



HAL
open science

”HY-CHANGE”: AN HYBRID METHODOLOGY FOR CONTINUOUS PERFORMANCE IMPROVEMENT OF MANUFACTURING PROCESSES

Michele Dassisti

► **To cite this version:**

Michele Dassisti. ”HY-CHANGE”: AN HYBRID METHODOLOGY FOR CONTINUOUS PERFORMANCE IMPROVEMENT OF MANUFACTURING PROCESSES. *International Journal of Production Research*, 2010, 48 (15), pp.4397-4422. 10.1080/00207540801901840 . hal-00599504

HAL Id: hal-00599504

<https://hal.science/hal-00599504>

Submitted on 10 Jun 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



□HY-CHANGE□: AN HYBRID METHODOLOGY FOR CONTINUOUS PERFORMANCE IMPROVEMENT OF MANUFACTURING PROCESSES

Journal:	<i>International Journal of Production Research</i>
Manuscript ID:	TPRS-2005-IJPR-0524.R1
Manuscript Type:	Original Manuscript
Date Submitted by the Author:	27-Jun-2007
Complete List of Authors:	Dassisti, Michele; Politecnico di Bari, Dipartimento di Progettazione e Produzione Industriale
Keywords:	BUSINESS PROCESS RE-ENGINEERING, TQM, PERFORMANCE ANALYSIS
Keywords (user):	BUSINESS PROCESS RE-ENGINEERING, TQM



“HY-CHANGE”:**An Hybrid Methodology for Continuous Performance Improvement
of manufacturing processes**

MICHELE DASSISTI*

Dipartimento di Ingegneria Meccanica e Gestionale, Politecnico di Bari, Viale Japigia 182, 70126 Bari - Italy

An hybrid methodology for Continuous Performance Improvement (CPI) is presented, basically funded on the joint recourse to Business Process Reengineering (BPR) and Continuous Quality Improvement (CQI) principles and tools. The methodology (named “HY-CHANGE”) is conceived as a logical and technical support to the decision maker. It results in a number of recursive phases, where the rational and synchronous use of several tools and techniques, borrowed from the two methodologies above mentioned, is structured into an unique approach. HY-CHANGE thus offers a structured guide for performance improvement processes, more adherent to the enterprise reality and its dynamical evolution. The value of the methodology is to provide a structured frame to use several methodologies and tools (here referred to as “decisional toolkit”) with the scope of effectively managing change processes at any level within the enterprise.

The practical implications of the idea are discussed based on a case study conducted in a Italian S.M.E. producing sofa.

Keywords: Continuous Performance Improvement; Business Process Reengineering, Continuous Quality Improvement, Hybrid methodology; decisional toolkit.

1. Introduction

Similarly to the law of “software entropy” introduced by Ducasse and Demeyer (1999), business organisations are naturally doomed to change because of their intrinsic nature of systems interacting with other systems and subject to external customer’s demand. In the wider market, the increase of complexity of the business environment in which they operate —due to the number of contemporary factors involved (refer, for instance, to the interesting concepts of scalar enterprise systems in Temponi (2006)— reflected in the recent years into even more turbulent internal transformation processes. In a brief summary, these are the reasons of the interest of scientists and practitioners about the “management of change” of the last decades (Hammer and Champy (1993), IBM (1995)).

The most popular of these approaches recently appeared are Business Process Reengineering (BPR), Continuous Process Improvement, Total Quality Management (TQM) (or, later, Continuous Quality Improvement), and Organisational Transformation (Aguilar-Savén (2004)): the reader can refer to Dooley and O’Sullivan (1999) for a wider analysis. A crop of techniques and methodologies (referred to hereon as tools) was conceived accordingly to support operators within enterprises to face change decisional tasks.

Most of these techniques can be comprised under the umbrella of Continuous Performance Improvement due to the common aim to maintain the organisational competitiveness, and thus to obtain a significant improvement of the organisational performances. Continuous Performance Improvement (CPI) can be best understood referring to a similar definition of continuous improvement <<...the planned, organized and systematic process of ongoing, incremental and company-wide change of existing practices aimed at improving company performance>> (see, e.g. Choi (1995), Rijnders and Boer (2004)).

BPR and CQI, sometimes perceived as opposite methodologies, in reality embody the same need to manage the process of change in different forms: these can indeed be seen as part of the Continuous Performance Improvement. Continuous improvement per sé is, in fact, defined as the <<propensity of the organization to pursue incremental and innovative improvements in its processes, products, and services>> in Dooley and Johnson (2000), thus encompassing both the concepts (BPR and CQI) and the CPI.

Too little attention has been paid to the process of appropriately designing, implementing and managing tools and methodologies in practice for the CPI purposes (see, for instance, Kutucuoglu *et al.* (2002) or Jack and Brock (1995)). In particular, a lack of a structured use-guide to this aim is felt by several authors as a as one of the important reasons, amongst others, behind BPR failures (see, e.g. Al-Mashari *et al.* (2001)); few authors indeed focused on the identification of commonalities between different existing approaches (see, e.g., Altinkemer *et al.* (1998), Rijnders and Boer (2004), Choi (1995)).

*Email: m.dassisti@poliba.it

1 The process of selecting the right approach, as well as the right tool to apply for a specific case, can still be significantly
2 complex, because of the huge number of solutions available and also due to the lack of commonly agreed criteria that
3 explains and describes their usefulness (see Aguilar-Savén (2004), Mohanty and Deshmukh (2001)); some authors
4 recognises this need by introducing the idea of a system innovation “tool-kit”, like in Dooley and O’Sullivan (1999) where this
5 is there adopted and deployed with a slight different aim.
6
7
8
9

10 The scope of this paper is to propose an “hybrid” methodology (here named “HY-CHANGE” from HYbrid CHANGE) to
11 provide a useful guide to support decisions in the “changes exercises” that quite frequently occur into organisations. The HY-
12 CHANGE lends several ideas from BPR, CPI and CQI approaches present in literature so far, with particular reference to
13 the two approaches combined (Altinkemer *et al.* (1998), Harvey and Millett (1999), Yeo (1996), Shani and Mitki (1996),
14 Halacmi and Bovaird (1996)), trying to integrate methodologies and tools there applied.
15
16
17
18
19
20
21

22 **1.1 Business Process Re-Engineering**

23 The widely-accepted definition of Businesses Process Reengineering (BPR) comes originally in 1990 from Hammer and
24 Champy, who define it as <<*the fundamental rethinking and radical re-design of business processes to achieve dramatic*
25 *improvements in critical, contemporary measures of performance such as cost, quality, speed, service and speed*>> as
26 reported in Aldowaisan and Gaafar (1996). Apart the significant naming issue of several change projects (see Dobson
27 (2003) for an interesting discussion), a plethora of Business Process Reengineering (BPR) cases and approaches have
28 been proposed in literature; according to this one cited as being normative (Eisner (2000), Im *et al.* (1999), Grover and
29 Malhotra (1997), Talluri (2000), Glykas and Valiris (1998), Cameron and Braiden (2004), Kim and Jang (2002)). These
30 widely —and also recently upcoming— different views of BPR may be taken as the evidence that this subject area is yet to
31 be mature.
32
33
34
35
36
37
38
39

40 Some authors state that, even though BPR is a fascinating concept, it is simply another managerial “fad”, because business
41 systems are never reengineered, they simply develop (Jones *et al.* (1997), Altinkemer *et al.* (1998), Chang and Powell
42 (1998), Guimaraes (1995)): the concept of the “improvement paradox” well represents this situation according to Keating *et al.*
43 (1999). This top-down radical perspective of change, sometimes named as “organisational change philosophy” (see
44 Sarkis *et al.* (1997)), is recognised as an high risk and difficult task by Kutucuoglu *et al.* (2002) and by Terziovski *et al.*
45 (2003): with the increasing of implementations the stress turned to a more mild concept of “change” over the last decade.
46 Some authors, in fact, introduced the concept of categories of change like Dooley and Johnson (2000), while others
47 recognise a sort of continuum between continuous and radical changes like Al-Mashari *et al.* (2001): here BPR is perceived
48 in an holistic vision as <<. . . *a continuum of change initiatives with varying degrees of radicalness , at the heart of which is*
49 *to deliver superior performance standards through establishing process sustainable capability.*>>.
50
51
52
53
54
55
56
57

58 In the author’s view, BPR implementation may differ either for the different scopes of its application or for the perspective felt
59 by end-users. Accordingly, four different perspectives can be used to distinguish different applications, as follows.
60

From an **operational** perspective of BPR implementations, the focus is on business processes and its correct management,
that means to give priority to those real-flow of adding-value activities aimed to realise a product or a service as sustained by

1
2 Im et al. (1999). In the operational perspective of BPR fall also those application strongly relying on Information Technologies
3 (IT) as critical enabler of change (as stressed by Grover and Malhotra (1997)), even though it is not so clear the correlation
4 between IT investment and BPR rate of success according to Willcocks (2002) and Terziovski *et al.* (2003). Several project
5 management efforts fall also in this category, for budgeting and scheduling scopes according to Al-Mashari et al. (2001).
6
7

8
9 According to a **dynamical-evolutionary** perspective, the focus of implementations of BPR can be classified more according
10 on the scope than on the activities, suggesting the need to combine radical re-engineering activities (the revolutionary stage
11 of Choi (1995)) with initiatives and methods aiming at a continuous improvement of the performances according to O'Neill
12 and Sohal (1999) (evolutionary stage as in Choi (1995)). Other authors stress on flexibility to develop solutions from the
13 future needs, i.e. taking into account the dynamical nature of organisations as in Fitzgerald and Siddiqui (2002).
14
15
16
17

