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MODEL FOR INTEGRATED PROJECT MANAGEMENT

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Abstract. Although there has been important research on construction management's life cycle, stakeholders, micro and macroenvironment, there has not been a model defined that can link the above. This while the need to integrate construction management's life cycle, stakeholders, micro and macroenvironment into both theory and practice is essential. The Model for integrated project management, described in this paper, consists of six stages. The purpose of this study is also to examine micro and macroenvironment impact on efficiency of project managers and project performance, based on the proposed Model. We conclude that the proposed Model offers a promising research toward improving construction management efficiency through giving construction managers method for enhancing a project's efficient micro and macroenvironment.

Keywords: integrated project management, micro and macroenvironment, stakeholders, life cycle, global development trends, alternatives, modelling and forecasting.

1. Introduction

Project management in the construction involves coordination of many tasks and stakeholders, affected by complexity and uncertainty, which increases the need for efficient cooperation and multiple criteria decision making.

There is no single accepted or correct definition of project management and there are as many definitions of project management as there are people capable of defining it:

- Construction Management refers either to the study and practice of the managerial and technological aspects of the construction industry (including construction, construction science, construction management, and construction technology), or to a business model where one party to a construction contract serves as a construction consultant, providing both design and construction advice[1].
- Where a contractor is engaged to manage the construction of a project for an agreed fee and the trade contractors are engaged either directly by the client or an open book analysis[2].
- The application of modern management techniques and systems to the execution of a project from start to finish, to achieve predetermined objectives of scope, quality, time and cost, to the equal satisfaction of those involved[3].
- Project management is a critical skill required for execution. It is an essential organizing and managerial discipline in getting things done. The art of managing the product and service development cycle to achieve a balance of time, cost and quality is project management[4], etc.

The Construction Management Association of America[5] indicates the 120 most common responsibilities of a construction manager fall into the following 7 categories: project management planning, cost management, time management, quality management, contract administration, safety management, and CM Professional Practice which includes specific activities like defining the responsibilities and management structure of the project management team, organizing and leading by implementing project controls, defining roles and responsibilities and developing communication protocols, and identifying elements of project

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design and construction likely to give rise to disputes and claims[1].

The primary challenge of project management is to achieve all of the project goals and objectives while honouring the project constraints. Typical constraints are scope, time and budget. The secondary—and more ambitious—challenge is to optimize the allocation and integration of inputs necessary to meet pre-defined objectives. A project is a carefully defined set of activities that use resources (money, people, materials, energy, space, provisions, communication, motivation, etc.) to achieve the project goals and objectives[1].

Useful techniques in project management include the concepts of cash flow and present worth, decision tree analysis, critical resource analysis and critical path scheduling[6].

Integrated project management has various approaches and different priorities in different countries. It is not surprising that there are widely divergent views and interpretations in various countries, with marked differences between countries that have a developed market economies, those with transition economies and in developing countries. Not all countries with one of these three development levels, understand integrated project management in the same way and so have different strategies.

Successful strategies for integrated project management should be more-or-less compatible with economic, social, cultural, institutional, technological, technical, cultural, environmental and legal/regulatory situations in the country under consideration. A varied spectrum of strategies can be launched, while keeping in mind that the mix of influencing factors and the relative emphasis is on one or other of the factors and overall will depend on local conditions.

Therefore, the best integrated project management strategy of another country cannot just be copied. Strategies may only be adapted to a real economic, social, cultural, institutional, technological, technical, cultural, environmental, legal/regulatory and the provisional situation of the existing state. There is no such thing as a single integrated project management strategy to suit all projects and that could be applied to all countries.

It can be noticed that researchers (see Chapters 3 and 4) from various countries engaged in the analysis of a construction project management but did not consider the research object as was analysed by the authors of the present investigation. A life cycle of a construction project management may be described as follows: the stakeholders involved in its design and its realization as well as the micro and macroenvironments, having a particular impact on it and making an integral whole. The paper is structured as follows. Following this introduction, Section 2 describes the Model for integrated project management. In Section 3 we have analysed an effect of changing the macro and microefficiency level factors on the efficiency of integrated construction management. Methods of multiple criteria analysis of integrated construction management are presented in Section 4. Performance of transformational learning and redesigning the manager's mental and practical behaviour are presented in Section 5. Finally, some concluding remarks are provided in Section 6.

