CHANGE MANAGEMENT IN CONSTRUCTION: THE CURRENT CONTEXT

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Construction companies are sometimes required to implement changes at business level related to management, technology, people and cultural issues as well as handling many changes at project level. Changes in projects, most of which are related to design, are inevitable even if there had been detailed studies during the design development, and prior to the construction stage. The changes need to be managed to reduce the negative impacts and to safeguard quality and profitability. The impacts and consequences of changes vary according to the type and nature of changes, but most importantly according to how they are managed. In an environment characterised by ever-increasing global competition and customer expectations, change management has become a key factor in the quest by organisations to stay ahead of the competition. Change management becomes more important, and at the same time more difficult, when the construction companies have a geographically dispersed organisational structure, are multi-disciplinary in nature, and manage one-off projects with interactions changing for each project. This paper presents the results of a literature review carried out on change management in construction. Change management is explored at two levels: organisational level and project level. The classification and nature of changes at each level and the change management tools and techniques available are investigated and analysed. The problematic areas in construction change management which require further research are highlighted.

Keywords: change management, project change, organisational change, barriers.

INTRODUCTION

Change is defined as “the act or an instance of making or becoming different, an alteration or modification”(Concise Oxford Dictionary). There are many different reasons and sources for change which will never fade or vanish. Since changes will never disappear, the best option is to manage them to prevent negative consequences. The impacts and consequences of changes on an organisation and people vary according to the type and nature of changes, but most importantly according to how they are managed. The changes are to be managed to maximise the benefits, minimise the penalties, and ensure that both benefits and penalties are distributed equitably (Lazarus& Clifton, 2001).

Change management (CM) becomes more important, and at the same time more difficult for the construction companies which have a geographically dispersed

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organisational structure, are multi-disciplinary in nature, and manage one-off projects with interactions changing for each project. On the other hand, changes are not always unwelcome. In an environment characterised by ever-increasing global competition and customer expectations, CM has become a key factor in the quest by organisations to stay ahead of the competition (Cao et. al, 2004).

CM occurs in construction at two levels: organisational and project level. Throughout a project, construction organisations are faced with many changes, most of which are design changes (DC). Project changes(PCs) are inevitable even if there had been detailed studies during the design development, and prior to the construction stage. Besides handling changes at project level, construction companies are sometimes required to implement changes at organisational level related to management, technology, people and cultural issues. The main aim at the organisational level is managing how to introduce a change to the organisation effectively and efficiently whereas, at the project level, the focus is on trying to cope with the changes that occur in the project due to internal or external reasons.

This paper presents the results of a literature review carried out on CM in construction both in organisational and project level and aims at determining the research gaps which have not been covered in the literature so far.

CLASSIFICATION OF CHANGES

There are several different classifications for organisational and project changes in the literature and these are summarised in Table 1.

Table 1. Classification of Changes

According to	**PROJECT CHANGES (PCs)**	
Type of impact (CII 1994)	Beneficial Changes	Detrimental Changes
	reduce cost, schedule or degree of difficulty	reduce owner value, have negative impact on the project.
Need for change (CII 1994)	Required Changes	Elective Changes
	Implemented to meet the objectives or regulatory/ legal/ safety/ engineering requirements/standards	Enhance the project, but are not required to meet the original objectives
Initiation Nature/ Responsiveness of change (Burnes 1996)	Emergent/ Reactive Changes	Anticipated/ Proactive Changes
	Unplanned, unexpected. The response is after the occurrence.	Expected before it occurs, therefore necessary actions are taken.
According to	**ORGANISATIONAL CHANGES (OCs)**	
The difference in the organisation due to change (Tichy 1982)	Strategic Changes	Non-strategic Changes
	Nonroutine, nonincremental and discontinuous, alter the overall orientation of the organisation	Do not affect the overall orientation of the company, do not result in a drastic difference
Speed of the transformation in the organisation (Cao et al 2000; Cummings and Worley 1997)	Incremental/ Gradual/ Fine Tuning	Radical/ Quantum Changes
	Routinely necessary for any organisation to adapt to its environment	Necessitates a thoroughgoing re-examination of all facets of an organisation
Initiation Nature (Burnes 1996)	Emergent Changes	Planned Changes
	driven from bottom up and is an open-ended and continuous process of adaptation to changing conditions	result of an action research& an analysis of the social and organisational problems in question
Initiation Nature (Burnes 1996)	Emergent Changes	Anticipated Changes
	Same as above	not planned by the organisation but its happening is expected