18 From an **organisational** perspective, implementing a BPR methodology requires sharing a vision and motivating personnel
19 (O'Neill and Sohal (1999), De Bruyn and Gelders (1997)). Main problem addressed is the top-management commitment
20 according to Choi (1995) and to create a shared vision for realising the changes: it is the most common statement for the
21 success of any BPR action (Altinkemer *et al.* (1998), Terziovski *et al.* (2001)). Stakeholder commitment is often addressed as,
22 for example, in Teng *et al.* (1996). The constant focus on business processes represent a critical success factor for any BPR
23 initiative as sustained by Gunasekaran and Ichimura (1997).
24
25
26
27
28

29 Finally, from a **systemic** perspective, implementing a BPR means to stress the necessity for a suitable environment to
30 manage the change, where customers have to play an important role according to Terziovski *et al.* (2003). System's theory
31 recognises that organisation's business processes are fragmented into sub-processes and tasks, that are carried out by
32 operators belonging to several specialised functional area within the organisation. In this light, the expected result of a BPR
33 action is a plan of improvements and their implementations, also according to O'Neill and Sohal (1999).
34
35
36
37

38 A number of tools and techniques to implement BPR have been proposed so far, independently of the different perspectives
39 above cited: still poor attention was paid on the way BPR can be implemented, as also sustained by Kutucuoglu *et al.* (2002)
40 despite their significant impact in terms of incremental effects, particularly as concerns organisational learning. All these
41 change initiatives can be viewed to fall under the CPI umbrella, since their final effect is always related to the improvement of
42 performance level (Bessant *et al.* (2001), Vits and Gelders (2002)). Methodologies and tools adopted in BPR actions,
43 sometime named "technological enablers", are quite often difficult to bring together or even to integrate; tentative to provide
44 helpful guides is represented by frameworks (see, e.g. Mansar and Reijers (2005)) which, on the other hand, lack of practical
45 applicability.
46
47
48
49
50
51
52

53 To the aim of the present paper, firstly several tools were grouped in classes, according to the similarity of their scope, and
54 then characterised later on to let them be used as ready on-hand. The following list is a non exhaustive picture of the most
55 known or adopted tools found in literature for BPR applications:
56
57

- 58 • A set of tools is oriented to support **collaborative group working** in any form; these are namely: Group
59 technology and cellular manufacturing to manage group working as in Jones et al. (1997); X-ware approach (Dennis *et al.*
60 (2003); Corbit et al. (2000)); IT functions (Willcocks and Smith (1995); Willcocks (2002)) —namely: expert systems
(Guimaraes *et al.* (1997); Yoon et al. (1997)); web-based automation and Electronic Data Interchange; multimedia; image

processing; Computer Aided – X technologies (where X stands for Design, Manufacturing, etc.); Concurrent Engineering in Gunasekaran and Nath (1997); Electronic Commerce in Attaran (2004); brainstorming workshop in Kim and Jang (2002); cooperative network management systems in Ray et al. (1999).

- A set of tools oriented to support **people management**; amongst all: change management in O'Neill and Sohal (1999); team work and motivation (Choudrie et al. (2002); Gunasekaran and Ichimura (1997)); seven S in Eisner (2000); role theories of Launonen and Kess (2002); employee empowerment in Gunasekaran and Ichimura (1997); ontological approaches (Glykas and Valiris (1998), Irani et al. (2001)).

- A set of tools oriented to **support decision making** by recurring to visual support of any form; a part of these are: flow charts; data flow diagrams; action diagrams; role-activity diagram and role-interactions diagrams; Gantt chart in Aguilar-Savén (2004); IDEF diagrams; top-map business flows and skills (Jones et al. (1997); Aguilar-Savén (2004); Kim and Jang (2002)); formal modelling (e.g. in Klauk and Muller (1997)); observation analysis in Aldowaisan and Gaafar (1999); process mapping and visualisation (O'Neill and Sohal (1999); Gunasekaran and Nath (1997)); coloured Petri nets in Aguilar-Savén (2004); object oriented methods in Aguilar-Savén (2004); work flows techniques (Aguilar-Savén (2004); IBM (1995)); stream analysis in Zakarian and Kusiak (2001); Process Evaluation and Review Technique; Critical Path Method in Al-Mashari et al. (2001); process prototyping and simulation in Al-Mashari et al. (2001); process innovation in Papinniemi (1999); Just-in-time in Fitzgerald and Siddiqui (2002).

- A set of tools is oriented to **support decision making** by recurring to familiar intuitive support; these are: Soft system methodology in Chan and Choi (1997); 3Cs model in Irani and Rausch (2000); Clean-slate analysis as in Dennis et al. (2003); simulation and scenario analysis; hybrid dynamic modelling (Kim and Jang (2002); Zakarian and Kusiak (2001)); process orientation view in MacIntosh (1997); benchmarking in Al-Mashari et al. (2001); gap analysis as in Dooley and Johnson (2000); creative thinking in Al-Mashari et al. (2001); Analytical hierarchical process in Sarkis et al. (1997); strategic justification of enterprise technology in Sarkis et al. (1997); functional economical analysis in Kim and Jang (2002); strength-weakness-opportunities-threats (SWOT) analysis (see Dyson (2004)); requirement engineering in Jackson (1983); six hut of De Bono (1967).

Most of the BPR applications found in literature adopt a customised mixture of tools, as a function of the specific application and of the decision maker. The question here put is that this is usually tied to the subjective judgement of the expert adopting it, without a clear rationale in the use either according to the scope or to its stage in the change process.

1.2 Continuous Quality Improvement

Continuous Quality Improvement (CQI) has its roots in Total Quality Management and Deming according to Dooley and Johnson (2000). CQI is essentially an agreed company-wide strategy, made of an integrated and sequential steps that can help tracking the progress toward continuously improving quality-driven business processes; quite often it has been defined as a philosophy by Irani et al. (2004). CQI efforts typically focus on small, incremental changes, which modify in time and thus eventually creating a large, cumulative effect: for these reasons CQI processes can lead to radical breakthroughs. CQI

1
2 is sometimes described as a bottom-up approach — a form of "learning by doing" as in Dooley and Johnson (2000)— that
3 maximises competitiveness of an organisation through the continual improvement of the quality of its products, service,
4 people, process and environment (Spencer (1994), Harvey and Millett (1999), Conca et al. (2004)).

5
6
7 The four perspectives recognised above for the BPR application can be similarly identified in the implementation of CQI
8 approaches; these are namely:

- 9
10
11 • the **Operational** perspective, where the stress in CQI implementation is on data and evidences to measure
12 improvements, but also it is on processes, with their centrality in the continuous strive and appointment to add value to
13 them, by redrawing or improvements;
- 14
15
16 • the **dynamical-evolutionary** perspective is intrinsically embedded into any CQI implementation, in its continuous
17 improvement principle, made of a never-ending adaptive loop of search for new challenges; the natural reference to
18 external benchmarks makes the need for innovation and improvement a sort of "automatic" mechanisms, where the
19 change become a sort of routinely task to perform;
- 20
21
22 • the **organisational** perspective is the so called "soft aspects" of CQI as in Rahman and Bullock (2005) — see the
23 human factors such as the involvement of all organisational levels, training and team-working)—; the people focus of
24 Ghobadian and Gallear (2001) or the total quality culture, according to Irani et al. (2004), are evidences of the particular
25 attention paid during CQI efforts;
- 26
27
28 • according to the **systemic** perspective, CQI stresses on the concept of customer focus, extended quite often to
29 market and stakeholders as in Ghobadian and Gallear (2001), as well as to the attention paid to cooperative supplier
30 relations according to Rahman and Bullock (2005).

31
32
33
34
35
36
37
38 Several tools and techniques for CQI implementation have been proposed so far; a non exhaustive list of these is here
39 presented, grouped into homogeneous classes according to their scope of use found in CQI applications:

- 40
41
42 • a class of tools oriented to **support decision making** by recurring to **logical** supports; it includes: Symptom-Origin-
43 Remedy-Action methodology in Kim and Jang (2002); Analytical Hierarchy Process (Noci and Toletti (2000); Chin
44 et al. (2002)); benchmarking Ghobadian and Gallear (2001); multiple-attribute decision making as in Noci and
45 Toletti (2000); fuzzy linguistic approach in Noci and Toletti (2000), Total System Intervention in Clarke et al. (2000);
46 theory Z of Eisner (2000); 5W-1H approach (What, Who, Why, When, Where, How);
- 47
48
49 • a class of tools oriented to **support decision making** by highlighting **evidences** (either by visual help or
50 appropriately presenting factual data); it includes: graphs, Pareto diagrams, histograms, cause-effect diagrams
51 (Hishikawa diagrams), check sheet, stratification diagrams; scatter, affinity, relation, systematic and matrix diagrams
52 (Ozeki and Asaka (1996), Ledolter and Burril (1999));
- 53
54
55 • a set of tools oriented to put evidence on **cause-effect links**; it includes: statistical process control; process
56 capability; control charts, process control diagrams, standardisation in Ozeki and Asaka (1996); 6 sigma as in
57 Terziovski and Sohal (2000); Failure Mode effect Analysis as in Terziovski and Sohal (2000); FMS as in Chan and
58
59
60

Jiang (2001); SMED; visual control; multivariate analysis (and related clustering analysis) as in Jobson (1991); theory of constraint; group problem solving as in Ledolter and Burril (1999);

- a class of tools oriented to **support management** efforts by facilitating coordination and people management; it includes: brainstorming and idea development checklist; quality circles as in Ozeki and Asaka (1996); leadership as in Samson and Terziowski (1999), Total Productive Maintenance as in Terziowski and Sohal (2000); reliability-centred maintenance (RCM) as in Hipkin and De Cock (2000); 5 S housekeeping as in Terziowski and Sohal (2000); supportive leadership as in Terziowski and Sohal (2000); teamwork as in Routhieaux and Gutex (1998); lean manufacturing; focus on customer (see Temponi (2006)); the "Seven S model" of organisation —structure, strategy, system, skill, style, staff and shared values —Jansson and Eschenbacher (2004);
- a class of tools oriented to **measure gaps** from given references; it includes: performance measures as Chenhall (1997); benchmarking as in O'Neill and Sohal (1999); Quality Function Deployment as in Terziowski and Sohal (2000); quality deployment chart as in Ozeki and Asaka (1996); performance measurement systems as in Lockamy and Smith (1997); gap analysis as in Dooley and Johnson (2000); scenario analysis;
- a set of tools oriented to **synchronise** and manage improvement initiatives; it includes: Plan-Do-Check-Act cycle as in Ghobadian and Gallear (2001); ISO 9000 as in Terziowski and Sohal (2000), systemic perspective as in Routhieaux and Gutex (1998); auditing techniques as in Terziowski and Sohal (2000).

