation by technology.

Based on this self-understanding, the CSCW community should make a step further. First, the linkage of CSCW with organisational development. Second, the development of support technology to improve innovation and the human ability to live with change. As a third point, argument CSCW has to link its also to the sociotechnical school. This is the theme of the next paragraphs.

4. Lean production and Toyota Production System

Starting from the ’90s, most companies in the world tried to copy the powerful operating system of Toyota, the Toyota Production System made of *Total Quality Management, kanban, kaizen, 5S*: competitors, aviation companies, medium-sized enterprises, public bodies recruit armies of lean production consultants, but few have Toyota’s success. Later on, it will be named as World Class Manufacturing. That is, TPS is necessary, but not sufficient.

Osono, Shimizu and Takeuchi in 2008, later on than the first release of this paper, were able to explain why Lean Production could not be only a technique. Toyota is not only an automotive company, but an “enterprise of knowledge”. All (competitors, large companies) have formidable information systems and extensive teamwork training programs, but Toyota developed the infrastructure of a “nervous system” that self-develops (a true “learning organization”) by creating management systems of knowledge extended to all levels, practices and cultures of community work (*yakoten, obeya, gemba*, among those mentioned in their book) which

link face-to-face communities and remote communities where the knowledge of 300.000 people is generated and flows: they operate all over the world and less than half of them are now in Japan.
The second fundamental secret of Toyota is the *soul of the company*, on the line of the revolutionary Adriano Olivetti's thought, that gives vision, orientation, meaning to everyone's work and generates their motivation. The soul of the company is given by its values and its transparent culture practiced at all levels. It is not given by glossy "papers of values", but by real "forces", sources of energy. The authors distinguish *expansion forces*"and *integration forces*.

Among the *expansion forces*, there are the *impossible goals*, that is, the long-term goals and dreams that the top management proposes and practice every day, and in which those 300.000 people identify themselves. They are the drivers who speak to their ambition, their pride and their ethics. When recently Toyota decides to produce cars that "improve air quality", it is clearly a contradiction: but this "madness" has a great weight, together with the continuous improvement of the design processes and the development of technological knowledge, in the very fast design and commissioning in production of hybrid cars, a step toward a future car without emissions. The continuous improvement practices are another expansion force of Toyota's Dna: from the innovative effort of the engineers who gave birth to the Prius, to the 740.000 improvement proposals that were suggested by the 300.000 employees and actually implemented (2 proposals approved each employee!).

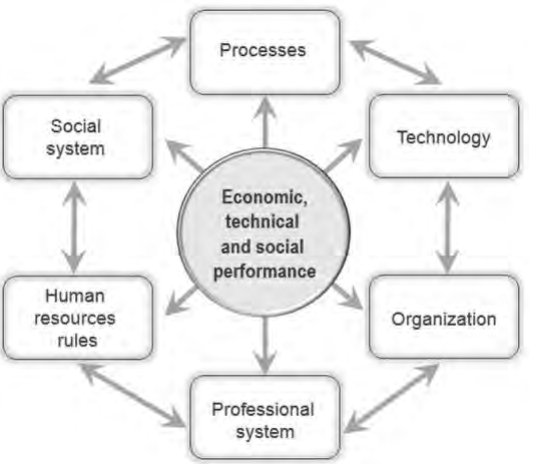
The *integration forces* move from the values of the founders and develop through a shared way of practicing them in everyday life: humility, obsession with quality, the concreteness of craftsmanship within a gigantic enterprise, respect for people, attention to the customer, always being on the field (*gemba*), going and see things with your own eyes (*genchi genbutsu*) at all levels. This "being on the spot" is manifested in widespread practices, from the *andon*, that is, the work authority assigned to each of the employee to stop a defective process (even an assembly line).

5. The sociotechnical design 2.0

Process-centredness, business process re-engineering revisited, CSCW expanded, lean production by alone are not enough for successful organisational development. We need to go back to the basic, revitalising an innovating an approach which may be updated and encompass all those

approach: the *sociotechnical approach revisited*, a sort of *STS 2.0*, taking into account the deepening crisis of hierarchical organisations, the dramatic changes in business processes, the disruptive rise of digital technologies, the worldwide development of lean production.