NATURE AND SOURCES OF CHANGE

There are many different categorizations of reasons for change in literature but they can all be considered under two headings: External reasons and Internal reasons. External reasons are the factors that occur outside the organisation or project and they can not be controlled by the organisation. Internal reasons result from the changes in the organisation and project. The reasons in the literature are summarised in Table 2. Although the specific change reasons for each level differ at some point, the big picture is the same. Project level CM is about coping with the changes in the project and taking the necessary actions to minimize loss and if possible increase the profit. Organisational level CM is similar but the action to take is more likely to change the organisational characteristics to adapt the changing conditions.

Table 2. Reasons for changes at project and organisational level

	EXTERNAL REASONS	**INTERNAL REASONS**
Reasons for Project Changes (Kast&Rosenweig 1974) (Kitchen&Daly 2002) (Lazarus& Clifton 2001)	Changes (Cs) regarding economic and financial issues Cs in environmental issues Cs in ecological issues Technology Cs Cs in the standards and regulations Political changes Force majeure	Cs in the organisational culture Cs in the system of project planning Cs in the project plan execution Cs in the overall change control system Cs in the documentation system Ineffective decision making Design improvements Unexpected weather conditions Design error Designer change of mind Changed design parameters Contract disputes Cs in the project
Reasons for Organisational Changes (Voropajev 1998) (Love et. al 2002) (Smither et.al 1996)	Cs in environment New technologies Cs in the market place Changing customer expectations, Cs in competitor activities Cs in quality and standards Cs in legislation Cs in prevailing political values Cs in the economy Demographic changes Ecological changes Cs in cultural factors	Cs in goals and values Cs in the technical system Cs in organisational structure Cs in the management philosophy Cs in the psychological system Cs in managerial system Cs in organisational culture Cs in the systems of internal power and control

PROJECT CHANGE MANAGEMENT (PCM)

PCs are considered to be any additions, deletions, or other revisions to project goals and scope, whether they increase or decrease the project cost or schedule (Ibbs et al., 2001). Lazarus and Clifton (2001) widen this definition and define the change in a construction project as anything that affects: 1) The scope, requirements or brief for the project; 2) The capital cost, whole-life cost or value of the project; 3)The time required to design or construct the project; 4) The project team relationships and appointments; 5) Project-associated risk allocation or scope; 6) The form of procurement.

The changes in projects are primarily due to rework, variations (change orders), or unexpected events such as industrial action and inclement weather (Love et. al, 2002).

The problems in rework are investigated in literature mainly under the heading of quality in construction, or cost of construction. The main causes of rework are DCs, construction changes and design errors (Love and Li 2000).

DCs, also referred as engineering changes(ECs) in the literature, are defined as changes and/or modifications in forms, fits, functions, materials, dimensions of products and constituent components (Huang et. al, 2001). The ECs are one of the biggest problems both in the construction and manufacturing industries. Three kinds of ECs are specified in the manufacturing industry depending on when they occur in the design process: 1) ECs during initial design, 2) ECs after the initial design period, 3) ECs during the major reconstruction of a product (Rouibah and Caskey 2003). The first two kinds are also observed in the construction industry as change in design development and change after design development, namely *pre-fixity change* and *post-fixity change* respectively (Lazarus and Clifton 2001). The impact of the changes occurring early in the design process is not very large. The second type, ECs after the initial design period, cause greater disruption since the production has already started. The third type of ECs in the manufacturing industry refers to the development of versions and variants of the product is not observed in the construction industry, since construction projects are one-off projects.

The most common reasons and sources referred in the literature for the change orders in construction can be summarised as: 1) Changed requirements of the employer; 2) Design errors such as mistaken quantity estimates, planning mistakes, inadequate arrangement of contract interfaces, inconsistency between drawings and site conditions, citation of inadequate specifications and etc.; 3) Unforeseen conditions regarding the site conditions or administrative aspects such as change of work rules/regulations, change of decision making authority, special needs for project commissioning and ownership transfer, neighbourhood pleading (Hsieh et. al, 2004; Cox et. al, 1999; Love et. al, 2002).