Up to date it seems there is no structured methodology or industry standard that regulates the introduction of a CQI process according to Hipkin and De Cock (2000). This fact may represent a problem for the success of any CQI effort.

1.3 BPR vs CQI

Substantial differences still remains in the vision of change processes from BPR and CQI, due to their nature and scopes: while the objective of CQI is to get some small scale and continuous improvements through an incremental approach — the evolutionary stage of Choi (1995)— BPR aims to reach a radical change of the process, presumed to result in a "dramatic" change according to O'Neill and Sohal (1999) — the revolutionary stage of Choi (1995)— .

The starting point can be also different: the CQI starts from the existing processes while the radical improvement of BPR asks to start "from scratch". Hammer & Champy have suggested that <<TQM should be used to keep a company's processes tuned up between the periodic replacements that only BPR can accomplish>> in their Hammer and Champy (1993). This means that the idea of integrating CQI and BPR is always present, but it was rarely put into practice. The question appears here: how to do it?

Coexistence of Business Process Reengineering and Continuous Quality Improvement within the same organisation is not commonly agreed (see, e.g., Rotab Khan (2000), Al-Mashari et al. (2001), Temponi (2006)). Sometimes these are perceived as two alternatives to the organisation to pursue improvement, since BPR is mainly top-down driven on the contrary of the CQI approach, more participative in its nature. Sometime BPR is seen as an extension of the concepts of the continuous

1
2 improvement of the CQI, since this latter put the basis for BPR efforts (see, e.g. Grover and Malhotra (1997), Eisner (2000),
3 Al-Mashari and Zairi (2000)). Both views are far from reality of things, due to the reference to trivial stereotypical categories.
4 Several studies have attempted to distinguish the two practices in terms of their differences and similarities (see, e.g. Al-
5 Mashari and Zairi (2000)).
6
7
8

9
10 Based on the above reasoning, it is possible to affirm that CQI and BPR share common features, either of scope (i.e.
11 strategic) or of goal (i.e. tactical) while maintaining several aspects different. To sustain the potentialities of integration there
12 are authors that sustain <<Organizations which have adopted CQI show greater use of strategic and process management
13 techniques, benchmarking and self-assessment, which place them in an ideal position to make use of re-engineering
14 techniques.>> as Al-Mashari et al. (2001). An interesting concept of change continuum from BPR to CQI has been proposed
15 in Dooley and Johnson (2000), since both approaches have common underlying goals but differ by means adopted; this last
16 concept is here embraced, since it is closer to the reality of things and thus to the natural evolution of organisations. New
17 questions on their "coexistence" or their "complementarity" are still on the ground, thus opening new spaces for the search
18 and the experimentation of new hybrid models based on CQI and BPR. Most of the outcomes present in literature on change
19 management are based on general prescription (say top-down point of view), which mostly belongs to the organisational
20 perspective (see, e.g., Teng et al. (1996); O'Neill and Sohal (1999), Altinkemer et al. (1998), Chan and Choi (1997),
21 Choudrie et al. (2002), Sutcliffe (1999), Spencer (1994)). Other sources are more technical (say bottom-up point of view), i.e.
22 more oriented on suggesting a what-if approach, belonging to an operative perspective (see, e.g., Aldowaisan and Gaafar
23 (1999), Jones et al. (1997), Aguilar-Savén (2004) , Corbit et al. (2000), Klauk and Muller (1997), Dennis et al. (2003), Kim
24 and Jang (2002)).
25
26
27
28
29
30
31
32
33
34
35

36 For the scopes of the hybrid methodology presented, the deep analogies of BPR and CQI has been exploited to form the
37 strategic elements of the *HY-CHANGE* methodology, derived from well assessed scientific contributions or applicative
38 testimonials found in literature. These analogies have been expressed in terms of **focus criteria** to define and follow in any
39 CPI process, and distinguished into two groups: *strategic* (named strategic criteria or SC, i.e. those influencing the scope or
40 vision guiding any change process) and *tactic* (named tactical criteria or TC, i.e. those operative criteria that guide all the
41 steps of the change processes). Here following these strategic elements of HY-CHANGE methodology are listed:
42
43
44
45
46

- 47 ▪ **SC1 (strategic) -Always pursue benefits:** Decide whether incremental thinking or radical change need to be
48 performed depending on the related benefits (see, e.g. Dennis et al. (2003), Chan and Choi (1997)). Improving
49 business performance (i.e. having the aim for competitive gains) is another commonly agreed criterion of BPR and CQI.
50 Improvements should start from the most value-adding processes or most important to the customer as in Lockamy and
51 Smith (1997).
52
- 53 ▪ **SC2 (strategic) - Customer centered:** "let the customers be"; the customer orientation is claimed as the central focus:
54 the problem to face is always to correctly understand who are the customer (more correctly, stakeholders) and identify
55 their needs .
56
- 57 ▪ **SC3(strategic) - Focus on innovation:** The use of technologies to improve processes is always claimed as a core
58 factor — several IT oriented approaches can be found in literature (se, e.g. Attaran (2004))— since the most of the
59
60

change processes are required to follow the last innovations of technologies. Also thinking parallel as in Rotab Khan (2000) can afford different innovation.

- **TC1 (tactical) - Eliminate dysfunctions:** minimize or eliminate waste (Rotab Khan (2000)). The worst processes should be identified first by acquisition of information from the original sources according to Irani et al. (2001); then a vision of improvement has to be created (Jones et al. (1997)), paying particular attention to the risk of overextension according to Altinkemer et al. (1998). Simplification is a wider accepted must as sustained by Rotab Khan (2000). The lack of management commitment and neglected or poor employees' training and orientation are often perceived as criticalities like in Temponi (2006): people commitment is always a critical barrier to the common implementation of any change (either mild or radical) within an enterprise. Sometimes the need for organizational and cultural change is addressed as strategic to this aim. These points should be addressed in HY-CHANGE.
- **TC2 (tactical) - Feasibility:** change applies where there is the highest probability of success according to Irani et al. (2001), which in turns means to put achievable goals according to Chan and Choi (1997). Identification of the decision points is thus required, where activities are developed and the control is possible.
- **TC3 (tactical) - Sequencing :** the business process perspective is critical to success: changes are usually conceived as an ordered set of phases; generally speaking: envision, inaugurate, diagnose, redesign, reconstruct and evaluate (Dennis et al. (2003), Teng et al. (1996)). Combine process steps as in Rotab Khan (2000) or design processes with alternative paths are here claimed as very important.
- **TC4 (tactical) - Measurement centring:** collect data once at its source —see the principles of Harbour of Rotab Khan (2000)— since the process measurement is of utmost importance. For instance, the recurrence to benchmark of the performance and relative drivers is always required (Jones et al. (1997), Altinkemer et al. (1998), Kim and Jang (2002), Talluri (2000)) as well as to Balance scorecard Kaplan and Norton (1992).

These focus criteria, as well as the **principles** introduced by the four perspectives above mentioned, will be the basis of the HY-CHANGE approach proposed: these will inspire the phases and their activities for a success implementation of a change process and appropriate use of tools, as better explained in the following paragraphs.

3. The Decisional Tool-Kit

Most of the change applications found in literature adopt customised mixture of tools, as a function of the specific application and of the subjective rationality of the decision maker. The question put in defining HY-CHANGE is if it is possible to find a clear rationale in the choice of these to the scope of the change process. Tools is a general term here adopted to indicate methodologies, approaches, frameworks, technical solutions, procedures, or whatever techniques oriented to support decision making process at any phase of continuous performance improvement process.

The basic idea of the HY-CHANGE methodology is that by appropriate criteria of use of tools it is possible to create a sort of “tool-kit” to support the change processes; this thus result a “higher-level tool” much more effective with respect to the use of tools singularly, thus endeavouring the synergic effect derived from their coordination.

In the following table 1 we firstly summarise most of the tools previously mentioned, trying to give an unique classification of the previously mentioned tools, so as to avoid duplication or uncertainty in their identification. As a consequence, a set of classes were identified, where tools were grouped according their prevalent share of scope inherited either from BPR and CQI. Thus the following list is simply a summary of all the classes introduced above. These are, namely: Groupware; Human-ware; Managerial; Phasing; Modelling; Decisional; Problem solving; Factual; Control; Measurement. The reader can easily recognise the classes above cited for BPR and CQI, bearing in mind that each tool can belong to more than one classes but that, at the same time, it may have a prevalence of belonging to only one of these.

