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SIMULATION MODELLING: THE LINK BETWEEN CHANGE MANAGEMENT PANACEAS

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ABSTRACT

Although change management panaceas have been widely discussed in the business and management literature for several decades, not many publications address the role of simulation modeling in supporting these panaceas. This paper investigates four management innovation and change programs: TQM, JIT, BPR and Process Innovation and discusses how simulation modeling could increase their effectiveness. These change management approaches are compared and contrasted and the applicability of simulation modeling to support the principles of these methods is investigated. It is argued that simulation could be viewed as a missing link between these approaches.

1 INTRODUCTION

In contemporary business environments, organizations need to continuously adapt to new conditions and respond to competitive pressures. As a result of this, various change management approaches have been developed. The subject of managing innovation and change has been widely discussed in the business and management literature for several decades. Every few years, a new management philosophy, method or technique (or panacea or fad) is developed which is believed to enhance business performance (Land 1996). Many of them emanate from North America and are developed by practicing management consultants.

This paper investigates four management innovation and change programs: TQM, JIT, BPR and Process Innovation in the context of their methodological similarities and suitability for simulation modeling. These change management approaches are discussed in chronological order beginning with TQM and ending with Process Innovation. They are compared and contrasted and the applicability of simulation modeling to support the principles of these methods is investigated.

The investigation has revealed that, although these approaches are developed from different disciplinary or functional areas within management, they share a common set of key characteristics. For example, they advocate a company-wide approach to managing change, they seek to change the philosophy or culture of the organization, they are developed largely by management consultancies rather than the academic community, and they are intended to improve business performance. To be successful, they must be top-down led and managed. Simulation models may be used to measure their impact on business processes and performance.

The historical analysis of these change management panaceas shows that eventually their popularity and applicability declines and they are replaced by 'new' panaceas which, although labeled differently, are in many ways similar to their predecessors. The main objective of all these panaceas is to improve business processes, reduce costs and provide better products and services to customers. This paper investigates the role of simulation modeling in achieving these objectives.

This paper is structures as follows. An overview of four management innovation and change programs is given and the concept of simulation modeling is introduced. A discussion on the suitability of this method to support change management programs (panaceas) is provided. A comparison of four management panaceas from a methodological and simulation modeling perspective is presented. Finally, the conclusions outline the main findings of this research.

2 MANAGEMENT INNOVATION AND CHANGE PROGRAMMES

The investigation of the relevant literature reveals that there have been very few comparative studies that consider the use and effectiveness of management innovation and change programs (Currie 2000). However, one such study by Waterson *et al.* (1997) analyzed the results of twelve manufacturing practices: Business Process Re-engineering (BPR); Supply-chain Partnering; Outsourcing; Learning Culture; Empowerment; Team-Based Working; Total

Productive Maintenance; Concurrent Engineering; Integrated Computer-Based Technology; Manufacturing Cells; Just-In-Time Production (JIT) and Total Quality Management (TQM).

One of the main findings from this study was that JIT and TQM were among the most commonly used manufacturing practices. However, even the most prevalent practices were used either "not at all" or "a little" in over a third of sites (the sample was 564 manufacturing sites across fifteen manufacturing sectors ranging from 150 to 1000 employees). The authors further found that improving quality was the main reason given for introducing TQM; cost reduction was given for BPR; and responsiveness to customers was the main motive for introducing JIT (Cobb 1991). These practices were deemed to be the most successful in achieving their different objectives of quality, cost reduction and responsiveness to customers compared with other practices, although a proportion of companies in each case had experienced failure.

Total Quality Management, or TQM, is perhaps one of the most popular of the innovation and change programs which have emerged over the last few decades. First developed by US writers such as Crosby (1979), Deming (1982) and Juran (1986) in the post-war period, TQM has widespread appeal in both the academic and practitioner communities. This is largely because it offers a company-wide perspective on managing change that includes all members of an organization, from top management to operational and clerical personnel. In essence, TQM is concerned with quality improvement on a company-wide basis. It is a comprehensive approach to improving competitiveness, effectiveness and flexibility through planning, organizing, and understanding all the activities and tasks undertaken by people within an organization.