2. Model for integrated project management

The research's aim was to produce a Model for integrated project management by undertaking a complex analysis of micro and macroenvironment factors affecting it, and to present recommendations on increasing its competitive ability. The research was performed by studying the expertise of advanced industrial economies and by adapting it to Lithuania by taking into consideration its specific history, development level, needs and traditions. A simulation was undertaken to provide insight into creating an effective environment for the Model by choosing rational micro and macro factors. The level of efficiency of the integrated project management depends on the many micro and macrolevel variable factors and all these variable factors can be optimized. The main objective of this Model is to analyse the best experiences in the field, to compare it and consequently to present particular recommendations. In this particular case, the construction management development perspectives of Lithuania were analysed.

The word 'model' implies 'a system of game rules', which the integrated project management development could use to its best advantage. The stakeholders of the integrated project management cannot correct or alter the micro and macrolevel variables, but they can go into the essence of their effect and take them into consideration in their activities. Stakeholders, by knowing the environment affecting their projects, can organize their present and future activities more successfully. *This research included the following six stages.*

Stage I. Comparative description of the integrated project management in developed countries and in Lithuania:

- A system of criteria characterizing the efficiency of integrated project management was determined by means of using relevant literature and expert methods;

- Based on a system of criteria, a description of the present state of integrated project management of developed countries and Lithuania is given in conceptual (textual, graphical, numerical, etc.) and quantitative forms.

Stage II. A comparison and contrast of integrated project management in developed countries and Lithuania includes:

- Identifying the global development trends (general regularities) of the integrated project management;
- Identifying integrated project management differences between developed countries and Lithuania;
- Determining pluses and minuses of these differences for Lithuania;
- Determining the best practice for integrated project management for Lithuania as based on the actual conditions.
- Estimating the deviation between construction managers' knowledge of worldwide best practice and their practice-in-use.

Stage III. A development of some of the general recommendations as how to improve the efficiency levels for construction managers and construction firms.

Stage IV. Submissions of particular recommendations for construction managers and construction firms were presented at this stage. Each of the general recommendations proposed in the fifth stage carry several particular alternatives.

Stage V. A multiple criteria analysis (Ginevičius 2008; Ginevičius and Podvezko 2008; Ginevičius *et al.* 2008; Ginevičius and Krivka 2008; Kaklauskas 1999; Kaklauskas *et al.* 2005, 2007a, b; Zavadskas *et al.* 1994, 2008) of integrated project management's components and a selection of the most efficient version of project's management life cycle were determined at this stage. After this stage, the received compatible and rational components of integrated project management are joined into the full integrated project management process by using intelligent systems (Kaklauskas and Zavadskas 2002; Kaklauskas *et al.* 2006a, b, 2007c; Kaklauskas and Zavadskas 2007).

Stage VI. Performance of transformational learning and redesigning the mental and practical behaviour:

– Construction managers (firms) becoming aware and conceptualize of their practice-in-use;
– Construction managers (firms) becoming aware and conceptualize of their knowledge of worldwide best practice;
– Construction managers (firms) estimating the deviation between knowledge of worldwide best practice and their practice-in-use;
– Performance of best practice learning;
– Fulfilling of best practice actions (understanding what the recurring motives caused managers' initial behaviour are; redesigning managers' core patterns of thought and behaviour);
– Performance of transformational learning (acquiring new manners of technological, social, ethical, etc. behaviour, get better understanding of how to interact with micro and macroenvironment) and redesigning the behaviour.

The above models have already been applied for Lithuanian construction industry development (Kaklauskas 1999; Zavadskas and Kaklauskas 2008), sustainable development of Vilnius (Zavadskas *et al.* 2004), housing credit access (Zavadskas *et al.* 2007), facilities management (Lepkova *et al.* 2008).