(Insert TABLE 1 here)

Classification and selection criteria for tools are here recognised as follows:

- **Requirements** (*scope*): tools should fit to a specific criteria or requirements explicitly declared of the phase/stage of its use.
- **Conceptual features** (i.e. logic behind): tools have internal logic of the tool in supporting decision making.
- **Logical features** (i.e. deductive tools): this feature make explicit the requirement to identify logical chains (cause-effect chains) to make explicit all the logical implications driving to problems or disturbance.
- **Outputs feature** (i.e. inductive tools): this aspect deals with the nature of the answer provided by the tools to the decision maker (namely qualitative/quantitative).
- **Groupware features**: i.e. proneness of tools to support cooperative efforts, felt as fundamental prerogative to success of CPI actions.
- **Shareability features**: distinguished in
 - *Ontological*: the proneness of tools to be recognised (and thus shared) by each one.
 - *Semantical*: the proneness of tools to be understood (and thus shared) by most of the operators.
- **Technical features**: it is a matter in a certain sense of “hardware”, i.e. the instruments or technologies adopted by the tool to be performed. It represents proneness to be implemented using standard or advanced technologies (e.g. Information Technology).
- **Operability features**, distinguished in
 - **INTER_operability**: referring to the capability of outcomes to be consistent with scopes of different tools but in the same context.

- **INTRA_operability**: referring to the capability of outcomes to be consistent with scopes of different tools but in different contexts.

Taking into account these features, the following table clarifies the level of congruence of each feature (column) here introduced with the scope of classes of tools (rows) cited in table 1:

(Insert TABLE 2. here)

Provided the information of table 1, it will turn easy to select the most appropriate tool to support decisional efforts at any stage of the change process. In the following paragraph it will be explained how the HY-CHANGE methodology helps in forming the tool kit and drive to effective improvements.

4. The HY-CHANGE Methodology

The context of the use of the HY-CHANGE methodology here proposed is the support of decisional processes for managing performance improvement within a given enterprise or department. A semi-formal approach was followed, since research findings in similar fields indicate that formal implementation procedures have favourably influenced successful projects despite their elusive definition (e.g. the JIT success reported in Hipkin and De Cock (2000)). Since changes processes will never be so definite in their essence, formalisation may provide a frame to understand signals and elements to be evaluated and endeavoured.

The change that might be brought by the HY-CHANGE encompasses both the revolutionary and the evolutionary phases of change, as in Choi (1995). It, in fact, starts from the bottom-up approach of CQI (evolutionary stage) to put the basis for build up a revolutionary stage; revolutionary changes —if ever will come— will thus result naturally fostered by the evolutionary stages, thus sharing the same bottom-up feature of the evolutionary stage. In this sense, the HY-CHANGE addresses a more pragmatic dimension with respect to BPR, focusing on real performance improvements and not funding on organisational theorems, in line with the stability criterion often claimed by top-management (see Choi (1995) or Bessant et al. (2001)).

The recurrence to the four perspectives before mentioned is quite new and assures a structured frame for the coordinated use of already existing tools and methodologies: following system theory, in fact, perspectives allows recognising parts of problems as well as interdependencies between parts of the whole system to reach an effective answer. The systemic perspective assures a contextualisation of the actions to be performed within a clear space-time frame of the enterprise; the organisational perspective allows to contextualise tools within internal change actions within the personnel involved in the change; the operative perspective focuses onto the scope of use of the most appropriate tools and techniques; the evolutionary perspective assure the change to be self-consistent, i.e. allowing the enterprise to learn from change and continue autonomously the innovation process.

To clarify the essence of HY-CHANGE methodology, an high level semi-formal model was built using the IDEF0 syntax (Kim and Jang (2002), Sarkis et al. (1997)), as summarised in figure 1 at an high level of detail. The HY-CHANGE consists of a

1
2 set of almost sequential phases of the performance improvement process (boxes interconnected in figure 1) —as detailed in
3 the following subparagraphs—. Each phase consists of a set of steps (i.e. a specific piece of action): a sort of practical guide
4 thus results for operative purposes.
5
6
7
8

9
10 (Insert Figure 1 here)
11
12
13
14

15
16 The idea behind HY-CHANGE to assure a correct phasing, borrows the fundamental concept of the second principle of
17 thermodynamics: it is always better to find the minimum-energy state of equilibrium, i.e. to explore paths which minimise the
18 effort for improvement. The reference to specific tools and techniques thus is made in each phase using specific criteria
19 before mentioned, providing an useful support for decisions. Local performances (per each phase), and their relations with
20 the proceeding and succeeding ones, will allow to build a frame of global performance indicators, to control the state of
21 change at a glance, to understand the success or the needs to improve its enacting.
22
23
24
25

26
27 The phases devised by HY-CHANGE respond to the simple logical chain of Why-What-Where-How-When-Who, widely
28 adopted almost in any human action (consciously or not), these are namely: the push event, the preliminary study, the
29 analysis of existing situation, the plan of improvement, the implementation and the measure & control phases. Activities to be
30 performed within each phase are detailed below, indicating also the outcomes of these (highlighted in bold within the text),
31 providing comments on the rationale of each phases or activity, and on the selection of the most appropriate tools, according
32 to classes and criteria given in tables 1 and 2. For the sake of simplicity, we did not provide comments on each tool, since it
33 is beyond the scope of the present paper, leaving to a future paper the burden to go in deeper details on tools. The show
34 case will give the flavour of the methodology and its easy-of-use.
35
36
37
38
39

40
41 It is worth to stress again that activities comprised within phases are not necessarily sequential, even though it will result
42 logically evident the temporary sequence of outputs between subsequent phases and their activities.
43
44
45

46 47 **4.1 Push Event (WHY)** 48

49 This phase responds to the SC1 criterion, i.e. putting the question of pursuing benefits. Recognising the “push event” is rarely
50 recalled or explicitly addressed in most of the studies and the scientific approaches presented so far. Change is always
51 driven by a specific motivation (either hidden or not), which fuels the need for change. If explicitly recognised, it may
52 represent the key success factor of utmost importance for fostering all the phases of the improvement process.
53
54
55

56 The so-called “substantive” process introduced in Rijnders and Boer (2004) reminds the need to identify problems or
57 opportunities. BPR methodologies available so far prescribe, as starting point, the “establishment of business vision and
58 objectives” as in Glykas and Valiris (1998) and also to establish the “envision” as in Al-Mashari et al. (2001). Understanding
59 what the customer requires and mapping out the current process is also recognised almost universally as a critical first step
60 for a reengineering project team as in Dooley and Johnson (2000).

All existing approaches does not explicitly recognise the phase here identified: the “push event” is intended as the last tangible event —i.e. that event which can be recalled or recognised and shared by a group of people as causative of unfairness or problems within the system under study— that then may motivate a business organisation to start a change process.

This phase, mostly sharing the principles of the organisational perspective above mentioned, should consist of three activities:

- i) to ask for an internal and external consciousness for a change or a re-engineering (“Why are we here?” responding to SC1 criterion); this means to allow involved personnel to realise the **existence of a need** or an original problem either directly or indirectly. The best tools to be adopted then can be *factual tools* or, to a less extent, *measurement tools* if stronger evidences are needed from facts;
- ii) to metabolise the problems/needs from managers (“Why should I do this?” responding to SC2 or TC2 criteria), i.e. to create a **convincement** toward change: *problem solving* tools reveal very useful to this aim. Again, *measurement tools* and/or *factual tools* may provide stronger evidences to convincement;
- iii) to **spread the motivation** throughout the organisation (responding to SC2): – *human-ware* or *groupware* tools seem the most appropriate to this aim.

All these steps are of utmost importance for the success of the whole change process: the correct understanding of the reality guarantees the true involvement of the change-teams formed (organisation should borrow principles of quality circles for *team management*) as well as a whole support of all levels of personnel in the improvement processes. In this regards, the degree of involvement of personnel will be a very good local performance indicator of the success of the methodology proposed at this stage .

4.2 Preliminary Study (WHAT)

As shown by an on-field researches (see Rijnders and Boer (2004)), what stands out clearly is that companies do very little concept development and detailing: they appear to find it difficult to translate abstract concepts into practical details. The preliminary study has to provide a set of outputs corresponding to several activities to be performed:

- 1) To provide a clear picture of the **external opportunities to change** (responding to SC1 criterion), eventually from stakeholders (SC2 criterion). According to the principles of the systemic perspective, we recognise similarities of this activity with the “initiate” stage of holistic BPR of Al-Mashari et al. (2001): *factual tools* seems to be the best fitting to this aims. The inputs of this activity come from comparative techniques, providing a careful analysis of the needs of the customers or stakeholders. Also internal environment has to be studied using *human-ware* tools, to verify the existence of appropriate conditions to develop a plan of improvement.
- 2) To define the **goals** to pursue and to define the **expected results** of the change (following the ideas of the systemic perspective and the TC4 criterion): *decisional* tools are mostly deputed to this aim.

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
- 3) To set a **shared policy** or a **strategy of change** (SC1 criterion); in the light of principles of the organisational perspective, this means ensuring a true leadership of the change of any order, i.e. a deeper convincement for change overcoming also personal resistances (see Haume *et al.* (2000) for some hints): adopting *decisional or measurement* tools is preferable at this stage.
 - 4) To identify **involved areas** (following the TC2 criterion) and to form the **task groups** responsible for the whole change process, according to the principles of the organisational perspective: *managerial* tools or *human-ware* tools are good decisional support in this activity.