Throughout the 1980s many authors concentrated their attention on the advantages to be gained by incorporating Just-In-Time (JIT) methods and techniques (focusing on the reduction of inventory) into their production management strategies and operations (Currie and Seddon 1991). The background to much of this interest was a fear that manufacturing in the western world, North America, Canada and Europe, in particular, was experiencing industrial and economic decline. Hayes and Abernathy (1980) argued convincingly that the North American manufacturing industry was being seriously challenged by overseas competitors who could compete more favorably on labor, price, quality and cost. This fuelled further interest in the 1980s with the publication of work, some theoretical and others empirically based, on how industrialized nations could avoid further economic decline (Hirst and Zeitlin 1989).

Business process re-engineering (BPR), or *re-engineering*, emerged in the late 1980s and early 1990s as a new approach to managing innovation and change. Essentially it was designed to be highly prescriptive since it advocated that managers should constantly seek new and improved methods and techniques for managing and controlling core and service business processes (Belmonte and Murray 1993). A more cynical interpretation is that BPR was a euphemism for 'Big Personnel Reductions' (Kavanagh 1994) as it called for the ambitious restructuring of organizations through *downsizing* and *delayering* of managerial hierarchies and functions. In an article entitled: "Re-engineering work: don't automate, obliterate", Hammer (1990) claims the essence of re-engineering is about 'discontinuous thinking' and the relinquishing of "outdated rules and fundamental assumptions that underlie operations". It is a move away from linear and sequential thinking to a holistic, all-or-nothing, perspective on strategic change in organizations. Managers are criticized for *thinking deductively*. That is, defining a problem and then seeking its resolution by evaluating a number of possible remedies. Instead, Hammer and Champy (1993) make the case for *inductive thinking*. This is to "recognize a powerful solution and then seek the problems it might solve, problems the company probably doesn't even know that it has". Other writers suggest that re-engineering is about serving the external environment through improved customer service and not simply about meeting a narrow range of internal performance targets. Thus, "Re-engineering is a radically new process of organizational change that many companies are using to renew their commitment to customer service" (Janson 1993). But some writers question re-engineering's claims to radicalism and novelty, and also the notion that organizations can engage in a process of 'collective forgetting', of wiping the slate clean, and starting with *a blank sheet of paper* (Grint *et al.* 1995).

Perhaps a result of direct competition with Hammer and Champy (1993), Davenport (1993) developed the concept of *process innovation,* which he claimed was different from process improvement. In short, process innovation was an ambitious management change program designed to 'fuse information technology and human resource management' for the purpose of improving business performance. As with BPR, process innovation focuses upon company-wide innovation and change and is not intended to be a managerial 'quick fix' to resolve short-term functionally based, operational problems. According to Davenport (1993) "process innovation combines the adoption of a process view of the business with the application of innovation to key processes. What is new and distinctive about this combination is its enormous potential for helping any organization achieve major reductions in process cost or time, or major improvements in quality, flexibility, service levels, or other business objectives".

The analysis of four change management panaceas (TQM, JIT, BPR and PI) reveals that all of these panaceas offer solutions to ongoing business and managerial problems. Yet the rhetoric surrounding their success is always more convincing than the reality. Indeed, there are now many criticisms about the lack of success of these panaceas

in the workplace. Simulation modeling is therefore considered as a means by which business processes may be analyzed and evaluated, prior to implementing large-scale change.

3 SIMULATION AND BUSINESS PROCESS MODELLING

Simulation modeling could offer a great potential in modeling and analyzing business processes. For example, these models can represent different samples of parameter values, such as, arrival rates or service intervals, which can help identify process bottlenecks and suitable alternatives. Simulation models can provide a graphical display of process models that can be interactively edited and animated to show process dynamics.

