International Journal of Technical Research and Applications e-ISSN: 2320-8163,
www.ijtra.com Special Issue 17 (June, 2015), PP. 32-

ENGINEERING MANAGEMENT IN DEVELOPING COUNTRIES A FUTURE PROSPECTIVE

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International Islamic University Malaysia, June 2015

Abstract- As a result of globalization, one of the most major issues affecting the success of projects would be the formation of a multicultural project management style. As projects leaders continue to lead global, multicultural projects, there is a demand for managing a workforce that is more diverse than ever. The multigenerational workforce has distinct views on work ethic, communication and incentives; finding common ground is essential.

As the world of multinational projects is rapidly developing new concepts and methodologies are being introduced, especially in the management direction, as well as, the serious need for the use of engineering management modern practices. In many developing countries now the mega projects are multicultural projects different designers, contractors, subcontractors and suppliers from all over the world work together to achieve excellence but such projects bring with it many challenges on how all these people from different background, different laws, policies, legislations and ways of work can achieve harmony and finalize the projects within vale and time. Here comes the serious need for engineering and managers to design and provide a system that allows the projects such as construction process to be organized, harmonized and achieve the best quality from such activities and projects at the same time minimizing various risks to the minimum.

The increase of the citizens of the globe and its urban population calls for more construction activities especially for accommodation .in developing countries, in general ,the rate of construction is far below the demand for shelter , infrastructure and other amenities .many factors such as demographic growth, shifts from rural to urban areas, natural and human made resources depletion, and significant changes in expectations and life styles, all combine in their various ways impose considerable pressure on the construction industry of developing countries.

From this prospect comes the urgent need to engineering management to be introduced in these developing countries and for its recommendations and reflections to become a practical actions specially its effects of laws and new policies to ensure ease of operations and motivation of investors both externally and internally.

I. AN OVERVIEW OF THE CHALLENGES OF MULTINATIONAL ENGINEERING MANAGEMENT PRACTICES IN DEVELOPING COUNTRIES

Engineering Management or Management Engineering is a specialized form of management and engineering that is concerned with the application of engineering principles to business practice. Engineering Management is a path that brings together the technological problem-solving savvy of engineering and the organizational, administrative, and planning abilities of management in order to oversee complex enterprises from conception to completion.

In this paper the focus is on construction industry in developing countries and Sudan is the case study and where the questionnaire was carried on.

The significance of the construction industry in developing countries is well documented (cf. Turin, 1973; Lopes, 1998; Zawdie and Langford, 2000). For example, in most sub-Saharan African (SSA) countries where previous surveys are particularly most relevant, the industry accounts for close to 5% of the gross domestic product (GDP) in relation to a corresponding average of 7% in the developed economies (Zawdie and Langford, 2000). MHBPs (multidimensional conceptual model has been adopted for mass house building projects) alone account for nearly 60% of the construction GDP accredited to all building projects (Wells, 1986; Zawdie and Langford, 2000; Wells, 2007).

Therefore, it could be argued here that MHBPs make the single most important contribution to the gross fixed capital formation (GFCF), and also constitute one of the most recognized project-established sectors in most developing economies. It thus appears sensible to argue that MHBP could potentially offer an effective (if not the best) platform for developing and advancing effective managerial practices in many developing nations and countries like Sudan.

Nevertheless, the public presentation of construction projects in many of these countries presents some of the most challenging areas within which to put on effective project management techniques (El-Saaba, 2001). Evidence hints that these projects tend to be characterized by crises, uncertainty and suspense, Which necessitates a test of PMs' ability in organizing and controlling a diverse choice of functional specialist (ibid). Therefore, apart from possessing the relevant technical knowledge and expertise, PMs need to demonstrate a whole range of competencies that can engender effective multi-organizational teamwork and communication towards achieving successful project outcomes (Faniran et al., 2000; El-Saaba, 2001).