15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34

The performance indicators for the success of this phase should be the measure the resistance to change from personnel.

4.3 Analysis of the existing situation (WHERE)

35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

The AS-IS analysis of the existing organisational reality (information flows, resources, criticalities, etc.) responds to principles of either operational and systemic perspectives, common to any change process. Due to the complex and dynamic nature of organizations as sustained by Irani *et al.* (2002), the outcome of this phase should be the identification of the **behavioural rules** (according to TC1 criterion), i.e. practices and processes actually in use within the organisation, more than a picture of performances and data of the existing processes (Gunasekaran and Ichimura (1997), Irani *et al.* (2001)).

This phase, corresponding to the “diagnose” stage of Al-Mashari *et al.* (2001) of holistic BPR, consists of several activities (all responding to the TC1 and TC4 criteria):

- i) to provide a **description of the processes**: *modelling* tools can be used to this aim;
- ii) to perform a **functional analysis** of the activities to identify the behavioural rules (according to SC3 criterion): again *modelling* tools responds to this need;
- iii) to recognise the **interactions** with the external environment (following the systemic perspective): *modelling* tools are preferred, even though *problem solving* tools may be sometime useful;
- iv) to design a complete **performance measurement** system (TC4 criterion): *measurement* tools re the most indicated to this aim.

The effectiveness of this phase is not easy to measure, since it is hard to compare results for a given reality without any reference benchmark; several threshold values may be adopted in each area, under the judgement of experts, to understand the pertinence of the picture taken (e.g. number of processes recognised, internal dynamics recognised, etc.).

4.4 Plan of improvement (WHEN)

This phase responds to the principles of the evolutionary perspective, by prescribing a TO-BE analysis. This phase, which corresponds to the “redesign” stage of holistic BPR of Al-Mashari *et al.* (2001), requires several activities to decide the degree of changes in any local process, as follows:

- 1) to prepare a complete **formalization of all the alternatives** (TC2 criterion), whose effectiveness and efficiency need to be appraised through experimentation. Typical use of *decisional* tools (eventually with the support of *factual* tools) is indicated at this stage;
- 2) to **evaluate the alternatives solutions** of change (TC2 and TC3 criteria); using *decisional* tools is a very important step to perform within each area of organisation, since it may allow a faster reaction to potential adjustment eventually required. To compare alternatives can be done using *problem-solving* tools, where "TO-BE" solutions are compared according to parameters of Cost-Time-Quality;
- 3) to **integrate** the change actions with other similar projects. Due to the interaction or combination with other local improvements programs, a final coordination is required to decide the global level of change: *phasing* tools as well as *managerial* tools can be the best candidate to support decision making to this aim;
- 4) to prepare a **plan of improvements** (responding to TC1 criterion), indicating timing, activities and resources: *decisional* tools as well as *phasing* tools can be adopted;
- 5) to **diffuse the knowledge** about the plan of Improvement (SC2 criterion): *managerial and/or human-ware* tools can be adopted for this activity, depending on the specific reality.

Performance indicators of the effectiveness of this phase can be the number of alternatives generated, the logical sequencing of the plan of improvement, the historical knowledge about similar initiatives already implemented.

4.5 Implementation (WHO)

This phase derives from the organisational perspective, and it corresponds to the "reconstruct" stage of holistic BPR of Al-Mashari et al. (2001), consists in deploying the plan of improvement throughout the organisation and allowing to implement it.

This phase may consist of a loop of the following activities:

- i) to implement **local change** actions (TC3 criterion), recurring to *groupware and management* tools;
- ii) to **analyse problems** occurring during change actions (TC4 criterion), recurring to the use of *control* tools;
- iii) to solve of possible **local problems** (TC1 criterion) using *problem-solving* tools or *human-ware* tools.;
- iv) whenever some of the local target improvements are not satisfied, the change process need to be dynamically reapplied. This can be done eventually **reinforcing the creativeness** (SC3 criterion) of the teams for the re-design of the processes using *problem-solving* tools (loop links in figure 1).

The whole trends of gaps between target performances and actual values in different areas can be a good indicator of the measure of the success of this phase.

4.6 Measure & control (HOW)

According to the principles of the evolutionary perspective, at given milestones or after the final change process, it follows the checking the attainment of global performances from the change process and the verification of satisfaction goals established. This phase, which corresponds to the “evaluate” stage of holistic BPR of Al-Mashari et al. (2001), and it is thus phased in a cycle of the following activities:

- i) to measure **local performances** and evaluation of global performances (TC4 criterion): *measurement* tools are obviously the most appropriate;
- ii) to **compare** results against threshold results, using *factual* tools;
- iii) to plan for the **future change** cycle again (SC3 criterion), using *decisional* tools.

The output of this phase is always a clear statement of the effectiveness of the change process, and its measure is the attainment of the objectives that can be – in a loop fashion- the input for the next refinement of the change process, i.e. the phase of preliminary study.

5. THE INDUSTRIAL SHOW CASE

An initial application of the HY-CHANGE methodology has been made directly by the author over a six-months period within an Italian small- medium enterprise (SME) working as first-tier supplier of padding's for sofa producer. The outcomes of the performance improvement action are here presented to show its use and give the flavour of potentialities as decision-support tool for continuous performance improvement of small and medium enterprises. The features of the SME will come out throughout the deployment of the methodology as it was applied. It must be clarified that narration of events here follows strictly temporal order of happenings: this will result in a mixed sequence of the phases mentioned in §4.

The push event (WHY) was realised during several brainstorming sessions, performed only with the company owners and the top management, avoiding to involve stakeholders due to the specific reality of SME (one major client was responsible for more than 95% of the total sales): the negative trends of the economic results in the last four years came out as the most critical need. Very simple *factual* tools (Pareto histograms and graphs) were adopted for analysing balance sheets and financial indicators; performance indicators considered in this phase were the share of market, sales trends, production volumes. Several meetings were then set-up, together with the middle management and most of the employees, to share the feeling of the criticality of change to survive. Nevertheless, it was not possible to get over historical internal stresses between management and operators: this fact turned into several difficulties in the next phases of the CPI process.

After a preliminary study (WHAT), developed jointly with the top management, it was realised that also external factors were causative of the push event, since the whole industrial sector was suffering a strong crisis due to international market dynamics. Simple *factual* tools (check sheets for bibliographical research) and *human-ware* tools (group problem solving techniques) were adopted to this aim. The analysis of customer's needs brought also new hints on the internal reality: the

1 costs structure was not adequate. This analysis allowed recognising which functional areas were to address within the plant,
2
3 namely: the production control, the production flows management and the processing of raw materials.
4

5
6 Afterward, a clear analysis of the existing situation (WHERE) was performed, adopting *modelling* tools (an IDEF-0 modelling
7 of the existing processes and activities). It resulted quite clear, from the functional analysis made, the reasons for the
8 problems highlighted in the previous phases; also by recurring to *measurement* tools (performance concerning non
9 conformities) it was clear the existence of training problems of operators, as well as that typical attitude of management to a
10 trial-and-error approach in managing emergencies (analysis of quality sheets for non conformities). Afterward, the most
11 critical areas of intervention were found, according to the factual evidence of performances (*measurement* tools were
12 adopted, namely benchmarking and Balance Scorecard methodology); these areas resulted to be: production activities,
13 quality assurance activities and logistics activities. As a consequence, an important scrap reduction program was identified
14 as the first goal to set, while the optimisation of nesting in the cutting of raw materials was the second one.
15
16

17
18 The outcomes of this phase suggested to go back to the root causes, before going on with remedies. We came back to the
19 first phase (WHY) and ask the team the reasons of a so long period of absence of improvements; by using *factual* tools
20 (graphs showing trends) and *problem-solving* tools (brainstorming sessions with Hishikawa diagrams) the reasons resulted
21 quite clear. The size of the company and the situation of richness experienced for a longer period, in fact, brought the
22 company to rely on the initial core strategies: almost no significant innovation were promoted for at least twenty years up to
23 date, either for processes or for products, due mainly to managerial inertia. A set of critical performances were recognised by
24 defining the state space (recognition of causative links between processes) and then prioritizing the strategies and areas of
25 intervention by scoring (subjective judgements of teams and managers).
26
27

28
29 The plan of improvement (WHEN) was then designed, according to the outcomes of the preceding phases; the areas of
30 intervention identified were the change of attitude of management and operators. A *factual* tool (Pareto analysis) was
31 adopted to set up the priorities and plan the actions of improvement. Due to the fact that the management still relied on
32 traditional global financial indicators, milestones recognised as sharable at each significant change were financial
33 performances used after given periods of time. An adaptive *phasing* tool was adopted, to plan the future improvement actions
34 after the achievement of a significant change in each area: an electronic shared agenda of activities, with the assignment of
35 responsibility for a change to each team member. As a strategic vision of the CPI initiative, and to pursue the TC2 criterion of
36 feasibility, it was initially decided to intervene in the three organisational areas before mentioned, independently of each other.
37
38 Despite this and the tools adopted (quality circles as *managerial* tools were adopted to support this effort), serious problems
39 resulted in defining a definitive plan of improvement, since no agreement was reached between management and working
40 teams: the main reason was the absence of serious use of *performance* tools to estimate the exact efforts of the actions of
41 improvement. This criticality was realised adopting a *phasing* tool (in-process audit review of the CPI action at the first
42 milestone selected). Finally, a final goal was set-up, namely to implement a tighter control of industrial performances with the
43 strong direct involvement of management. To this aim, three teams were formed to pursue the respective goals (namely
44 flows; materials; costs); in each team were included one external consultant and at least one operator. The author took the
45 role of project leader.
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2 The implementation phase (WHO) came after three months, with the implementation of those corrective actions and
3 deployment before planned. In particular, a redesign of the layout was experimented and implement according to a precise
4 scheduling in terms of time, responsibility and objectives to achieve (using brainstorming sessions according to the
5 organisational perspective). A partial solution was only possible as concern the re-design of the productive flows, since the
6 amount of the investments required and the related stronger organizational implications. Nevertheless this solutions resulted
7 good, since in the planning phase the scenario evaluation (problem solving tool) allowed to include the occurrence of this
8 partial changes and thus to devise the related corrective actions to be taken in the next future.