In order to throw more light on the Model for integrated project management, further follow more detailed description of some above-mentioned stages of analysis (the effect of changing the macro and microefficiency level factors on the efficiency of integrated construction management and methods of multiple criteria analysis of integrated construction management).

3. The effect of changing the macro and microefficiency level factors on the efficiency of integrated construction management

One of the major tasks of a construction manager is to carry out its activities under the most favourable micro and macrolevel environment conditions. Efforts are made to ensure that the structure, goals, output, efficiency and quality of production of the organization would be in maximum conformity with the existing environmental conditions. The pursuit of impracticable goals, for instance, trying to realize projects which surpass the organization's capabilities or the environment (economic, social, legal, political, competitive and technological conditions) is adverse, may cause undesirable consequences.

In order to assure the efficiency of project management, it should be executed within certain bounds which are determined by micro and macrolevel factors.

3.1. Macroefficiency level factors

The highest level at which efficiency factors may be considered is the macroefficiency level factors. The level of efficiency and the scope of activities of the project management depend on the different macrolevel variable factors (see Fig. 1).

Demand		Insurance		Financial sector
Supply				Interest rate
Legislation				Environment issues
Politics				Unemployment
		Efficiency of the project management depends on the different macrolevel variable factors		
Culture				Labour skill level
Religion				Wages level
Inflation				Physical infrastructure
Innovations		Exchange rate		Unofficial economy

Fig. 1. Efficiency of the project management depends on the different macrolevel variable factors

As an example, further on we shall briefly discuss some above-mentioned macroefficiency level factors.

Miller (1992) argued that international firms are exposed to five types of international risk: natural, legal, societal, political and governmental. Daniell (2000) confined such risk to four components: financial, cultural, legal and political. Similar components were reported by Hill (2002), excluding financial risk. Butler and Joaquin (1998) defined the term as the risk that a sovereign host-government will unexpectedly change the 'rules of the game' under which a business operates. Political risk, as suggested by Brink (2004) and Stosberg (2005), arises not only from governmental, but also societal sources. Howell (2001) referred the term 'political risk' to the possibility that political decisions or political or societal events in a country will affect the business climate in such a way that investors will lose money or not make as much money as they expected when the investment was made.

Typically, political risk insurance, as reported by Bradford (2005), covers assets against expropriation, confiscation, contract repudiation and currency inconvertibility. Political risk, meanwhile, should encompass all political and societal events that can harm international projects, internal or external, insurable or uninsurable and favourable or unfavourable (Wilkin 2001); should not focus exclusively on the most extreme forms of political risk, such as forced disinvestment; rather it should include the more common, but milder risks (Nawaz and Hood 2005).

Governments, according to Burmester (2000), are extremely influential actors in international business. A government has a variety of interests and may pursue a course of action that affects the business environment for good or bad. The government of a country, on the one hand, is usually keen to encourage the development and growth of commerce and industry (Minor 2003). The government, as a result, might offer incentives to encourage new investment from abroad, for example by offering tax incentives or cash grants towards the building of factories. To the host-government, as explained by Brink (2004), international projects can represent an important source of funds, technology and expertise that could help further national priorities such as regional development, employment, import substitution and export promotion. The government of a country, on the other hand, may also intervene in the business environment for a variety of reasons. Such reasons include: protecting national industries from external competition; limiting foreign exploitation; increasing national welfare; redistributing wealth (Bartlett *et al.* 2004).

Taxation can also be used either to encourage or restrict particular industries. In the event of imposing taxation restrictions, a firm's expenditure increases and, as a consequence, its profits decrease. However, as a result of the importance of foreign investment to a country's economic growth, a government may encourage inward investment by, inter alia, offering tax incentives (Chartered Institute … 2001) rather than imposing tax restrictions. The importance of foreign investment to a country's economic growth may, therefore, explain the little attention paid to taxation restrictions by international projects, while operating internationally (Stosberg 2005).

A government may terminate contracts without compensation for existing investment for reasons related to contract performance. Since such risk can have devastating impact upon firms, the breach of contract, according to Moran (2001), is considered as an important risk of concern to international projects. In this context, firms with large fixed assets are more vulnerable to such risk and still 'worry' about the terms of their operating agreements being changed (Kettis 2004).

