

PM-03

Proceedings of the 3rd Scientific Conference on
Project Management
"Clustering in Construction Project Management"



24-25 September, 2004, Thessaloniki, Greece.

Edited by
J.P. Pantouvakis

Proceedings of the
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Editor

John-Paris Pantouvakis

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Foreword

The roots of this conference can be tracked back to 20 December 2001 when the 1st event on Project Management, entitled "Project Management Software in Greece" was organised by the Department of Construction Engineering and Management (CEM), Faculty of Civil Engineering, National Technical University of Athens (N.T.U.A.). Four major Greek construction management companies (Ergose S.A., Egnatia Odos S.A., Attiko Metro S.A. & Attiki Odos S.A.) presented their information systems based upon a pre-specified questionnaire and eight of the foremost software suppliers presented their matching products. Approximately two hundred people attended the event.

Based on the success of this occasion, almost a year later (13-14 January 2003) a workshop entitled "Education & Professional Training in Project Management: Needs & Prospects" was jointly organised by the Department of CEM, N.T.U.A. and the Technical Chamber of Greece. Twenty-two papers covering both the education needs of the industry and the contemporary education plans of the Universities were presented to an audience exceeding two hundred and fifty practicing engineers and researchers. The very positive feedback received from the workshop participants gave the necessary thrust to start planning for a bigger and more ambitious event.

The result was the organisation of this 3rd conference on project management which is the first to be hosted outside Athens. The conference focuses on ways to increase the competitiveness of the construction industry through clusters. A number of other construction management related issues is also included. In all, around fifty papers have been included in the conference proceedings. All presentations will be simultaneously translated into Greek and English. A number of other conference features should also be mentioned:

- This is the first time that a conference on project management is jointly organised by the National Technical University of Athens and the Aristotle University of Thessaloniki, two of the oldest and arguably most prestigious Technical Universities in Greece, denoting in this way their active interest in the advancement of the discipline.
- The conference is supported by the nCPM project. nCPM (network of Construction Project Management) is a joint Academia – Industry effort aiming at increasing the competitiveness of the construction industry through the creation of human technological networks of researchers and professionals. The conference was considered as a valuable means for disseminating nCPM results, inviting papers on current advancements in the discipline and attracting professionals, companies and researchers to consider contributing to the project. More specific information on the nCPM project and on how you can get involved can be found on page 5 of these proceedings.
- The conference has a strong industrial input as this was considered the key for the success of any clustering attempt. After all, it is the industry that may provide the necessary backing for the continuation of the effort. In this conference, the industrial input is secured by the active participation and contribution of a number of professionals. Representatives from such bodies as Egnatia Odos S.A., Edrasis – Ch. Psallidas S.A., Ellinotexniki S.A., Technical Chamber of Greece - Chapter of Thrace and others can be found both in the list of speakers and in the list of conference attendees. Their contribution is highly esteemed and deeply appreciated.

Last but not least, this event could have never been possible without the conference speakers' contribution, as well as, without the participation of the conference attendees. To all of you, on behalf of all of us who worked for this venue, are due our sincere thanks.

We hope that you will enjoy this conference and that you will find it useful. If you are interested in finding more about future events, please visit our announcement page at <http://cem.civil.ntua.gr> occasionally or, alternatively, subscribe, free of charge, to the PM-Greece mailing list at <http://www.pm-greece.cjb.net>.

With best regards,

John-Paris Pantouvakis
Conference Chair
Thessaloniki, Greece, 2004.

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A few words about the nCPM Project

The 3rd Scientific Conference on Project Management (PM-03) is greatly supported by the human and financial resources of the nCPM (network of Construction Managers in Greece) project. The project is incorporated into the Operational Programme "COMPETITIVENESS" - Community Support Framework 2000 - 2006 which is co-funded by the European Social Fund (75%) and by National resources (25%), in the frame of Measure 8.3 "Research and Technology Human Resources", Action 8.3.6 "Creation of Communication Channels for Academics, Research/Technology Entities and Enterprises with common Scientific Interests - 'HUMAN NETWORKS'".