9
10 The measurement and control phase (HOW) was performed iteratively during all the CPI process. According to measurement
11 criterion (TC4), and with the scope of constantly measure and control the change process taking place, a "dashboard of
12 performances" was set and shared between different teams. The dashboard gathered constantly the local measurements
13 and the business performances during the change period. Threshold values were set, using a gap analysis, to compare
14 actual performances with the initial situation. The performance measurement system consisted of a number of performance
15 indicators per each phase, measuring the gaps (Δ) between the targets fixed and the actual state of the performances at i-th
16 time:

$$\Delta_i = [(\text{actual } i\text{-th value}) - (i\text{-th target})] / (i\text{-th target}).$$

17
18 This performance improvement process brought to a slight improvement of some performance indicators within the six
19 months time-frame observed, that can be estimated as follows: +10% of productivity growth; +34% reduction of the
20 throughput time achieved after the implementation of a new lay-out.

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 **6. DISCUSSION AND FINAL REMARKS**

40 In the practical application of HY-CHANGE methodology presented in this paper, it resulted questionable if other factors
41 contributed to positive results reported in paragraph 5, given the synergic effect of the participation of manager and operators
42 to teams, with positive side-effects in the productivity and organisational climate.

43 This means that the show case is far from being a proof or even a validation of effectiveness of the methodology.
44 Nevertheless, all team members appreciated the rational structuring of a decisional improvement process, which is always
45 very complex to start from scratch.

46 Starting from the postulation the coexistence of more than one approach is feasible and that complementarities has to be
47 endeavoured, the proposed hybrid methodology goes into the direction of the project-enabled management of change of Yeo
48 (1996), trying to cover the whole spectrum of changes – from gradual to radical. Despite its simplicity, HY-CHANGE'
49 usefulness rely in the logical structuring according to approach phases and use of tools to perform a continuous performance
50 improvement processes; by relying on the idea of finding objective criteria of optimal use of tools and techniques in each
51 phase it tries to provide an effective tool-kit that may help to improve effectiveness of change processes as well as its
52 effectiveness, in line with the transformational nature of the organisations.

1
2 As a final remark, the proposed methodology still does not answer the question of how to transform the employees into a
3 push factor, to overcome the improvement paradox often claimed for failure of change processes as stressed in Keating et al.
4 (1999), as also directed witnessed in the show case.
5

6
7 Future improvements of the methodology presented can be a deeper level of detail in tool selection, exploring their inner
8 features and potentialities with respect to continuous improvement process and also a deeper understanding of interfaces
9 between activities of each phase, so as to better control the flows of outputs, which still remains a subjective matter of the
10 decision maker.
11

12
13 The final goal of any methodology for supporting continuous process improvement should be eliminating subjectivity in the
14 operative decisional phases of change processes —almost widely claimed as inherently subjective—, as well as within the
15 specific goals and targets set, while allowing room for intuition and strategic decisions with respect to the specificity of each
16 organization.
17
18
19
20
21

22 23 24 25 26 27 28 **7. Acknowledgement**

29
30 This research was partially funded by Italian Ministry of Research (MIUR) within the F.R.A. 2002-2003 program.
31
32

33 34 **References**

- 35
36
37
38 Aguilar-Savén, R.S., 2004. Business process modelling: Review and framework; *Int. J. Production Economics*, 90, 129–149.
39
40 Aldowaisan, T.A. and Gaafar, L.K., 1996. A framework for developing technical process reengineering designs. *Comp. in*
41 *Industry*, 32, 657-670.
42
43 Aldowaisan, T.A. and Gaafar, L.K., 1999. Business process reengineering: an approach for process mapping; *Omega. Int. J.*
44 *Mgmt. Sci.*, 27, 515-524.
45
46 Al-Mashari, M. and Zairi, M., 2000. Creating a Fit Between BPR and IT Infrastructure: A Proposed Framework for Effective
47 Implementation. *The International Journal of Flexible Manufacturing Systems*, 12, 253–274.
48
49 Al-Mashari, M., Irani, Z. and Zairi, M., 2001. Business process reengineering: a survey of international experience. *Business*
50 *Process Management Journal*, 7 (5), 437-455.
51
52 Altinkemer, K., Chaturvedi, A. and Kondareddy, S., 1998. Business process reengineering and organisational performance:
53 an exploration of issues. *Int. J. of Information Management*, 18 (6), 381-392.
54
55 Attaran, M., 2004. Exploring the relationship between information technology and business process reengineering.
56 *Information & Management*, 41, 585–596.
57
58
59
60

- 1
2 Bessant, J., Caffyn, S. and Gallagher, M., 2001. An evolutionary model of continuous improvement behaviour. *Technovation*,
3 21, 67–77.
4
- 5 Choudrie, J., Hlupic, V. and Irani, Z., 2002. Teams and their Motivation for Business Process Reengineering: A Research
6 Note. *The International Journal of Flexible Manufacturing Systems*, 14, 99–107.
7
- 8 Chang, L-J and Powell, P., 1998. Business process re-engineering in SMEs: current evidences. *Knowledge and Process*
9 *Management*, 5 (4), 264–278
10
- 11 Choi, T., 1995. Conceptualising continuous improvement: implications for organisational change. *Omega, Int. J. of*
12 *Management Science*, 6, 607-624.
13
- 14 Cameron, N.S. and Braiden, P.M., 2004. Using business process re-engineering for the development of production efficiency
15 in companies making engineered to order products. *Int. J. Production Economics*, 89, 261–273.
16
- 17 Chan, F.T.S. and Jiang, B., 2001. The application of Flexible manufacturing Technologies in Business Process
18 Reengineering. *The International Journal of Flexible Manufacturing Systems*, 13, 131-144.
19
- 20 Clarke, S., Elliman, T. And Lehaney, B., 2000. Reengineering an Information System: A Case Study in Risk Reduction. *The*
21 *International Journal of Flexible Manufacturing Systems*, 12, 305–320.
22
- 23 Chan, S.L. and Choi, C.F., 1997. A conceptual and analytical framework for Business process reengineering. *Int. J. of*
24 *Prod. Economics*. 50; 211-223.
25
- 26 Chin, K.-S., Pun, K.-F., Xu, Y. and Chan, J.S.F., 2002. An AHP based study of critical factors for CQI implementation in
27 Shanghai manufacturing industries. *Technovation*, 22, 707–715.
28
- 29 Chenhall, R.H., 1997. Reliance on manufacturing performance measures, total quality; *Management Accounting Research*,
30 8, 187-206.
31
- 32 Conca, F.J., Llopis, J. and Tari, J.J., 2004. Development of a measure to assess quality management in certified firms.
33 *European Journal of Operational Research*, 156; 683-697.
34
- 35 Corbitt, G.F., Christopolus, M. and Wright, L., 2000. New Approaches to Business Process Redesign: A Case Study of
36 Collaborative Group Technology and Service Mapping. *Group Decision and Negotiation*, 9, 97–107.
37
- 38 Dennis, A.R., Carte, T.A. and Kelly, G.G., 2003. Breaking the rules: success and failure in groupware-supported business
39 process reengineering. *Decision Support Systems*, 36, 31– 47.
40
- 41 De Bono, E., 1967. *The use of lateral thinking*. New York. E. De Bono.
42
- 43 De Bruyn, B. and Gelders, L., 1997. From CQI to BPR: Two case studies in personnel administration. *International Journal of*
44 *Production Economics*, 50, 169-181.
45
- 46 Dooley, K. and Johnson, D., 2000. Changing the New Product Development Process: Reengineering or Continuous Quality
47 Improvement?. *Measuring Business Excellence*, 5(4),32-38.
48
- 49 Dooley, L. and O'Sullivan, D. , 1999. Decision support system for the management of systems change, *Technovation*, 19,
50 483–493.
51
52
53
54
55
56
57
58
59
60