3.2. Microefficiency level factors

The second level factors may be considered as the microlevel and these depend upon those at the macrolevel. In order to efficiently implement project management, it is necessary to investigate as many of the possible alternative solutions for each variable and to select the most rational one. The selected variables are then combined into one efficient integrated project management life cycle. Hence, the efficiency of a project management will depend to a very great extent not only on the selected variables, but also on macro and microfactors affecting them.

The level of efficiency and the scope of activities of the integrated project management depend on the next groups of microvariable factors:

– strategy/portfolio management;
– operations research (decision sciences);
– organizational behaviour (human resources management);
– information technology (information systems);
– technology applications (innovation);
– performance management (earned value management);
– engineering and construction;
– quality management;
– motivation;
– risk management;
– electronic markets.

Microenvironment have a direct impact on integrated project management opportunities. This may facilitate integrated project management or, on the contrary, may create constraints. Until recently, researchers were unable to reach a unanimous conclusion as to the structure of factors of microenvironment and therefore several variations can be found in articles and books on this subject.

Problems related to the management of projects are addressed in many studies. Sambasivan and Wen Soon (2006) present several causes for losses in construction project management, such as a contractor's faulty planning, inadequate contractor experience, problems with subcontractors, shortage of material, non-availability of and failures in equipment, lack of communication between parties and mistakes during the construction stage.

Some considerations on construction project management at the building site need to be emphasized such as the high degree of current uncertainty about the construction process, the predominance of excessively informal decision aid coming from the project manager and the exaggerated over-emphasis given by project managers to controlling time and costs (Laufer, Howell 1993). According to Cooke-Davies (2002) there have been several past studies on the success of projects and which factors lead to project success. Despite this, a project may still under-perform and an understanding of project success factors alone is not sufficient for the success of a project (Pheng and Chuan 2006).

The role of the project manager and his/her leadership style has been addressed as important aspects for the success of a project (Pheng and Chuan 2006), although most of the literature ignores this (Turner and Muller 2005). Greek and Pullin (1999) also assert that many construction project management teams do not focus on those critical issues of projects. Project management, according to these authors, is an activity characterised by failure and these failures happen for two basic reasons: technical uncertainty and misjudgement of a project's urgency.

Baker *et al.* (1983) defined project success as follows: "If the project meets the technical performance specifications and/or mission to be performed and if there is a high level of satisfaction concerning the project outcome among: key people in the parent organization, key people in the client organization, key people in the project team and key users or clientele of the project effort, the project is considered an overall success (Baker *et al*. 1983)".

Freeman and Beale (1992) concluded that success means different things to each individual. An architect may consider success in terms of aesthetic appearance, an engineer in terms of technical competence, an accountant in terms of dollars spent under budget, a human resource manager in terms of employee satisfaction, etc.

Sayles and Chandler (1971) listed five critical success factors for a project. These are project manager's competence, scheduling of activities, control systems and responsibilities, monitoring of project and continual involvement in the project. Martin (1976) identified eight success factors in a project. These are defined goals, organizational philosophy, management support, proper delegation of duties, selection of team, proper allocation of resources, information mechanism and planning reviews. Morris and Hough (1987) found nine success factors of a project. These are clear project objectives, technical uncertainty innovation, politics, community involvement, schedule duration urgency, finance, legal agreement, contracting and solving of problems.

According to Liu and Walker (1998), project success is a concept which can mean so much to so many different people because of varying perceptions, and leads to disagreements about whether a project is successful or not. Avots (1972) identified reasons for project failure and concluded that the wrong choice of project managers, unplanned project termination and unsupportive top management were the main reasons for the failure of a project. Hayfield (1979) established two sets of factors that determine the successful outcome of a project. According to Hayfield (1979), these are macro and microfactors. The macrofactors include realistic and thorough definition of the project, efficient manner of project execution, comprehension of project ''environment'' and selection of organizations for realizing the project. On the other hand, the microfactors include formulation of sound project policies, clear and simple project organization, selection of key personnel, efficient and dynamic management controls and reliable management information systems.