More specifically, the nCPM project is a joint venture between six different entities: two Universities (National Technical University of Athens (Coordinating Institution) and Aristotle University of Thessaloniki), the Technical Chamber of Greece - Chapter of Thrace, one state-owned company (Egnatia Odos S.A.) and two private companies (Edrasis – Ch. Psallidas S.A. and Ellinotexniki S.A.) which represent three different geographical areas of Greece (Attica, Central Macedonia and Thrace). Two experts from the UK (Prof. C. Gray, University of Reading and Prof. S. Wearne, UMIST) also participate in the effort. The participants - network members are forty-five (45) professionals. The project started in October 2003 initially for a two year period.

nCPM is based on the assumption that the construction industry is prepared to invest in human and technological assets and to collaborate further, so that it will become more competitive in foreign markets (especially those of the nearby EU accession countries) in the expected recession period following the completion of the Athens 2004 Olympic games and the delivery of a number of other EU co-funded infrastructure projects.

The main activity of nCPM is to organise common education programmes in the form of short-term specialised seminars for groups of construction professionals with similar interests, mainly for the network members but with the possible inclusion of external participants. The education relates to the present state of affairs in construction management, and to their planned developments over the coming 5-10 years. Other planned activities and related information can be found in paper A0-3, page 11 of these proceedings.

Overall, nCPM aims at the assimilation of innovative methods and technologies, the enlightenment of each other and the contribution towards the formation of common practices and standard procedures that will assist the participating companies at first and the construction industry in general in the attainment of competitiveness in the international context.

How can you get involved?

You can communicate your interest to Dr. J.P. Pantouvakis, Scientific Coordinator of the project, by e-mail to jpp@central.ntua.gr, tel. +30-210-772 1268 or fax +30-210-772 3781.

... To attend network activities:	send your one page CV indicating your interest. Your commitment is required and limitations apply.
... To participate as an entity, agency, company or association:	if you wish to participate in the network please indicate your interest. You can educate your staff at a minimal cost, while benefiting from peer experiences. You can also contribute by participating in the industry-academia construction forum, by preparing case studies, present technological solutions, jointly direct student dissertation projects, contribute to the construction management information centre etc. A minimum commitment is required and limitations apply.
... To participate as an expert, University of Research Institute:	indicate your intended contribution (e.g. seminar title and content). Reimbursement is available subject to the limitations of the programme regulations and of generating the necessary industrial interest.

Additional information & updates

nCPM – The Project Website: <http://cem.civil.ntua.gr/ncpm>

**Conference Committees of the Third Scientific Conference on
Project Management (PM-03)
Clustering in Construction Project Management
24-25 September, 2004, Thessaloniki, Greece.**

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S. Wearne, UMIST, UK

KEYNOTE LECTURE

THE REFORMATION OF THE UK CONSTRUCTION INDUSTRY – RHETORIC OR REALITY

D.A. Langford

Dept. of Architecture & Building Science, Strathclyde University, Glasgow, UK.

Professor Langford holds the Barr Chair of Construction in the Department of Architecture & Building Science at Strathclyde University. He is the Director of the Graduate School in the Department and heads the Design Process and Construction Management Research Group. Professor Langford has been involved in Construction research for 25 years, has authored or co-authored 11 books and has published over 100 papers in journals and conferences.

ABSTRACT

This paper is a reflection on the changes that have taken place in the UK construction industry in the period 1998-2004. It looks backwards to the end of the second world war to decipher long waves of change in the industry. Here 4 epochs are found which shape the contours of construction procurement and the cultural and business models in action in each epoch.

In order to label them each epoch has been assigned a metaphor as a description so the epochs move through a mechanical, organic, political and cultural states.

The paper then reports on the progress made by the industry since 1998 and records performance improvements in terms of time, cost, defects, accidents, productivity profitability and client satisfaction. Finally it critically reviews these achievements against a question of which group of stakeholders in the construction process has obtained most from the reformation of the industry. It concludes that whilst improvements have been made the benefits of the improvements have been asymmetrically distributed. Clients doing well frequently at the expense of others in the construction team

KEYWORDS

Procurement, Construction industry

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A-0 RELATIONSHIP ISSUES IN CONSTRUCTION MANAGEMENT

Paper Code : A0-1

TECHNOLOGY CLUSTERS USED TO ACHIEVE PROJECT PERFORMANCE CHANGE

C. Gray

School of Construction Management and Engineering,
The University of Reading, Whiteknights, Reading, UK.

