

CONTEMPORARY STRATEGIC PLANNING TOOLS AND APPLICATIONS FOR CONSTRUCTION MANAGERS

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ABSTRACT

Strategic planning (SP) has received significant attention by construction executives in recent times, perhaps due to an increasingly competitive marketplace and perhaps because university-trained managers have assumed positions of authority in construction companies.

For whatever reasons, there is a large and, sometimes baffling array of SP tools and applications. The size of this array makes selection and application difficult. Business Process Reengineering (BPR), Total Quality Management (TQM) and Continuous Process Improvement (CPI), are three of the more prominent. This paper outlines those different tools and presents the authors' views on which tools are appropriate for specific circumstances particular to the construction industry. One of the main contributions is the set of guidelines which may be employed for choosing these different SP tools and applications.

The paper concludes with a discussion of the subject of "Reengineering Therapy", which appears to be a critical and under appreciated criterion for reengineering success.

1. INTRODUCTION

Construction as an economic activity is becoming exposed to an increasingly competitive set of environmental circumstances in many parts of the world. This is largely facilitated by global communication networks which have opened a worldwide marketplace for construction goods and services. While some are specific to local circumstances others are rapidly growing more universal in reflection of the increasing globalization of construction activity. The largest construction companies compete for work on an international basis and collaborative ventures have become the norm to manage projects on an unprecedented scale.

Construction is also increasingly finding itself competing with other economic activities for investment. This is particularly the case in mature and developing markets where either the scarcity of funds or the range of other rapidly growing industries is such as to require

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construction to innovate and achieve substantial levels of productivity improvement and quality attainment to warrant competitive investments.

To meet these global demands there is an increasing need for construction enterprises to plan strategically and apply revolutionary customer-oriented theories emerging within the management discipline. Construction management as an academic discipline appears to be largely unaffected by these mainstream theories. The inability of the discipline to adopt such practices and perspectives could culminate in firms within the industry seeing their competitive element, within construction and between outside industries, being seriously eroded.

2. CONSTRUCTION MANAGEMENT IN THEORY AND PRACTICE

Within the changing economic environment described above, management of construction companies and projects is in itself exposed to the requirement of a stricter discipline. Targets for productivity improvement are quickly becoming increasingly ambitious in the light of discerning clients who demand stringent quality consciousness, service and performance standards as part of a shift towards greater customer satisfaction. Such developments are the standard in other industries but recent years has seen them become similarly common within construction. This migration of priorities from outside construction to within has at the same time led to the need for innovations and managerial approaches to follow the identical migration pattern.

Instead, an increasingly common type of research appears to be our observation, documentation and analysis of current construction industry practice which, from a research point of view, is often seen as an end in itself. Moreover, we appear to feel justified in describing local common practice rather than seeking to find and apply best global practice. One could argue that construction management research is in need of an urgent stimulus of new thinking to prevent it from settling into a stale pattern of parochial observations which are as yet unguided by any substantial theories.

We can draw an interesting distinction between the traditional role of the researcher and consultant. The former is seen as one who collects data from practice from which to generate theory in a descriptive way, whereas the latter is seen as a prescriber of theory into a practical environment. With the SP issues with which we are dealing here, the distinction between these two roles becomes increasingly blurred in the need for action research processes as advocated by Gummesson (1991).

3. THE EMERGENCE OF NEW MANAGEMENT CONCEPTS

The academic discipline of construction management appears to be developing in an evolutionary way based on developments in practice which appear to be largely unaffected by mainstream management theories.

There is an increasing range of customer-oriented theories emerging within the mainstream management discipline which are finding increasing acceptance within other application domains both from a theoretical and practical standpoint. Their application within construction appears to be delayed.

This paper argues generally for a wider adoption of innovative, emerging management philosophies to construction. It specifically does this through an assessment and analysis of the implications of the emerging principals of BPR, TQM, CPI and the new production philosophies.