Business process modeling tools are continuously being released on the software market (e.g. ARIS Toolkit, IDEF, Meta Workflow Modeller, Process Mapping, Visio and WorkSmart Analysis). Many of these tools represent business processes by graphical symbols, where individual activities within the process are shown as a series of rectangles and arrows. A majority of software tools for business process modeling have an origin in a variety of process mapping tools that provide the user with a static view of the processes being studied. Some of these tools provide basic calculations of process times. Other, more sophisticated, tools allow some attributes to be assigned to activities and enable some form of process analysis. However, most of these tools are not able to conduct 'what if' analysis. Nor are they able to show a dynamic change in business processes and evaluate the effects of stochastic events and random behavior of resources. Simulation modeling, on the other hand, offers wider opportunities for understanding business processes. Simulation software tools are able to model dynamics of the processes, such as, the build up of queues. This may be shown visually which enables the generation of creative ideas on how to redesign existing business processes. Some of the examples of simulation modeling tools include ARENA, AutoMod, EDTaylor, SIMPROCESS, Simple++, Simul8, and WITNESS.

There are relatively few examples of using simulation for business process modeling available in the literature. The majority of these publications were written by simulation modeling practitioners rather than business analysis specialists. One article on business process simulation stresses that over 80% of BPR projects used static flowcharting tools for business process modeling. Yet static modeling tools are deterministic and do not enable the evaluation of alternative redesigned processes (Gladwin and Tumay 1994). The use of business process modeling tools is usually focused on modeling current business processes, without a systematic approach to the evaluation of alternatives. On the other hand, simulation models can incorporate and depict dynamic and random behavior of process entities and resources (Tumay 1995). A physical layout and interdependencies of resources used in processes under consideration can be shown visually and the flow of entities among resources can be animated using simulation as a modeling tool.

4 SIMULATION MODELING AND CHANGE MANAGEMENT PANACEAS

Simulation models provide quantitative information that can be used for decision-making and can be regarded as problem understanding rather than problem solving tools. There are several characteristics of simulation that make it suitable for business process modeling (Paul *et al.* 1998): For example, a simulation model can be easily modified to follow changes in the real system and as such can be used as a decision support tool for continuous process improvement. Furthermore, a process - based approach (world view) in simulation modeling terminology relates to a time-ordered sequence of interrelated events which describes the entire experience of entity as it flows through the system. The visual interactive features of many simulation packages available on the market enable a graphical display of dynamic behavior of model entities, showing dynamic changes in state within processes. Simulation model can incorporate the stochastic nature of business processes and the random behavior of their resources. Finally, simulation models can capture the behavior of both human and technical resources in the system.

Simulating the effects of redesigned processes before implementation improves the chances of getting the processes right at the first attempt. Visual interactive simulation models, together with a variety of graphical output reports, can demonstrate the benefits of redesigned processes which is useful for business process re-engineering approval. Simulation could also be useful for focusing 'brainstorming' meetings, where various new ideas can be tested using a simulation model, and informed decisions can be made on the basis of model results.

The main objective of TQM is to improve competitiveness and effectiveness through planning, organizing and understanding activities undertaken by people within an organization. Simulation models can incorporate business activities undertaken by employees and provide a graphical display of tasks undertaken by different workers, their duration and sequence, dynamic changes of activities and any potential bottlenecks can be discovered. As such, simulation models could be used regularly as decision support tools for continuous improvement. For example, a simulation model of a production system could be used for investigating operating strategies that would reduce the size of inventory, machine cycle times, assess various scheduling rules, or reduce the level of faults. By doing this, any changes to be done to the real system could be tested on the model to avoid risks of inadequate decisions, and business activities could then be better understood.

When changes tested on the model are implemented in the real system, effectiveness of the system should be improved as well as the competitiveness of an organization.

Whilst JIT has been viewed as a management philosophy of integrated manufacturing, planning and control in Japan (Hori 1993), the western countries often see JIT in the narrow context of inventory control. Simulation modeling can support both approaches to JIT. Real-time models of an integrated manufacturing system could incorporate models of inventory control systems, production design, resource planning and scheduling. In addition, detailed models of inventory control systems can be used regularly to assess the impact of various JIT strategies, the inventory re-ordering policies, optimal levels of inventory and so on (Wu *et al.* 1992).