Might and Fischer (1985) investigated structural factors assumed to affect project success. These factors include the organizational structure, the level of authority delegated to the project manager and the size of the project. They found a weak relationship between organizational structure and project success and no relationship between project size and success. Delegation of authority was found to be positively related to all internal measures of success.

Pinto and Slevin (1988) reported that critical success of a project depends on ten factors. These are project mission, top management support, project schedules, client consultation, personnel recruitment, technical tasks, client acceptance, monitoring and feedback, communication and trouble-shooting. Anton (1988) listed six factors to enhance project success. These factors are planning effort in design and construction, project manager goal commitment, project team motivation, project manager technical capabilities, scope and work definition and control system.

Belassi and Tukel (1996) categorized success factors into four main groups. These are factors relating to the project managers, factors relating to the project, factors relating to the organization and factors relating to the external environment.

A construction project is characterized by a high number of project participants and a multitude of contract relations. The Principal Agent Theory deals with the design of contracts, especially with respect to asymmetric information. Asymmetric distribution of information in cooperations can have effects before as well as after closing a contract. In construction project management therefore attention has to be paid to where information imbalances occur. Several methods are known with which one can cope with the resulting problems but which in turn cause costs (Schieg 2008).

Typically, the construction industry includes four parties: an owner, a designer (architect or engineer), the builder (usually called the general contractor), and the government (local laws and regulations). Traditionally, there are two contracts between these parties as they work together to plan, design, and construct the project. The first contract is the owner-designer contract, which involves planning, design, and construction administration. The second contract is the owner-contractor contract, which involves construction. An indirect, third-party relationship exists between the designer and the contractor due to these two contracts[1]. An alternate contract or business model replaces the two traditional contracts with three contracts: owner-designer, owner-construction manager, and owner-builder. The construction management company becomes an additional party engaged in the project to act as an advisor to the owner, to which they are contractually tied. The construction manager's role is to provide construction advice to the designer, on the owner's behalf, design advice to the constructor, again on the owner's behalf, and other advice as necessary[1]. Strategic planning is crucial for the survival of a company, wide-ranging decisions about future action must be taken. The information basis for such decisions is often gained from forecasts about the future with more or less accurate probability of the assumed event occurring. Electronic markets have been the subject matter of numerous investigations in recent years and if organized correctly show a high degree of accuracy in forecasting future events relevant to the business of a company. In major enterprises prediction markets have already been used successfully as a new kind of prognostic instrument. It is also suitable, however, for small and medium-sized enterprises for the gathering and assessment of the information available to the employees. When developing prognostic markets it is necessary to take into consideration psychological factors, which could favour incorrect results (Schieg 2005).

4. Methods of multiple criteria analysis of integrated construction management

The determination of the utility degree and value of the integrated construction project management under investigation and establishment of the priority order for its implementation does not present much difficulty if the criteria numerical values and weights have been obtained and the multiple criteria decision making methods are used.

When drawing up the system of criteria that fully describes the life cycle of construction management, it is worthwhile taking into account the suggestions of other researchers. This is explained by the fact that the goals pursued by the stakeholders and the system of criteria describing the integrated construction management in a certain sense is rather subjective. Therefore, in order to increase the degree of objectivity, the authors shall rely on the suggestions of specialists working in this field, when drawing up the system of criteria describing the integrated construction management. As example, some criteria systems are presented below.

Sidwell (1983) listed several criteria which were generally used to evaluate a project. These include time, cost, aesthetics, function, quality, client's satisfaction and team members' relation. Pinto and Slevin (1988) also argued that the triple constraints approach toward project evaluation is too simplistic. They highlighted customer satisfaction as an important criterion for project evaluation, in line with Sidwell's (1983) evaluation method.

Freeman and Beale (1992) identified seven main criteria used to measure project success. Five of the frequently used criteria were the technical performance, efficiency of execution, managerial and organizational implications, personal growth and manufacturer's ability and business performance. Shenhar *et al.* (1997) mentioned that it is necessary to understand the two components of project success in order to measure success, which may comprise of project management success or product success, or both. Project management success measured in terms of cost, time and quality can be viewed as internal measures of efficiency while product success is concerned with the project's external effectiveness.