These have each been portrayed as management principles that can be used to achieve large scale productivity and efficiency improvements and subsequently, substantial changes in business fortunes. Analyzing the place of some of the core principles of each of these managerial philosophies within the way construction management is evolving shows there to be many similarities between them. The contribution of this paper is in the clarification of the circumstances for the relative adoption and selection of these new management philosophies.

Management literature abounds with examples of companies improving key performance measures after the application of the above techniques: IBM Credit now prepare quotes in one day rather than seven, Federal Mogul reduced product development from twenty weeks to twenty days. The average Japanese company rejects 1.2 components in 10,000, while UK companies reject 1 component in 1000. These cases exemplify why we should look outside of construction at theories and practices arising from other sectors. This will lead us to expose our current construction practices to new theoretical paradigms that have provided high performance standards in other industries.

A common reason construction uses to excuse its failure to adopt new paradigms is a belief of uniqueness. Koskela (1992) observes that construction's propensity to perceive uniqueness is ironically, not unique to construction. Many manufacturing plants claim uniqueness which could be indicative of a psychological need to perceive one's own system as unique. The perception of a lack of applicability of wider techniques seems to be an implementational hindrance, although the Japanese construction industry has benefited from borrowing principals from outside construction and utilizing them to great effect (Bennett, 1991).

4. THE NEW BUSINESS PROCESS BASED IDEAS

The recent developments in business process oriented theories represent the application side of SP techniques. If the strategic plan defines what the company will do, then the business process defines how it is to be done. Davenport (1993) observes that reengineering is

ultimately futile unless it procures a particular strategic vision. IBM's processes deploy resources which deliver service excellence to their customers, while Rolls Royce concentrate on image and quality. From Ansoff's original model (1965) we can illustrate the position of process oriented theories within the SP process.

The first concept is gap analysis which seeks to describe the difference between the firms strategic objectives and current position. In this context the selected business process fulfills "gap reducing properties" to close the gap.

The second concept is synergy, or strategic fit, denoting the combined effect of the organization's parts and the required alignment of those parts. Process oriented methodologies must therefore align, or synergize the organization to close the gap between its current position and strategic objectives.

The argument for using process oriented methods blames current business failure upon past success. Most companies are organized to the principles of Adam Smith (1776) and Frederick Taylor (1911) who promoted task decomposition and the organization of human resources by applying engineering principles to work structures. The effect of these philosophies is that work is oriented to tasks and functions as opposed to processes and outcomes. The former is suitable to a marketplace characterized by high demand, low competition and a narrow product differentiation, but not the company of the 1990's which encounters global competition, cyclical economies and rapid advances in technological development. These latter circumstances are increasingly becoming the context of the modern construction firm.

The process philosophy aims to re-orientate the organization from a collection of vertical functions that combine to produce an output, to horizontal processes that focus upon the output. A process based company aims to effectively co-ordinate interdependent activities, rather than maximizing individual and departmental efficiency. As companies change focus from producer to customer, "the watchwords of the new decade are innovation and speed, service and quality" (Hammer, 1990).

A key lever for the effective operation of process methodologies is Information Technology (IT). Although IT's impact on business has not heralded the productivity increases its pundits promised, adoption of process methodologies aim to address fundamental flaws with the application of IT. The main objectives for information systems have been automation and process rationalization which have only produced minor incremental productivity improvements. BPR protagonists see IT induced reconfiguration, from function to process as IT's savior. By changing the way we work and taking advantage of IT's potential to deliver competitive advantage (Porter and Millar, 1985) we will see business fortunes increase dramatically, rather than incrementally.