ABSTRACT

The failings of the construction process due to its fragmentation can no longer be tolerated. With targets for productivity and production improvements being set at world class levels in the UK the conventional approaches to design and construction have to be challenged. The experiments in integration of design and production through procurement routes such as design and build, management contracting and construction management have achieved major improvements, but they are nearing the end of their potential. A new approach is required. In order to meet this challenge the concept of the technology cluster has been developed.

The technology cluster can be approached in a variety of ways, but for construction and its temporary organisation structure, quite radical organisational approaches can be taken. As a new construction project is a new organisation it is possible that its structure can be developed without heed to conventions. This paper describes the development of the approach together with a full scale experiment on two projects.

The approach is not without its problems and these are reviewed. However the projects demonstrated the potential of the approach with such success that this is now the preferred procurement path of the UK Defence Ministry for its construction projects.

KEYWORDS

Technology clusters, Construction projects, Management

BASIC BIBLIOGRAPHY

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Paper Code : A0-2

UNIVERSITY – INDUSTRY COLLABORATION IN SWEDISH CONSTRUCTION PROJECT MANAGEMENT: PATTERNS AND EXPERIENCES

J. Bröchner, S. Gunnarson & A. Kadefors
Chalmers University of Technology, Göteborg, Sweden.

ABSTRACT

University-industry collaboration in the field of construction project management has a long history in Sweden and takes several forms. The purpose is to describe and analyse experiences from two major Swedish technical universities, Chalmers University of Technology in Göteborg and the Royal Institute of Technology in Stockholm.

A stronger element of interaction was brought into the Stockholm Civil Engineering curriculum a decade ago. The intentions were to improve communicative skills, increase interaction with the construction industry, support integration between management and technology, and strengthen the links to management research.

Since the 1980s, part-time 'PPL' courses in Project Management are organized by Chalmers University of Technology for practitioners, typically about seven years after graduation, and where participants with a construction background are mixed with others. Each of four courses has a perspective of its own, a team assignment with a focus on the course theme, two intensive days including evening work during the first day, and also home essays that synthesize elements of the course, literature and individual experiences. The four courses focus (1) on the project phenomenon seen from the outside and from the top of the organization, (2) the tools for the project manager, (3) the systems that support the project manager, and finally (4) an inside view of the project team, how it works, its functions, roles and leadership.

The Chalmers Centre for Management of the Built Environment supports both MSc(CE) teaching and research projects in close industry-university cooperation; currently, there are more than thirty member firms and organizations. MSc theses in the PM field are often sponsored by firms and written in collaboration with industry. Guest lectures are frequent.

Collaborative research projects, partly with central government funding, are carried out. A recent example from Chalmers University of Technology concerns the development of partnering practices in construction projects, with active participation from industry experts in the analysis itself and in seminars; four actual projects were selected for case studies. Interactive research methods are exemplified by a project on multi-project organizations: a comparison between a Swedish project developer in the home-building sector and a mobile systems supplier looks at how they deal with the interface between organizational units and projects.

Summing up, we find strong synergies when there is parallel interaction in MSc level teaching, in continued education for practitioners, and in research projects.

KEYWORDS

Project Management, Civil Engineering, University, Sweden.

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Paper Code : A0-3

THE nCPM PROJECT: BACKGROUND & ACTION PLAN

J.P. Pantouvakis

Department of Construction Engineering & Management, Faculty of Civil Engineering,
National Technical University of Athens, Greece.

ABSTRACT

The nCPM project, funded by both public and private sources, involves different type organisations (such as Universities, companies and professional associations) with the purpose of establishing a human network in the field of construction project management in Greece. Two foreign experts participating in the project indicate the international dimension.

This network provides professional training where peer-to-peer collaboration and interaction are encouraged, links University research efforts to industrial needs and disseminates its findings through conferences and seminars.

In addition to the above, a number of other activities are planned: these include the identification of the knowledge acquisition and transfer mechanisms employed in the industry, the assessment of its innovation potential, the recording of the special interests and capabilities of the professionals engaged, the development of an industry – academic construction forum and the development of a University-led information centre accessible to all those concerned.

It is expected that through such co-ordinated actions, the nCPM project can take the first steps towards delivering a self-sustainable construction management network in Greece for the benefit of both the discipline and the economy as a whole.