Figure 1- The dimensions of sociotechnical ystem design (Butera, 1995)



The sociotechnical concept for system design, as it is well known, arose in conjunction with the first of several field projects undertaken by the *Tavistock Institute* in the British Coal Mining Industry. The time was that of the post-war reconstruction of industry in relation to which the Tavistock Institute developed several *action research projects.*

The sociotechnical school was opposed to the rationalistic technology thinking which has mainly influenced system design in this century following tayloristic models. The sociotechnical approach was intending to combine the *joint design of technology, organisation and human growth* in order to maximise system performance by augmenting human capabilities and technological adequacy.

The sociotechnical model has been able to take into account the complexity of the work process activities and of the related social system. The dimensions of the sociotechnical system however were often conceived mainly as a given to be optimized and as independent from the force which gives sense to it. Any *variance* was perceived as a threat whose impacts have to be minimised. A little space remained for re-defining the whole business process and the social organisation of work outside the system.

Sociotechnical school then related mainly to physical transformation and not so much to information system. Digital technologies were not part of the scene.

The classical thoughts should have a revival in our days.

The transformation of modern organisations into long-lasting systems require to design or redesign long lasting goals and main/business processes. The components of the sociotechnical system should be not only integrated and optimized with the others, but in many cases they should be invented and reinvented. Digital technology is the more disruptive among those dimensions. Also other components in most cases are based upon new concepts: coordination and control mechanisms, simplified and flat organisational structure, professional system, workflow management technology etc.

This address to *a form of new generation of sociotechnical system design.* It was relaunched in 1988 during the international conference *Joint design of technology, organisation and people growth*, organised in Venice by Istituto RSO, whom this special issue is dedicated to. The *second sociotechnical system approach* (*STS 2*) was also indicated by the 1996 Santa Fe meeting of sociotechnical scholars and practitioners[2].

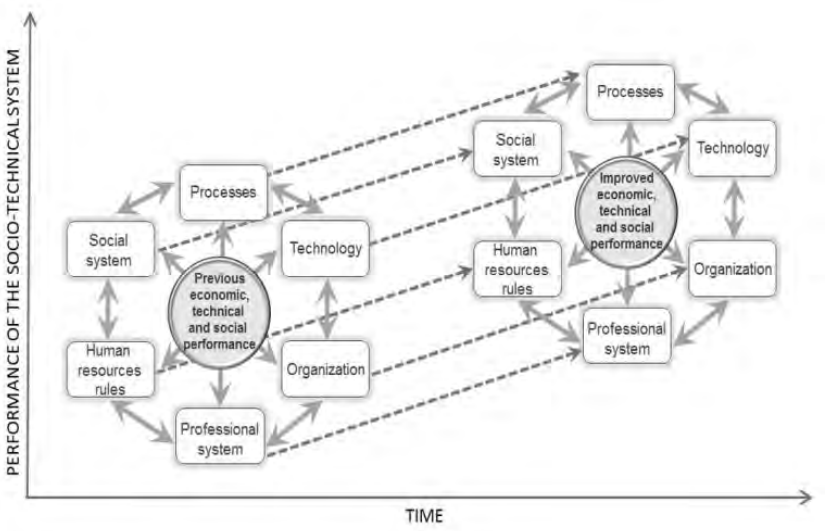
This STS 2, which may include approaches named BPR or CSCW or *lean production* or *World Class Manufacturing* practices, means to adopt a new concept of sociotechnical system as a process-oriented production system where processes, technology, organisational structure, professional system, human resource rules and social system (human community) fit together ad evolve. Economic, technical and social goals are agreed and developed among managers, educational systems, unions, workers, users. The *real person* is at the centre of the system (Butera, 1990).

The key issue is the path for moving the sociotechnical systems to different states.

The model sees the organisation as a living system with an organic relation of its constituent components, among which there are *natural* or *institutional* systems. It includes professional systems which are *social institutions* hosted both in the organisation and in the society at large. It includes staff rules (wages, grades, training, working time, pension, fringe benefits etc.) which are less the result of internal rules and more of societal factors (legislation, union/management agreements, educational systems).

[2] Among others, Charles Berezin, John Cotter, Joel Fadem, Bill Lyttle, James Taylor, Harvey Kolodny and Stu Wimby joined in Santa Fe, New Mexico, from October 22-25, 1996.

Figure 2 – Processes of change (Butera)



Social system is the community, the *small society* included in the systems: it has its own internal *social history* of social roles, internal informal rules, friendships, enemies, lenience, collaboration etc. (Gouldner, 1954), but also rites, myths, ceremonies imported by the institutional setting in which they are embedded (Granovetter, 1985; Powell and Di Maggio, 1991). An *overall real organisation*, in a word (Butera, 1979).