How to handle changes in construction projects?

Lazarus and Clifton (2001) divide the effects of the changes within the project team into two as direct effects and indirect effects. Direct effects are easily visible compared to indirect effects. Direct effects of change within the project team may be the need to review their work, change their project information and outputs, update their communications to the others, expend additional time and cost implementing the change, reorganise and schedule their work methods, production schedules and deliveries, introduce acceleration measures to maintain the project programme. Potential indirect effects include: increased coordination failures and errors, increased waste in the process from abortive work and out-of-sequence working, reduction in productivity, quality of the product and profit, uncertainty and consequently lower morale.

Most of the studies in the literature provide guidelines for how to manage changes. The principles of effective CM model set by CII (1994) are as follows: 1) Promote a balanced change culture, 2) Recognize change, 3) Evaluate change, 4) Implement change, 5)Continuously improvement from lessons learned. This model and the algorithms based on these principles are also published by Ibbs et. al (2001). Reviewing these principles and algorithms, Lazarus& Clifton (2001) proposed separate CM procedures for changes during design development, urgent post fixity changes and non urgent post fixity changes.

The EPSRC-funded research project ‘Managing Change and Dependency in Construction’ developed a toolkit enabling users to produce a rich description of the change event. The toolkit blends change prediction and CM with knowledge management concept and work flow approach. (EPSRC, 2005)

Love et. al (2002) investigates the CM through a system dynamics perspective and suggests that the dynamics of a project system should be evaluated and monitored by the project managers in accordance with the following functions: 1) Planning for being proactive; 2) Organizing; 3) Commanding; 4) Controlling.

Since most of the PCs are DCs, the design process requires more attention. Therefore another approach in literature aims at leading the companies to implement concurrent engineering to improve communication and handle changes quickly. Concurrent engineering and Design & Build approaches are believed to be more successful in minimising the number of design changes or coping with them during the construction stage provided that they have a well built communication system and focus on the customer needs (Moore and Dainty 1999; Faniran et. al 2001; Lau et. al 2003).

ORGANIZATIONAL CHANGE MANAGEMENT (OCM)

OCs are changes to organisational processes, changes in organisational functions, their organisation, co-ordination and control, changes in values, beliefs and human behaviour in terms of relationships to social rules and practices and changes in power distribution and the way organisational issues are influenced (Cao et al 2000). All of these are interconnected and affect each other.

The main reason for OCs and why they are organisation-specific can be explained by the Contingency Theory. According to contingency theory there is no “one best way” of structuring an organization. It all depends on the circumstances, referred to as contingencies (such as environment, organisational size, technology and organisational strategy), and each organisation will have different contingencies. According to the theory, organisations obtain high performances when the organisational characteristics fit these contingencies. Organisations try to avoid misfits which mean loss of performance; therefore, they adapt themselves according to the changing contingencies to maintain effectiveness. In other words, the will of fitting the organisational characteristics to the contingencies result in organisational change.

OCM has strong links with human resource management, risk management, organisational learning, strategic management, information technology management and quality management and overlaps with organisational development and organisational dynamics. Some OCs are known by their specific names according to the level they serve. Business process reengineering (BPR) and Total Quality Management (TQM) are examples of this. Another common terminology used in the literature to denote strategic radical changes is innovation. Emergent model of change has been given a number of different labels such as continuous improvement or organisational learning (Burnes, 1996).

The research in OCM has focused on three main areas: 1) barriers, success factors and change levers; 2) tools used; 3) perspectives.

Barriers, success factors and change levers for OC

When a change is to be introduced in an organisation, one of the barriers is the inevitable resistance from the employees. Sources of resistance to change have been analysed by authors in literature. The reasons are summarised as: fear of the unknown,

lack of information/knowledge/skill, threats to status, fear of failure, lack of perceived benefits, uncertainty regarding the change outcomes, lack of knowledge/skill, and internal politics (Ford et. al, 2002; Hoag et. al, 2002; Proctor and Doukakis, 2003).