Contractor prequalification is characterized as a multicriteria problem with uncertain inputs. The criteria used for contractor prequalification include qualitative and quantitative information. Owing to the nature of prequalification which depends on subjective judgements of construction professionals, it becomes an art rather than a science. Further, there is an inherent nonlinear relationship between the input and the output of contractor's prequalification models (El-Sawalhi *et al.* 2007).

The most important element in construction procurement is the contractor selection, which can result from contractor's ranking. Contractor prequalification is essential in most construction projects, and the process has been performed by many different methods in practice. In most studies of contractor selection, selection criteria are assumed to be independent of each other. However, these criteria are likely to affect each other (Darvish *et al.* 2008).

Risk management is used more and more in building industry projects. An essential element of the risk management process is the analysis and evaluation of risks. Therefore, project assessment with the help of the post-mortem analysis plays an important role. The post-mortem analysis is a tool frequently used in software projects today for the reduction of risks. The clearness of the goal of improvement measures is sharpened by the examination of the project steps in connection with the success factors of the organization. The results of a post-mortem analysis deliver detailed information on where improvement measurements are necessary in the project future. Growth in project management know-how is created through the discussion of the participants of all hierarchy levels. Therefore, the post-mortem analysis is also applicable for use in the construction project. The procedure is introduced in the work at hand (Schieg 2007).

By adopting risk management, savings potential can be realized in construction projects. For this reason, for project managers as well as real estate developers, a consideration of the risk management process is worthwhile. The risk management process comprises 6 process steps, which will be discussed in greater detail below. The integration of a risk management system in construction projects must be oriented to the progress of the project and permeate all areas, functions and processes of the project. In this, particular importance is attached to the risks in the personnel area, for, particularly for enterprises providing highly qualified services, specialized employees are essential for market success (Schieg 2006).

The multiple criteria decision making area has a large set of tools, the purpose of which is to help the decision-maker solve a decision problem by taking into account several, often contradictory, points of view. In general, multiple criteria decision making methods are divided into three large families (Vincke 1992): unique synthesis criterion, consisting of aggregating different points of view into a unique function which must subsequently be optimised; the outranking synthesis approach, using methods which aim first to build a relation, called an outranking relation, which represents the decision-maker's strongly established preferences, given the information at hand; and the interactive local judgment approach, proposing methods which alternate calculation steps and dialogue steps.

Multiple criteria decision making methods have been applied to a variety of problems, such as maintenance outsourcing (Almeida 2005), construction and real estate (Ginevičius 2008; Ginevičius and Podvezko 2008; Ginevičius *et al.* 2008; Ginevičius and Krivka 2008; Kaklauskas 1999; Kaklauskas *et al.* 2005, 2007a, b; Zavadskas *et al.* 1994, 2008), maintenance strategy (Almeida and Bohoris 1996), water supply management (Morais and Almeida 2007), project risk assessment (Zeng *et al.* 2007), multi-criteria risk analysis (Brito and Almeida 2008), service outsourcing contracts (Almeida 2007) and construction bidding (Seydel and Olson 2001). Mian and Dai (1999) show the main decision problems related to project management to be resource allocation, prioritising the project portfolio, selection of managers, budget evaluation and selection of salespersons.

Mota *et al.* (2008) present a model for supporting project managers to focus on the main tasks of a project network using a multiple criteria decision aid (MCDA) approach.

The researchers from various countries engaged in the analysis of construction management life cycle and its stages did not consider the research object being analysed by the authors of the present investigation. The latter may be described as follows: the life cycle of construction management, the stakeholders involved in its design and realization as well as micro and macroenvironment having a particular impact on it making an integral whole. To investigate the research object defined in the present research, some methods of multiple criteria analysis were applied.

5. Performance of transformational learning and redesigning the managers' mental and practical behaviour

Performance of transformational learning and redesigning the managers' mental and practical behaviour included six stages (Fig. 2).

Once construction managers become aware and conceptualize of their practice-in-use, they can begin the process of changing their practice-in-use to become aligned with their knowledge of worldwide best practice.