Furthermore, the PMs' knowledge of the relevant competency measures could be useful for providing that both a prediction and consultative system for any performance improvement agenda. Therefore, the identification of the appropriate PMs' competencies could provide as an important stride in acquiring the skills of potentially competent PMs, who can encourage the effective management of MHBPs in a relatively active and increasingly difficult business environment (cf. Ahadzie et al., 2004; Ogunlana et al., 2002; Rwelamila, 2007). It could likewise offer an important foundation for validating requirements relating to for instance PMs' continuing professional development (CPD) (Trejo et al., 2002).

The recipient countries (in this case Sudan) lack the technical and management skills required to successfully implement and manage project (Mohammed and White, 2008). As a result, many of the financial institutions require them to seek foreign expertise to assist with project preparation and implementation (Kwak, 2002). The foreign expertise may not be familiar with resources, the socio-cultural background, and are accustomed to different approaches to engineering and project management practices (Duc and Martins, 2002). This induces conflict of interests, extra pressures on executives, and frustration, which restrains or obstructs project progress and often lead to lost opportunities, directing of development efforts at wrong groups, project cost overrun and schedule delays (Vonsild, 1996). Intended beneficiaries can reject the project if there is a cultural misfit of the project objectives and a lack of local knowledge and understanding (Duc and Martins, 2002).

In order for these projects to be successfully implemented and managed, the project manager must take cultural factors of traditional values, customs, and beliefs into consideration at the project planning stage itself, so that, project objectives are consistent with the values and customs of the beneficiaries (Baranskaya, 2007).

To achieve successful project management in this scenario, project managers in Sudan should take few steps, such as adapting new management techniques and methodologies to match the companies from aboard. Stepping up in projects terms such as matching with the international standards and specification when it comes to designing the project as well as in the contractual period and beyond. Avoiding any mysterious or un clear tasks and identifying the scope and objective of the work in very early stages of the project.

Ensuring all requirements of the project can be met and trying to ensure all external needs , such as third part testing , or laps for testing materials both internally and outside of Sudan. Having strict policies on matters such as, financial processes. Economical plans, labor management, export and import policies and procurement processes, as well as keeping in mind all the legal and finical requirement and demands that matches both parties interests.

A. Research Methodology And Results

In the present study, 300 usable responses were used to conduct the analyses. EFA (explanatory factor analysis) using the principal component extraction method with promax, as a data reduction function of SPSS, was employed on all the items of the questionnaires to determine the possible underlying factors. It is also important to note that prior of running the EFA, data was screened by examining the descriptive statistics on each item, correlations among variables and necessary statistical assumption.

As a result for this study, the following model was initiated the model simply offers a four major elements that were found to have a critical effect on the engineering management process on projects in Sudan. these element have relations between them self's affecting each other in many directions , the need to modernize them and offer new management techniques and suggestions of upgrading policies and laws related to them is see as the best path to improve and develop projects in developing countries which will lead to countries development and advancement.

The four major elements are as follow:

- Risk Management for Developing Countries.
- Materials Industry Performance.
- Technology Transfer and Engineering Management.
- International Contracting and Finance.

As the model in the graph shows the technology transfer and engineering management were found to be the basic dependent element its effects all the other three elements but its most important relation is with the international contracting and finance.

To achieve a better understanding of how critical and interrelated these element are seven different hypotheses were created and tested. In summary, the results from the statistical analysis revealed that hypotheses 1, 2, 3, 4, 6 and 7 are supported while hypothesis 5 is not supported. Table 1 below summarizes the outcome of the hypotheses testing.

In addition to the questionnaire, interviews were held to give more depth to the study.

All interviewees met the following criteria: working as a project management professional (architects, engineers, and project managers); experience in construction projects in developed countries, developing countries, or both and participation in a multinational construction project previously. The interviews lasted one hour on average and were conducted during January February 2014.