Several publications claim that one of the major problems that contribute to the failure of BPR projects is a lack of tools for evaluating the effects of designed solutions before implementation (Paolucci *et al.* 1997), (Voss and Robinson 1987). Mistakes brought about by BPR can only be realized once the redesigned processes are implemented, when it is too late, costly and probably impossible to easily correct such errors. Although the evaluation of alternative solutions may be difficult, this may reduce some of the risks associated with BPR projects. For example, Hlupic *et al.* (1999) present a business process model of a telephony system of a large multinational company that has been used for determining business processes that needed to be radically changed. The impact of these changes was investigated using the model before the real system was changed.

Similar to BPR, the main objective of Process Innovation is to radically reshape or even transform key business processes to enhance business performance. This approach emphasizes innovation and not just improvement. The focus is on one-time change. Here, simulation models may be developed to investigate key processes to determine innovation strategies, to develop a vision of new processes and to evaluate alternative models of new processes.

5 CHANGE MANAGEMENT PROGRAMMES AND SIMULATION MODELLING: A COMPARATIVE ANALYSIS

Table 1 provides a summary comparison the four management innovation and change programs and shows how simulation modeling can support these programs. We also compare and contrast the benefits and improvements, similarities and differences, and the role of simulation relating to these approaches.

Table 1 shows that four panaceas are concerned with business improvement, albeit using different business drivers. During the 1980s in the US and Europe, there was much concern with quality improvement. Whilst this continues, the more recent approaches of BPR and PI during the 1990s have been concerned with how technology can be used to provide seamless and efficient business processes. Whilst TQM and JIT emphasize the role of shop floor staff in the continuous improvement process, these approaches also assert that top management must fully embrace these change programs if they are to be successful. Furthermore, all approaches suggest a need for cultural change in an organization, although the time scale, the type of change, and associated risks, are not the same.

It is also demonstrated that simulation modeling could play an important role in supporting all four approaches. Simulation models could provide a graphical display of physical elements and/or business processes, and capture dynamic changes. These models could be used as communication tools to help people to understand the current processes using AS-IS models, and to evaluate the impact of changes using TO-BE models. Random behavior of system elements can be simulated by models as well as changes to the layout of systems, priorities, sequencing of tasks and human resources management.

A major difference between change management approaches in the context of simulation is that models that support TQM and JIT are usually manufacturing oriented. They tend to represent the flow of physical objects (for example, the movement of parts between work centers). Conversely models that support BPR and Process Innovation normally deal with the flow of information and how resources may be redeployed. These models are usually 'people oriented' as business processes normally involve human resources.

Analyzing the similarities between TQM and BPR, Hammer and Champy (1993) recognized that some people questioned the authenticity of the latter approach and so put forward the view that, "Re-engineering and TQM are neither identical nor in conflict; they are complementary. While they share a focus on customers and processes, there are also important differences between them. Re-engineering gets a company where it needs to be fast; TQM moves a company in the same direction, but more slowly. Re-engineering is about dramatic, radical change; TQM involves incremental adjustment. Both have their place. TQM should be used to keep a company's processes tuned up between the periodic process replacements that only re-engineering could accomplish. In addition, TQM is built into a company's culture, and can go on working without much day to day attention from management. Re-engineering, in contrast, is an intensive, top-down, vision driven effort that requires non-stop senior management participation and support".

Analysis of the management innovation and change literature reveals that another important issue to be noted is the relative speed at which new panaceas enter the marketplace (Currie and Willcocks 1995). For example, TQM has many similarities with BPR and process innovation. Furthermore, JIT, according to some

