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!).

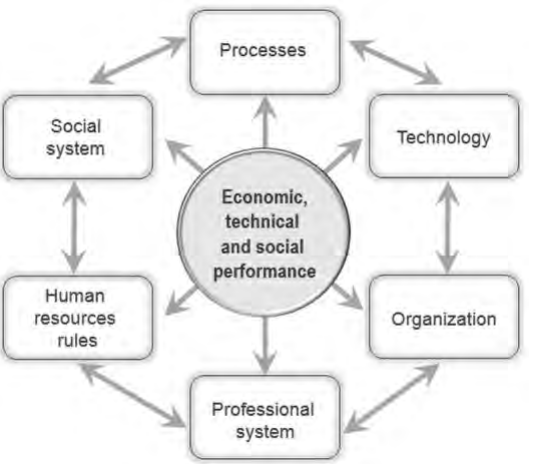
The *integration forces* move from the values of the founders and develop through a shared way of practicing them in everyday life: humility, obsession with quality, the concreteness of craftsmanship within a gigantic enterprise, respect for people, attention to the customer, always being on the field (*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].

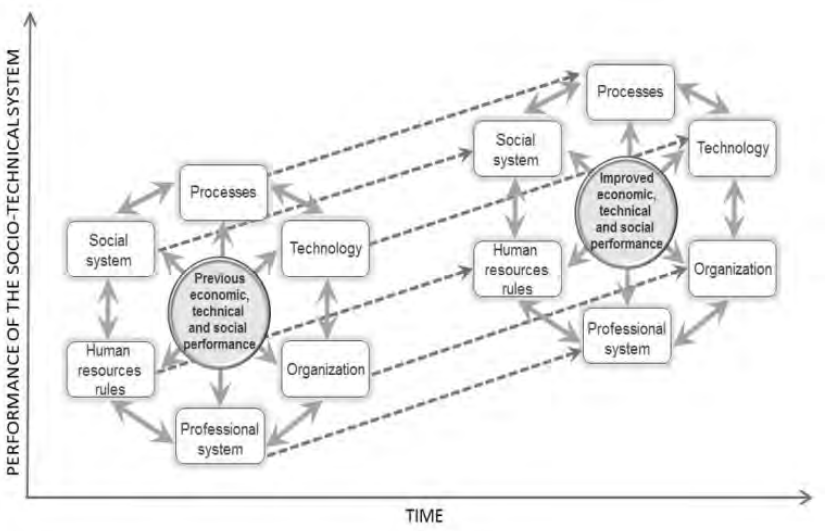
This STS 2, which may include approaches named BPR or CSCW or *lean production* or *World Class Manufacturing* practices, means to adopt a new concept of sociotechnical system as a process-oriented production system where processes, technology, organisational structure, professional system, human resource 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.

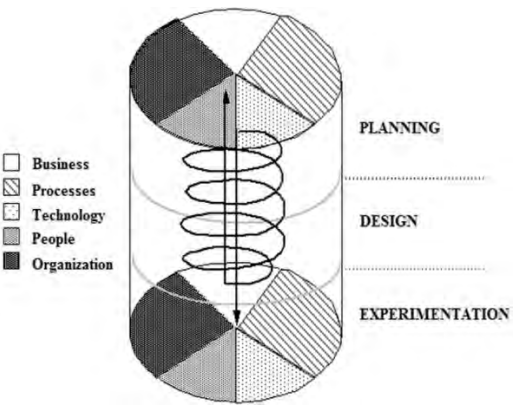
Modern sociotechnical systems should be, and sometimes are, built on *open professional roles of empowered people* (e.g. small firms in the firm), which have in large part the *workplace within* (Hirschhorn, 1988). All this is not given by itself, but as an outcome of individual growth. The empowerment 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).

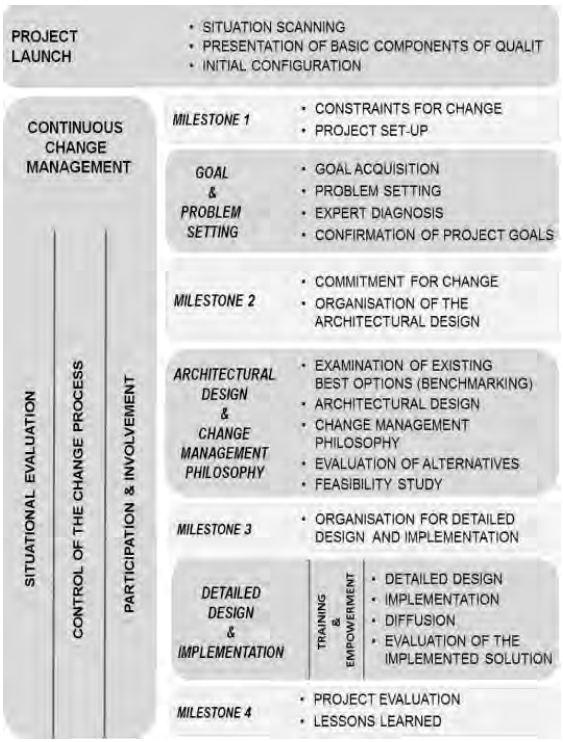
Figure 4 – Processes of change (Butera, 1995)



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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