4.1 Business Process Reengineering

BPR has become immensely popular in the US over the past 3 years, especially in the manufacturing and service sectors. The concept has been described by Hammer and Champy (1993) and Davenport (1993) but we are in the early stages of our understanding of the theory (Davenport, 1993). The Economist (1994a) states that the use of BPR within

European companies is approaching US levels of popularity, or even overtaking it as recent evidence has suggested that 75% of European and 69% of American firms are undertaking BPR initiatives (CSC Index, 1994). These percentages are of firms surveyed which has important implications for generalizations from the data. Many companies use the term euphemistically for downsizing, cost cutting and redundancies (Petrozzo and Stepper, 1994).

BPR consists of a set of qualitative tools which are used to describe existing work processes to facilitate the identification of weaknesses. By using cross-disciplinary reengineering teams, relatively high risk/high payoff process improvements are sought. In this paradigm, reengineers are encouraged to approach process redesign with a clean sheet, disregarding the rules that have shaped the organization in the past. In the pursuit of radical improvements in performance the full leverage of organizational structure, human resources and IT are used.

Due to the high risk/high payoff nature of BPR, strong commitment from executive management is crucial (CSC Index, 1994). As the re-orientation from functions to processes involves the integration of tasks that are often traditionally separate within organizational work flows, executive management have to develop strategies to manage what is often radical change. Reducing the impact of change expedites the operation of the reengineered organization, and benefits are reaped earlier. Implementation of BPR can take over 5 years (Petrozzo and Stepper, 1994) so the maximization of effectiveness is desirable as quickly as possible.

The current application of BPR is low in construction compared with other industries. As mentioned previously, increasing global competitive pressures are seriously affecting the construction industry and driving it to re-think business practices. BPR can be very effective when companies want dramatic improvements in business performance in a relatively short period of time. BPR should be considered as an effective tool not only to gain competitive advantage but also to satisfy internal and external customers. It is a first step towards the concept of the virtual corporation - flexible, quick, permeable, continuous and edgeless.

4.2 Total Quality Management

TQM is a comprehensive management tool by which companies elevate quality to the most important strategic issue in operating their businesses. Since the success of Japanese construction companies in instituting TQM in the mid-1970's, US and European construction companies have been broadly implementing TQM during the past few years. TQM is well described in Chase (1993) and Oswald and Burati (1992).

The objective of TQM is to continuously and incrementally improve organizational performance and achieve customer satisfaction. Organizations can experience strong commitment, improved communication and excellent co-operation through TQM. Employees are empowered by actively participating in decision making to improve their work processes. Continuous training of management and employees is essential to keep the entire organization quality conscious.

Due to the relatively moderate payoff/low risk nature of TQM, application in construction is rapidly growing. The payoff comes in less litigation, lower costs, higher quality of work and

increased customer satisfaction. Clear and strong vision and principles should be incorporated with the commitment of senior management prior to beginning a TQM project.

Companies with significant gaps between customer expectations and company performance should consider TQM. TQM itself is very beneficial for the entire construction industry as it can be extended to the parties in a construction project.

4.3 Time Based Competition

Time Based Competition (TBC) has been widely and successfully used in new product development for the manufacturing and service sectors. In TBC, time is the most critical variable. The goal is to meet the customers desire for rapid service. Many recent publications describe the application of TBC strategy in more detail (Meyer, 1993) (Wheelwright and Clark, 1992) (Stalk and Hout, 1990).

The objective of TBC is to be fast to the market with a high quality product. It usually requires a concurrent engineering approach with cross functional teams which include clients and customers.

The strength of TBC is that the required investment is relatively small compared to other strategic planning tools. This is because empowered teams with a strong project team leader can profoundly influence the entire organization. However, the gap between inception and payoff can be long largely due to the continuous training of employees which can be time consuming and expensive.

In construction, both owner and Architecture/Engineering/Construction (AEC) firms can take advantage of TBC. Owners can operate facilities and make profit earlier by completing the project ahead of time. Conversely, AEC firms can avoid liquidated damages from project overruns. The need for developers to coincide project completion for sale or letting within the upswing of property cycles is also widely acknowledged. TBC is therefore especially suitable for any process oriented project where time to market is critical.