Table 1: A Comparison of Four Innovation and Change Programs

CHANGE MANAGEMENT PROGRAMME	BUSINESS BENEFITS AND IMPROVEMENTS	SIMILARITIES/ DIFFERENCES	THE ROLE OF SIMULATION
Total Quality Management (TQM)	Quality enhancement, Customer satisfaction, Zero defects, Culture change, Better communications Cost reduction, Flexible working practices	Incremental change, Continuous improvement, Medium time scale, Top-down participation, Company wide scope, Medium risk, Cultural type of change	Decision support system for continuous improvement, Graphical display of physical elements, Simulating dynamic changes of the system, Communication tool, Problem understanding tool, AS-IS vs. TO-BE models, Random behavior of system elements captured in models, Manufacturing oriented models, Models usually represent the flow of physical objects
Just-In-Time (JIT)	Reduced machine downtime, Waste and re-work (of stock), Reduced cost, Fulfil innovation strategy, Improved customer/supplier relationships	Evolutionary change, processual change, Medium time scale, Top-down participation, Cross-functional scope, Medium risk, Cultural type of change	Decision support system for continuous improvement, Graphical display of physical elements, Simulating dynamic changes of the system, Communication tool, Problem understanding tool, AS-IS vs. TO-BE models, Random behavior of system elements captured in models, Manufacturing oriented models, Models usually represent the flow of physical objects
Business Process Re-engineering (BPR)	Eliminate non-core business processes, Achieve functional integration, Greater worker empowerment	Revolutionary change, On-going frequency of change, Long-term time scale, Top-down participation, High risk, Cultural/cost reduction type of change	One off study for evaluating strategy for radical change, Graphical display of business processes, Simulating dynamic changes of the system, Communication tool, Problem understanding tool, AS-IS vs. TO-BE models, Random behavior of system elements captured in models, 'People' oriented models, models usually represent the flow of information
Process Innovation	Eliminate non-core business processes, Fuse it and HRM, Encourage cross-functional team building	Radical change, One-time change, Long-term time scale, Top-down participation, High risk, Cultural/cost reduction type of change	One off study for evaluating innovation to core processes, Graphical display of business processes, Simulating dynamic changes of the system, Communication tool, Problem understanding tool, AS-IS vs. TO-BE models, Random behavior of system elements captured in models, 'people' oriented models, Models usually represent the flow of information

observers, incorporates many of the concepts and practices of TQM, particularly from a Japanese perspective (Gilbert 1989). The differences between BPR and process innovation are more to do with labeling rather than substance, scope and practice. In making these claims, it is important to adopt a more cautionary perspective on the theoretical and practical value of management innovation and change programs, since a critical and comparative analysis suggests they are largely the products of management consultancy firms which, like other products, have a relatively short shelf life! This is not to totally disparage the value of change programs per se, but to recognize that the business and management literature is fast becoming saturated with discarded or once popular business and management panaceas.

6 CONCLUSIONS

This paper explored four change management panaceas in the context of how simulation modeling may support them. The presented study has revealed that these approaches are differentiated more by labels, ideology and rhetoric, than by a strategic vision which explains their implementation in the business community. In the light of this, it is difficult to delineate the theoretical and practical boundaries of TQM and BPR, for example. This supports existing research, which shows that the same panacea does not produce identical results across companies operating in the same business sector (Galliers and Swan 1999). It is apparent that modeling provides an important means of discovering the essential aspects of the organizational system where improvements will make a real difference in performance as well as providing a sound basis for managing the consequences of the agreed actions (Ackermann *et al.* 1999).

There are many reasons for using simulation as a process modeling tool. For example, a new business process might involve a decision about capital investment that is difficult to reverse. It is usually too expensive to experiment with the real business processes, especially if this involves large scale organizational change. In many cases the variables and resources for new processes are not determined or understood. The process of simulation model development can facilitate a deeper understanding of some of these issues. The value of simulation depends on the model validity and the likelihood that the results of model experimentation may be replicated and implemented in the real processes.

Simulation modeling can not only be used for modeling business processes to support BPR and Process Innovation approaches, it can also be (and has been) used in a manufacturing sector to support TQM and JIT strategies. To conclude, it could be claimed that simulation modeling plays an important role in supporting change management panaceas, and it may help to delineate the boundaries between them. In addition, another important benefit of simulation is its ability to provide continuity for change management in companies where the fads seem to come and go.

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