Change is not just about how people act, but it is also about how they think and this perspective forms a basis for the link between CM in organisations and internal communication with the people responsible for making those changes happen (Kitchen and Daly, 2002). The reasons behind the resistance should be clearly known in order to take the correct action against it. Facilitation and support, manipulation or coercion are some methods to cope with the employee resistance but not very successful. Communication and employee empowerment, due to their contributions to overcome human resistance, are considered as key issues in effective and successful CM by many sources in literature. Education and communication can be used to overcome the resistance if it results from the lack of information, knowledge or skills. Effective communication effect a common understanding of the intended change and common perspectives over the specific issues (Rye,1996) and the ones affected from the change will understand why change is necessary and they will think that they have control over their destiny (Proctor and Doukakis, 2003; Holt et. al, 2000).

The organisational barriers to change other than the employee resistance are listed as: 1) A reward system that reinforces old ways of doing things, 2) Threats to existing balance of power, 3) Intergroup conflicts that inhibit cooperation, 4) Incompatibility of change process and organisational culture, 5) Heavy investment in previous decisions and courses of action(Smither et al 1996).

In order to strategically manage change, the following change levers, other than communication and empowerment, must be equally available for use (Tichy, 1982): 1) External Interface, 2) Mission, 3) Strategy, 4) Managing organisational mission/strategy processes, 5) Task, 6) Prescribed Networks, 7) Organisational process (Communication, problem solving and decision making), 8) People, 9) Emergent Networks. Through a cross-case analysis, Francis et. al (2003) suggest that five organisational and managerial competencies are needed for an organisation to undertake radical transformation with a probability of success: 1) Recognise the challenge; 2) Determine transformational strategy; 3) Require extensive innovation; 4) Manage systemic change; 5) Upgrade leadership processes.

OCM Tools

Organisational change is introduced to construction mostly through business process reengineering, total quality management or maturity models.

Introducing change through Business Process Reengineering (BPR)

Construction organisations are focused the on outcome and success of their individual projects, with relatively little consideration of the way to achieve the same success repeatedly and consistently. To increase the quality of the end product and productivity, they should focus on the processes followed and the elements and the sub-elements constituting the processes. The change for improvement can be inserted into the system in two ways; as lifecycle reengineering or as BPR. Lifecycle reengineering is a systematic incremental improvement program whereas BPR aims changing the manner in which business is done. The aim of BPR implementation is quick and substantial gains in organisational performance by starting from scratch in designing the core business process (Attaran, 2000).

It has been found that there is a lack of common and standardised terms and definitions for BPR and other types of improvements related to it (Al-Mashari et. al, 2001). It has been found weak in human and organisational issues and cost ineffective (Cao et. al, 2001; Vakola and Rezgui, 2000).

Several barriers to successful reengineering implementation are determined: poor top management support and involvement, lack of flexibility, lack of effective organisational communication, lack of proper training, failure to cope with people resistance, failure to assign organisation's best, misunderstanding and misapplication of the concept, and failure to test the process (Attaran, 2000). Although there have been some improvements in human and people issues, BPR fails to provide the OCM expectations since the results do not go beyond the process level.

Introducing change through maturity models

The maturity concept originated in the quality principles of Philip Crosby describing five evolutionary stages in adopting quality practices. Later on, this framework was modified for the software processes and was developed to include Capability Maturity Model (CMM) for software, which is the most popular maturity model in the literature (Humphrey, 1988). CMM describes five levels of increasing maturity for software process improvement. The maturity of the organisation increases with each level and each maturity level provides a layer in the foundation for continuous process improvement as shown in Figure 1. Each level comprises a set of goals that, when satisfied, stabilise an important component in the process, resulting in an increase in the process capability of the organisation (Paulk, 1993).