4.4 Lean Production

The revolutionary story of Toyota's production system has impressed many European and US manufacturing experts with the value of lean production (LP) techniques. The five year study of the Japanese automobile industry conducted by the MIT highlighted the efficiencies of LP (Womack et al., 1991). The principles of LP are applicable to the construction industry in many ways as have been described by Koskela (1992).

The main principles of LP are to distinguish between conversions and flows as value and non-value adding activities to be made more efficient or eliminated respectively. Means of achieving LP include teamwork, communication, efficient use of resources, elimination of waste and continuous improvement. Compared to the traditional mass production system LP applied to the auto industry led to reductions of half the human effort, manufacturing space, investment tools, engineering hours and time to develop and manufacture new products. LP partly focuses on the relationship between the assembler (like a prime contractor) and the

suppliers (like subcontractors) to utilize just in time inventories to integrate production and inventory control. Low inventories and high customer response are key characteristics of LP.

The team leader has a significant role in LP since the lowest organizational level is heavily involved in the continuous improvement process. Similar to TBC, investment to execute LP is moderate considering the relatively high likelihood of payoff. However, implementation is lengthy compared to other SP tools. This is because of the difficulty of forming a just in time environment for construction.

LP is suitable to achieve a low supplier base and reliable supply in construction. It can dramatically reduce the number of components, processes and operations in construction. The current level of LP application is moderate, but growing.

4.5 Computer-Integrated Construction

While the application of IT within the construction industry is widespread (Ibbs and Choi, 1990), it fails to address the fundamental issue of integration of the construction process. Computer-Integrated Construction (CIC) aims to fully integrate an engineering database for planning, design and construction using IT. The integration of management, engineering and construction work processes can improve performance, quality and use of resources. This philosophy has been behind many attempts at technical integration including Aouad et al (1993) and Luiten et al (1993).

Integration of information eliminates non-value adding processes and time wasting activities. Reengineering the existing work processes should be conducted before automating the newly designed work processes. To do so, a powerful commitment from the company's executive management is essential to develop and proceed with a long term CIC strategy. Continuous process improvement programs such as TQM should be incorporated with CIC.

Due to its relatively high cost, current application in the construction industry is moderate. Patience is required to see the actual benefits of CIC. Instituting CIC can be a lengthy process due to the multiple party arrangement of a construction project.

Some examples of CIC application include the development of decision support systems and simulation programs. Constructability reviews or work planning using 3-D interactive CAD software is also widely used. Construction automation with real time monitoring and the just in time concept is a futuristic application of CIC.

4.6 Comparing SP Tools

Five major SP applications have been discussed in the earlier sections (4.1-4.5). From this discussion, we have developed a matrix which allows explicit comparison of these SP tools: see Table 1.

The purpose of this table is to help construction executives compare the advantage and disadvantage of each of these tools. The rows of the matrix contain criteria such as principles, main elements, implementation steps, leaders, motivators, impacts, and relationships to other tools. Two other important criteria in this matrix is the relative size of

and likelihood of payoffs from using these SP tools. The measures are admittedly subjective and relative to each other. These assessments are based on our knowledge and experience. We urge the reader to focus on the criteria more than the assessments themselves.

5. OTHER PRACTICAL ISSUES: "REENGINEERING THERAPY"

Many reengineering authors have focused their work towards IT aspects and the shape of the reengineered organization of the future. However, a more serious and under-appreciated difficulty of reengineering is the impact it has on the morale, psyche and personal relationships of workers. Some of the main issues have been addressed by (Economist 1994) (Morrill 1994) (Morgan 1994) and (Singapore 1994).

Our own experience has led us to conclude that, in rough terms, about 20% of any reengineering project is analytical and strategic planning, and the other 80% is implementation details. Indeed working with the people involved in a reengineering project to relieve their concerns is such a major issue that we have dubbed this phase of the project *reengineering therapy*. Our choice of terms is very deliberately intended to raise an analogy to marriage or personal counseling therapy.