- 1
2 Dobson, P.J. 2003. Business Process Reengineering (BPR) Versus Outsourcing—Critical Perspectives. *Systemic Practice*
3 *and Action Research*, 16 (3), June.
- 4
5
6 Ducasse, S. and Demeyer S. (Editors) 1999, *The FAMOOS Object-Oriented Reengineering Handbook* [on-line]. Available
7 from URL www.iam.unibe.ch/~famoos/handbook/. [Access 25.06.2007]
8
- 9
10 Dyson, R., 2004. Strategic development and SWOT analysis at the University of Warwick. *European Journal of Operational*
11 *Research*, 152, 631–640.
- 12
13 Editors: Jansson, K. and Eschenbächer, J. (2004). *D32.1 Challenges in Virtual Organisations Management Report on*
14 *methods for distributed business process management*, Deliverable ECOLEAD, Contract FP6 IP 506958.
- 15
16
17 Eisner, H. 2000. *Reengineering yourself and your company*. Boston, Artech House Inc., ISBN 1-58053-396-5.
- 18
19 Fitzgerald, G. and Siddiqui, F.A., 2002. Business Process Reengineering and Flexibility: A Case for Unification. *The*
20 *International Journal of Flexible Manufacturing Systems*, 14, 73–86.
- 21
22
23 Jack, L. and Brock, Jr., 1995. *Business process reengineering assessment guide*. General Accounting Office DOD, Director,
24 Information Resources Management, GAO/T-AIMD-95-101, USA
- 25
26
27 Guimaraes, T., 1995. Outcomes assessment of Business process reengineering. *Technology management*, 2, 247-261.
- 28
29 Guimaraes, T., Yoon, Y. and Clevenson, A., 1997. Empirically testing ES success factors in business process reengineering.
30 *Int. J. of Production Economics*, 50, 247-259.
- 31
32
33 Ghobadian, A. and Gallear, D., 2001. CQI implementation: an empirical examination and proposed generic model. *Omega*,
34 29, 343–359.
- 35
36
37 Glykas, M. and Valiris, G., 1998. Management science semantics for object-oriented business modelling in BPR. *Information*
38 *and software Technology*, 40, 417–433.
- 39
40
41 Grover, V. and Malhotra, M.K., 1997. Business process reengineering: a tutorial on the concept, evolution, method,
42 technology and application. *J. of Operations Management*. 15, 193-213.
- 43
44
45 Gunasekaran, A. and Ichimura, T., 1997. Business Process Reengineering: modelling and analysis. *Int. J. of Prod.*
46 *Economics*, 50; 65-68.
- 47
48
49 Gunasekaran, A. and Nath, B., 1997. The role of information technology in business process reengineering. *Int. J. of*
50 *Production Economics*, 50, 91-104.
- 51
52
53 Halacmi, A. and Bovaird, T., 1996. Process reengineering in the public sector: learning SME private lessons. *Technovation*,
54 17 (5), 227-235.
- 55
56
57 Hammer, M. and Champy, J., 1993. *Le reengineering*. Dunod, ISBN 2 10 002027 7.
- 58
59
60 Harvey, S. and Millett, B., 1999. OD ,CQI and BPR: a comparative approach. *Australian J. of Mananagement and*
Organisation Behaviour, 2 (3), 30-42.
- Haumer, P., Jarkea, M., Pohl, K. and Weidenhaupt, K., 2000. Improving reviews of conceptual models by extended
traceability to captured system usage. *Interacting with Computers*, 13, 77-95

- 1
2 Hipkin, I.B. and De Cock, C., 2000. CQI and BPR: lessons for maintenance management. *Omega*, 28, 277-292.
- 3
4 IBM, 1995, International Technical Support Organization, 1995. *Business Process Reengineering and Beyond*. IBM San Jose
5 Center, SG24-2590-00.
- 6
7 Im, I.; El Sawy, O. A. and Hars, A., 1999. Competence and impact of tools for BPR. *Information & Management*, 36 , 301-
8 311.
- 9
10
11 Irani, Z. and E. Rausch, 2000. Empirical testing of a leadership and planning model for reengineering business process.
12 *International Journal of Flexible Manufacturing Systems*, 12, 341-357.
- 13
14
15 Irani, Z.; Hlupic, Hlupic, V. and Giaglis, G.M., 2001. Business Process Re-Engineering: A Modeling Perspective. *International*
16 *Journal of Flexible Manufacturing Systems*, 13 (2), 99-104.
- 17
18
19 Irani, Z.; Hlupic, V. and Giaglis, G.M., 2002. Business Process Re-Engineering: An Analysis Perspective. *International*
20 *Journal of Flexible Manufacturing Systems*, 14, 5-10.
- 21
22
23 Irani, Z., Beskese, A. and Love, P.E.D. , 2004. Total Quality Management and Corporate Culture: constructs of organisational
24 excellence. *Technovation*, 24, 643-650.
- 25
26
27 Jackson, M., 1983. *System development*. Prentice-Halls, London, ISBN 0-13-880328-5
- 28
29 Jobson, J.D., 1991. *Applied multivariate data analysis*. Springer, ISBN 0-387-97660-4
- 30
31 Jones, T.M., Nobles, J.S. and Crowe, T.J., 1997. An example of the application of production system design tools for the
32 implementation of Business Process Reengineering. *Int. J. of Prod. Economics*, 50, 69-78.
- 33
34
35 Kaplan, R.S. and Norton, D. P., 1992. The Balanced Scorecard—Measures that Drive Performance. *Harvard Business*
36 *Review*, Reprint 9210.
- 37
38
39 Keating, E., Oliva, R., Repenning, R., Rockart, S. and Serman, J., 1999. Overcoming the improvement paradox. *European*
40 *management Journal*, 17 (2), (April), 120-134.
- 41
42
43 Rotab Khan, M.R. 2000. Business process reengineering of an air cargo handling process. *Int. J. Production Economics*, 63,
44 99-108.
- 45
46
47 Kim, S.-H. and Jang, K.-J., 2002. Designing performance analysis and IDEF0 for enterprise modelling in BPR. *Int. J.*
48 *Production Economics*, 76 , 121-133.
- 49
50
51 Klauk, C. and Muller, H.Z., 1997. Formal business process engineering based on graph grammars. *Int. J. of Prod.*
52 *Economics*, 50, 129-140.
- 53
54
55 Kutucuoglu, K.Y., Hamali, J. and Sharp, J. M., 2002. Enabling BPR in Maintenance Through a Performance Measurement
56 System Framework. *The International Journal of Flexible Manufacturing Systems*, 14, 33–52.
- 57
58
59 Launonen, M. and Kess, P., 2002. Team roles in business process re-engineering. *Int. J. Production Economics*, 77, 205-
60 218.
- Ledolter, J. and Burril, C.W., 1999. *Statistical Quality Control*. J. Wiley & Sons, ISBN 0-471-18378-4.

- 1
2 Lockamy, A. and Smith, W., 1997. A strategic alignment approach for effective business process reengineering: linking
3 strategy, processes and customer for competitive advantage. *Int. J. Prod. Research*, 50, 141-153.
4
5
6 MacIntosh, R., 1997. Business process re-engineering: new applications for the techniques of production engineering. *Int. J.*
7 *of Production Economics*, 50, 43-49.
8
9
10 Mansar, S.L. and Reijers, H.A., 2005. Best practices in business process redesign: validation of a redesign framework.
11 *Computers in Industry*, 56, 457-471.
12
13
14 Mohanty, R.P. and Deshmukh, S.G., 2001. Reengineering of materials management system: A case study. *Int. J. Production*
15 *Economics*, 70, 267-278.
16
17
18 Noci, G. and Toletti, G., 2000. Selecting quality-based programmes in small firms: A comparison between the fuzzy linguistic
19 approach and the analytic hierarchy process. *Int. J. Production Economics*, 67, 113-133.
20
21
22 O'Neill, P. and Sohal, A.S., 1999. Business Process Reengineering: A review of recent literature. *Technovation*, 19, 571-581.
23
24
25 Ozeki, K. and Asaka, T., 1996. *Handbook of Quality Tools*. Productivity Press, Oregon, USA.
26
27
28 Papinniemi, J., 1999. Creating a model of process innovation for reengineering of business and manufacturing. *Int. J.*
29 *Production Economics*, 60-61, 95-101.
30
31
32 Rahman, S. and Bullock, P., 2005. Soft CQI, hard CQI, and organisational performance relationships: an empirical
33 investigation. *Omega*, 33, 73 – 83.
34
35
36 Ray, P., Fry, M. and Khasnabish, B., 1999. A Re-engineering methodology for cooperative management of enterprise
37 networks. *J. of Network and System Management*, 7 (1), 105-126.
38
39
40 Rijnders, S. and Boer, H., 2004. A Typology of Continuous Improvement Implementation Processes; *Knowledge and*
41 *Process Management*, 11 (4), 283-296.
42
43
44 Routhieaux, R.L. and Gutex, B.A., 1998. CQI/CQI effectiveness at team and departmental level. *J. of Quality Management*, 3
45 (1), 39-62.
46
47
48 Samson, D. and Terziowski, M., 1999. The relationship between total quality management practices and operation
49 performance. *Journal of Operation Management*, 17 , 393-409.
50
51
52 Shani, A.B. and Mitki, Y., 1996. Reengineering, Total Quality Management and Socio-technical Systems Approaches to
53 Organizational Change: Towards an Eclectic Approach?. *Journal of Quality Management*, 1 (1), 131-145.
54
55
56 Sarkis, J., Presley, A. and Liles, D., 1997. The strategic evaluation of candidate business process reengineering projects.
57 *Int.J. of Production Economics*, 50, 261-274.
58
59
60 Spencer, B. A., 1994. Model of organization and total quality management: A comparison and critical evaluation. *Academy of*
Management Review, 19 (3), 446-471.
Sutcliffe, N., 1999. Leadership behaviour and business process reengineering (BPR) outcomes An empirical analysis of 30
BPR projects. *Information & Management*, 36, 273-286.