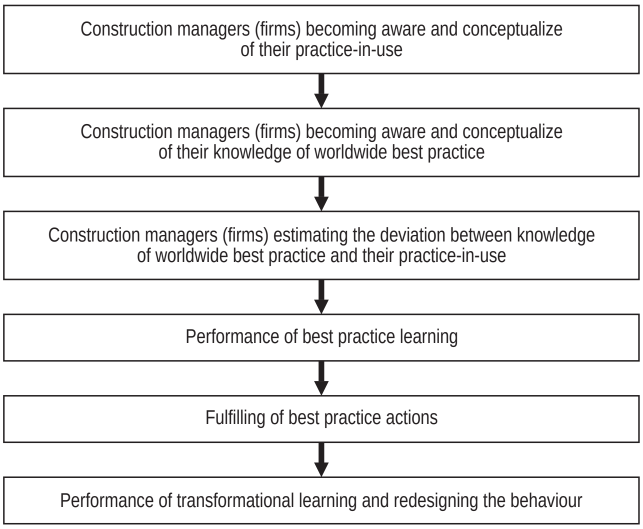

Fig. 2. Performance of transformational learning and redesigning the managers' mental and practical behaviour

If construction manager's activities produce an unsatisfactory result, he changes activities to amend the result. However, if he is unable to observe the typical situations that led to the not rational result occurring, it is likely that problems will continue to appear. The aim of best practice activities is to redesign construction managers' core patterns of thought and behaviour according to their knowledge of worldwide best practice. This is achieved if, after performing the best practice learning process and correcting construction managers' mistakes, managers go one step further and ask what the recurring demands and objectives that caused their initial mental and practical behaviour are. In redesigning the way managers think that he can become less protective, more open, and gradually more aware. This is the point where individual mental and practical behaviour change occurs.

There is a quite close relationship between best practice activities and construction managers' learning abilities. Construction managers who shifted from best practice learning to best practice activities are able to take on more responsibility, and better respond to micro and macroenvironment around them. The managers are able to test potential ideas, solutions, and develop possible alternatives to deal with likely results. Construction managers became more confident in their interpersonal skills and more inspired in problem-solving.

Also, it is possible to apply the best practice actions process to construction firms. For contractors to perform better, mistakes that occur should not simply be corrected, as occurs in best practice learning process. Rather, the underlying framework in the firm that led to the error occurring should be analysed. In this way, contractors can improve their goals, strategies, plans, technologies, values or beliefs, to improve their overall functionality.

Yeo (2006) examined a Singaporean higher learning institute that was being gradually transformed into a learning organization through the use of reflective-action learning groups. Reflective-action learning groups were intended to provide a specific forum for staff (the members of the firm) to analyse teaching and learning effectiveness in order to improve their skills in these areas.

Blackman and Henderson (2001) compare an organisation's knowledge system with a washing machine: In order for clothes to be really clean (which represents attaining new knowledge), all previous dirt (which represents experiences) must be removed. This means that, before a cleansing rinse commences, the dirty water has to be totally drained away. If even a small amount of the previous dirty water remains (representing the ingrained, limiting systems of learning), it will spread through and taint the entire rinse (making it impossible for fresh learning to occur) (Blackman and Henderson 2001).

Transformational learning investigates the context and nature of the learning process itself, and by extension, putting construction manager under the microscope. Transformational learning involves considering why managers think and act in the manner managers do, and exploring underlying hidden patterns of thinking and acting. Just as best practice actions go one step further than best practice learning by asking construction managers to examine the internal processes that led to the erroneous behaviour occurring, transformational learning goes one step further again, asking construction managers to consider why those particular internal processes even exist, and whether there are other factors operating on a subconscious level to affect construction managers' behaviour. In a contractor context, transformational learning also involves examining core principles on which the contractor is set, and testing its mission, vision, market position, technology and culture.