A case study illustrates how easily human factors provide obstacles to reengineering. One of the senior authors was invited to work with a government agency to actively redesign its work processes. The review of existing work processes and the brainstorming associated with defining new procedures was relatively straightforward. During these early stages, enthusiasm amongst the reengineering team was high about the potential of the new organizational architecture. However, meeting with the three senior department managers proved that a battle over functional boundaries would ensue.

Briefly, this particular military engineering organization was headed by a civil manager, who was trained as an environmental engineer. His deputies were a senior civilian in charge of a craft workforce, and a military officer heading the engineering and technical support groups. The production manager had risen through the craft ranks and felt an allegiance to his workers. The military officer, on the other hand, was college educated and, by nature, was impatient with the status quo.

One of the key findings of our initial analysis was that there were artificial and unnecessary barriers between these 2 groups. In our attempts to eliminate these barriers, we encountered considerable opposition from the 2 group managers. Namely, with new, integrated teams of engineers and production workers, who would be responsible? Neither of the deputies was willing to budge because of the (perceived) loss of power.

The result was an arduous, protracted process which was eventually resolved when the department director specifically directed a solution, rather than wait for one to emerge. And that is our key message: namely, whereas the start of a reengineering effort is usually grassroots in nature, the finalization is frequently accomplished by a top-down directive.

6. SUMMARY AND CONCLUSIONS

Reengineering is a new management concept that has emerged to help organizations focus on their core business lines and operations. It is one of several SP tools that are now available to senior managers in the Construction Industry. Unfortunately, choosing between these various SP tools (TQM, CPI, BPR) can be bewildering, inefficient, and even wrongheaded.

This paper is a report in progress which attempts to structure and clarify these SP tools. It presents a list of criteria and an ordering process by which the advantages and disadvantages of SP are enumerated. The article also describes a reengineering experience with one organization that led to considerable therapeutic implementation work; a reengineering therapy exercise. Other articles in the future will continue this line of inquiry.

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Table 1. Comparison of Strategic Planning Tools to Improve Performances in Construction Industry

Contents	Common to all SP Tools	Business Process Reengineering (BPR)	Total Quality Management (TQM)	Time Based Competition (TBC)	Lean Production (LP) System	Computer-Integrated Construction (CIC)
Principles	<ul style="list-style-type: none"> - work process improvement tools - continuous improvement 	<ul style="list-style-type: none"> - methodology to dramatically improve business performance - fundamental rethinking with radical redesign of processes - improvements in critical measures such as cost, quality, services and speed - focus on thoroughly examining organizational goals and priorities of the business - incorporate 	<ul style="list-style-type: none"> - a quality as a strategic issue - integrated efforts by all organization levels to increase customer satisfaction - classify organization as supplier, processor, and customer - continuous improvement of production process - incremental change of organizational performance 	<ul style="list-style-type: none"> - reduce overall response time of the system - consider time a strategic equivalent to money, quality, productivity and innovation - main focus on the customer and customer's needs - analysis and participation of all the operational activities - elimination of time wasted within different operations 	<ul style="list-style-type: none"> - teamwork - communication - efficient use of resources - elimination of waste - continuous improvement -just-in-time inventories 	<ul style="list-style-type: none"> - computer-based integration of design and construction work processes - full integration of databases for planning, design and construction - integration of island of automation - improve productivity, performance, quality and use of resources of the construction work process - use work processes mapping method