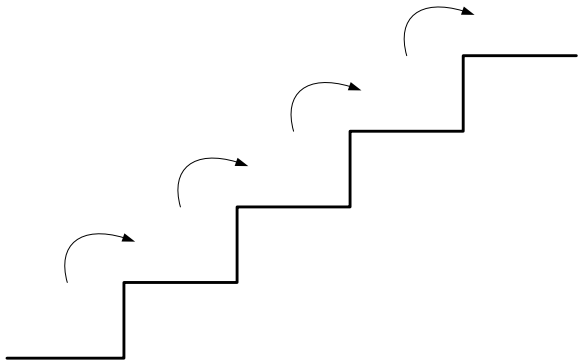

Figure 1: Maturity levels in CMM

The implementation of the maturity concept in construction is investigated in some projects. A hypothetical mechanism to explain how these capabilities may mature is offered for the process and IT capabilities of construction companies (Hinks et. al, 1997). The research project SPICE concerns the implementation of the maturity concept in construction and sets up a framework based on the principles of CMM model for software and focuses on upgrading the construction companies from level 1 to level 2. (Sarshar et.al, 2000; Finnemore et. al, 2000). All case studies in which SPICE were implemented had results supporting the concept. However, the maturity concept fails to provide the OCM expectations since it is at the process level and it is considered slow and ineffective.

Introducing change through TQM

Total quality (TQ) is defined as meeting customer requirements, where the customers may be both internal and external customers of the organisation. It comprises change invoked through four key components (Rye, 1996): 1) Systems, 2) Processes 3)

People, 4) Management. When organisations implement TQM, they are engaged in, inter alia, continuously improving operations, meeting customer requirements, reducing rework, thinking long range, increasing employee involvement, redesigning processes, conducting competitive benchmarking, measuring results constantly, and fostering closer relationships with suppliers (Singh and Smith, 2004).

Irani et. al (2004) discuss the concept of corporate culture, and place this social construct within the arena of TQM and conclude that the core concept of TQM, customer focus, linked with a continuous improvement plan that is supported by innovation can build a strong culture, which can positively improve an organisation's competitiveness and performance.

The main aim is to improve the organisation without making major changes; therefore, it has a high deficiency in achieving radical results. Most of the time TQM fails in reaching solutions beyond organising documentation and information transfer. TQM is not considered a very efficient OCM tool.

Perspectives in OCM

Tichy (1982) proposes that there are three perspectives in OCM: technical view, political view and cultural view. The technical view refers to changes due to new technologies, techniques and IT tools while the political view considers the allocation of power and resource problems an organisation faces. The cultural perspective refers to the shared beliefs, values and human behaviour in the organisation.

A study by Maguire (2000) investigates what to do when inserting a new information system/ technology in an organisation and proposes that there is a need for development methodologies to take a more business-led perspective. Gardner and Ash (2003) suggest that for an information and communication technology (ICT)-enabled environment, change is generated at the interface between people, technology, and change agents and it should be managed and shaped through mutual adjustment of the change implementation approaches employed by IT practitioners, line managers, and other stakeholders. Bartoli and Hermel (2004) investigate the problems of quality of design and implementation of innovation appear with IT, which result in non-quality in the overall operation of the company. In order to reduce these risks, the introduction and development of IT must be conceived and controlled as a true process of change with its global effects, considering the strategic, structural, cultural and behavioural barriers as well.

Cheng et. al (2001) discuss a CM approach for inserting an e-business model to support supply chain activities in construction. The factors supporting the e-business are addressed as resource planning, teamwork, process improvement tools and techniques, information management, training and development, and performance measurement. Moreover, the research discussed human resource, organisational and cultural issues and how to adapt the organisation to end up with a successful change.

FUTURE RESEARCH

There are many studies in literature focusing on project change management in construction, especially in recent years, aiming at increasing the benefits and minimising the costs. On the other hand, although there has been a lot of research on OCM, very little of this is focused on the construction industry and it does not go beyond implementations of TQM, BPR and maturity concepts with a slight mention of organisational issues. There has not been much research on the political and cultural

CM perspectives in construction. Some of the research has focused on the technical perspective of OCM in construction but not in depth.

The construction industry is constantly searching for new, efficient and effective IT-based collaboration methods. Although emerging information and communication technologies offer the construction industry many opportunities enabling computer supported collaborative environments, the companies adopting these technologies often fail in achieving the full benefits. This failure generally results from neglecting or underestimating the effects of the human, cultural and organisational factors on the success of the implementation or failing to build in the integration of these soft issues with the technologies.