Interviews were recorded and notes were taken. Interviewees were asked to identify a recent project in which they had actively participated. The purpose was to target specific experience rather than general perceptions. The interview was structured according to the three above-presented analysis categories. It included direct questions having a ‘yes’ or ‘no’ answer as well as open questions to encourage professionals to freely discuss the three analysis categories. Respondents were asked to explain the differences they found between the two contexts in the regulations, laws, responsibilities, cultural aspects, and professional training, among others. Participants described their experience in developing countries only.

The last methodology was observing case related to the subject at hand, the following conclusion and recommendations are offered to finalize the paper presented.

THE BASELINE MODEL

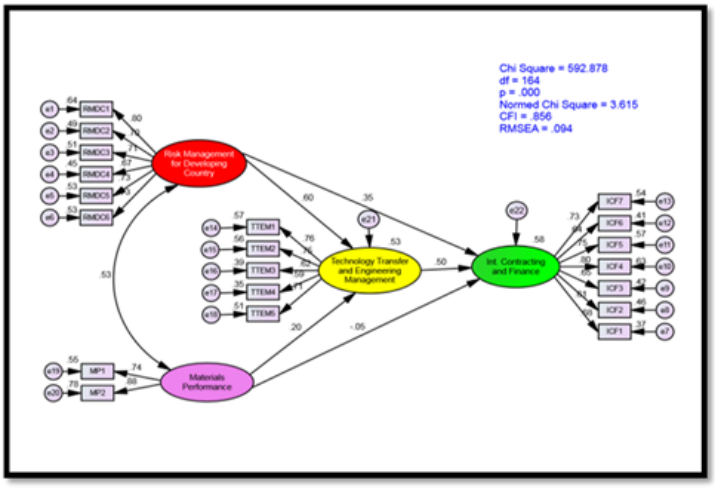

Table 1

No.	Hypothesis	Results
H1	Materials Performance has positive impact on Technology Transfer and Engineering Management	Supported
H2	Risk Management for Developing Country has direct influence on Technology Transfer and Engineering Management	Supported
H3	Technology Transfer and Engineering Management has relationship with International Contracting and Finance	Supported
H4	Risk Management for Developing Country has direct relationship with International Contracting and Finance	Supported
H5	Materials Performance has relationship with International Contracting and Finance	Not supported
H6	Technology Transfer and Engineering Management mediates the relationship between Materials Performance and International Contracting and Finance	Supported (full mediator)
H7	Technology Transfer and Engineering Management mediates the relationship between Risk Management for Developing Country and International Contracting and Finance	Supported (partial mediator)

II. CONCLUSION & RECOMMENDATIONS

This study initiates suggestions and establish the recommendations which are placed forward to aid counter the problems related to weakness and disputes in the multinational projects of in developing countries and in Sudan. There is an urgent necessitate to promote and develop indigenous engineering management practices so that they can be more effective ,hence companies and organization in Sudan can be competent of undertaking major and complex projects both at house and overseas. Taking on technology and management know-how from already developed sources is an option and has tried to be a more popular approach amongst developing nations. Even if involving foreign contractors in big and mega projects is inevitable at the moment, developing states should still tap their experience and expertise for their own benefits.

III. RECOMMENDATIONS

- Harmonization and unification between the laws, policies and legislations related to financial and economical operations and procedures is a serious requirement to encourage both internal and external investors.
- The legislators in developing countries including Sudan should adopt and amend the applicable laws related to a contract which involves foreign elements, by including clauses that provide freedom of choice to the different participants in multinational projects.
- There should be new sections or articles by the legislator that states the presence of an active bodies and organizations that monitor the engineering management processes of multinational projects, specially mega projects, were there is higher risks to be faced and controlled.
- Labor markets in developing countries should gain more attention and advancement in regards of skill upgrading, health and safety training, and proper knowledge to their legal rights, governments should be motivated to sign and join international conventions to ensure better working environments and conditions.
- Technology transfer through international management practices should be practiced on many different levels under legal, technical, cultural and human resources consideration.

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