The trajectories of these working communities cannot be designed top-down, but may be object of change management and development. For this reason, the continuous improvement of these systems might not be left to develop on its own, but development of the sociotechnical system needs guidance in its *rational* and *natural* components (Scott, 1981), in its dimensions of *systems* and *vital world* (Habermas, 1981). This approach has been the basis of the European Esprit Project "Qualit".

6. The "Qualit" approach: how re-engineer and improve sociotechnical systems

"Qualit" (Quality Assessment of Living with Information Technology) was an Esprit Project with the aim to help a range of users, such as human

resource managers, IT project managers, IT system designers and union representatives in the diffusion and adoption of information technology taking into account quality of working life.

The Qualit consortium included Cap Gemini Innovation, FIAT Telexis, Istituto RSO, FhG-IPK (Institute for Production Systems and Design Technology), SID (Danish General Workers Trade Union), University College Dublin and University of Siena. The project was finished in 1996 and provided a support system addressing consultancy purposes, an educational tool addressing training purposes, and a library of documented case studies. The architecture of tools and the guide to use them during a process of change has been engineered in the *change management process framework* (CMPF).

The conceptual framework of "Qualit" (Butera, 1996b) is based on sociotechnical systems, quality of working life and empowerment of the person. Butera (1990) introduced also the *ecology of work* approach for the assessment of quality of working life and gave recommendations for people empowerment in design, re-engineering and continuous improvement of sociotechnical systems. These are the basics of the change management approach explained further on.

The Qualit project gives three key-recommendations for sociotechnical development (Butera, 1996b).

First, the process of change should take in consideration values, goals, main processes, ecology of the organisation, follow the evolution of the system and its economic, social, physical environment and accordingly design the change: a process outside in, not only centred within the boundary of the system to be designed.

Second, people should control the not only ti work process but also the process of change instead of being controlled. This means that:

- people should *see* and understand the main and operational processes. They should be able (empowered) to intervene positively in the process. This includes the control of variances, proposals for improvements as well as the redesign of processes according to the specific circumstances. The general understanding of work should include *communication*, *co-operation*, *problem solving*, room for *creativity*;
- the *social process of change* and improvement should be highly *participative* with the involvement of all stakeholders and people concerned;
- change programmes should be designed in such a way to include from the very beginning opportunities for training, co-operation and involvement at any level of the organisation.

Third, in the recurrent changes of processes, technology, organisation, etc., people should not be hurt in their individual integrity, i.e. body, mind, emotion, profession, social identity etc. This protection, stability and the *integrity of the self* is what we mean for *quality of working life*.

The quality of working life dimensions are shown in Figure 3.

Figure 3 – The quality of working life

7. People empowerment

Real empowerment of the person (not the fashionable empty buzzword frequently used in the managerial jargon) has to be the key focus, because the improved performances of sociotechnical systems and quality of working life could and should be positively affected by the visibility, degree and pace of real empowerment of people.

The key concept of *empowerment of the person* (Butera, 1995) implies first of all that each individual should not only be protected, but should also become enabled (i.e., get the power) to actively defend and develop one's own integrity and quality of life through various means. These options comprise, e.g. to have more understanding and knowledge, emotional stability, clear roles, social integration, and to be a person, in order to choose paths and have the freedom for coping with external threats. It implies also that the person should hopefully have control on working processes and processes of change, instead of being controlled by the

organisation and technology, or being suddenly confronted with new situations.

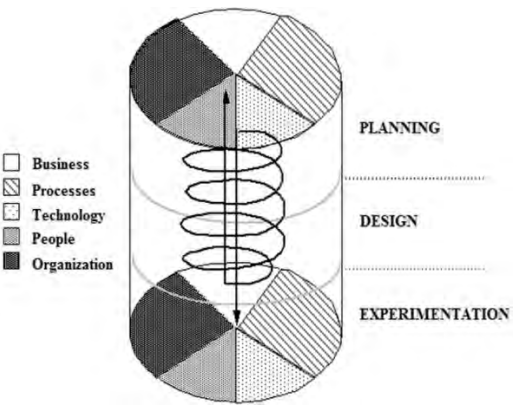
Modern sociotechnical systems should be, and sometimes are, built on *open professional roles of empowered people* (e.g. small firms in the firm), which have in large part the *workplace within* (Hirschhorn, 1988). All this is not given by itself, but as an outcome of individual growth. The empowerment in being a person should be strongly supported. The person should be enabled to face the anxieties of process control and the challenge of change. Empowerment includes the development of skills, social capabilities, communication abilities, inner power and so on. This means also that people have to be empowered for current and future situations.