These gaps in the literature are now studied by a new research project 'Planning and Implementation of Effective Collaboration in Construction (PIECC)' undertaken within the Civil and Building Engineering Department at Loughborough University in the UK. The project focuses on supporting high level strategic decision making to highlight areas where collaborative working may be improved incorporating the organisational, project and user needs. The organisational priorities for collaborative working are considered together with the project needs, user requirements and existing collaboration technologies to develop a decision making framework that can facilitate the strategic planning and implementation of effective collaborative working policies and practices. When carefully planned, and if based on informed decisions, it is believed that these policies and practices will help organisations improve their collaborative working, achieve full benefits from it, and maximise the use of tools and techniques available.

The project has two main research areas: one of them is the collaborative technologies while the other one is the CM required for the successful implementation of these technologies. One of the main arguments of the project is that effective successful collaborative environments realising the proper integration can only be achieved through thorough CM at the organisational level.

The CM part of the research aims at establishing how to introduce collaborative environments to construction and how to manage the change required to obtain full benefits. The CM process will focus on both project level and organisational level. The research objectives will be: 1) Conduct an industry survey to map the current CM approaches in construction companies; 2) Determine how specific collaboration systems are implemented in the sector through case studies; 3) Develop an improved CM framework based on the results of case studies and theoretical foundations; 4) Test and evaluate the framework proposed.

CONCLUSION

This paper has reviewed the findings of a literature review on change and CM concepts in construction. It has found that CM occurs at the project level and at the organisational level. The classifications of the changes and the nature of changes are reviewed and the enablers, barriers to CM are discussed. The CM tools for each level are reviewed and a recent research project on collaborative working, PIECC, is introduced. The future research steps on the CM part of the project are explained.

REFERENCES

Al-Mashari, M, Irani, Z, Zairi, M (2001) Business process reengineering: a survey of international experience, *Business Process Management*, 7(5), 437-55

Attaran, M (2000) Why does reengineering fail? A practical guide for successful implementation, *Journal of Management Development*, 19(9), 794-801

Bartoli, A., Hermel, P., 2004, Managing change and innovation in IT implementation process, *Journal of Manufacturing*, 15(5), 416-25

Burnes, B (1996) No such thing as…a "one best way" to manage organisational change, *Management Decision*, 34(10), 11-8

Cao, G, Clarke, S, Lehaney, B (2004) The Need for a Systematic Approach to Change Management- A Case Study, *Systemic Practice and Action Research*, 17(2), 103-26

Cao, G, Clarke, S, Lehaney, B (2001) A critique of BPR from a holistic perspective, *Business Process Management Journal*, 7(4), 332-39

Cao, G, Clarke, S, Lehaney, B (2000) A systemic view of organisational change and TQM, *The TQM Magazine*, 12(3), 186-93

Cheng, E W L, Li, H, Love, P E D, Irani, Z (2001) An e-business model to support supply chain activities in construction, *Logistics Information Management*, 14(1/2), 68-77

Construction Industry Institute (CII) (1994) *Project Change Management*, Special Pub. 43-1

Concise Oxford Dictionary (1990) 8ed., ed R.E., Alien

Cummings, T G, Worley, C G (1997) *Organization Development and Change*, 6ed. St. Paul: West Publishing.

Cox, ID, Morris, JP,Rogerson,JH,Jared,GE (1999) A quantitative study of post contract award design change in construction, *Construction Management&Economics*, 17, 427-39

EPSRC- Engineering and Physical Sciences Research Council Industrial Report (2005)Managing Changes in Construction Projects

Faniran, O O, Love, P E D, Treloar, G, Anumba, C J (2001) Methodological issues in design-construction integration, *Logistics Info Management*, 14(5/6), 421-6

Finnemore, M, Sarshar, M, Haigh, R (2000) Case Studies in Construction Process Improvement, *ARCOM Doctoral Workshop on Construction Process Research*, Loughborough, UK

Ford J D; Ford L W, McNamara R T (2002) Resistance and the background conversations of change, *Journal of Organizational Change Management*, 15(2), 105-21.