		with IT - develop strategies and systems that fit the organization's needs		- flexibility - first to market		to improve data flow
Main Elements	- focus on customer - top management commitment - benchmarking world class practices	- process-oriented management through cross-functional management and engineering teams - focus on customer satisfaction such as time, cost, and quality - teamwork and clear communication - radical cultural change of the firm - continuous BPR	- continuous improvement - team structures - tools and techniques for performance measurement - continuous training - long term planning - employee empowerment - participative management - strategic alliances	- cross-functional product teams - time-driven checkpoint process - continuous customer involvement - separate platform development from product development - concurrent engineering - modular design - flexibility - do-it-right-the-	- cross functional product teams low inventories and high customer response - low product cost and high quality - low operating cost and high training - low bureaucracy and high effectiveness and control - low supplier base and high	- work processes of integrated systems - integrated database systems -real time monitoring - networks - interactive 3-D CAD software - graphic presentations - decision support systems - robotics - apply to logistics (just in

			partnership development	first-time	reliability of supply - low risk profile and high entrepreneurial behavior	time concept)
Steps	- get top management commitment	- select pilot processes - conduct initial impact analysis - define the scope - analyze work processes information - define and design new process alternatives - use automated work flow technology to achieve flexibility - evaluate benefits and costs	- creation of a steering committee - strategic quality planning - develop work process flow diagram - conduct customer and employee surveys - quality education - establish quality improvement teams - implement process	- paradigm shift of old product development concept - create a team that involves people from different area including customer - early consideration of all possible constraints - set goals and targets specified by project definition phase - set several checkpoints to monitor the progress of	- develop a strategy and operational activities - identify customers and conduct world class benchmarking - reduce the number of components, processes and operations - focus on continuous improvement involving lowest level of organization - integrate production and	- identification of the needs of CIC - develop a long-term CIC strategy - designate a IT team to pursue CIC - evaluate current system and work processes - integrate work systems, processes and data with newly designed processes - implement automation and

		<ul style="list-style-type: none"> - select the best processes - extend implementation of new work processes 	<ul style="list-style-type: none"> improvements - begin supplier improvements 	<ul style="list-style-type: none"> project - concurrent engineering approach by cross functional teams - fast to market with high quality product 	<ul style="list-style-type: none"> inventory control - produce without error or process variation - continuous investment in human resources training 	<ul style="list-style-type: none"> integration of the systems with computers
leaders		<ul style="list-style-type: none"> - People familiar with target work processes 	<ul style="list-style-type: none"> - TQM group 	<ul style="list-style-type: none"> - project team leader 	<ul style="list-style-type: none"> - project team leader 	<ul style="list-style-type: none"> - IS department
motivators		<ul style="list-style-type: none"> - top management 	<ul style="list-style-type: none"> - entire organization 	<ul style="list-style-type: none"> - team members 	<ul style="list-style-type: none"> - team members 	<ul style="list-style-type: none"> - top management
Impacts	<ul style="list-style-type: none"> - customer (internal and external) satisfaction - competitive advantage 	<ul style="list-style-type: none"> - reallocation and re-training of human resources - intensive use of IT - redefining business strategy - first step of virtual corporation 	<ul style="list-style-type: none"> - cost savings - reduce rework - better use of human resources - provide high quality of work - creates participative management environment 	<ul style="list-style-type: none"> - paradigm shift - more effort on conceptual planning - faster start-up time to meet customer satisfaction - design for manufacturability 	<ul style="list-style-type: none"> - reduce the human effort - reduce the manufacturing space - reduce the investment tools - reduce the engineering hours - faster the time to develop new products 	<ul style="list-style-type: none"> - extensive data exchange between management engineering and construction - intensive research on automation - rigorous technology transfer between researcher and industry

Relation with other strategies	- many principles are shared	- one way of implementing TQM	- applies to all other strategies	- similar strategy to LP	- similar strategy to TBC	- needs BPR and TQM to be successful
Relative size of payoff*		- large	- moderate	- moderate	- moderate	- moderate
Likelihood of payoff*		- medium	-high	- medium	- high	- high
Investment required*		- moderate	- moderate	- small	- small	- large
Current level of application in A-E-C*		- low	- moderate and growing	- moderate	- moderate	- medium
Duration before payoff begins		- short	- short	- moderate	- long	- long

* In subjective and relative measures