- 1
2 Talluri, S., 2000. A Benchmarking Method for Business-Process Reengineering and Improvement. *The Int. Journal of Flexible*
3 *Manufacturing Systems*, 12, 291-304.
4
5
6 Temponi, C., 2006. Scalable enterprise systems: Quality management issues. *Int. J. Production Economics*, 99, 222–235.
7
8 Teng, JTC, Grover, V. and Fiedler, KD., 1996. Developing strategic perspectives on Business Process Reengineering: from
9 process reconfiguration to organisational change. *Omega, Int. J. of Management Science*, 24 (3), 271-294.
10
11 Terziovski, M. and Sohal, A. S., 2000. The adoption of continuous improvement and innovation strategies in Australian
12 manufacturing firms. *Technovation*, 20, 539–550.
13
14
15 Terziovski, M., Fitzpatrick, P. and O'Neill, P., 2001. Successful predictors of business process reengineering (BPR) in
16 financial services. *Int. J. Production Economics*, 84, 35–50
17
18 Terziovski, M., Fitzpatrick, P. and O'Neil, P., 2003. Successful predictors of business process reengineering (BPR) in
19 financial services. *Int. J. Production Economics*, 84, 35–50.
20
21
22
23 Vits, J. and Gelders, L., 2002. Performance improvement theory. *Int. J. Production Economics*, 77, 285-298.
24
25 Yoon, Y., Guimaraes, T. and Clevenson, A., 1998. Exploring expert system success factors for business process
26 reengineering. *J. Eng. Technol. Management*, 15, 179–199
27
28
29 Willcocks, L. and Smith, G., 1995. IT-enabled business process re-engineering: organisational and human resource
30 dimensions. *J. of Strategic Information System*, 4, 279-301.
31
32
33 Willcocks, L., 2002. How Radical Was IT-Enabled BPR? Evidence on Financial and Business Impacts. *The International*
34 *Journal of Flexible Manufacturing Systems*, 14, 11–31.
35
36
37 Yeo, K.T., 1996. Guest editorial, Management of change: from CQI to BPR and beyond. *Int. J. of Proj. Management*, 14 (6),
38 321-324.
39
40 Zakarian, A. and Kusiak, A., 2001. Process analysis and reengineering. *Computer and industrial engineering*, 135-150.
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

TABLE 1 – Definition of classes of tools and methodologies

Class	Tools
Group-ware	Group technology and cellular manufacturing to manage group working ; X-ware approach; expert systems ; web-based automation; Electronic Data Interchange; multimedia; image processing; Computer Aided - X technologies; Concurrent Engineering ; Electronic Commerce; brainstorming workshop; cooperative network management systems
Human-ware	Change management; team work and motivation; role theories; employee empowerment; ontological approaches; group problem solving .
Managerial Phasing	quality circles; leadership; Total Productive Maintenance; reliability-centred maintenance; 5 S housekeeping; supportive leadership; teamwork; lean manufacturing; focus on customer; the "Seven S model" of organisation
Modelling	Plan-Do-Check-Act cycle; quality standards; systemic perspective; Gantt chart; P.E.R.T.; C.P.M.; audit techniques
Decisional	Role activity diagram and role interactions diagrams; IDEF diagrams; top map business flows and skills; formal modelling ; observation analysis; process mapping and visualisation; coloured Petri nets; object oriented methods; work flows techniques; stream analysis; process prototyping and simulation; process innovation; hybrid dynamic modelling;
Problem solving	Soft system methodology; 3Cs model; Clean-slate analysis; simulation and scenario analysis; process orientation view; benchmarking; gap analysis; Analytical hierarchical process; strategic justification of enterprise technology; functional economical analysis; SWOT analysis; requirement engineering; six hut; multiple-attribute decision making;
Factual	Symptom-Origin-Remedy-Action methodology; Analytical Hierarchy Process; benchmarking; fuzzy linguistic approach; Total System Intervention; theory Z; 5W-1H; creative thinking; brainstorming and idea development checklist;
Control	Graphs; Pareto diagrams; histograms; cause-effect diagrams; check sheet; stratification diagrams; scatter diagrams; affinity diagrams; relation diagrams; systematic and matrix diagrams.
Measurement	statistical process control; process capability; control charts; process control diagrams; standardisation; 6 sigma; Failure Mode effect Analysis; FMS; SMED; visual control; multivariate analysis; theory of constraint; Just-in-time. performance measures; benchmarking; Quality Function Deployment; quality deployment chart; performance measurement systems; gap analysis; scenario analysis, balance scorecard.

TABLE 2. – Features of classes of tools to the scope of change processes

Feature	Requirements	Conceptual	Logical	Outputs	Groupware	Shareability	Technical	Operability
Class								
Groupware	Support collaborative group working	Foster relationships between groups	Human attitude to share information	Structured information	Very high	Very high	Very poor	Very high
Human-ware	Support people management	Motivating people to share objectives	Human knowledge of social roles within groups	Explicit roles	Very high	Very high	Very poor	Low
Managerial	Support coordination management	Social aggregation through sharing vision	Endeavour the human attitude to socialisation	Indirect: guide people in cooperating	Very high	Low	Poor	Very low
Phasing	Synchronise efforts	Make explicit sequences of actions	Use human attitude to sequencing actions	Indirect: coordinate actions	High	Low	Good	Low
Modelling	Support problem perception using familiar intuitive or schematic support	Aggregating effectively information	Human attitude to visual reasoning	Explicit praxis and organisational attitudes	High	Good	High	Very high
Decisional	Support problem perception using familiar logical chains	Help figure out future events	Human simulation attitude (prevision)	Explicit objective evidences	Low	Good	Poor	Good
Problem solving	Support problem perception using familiar logical chains	Support reasoning steps and logical deductions	Help logical inferences (logical reasoning)	Prioritise actions/solutions	Good	Good	Poor	Good
Factual	Highlighting evidences	Record quantitative evidence	Support memory and natural interpretation of trends	Highlight differences	Good	High	Good	Very high
Control	Put evidence on cause-effect links	Highlight risks and deviations from a target	Highlight the natural perception of deviation from a status	Highlight behaviors	Low	Low	Good	Good
Measurement	Give reference setpoints	Highlight differences	Support the natural attitude to learn by realising differences	Read future trends	Good	Good	Good	Very high

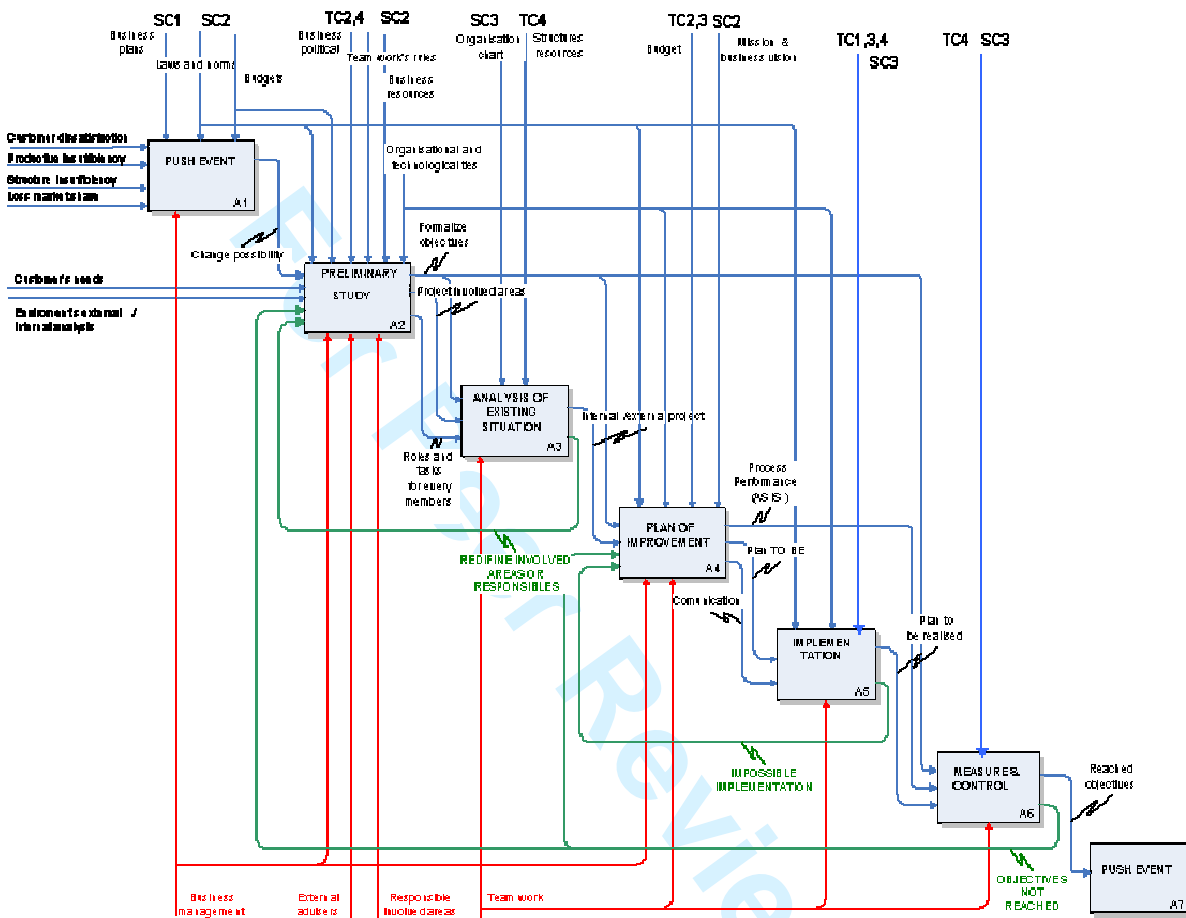


Figure 1 IDEF-0 structure of HY-CHANGE (red arcs= responsibilities; green arcs = feedback loops; blue arcs = outcomes of phases; black arcs = input information and criteria)