Francis, D, Bessant, J, Hobday, M (2003) Managing radical organisational transformation, *Management Decision*, 41/1, 18-31

Gardner, S, Ash, CG (2003) ICT-enabled organisations: a model for change management, *Logistics Information Management*, 16(1), 18-24

Hinks, J, Aouad, G, Cooper, R, Sheath, D, Kagioglu, M, Sexton, M (1997) IT and the design and construction process: A conceptual model of co-maturation, *International Journal of Construction Information Technology*, 5(1), 1-25

Hoag, B G, Ritschard, H V, Cooper, C L (2002) Obstacles to effective organizational change: the underlying reasons, *Leadership & Organization Development Journal*, 23(1), 6-15

Holt, G, Love, P E D, Nesan, L J (2000) Employee empowerment in construction:an implementation model for process improvement, *Team Performance Management*, 6(3/4), .47-51

Hsieh, T, Lu, S, Wu, C (2004) Statistical analysis of causes for change orders in metropolitan public works, *International Journal of Project Management*, 22, 679-86

Huang, G Q, Yee, WY, Mak, K L (2001) Development of a web-based system for engineering change management, *Robotics and Computer Integrated Manufacturing*, 17, 255-67

Humphrey, W. S., 1988, Characterizing the Software process, *IEEE Software*, 5(2), 73-79

Ibbs, C W, Wong, C K, Kwak, Y H (2001) Project Change Management System, *Journal of Management in Engineering*, 17 (3),159-65

Irani, Z, Beskese, A, Love, P E D (2004) Total quality management and corporate culture: constructs of organisational excellence, *Technovation*, 24, 643-50

Kast, F E, Rosenzweig, J E (1974) *Organization and Management: A Systems Approach*, McGraw-Hill, USA

Kitchen, P J, Daly, F (2002) Internal communication during change management, *Corporate Communications*, 7(1), 46-53

Lau, H Y K, Mak, K L, Lu, M T H (2003) A virtual design platform for interactive product design and visualization, *Journal of Materials Processing Technology*, 139, 402-7

Lazarus, D, Clifton, R (2001) *Managing project change: A best practice guide*, CIRIA C556, London, UK

Love, P E D, Holt, G D, Shen, L Y, Li, H, Irani, Z (2002) Using systems dynamics to better understand change and rework in construction project management systems, *International Journal of Project Management*, 20, 425-36

Love, P E D, Li, H (2000) Quantifying the causes and costs of rework in construction, *Construction Management and Economics*, 18, 479-90

Maguire, S (2000) Towards a "business-led" approach to information systems development, *Information Management& Computer Security*, 8/5, 230-8

Moore, D R, Dainty, A R J (1999) Integrated project teams' performance in managing unexpected change events, *Team Performance Management*, 5(7), 212-222

Paulk, M C, Curtis, B, Chrissis, M B, Weber, C V (1993) *Capability Maturity Model for Software, version 1.1*, SEI, Carnegie Melon University, Pittsburgh, USA

Proctor, T, Doukakis, I (2003) Change management: the role of internal communication and employee development, *Corporate Communications*, 8(4), 268-77

Rouibah, K, Caskey, K R (2003) Change management in concurrent engineering from a parameter perspective, Computers in Industry, 50, 15-34

Rye, C (1996) *Change Management Action Kit*, Kogan Page, UK

Sarshar, M, Haigh, R, Finnemore, M, Aouad, G, Barrett, P, Baldry, D, Sexton, M (2000) SPICE: A Business Process Diagnostics Tool for Construction Projects, *Journal of Engineering Construction and Architectural Management*, 7(3)

Singh, P J, Smith, A J R (2004) Relationship between TQM and innovation: an empirical study, *Journal of manufacturing Technology Management*, 15(5), 394-401

Smither, R D, Houston, J M, Mclntire, S D (1996) *Organization Development: Strategies for Changing Environments*, HarperCollins College Publishers, NY, USA

Vakola, M, Rezgui, Y (2000) Critique of existing business process reengineering methodologies- the development and implementation of a new methodology, *Business Process Management*, 6(3), 238-50

Voropajev, V (1998) Change management- A key integrative function of PM in transition economies, *International Journal of Project Management*, 16 (1), 15-9

Tichy, N M (1982) *Strategic change management*, John Wiley&Sons, USA