Utilising transformational learning techniques increases construction managers' awareness, helping construction managers gain more control over the factors that affect their behaviour, which ultimately helps construction managers to achieve required goals. By observing construction managers' language, premises, opinions, responses, and mental models that influence the way managers interact, managers enhance ability to create genuinely new manners of technological, social, ethical, etc. behaviour, habits of learning, and improve understanding of how to interact with micro and macroenvironment. This helps construction managers and contractors achieve goals more effectively, as managers become able to identify and remove barriers to goals. Transformational learning can be defined as creation of a setting where conscious collective mindfulness can be maintained. By using transformational learning techniques, individuals can learn to think and act together, ways that will benefit the firm.

Blackman and Henderson (2001) claimed that once firms are set in a particular routine, it is very difficult to implement change. The routines tend to perpetuate themselves, making it difficult for employees to extend beyond the ideas and processes already in place. Walsh and Ungson (1991) argue that it is very difficult to erase firmal memory because it is a result of a repeated action (whether appropriate/effective or not), and once the result has been associated with the action, it is defined and fixed as a process within the firm. Blackman and Henderson (2001) note the self-referential nature of learning processes as a barrier to learning: the organization will decide what it considers it needs to know, predetermining the knowledge that employees will then seek, meaning that all knowledge entering the organization is filtered.

Just because the routines, filters and self-referential systems are so deeply implanted in the construction firm, best practice actions cannot operate rationally. Because construction managers have become so deep-rooted within the routines and self-referential systems of learning embedded in the firm, construction managers are unable to achieve the higher level of the best practice actions, to meaningfully analyse the micro and macroenvironment that led to an error occurring.

The research was conducted in a British public sector organization with 2,800 employees, with a sample of 12 trainees. An initial internal attitude survey showed employees were willing to be involved in a change process in order to enhance their service and working performances. All participants indicated that they were not able to challenge existing assumptions in their workplace. If they did attempt to do so, they felt their position in their workplace was weakened. Juniors questioning traditional procedures were frightened and marked by managers as trouble makers. This enabled management to keep control over the way things were performed and minimise the opportunities for change (Turner *et al.* 2006).

Possibly the hardest matter for construction managers is to change their mental and practical behaviour.

As Blackman and Henderson (2001) state it is almost impossible to remove our natural defence mechanisms and embrace new practices and systems of learning, whether individually or in the organisational context. This does not mean change is impossible. Research has identified major factors blocking change, which include managers being afraid of challenges to their authority (Turner *et al.* 2006) and employees being afraid of losing their position as a result of sharing information (Yih-Tong and Scott 2005).

Finally we can draw a conclusion, that the most important obstacle to knowledge transfer is consruction managers' behaviour and awareness about future consequences. Managers seek to preserve the comfort zone they have already created. Transformational learning (acquiring new manners of technological, social, ethical, etc. behaviour, get better understanding of how to interact with micro and macroenvironment) and redesigning the behaviour can be understood as change of relative perception about the micro and macroenvironment they operate in, which could reduce economic and ethical managers being, social status and psychological comfort zone. To prevent this shake-up from happening, construction managers try to prevent information and knowledge transferring from managers to the firm.

A comfort zone denotes the limited set of behaviours that a person will engage in without becoming anxious. A comfort zone is a type of mental conditioning that causes a person to create and operate mental boundaries that are not always real. Such boundaries create an unfounded sense of insecurity. For example, inertia is when a person who has established a comfort zone in a particular axis of his/her life, tends to stay within that zone without stepping outside of it. To step outside a person's comfort zone, he/she must experiment with new and different behaviours, and then experience the new and different responses that then occur within his/her environment. The boundaries of a comfort zone can result in an internally rigid state of mind. A comfort zone may alternatively be described by such terms as rigidity, limits or boundaries, or a habit, or even as stigmatized behaviour (Bardwick 1995).

6. Conclusions

The main aim of this research is to help construction managers create a rational micro and macroenvironment for the construction project development by using groupware knowledge. Construction management is shared, purposeful activities based upon the development of common understandings and interpretations of means and ends. Stakeholders generate the personal and group decisions which contribute to their own success. This article describes the development of the Model for integrated project management based upon multiple criteria decision making theory. The developed Model involves steps that help to determine rational integrated construction management's life cycle by evaluating construction management's life cycle, stakeholders, micro and macroenvironment.

Endnotes

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