8. Structural change management

The effort in organisational development can only be successful when the required change is managed as a planned and managed process.

Figure 4 shows a *spiral model* which allows to start the innovation initiative at any stage among program, projects and experimentation (e.g., strategy and business process redesign, restructuring of single micro-organisations, continuous improvement).

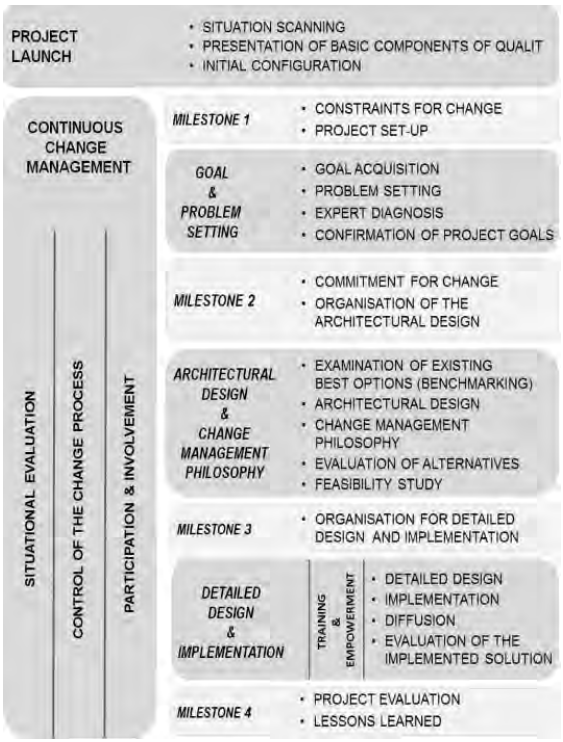
Figure 4 – Processes of change (Butera, 1995)



These three levels should not be seen as sequential water-fall events, but it is possible to start anywhere: pilot design, programs of continuous

improvement etc. In the second decade of 2000 this has been renamed as *agile*. These may accumulate enough learning in the organisation and in people to refurnish higher level, company-wide changes. Implicitly, this model makes clear that a system is never really finished. The spiral covers simultaneously the components business, processes, technology, people and organisation (Butera and Thurman, 1984; Butera, 1995).

Figure 5 – The main steps of change management process framework (CMPF) of the "Qualit" Project



In relation to this never-ending spiral, the "Qualit" Project proposed a *change management process framework* (CMPF) to guide the change in organisational development projects.

Figure 5 shows the main steps of the *change management process framework* (CMPF) as developed in the "Qualit" Project.

The spiral model and the steps intend to clearly differentiate:

- the *levels of change* (overall strategy/organisation design and business process re-engineering, design of an unit and improvement/implementation);
- the *object of change* for the appropriate selection of what elements of the sociotechnical system should and may be changed and how deeply (process, technology, organisation, work);
- the *time* and the issues where the design or the change are done All these features are recursive phases or steps which help the actors to augment the sustainable complexity of change;
- the *change management process*, being the process of understanding and decision making, the temporary organisations, the arena for confrontation and participation, the communication and learning processes etc.

9. Sociotechnical system revisited at the end of the XX century. Joint design of information technology, business processes and work

Today, the challenge is to design in an integrated way better information systems, better man-machine interfaces, better software, better compositions of different tasks in more integral work roles, more supportive organisations, more appropriate staff rules, an adequate education, a developing social system and work culture. Integration and care of social aspects of change were the missing aspects in most BPR and lean approaches.

The *joint engineering (or design) of information technology, business processes, organisation and work* should be considered as the new elective area of collaboration among different disciplines for successful organisational development. This new challenge has been termed in this paper as *structural change management of process-centred organisations*. Also BPR, Continuous Improvement, Lean methodologies and CSCW should be considered, however, as a preparatory and complementary area to a wider approach. To make this happen, collaboration is required among managers, technologists, social scientists, representatives of employees, public institutions and other people concerned.

Important components of successful efforts in the sociotechnical design revisited at the end of the century are the emerging innovative models of design of firms (network enterprise), processes (re-engineered business

processes), macro organisation (business units), micro-organisation (process centred units, teams), roles (professions of knowledge workers, process owners and process managers), technology (groupware, workflow management systems, Internet).

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