KEYWORDS

Construction management, Clusters, Networks, Development

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Paper Code : A0-4

THE LEADERSHIP FACTOR FOR MANAGING IN FUTURE VIRTUAL CONSTRUCTION PROJECTS

F.T. Edum-Fotwe & R. McCaffer

Department of Civil and Building Engineering, Loughborough University, Leicestershire, UK

ABSTRACT

The authors explore an aspect of AEC projects that is increasingly becoming relevant within industry as a result of the possibilities made available by the internet and collaborative ICT tools, essentially a shift in the management of AEC projects from physical environments to virtual ones. The consequence of such a shift is that project managers find themselves having to lead task without face-to-face contact with their team members, essentially becoming virtual leaders of project teams. They recognise the role that leadership, a latent factor in managing projects, plays to bring about successful projects. They further explore the virtual leadership tendencies engendered among project teams to identify aspects of knowledge and skills that will be required by future project managers in AEC sector. AEC professional may need supplementary skills in technology use, cultural aspects, task structuring and individual team member support to make a smooth transition from physical to virtual leadership.

KEYWORDS

Decision, Project Management, Organisation, Virtual, Leadership

A-1 PROJECT MANAGEMENT COLLABORATION ISSUES

Paper Code : A1-1

BUILDING INDUSTRIAL NETWORKS AND CLUSTERS: A BUSINESS STRATEGY VARIABLE WHICH LEADS TO THE INNOVATIVENESS OF A CONSTRUCTION FIRM

G. Kalfakakou, M. Pitsiava – Latinopoulou & F. Striagka

Department of Civil Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece

ABSTRACT

The subject matter of industrial organization economics is the behaviour of firms in industries. An industrial organization economic framework accepts that there are relationships between the 'structure' of markets, the conduct of firms and the performance of firms. In the past decade, the emergence of a wider perspective of industrial organization through concepts such as supply chains, industrial networks and clusters, inter-organizational relationships and strategic alliances is often associated with the aim to improve industry competitiveness and innovation. This is an indication of the growing importance of understanding the underlying nature of industries through the behaviour of firms, their relationships and interdependence between organizations (Grabher, 1993).

Over the years there has been mounting evidence of client dissatisfaction with the construction industry's inability to deliver quality products and services on time, at a reasonable price (The Economist, 2000). In response to this challenge, changes are taking place in the delivery of construction goods and services in order companies to successfully respond to the challenge of superior quality and lower prices through continuous improvement in their operational effectiveness. Thus, re-engineering, lean production, investments in the information technology, TQM and other techniques of optimising productivity and asset utilisation have now become parts of companies' efforts to remain/become competitive in the global market place. Also, the formation of alliances has been acknowledged as a potentially important way of improving construction project performance through the direct benefits it can bring to the involved parties.

The paper attempts to contribute to the growing literature by exploring the presumed link between partnering and cultural change within the construction industry, at both organizational and interorganizational levels of analysis. In order to do so, it draws upon theory and research from the social sciences (especially organizational theory) to explore some of the issues, problems and dilemmas which emerge due to the complexity of organizations, as well as some of the subtleties and intricacies of the concept of organizational culture.

In the meantime, the paper aims at reporting the findings of the implementation of a model developed by Seaden et al.(2003) in four Greek large-scale infrastructure projects. As this model links perceived business environment variables to various business strategy variables (i.e. marketing, human resources and technology), the paper examines the processes of collaboration from the viewpoints of clients, contractors, designers and subcontractors. These two sets of variables are linked to the innovativeness of the firm, measured by the number of advanced technologies and/or business practices currently used.

KEYWORDS

Construction industry, Industrial networks and clusters, Innovation, Industrial organization economy, Organizational culture

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Paper Code : A1-2

COMPETITIVENESS IMPROVEMENT IN THE CONSTRUCTION FIELD USING CLUSTERS. INTERNATIONAL EXPERIENCE AND HELLENIC REALITY

M. Georgiou, G. Zampos, N. Papaioannou & K. Polychronaki

Edrasis – Ch. Psallidas S.A., Koropi, Athens, Greece

ABSTRACT

The inapplicability and the weaknesses of economic strategies pursued in the past, have led to innovate new strategies for the competitiveness improvement. The clusters formation in businesslike and research activity is the domain trend of companies' competition vivification. These can be achieved via diffusion of innovative activities and know how, among the cooperative companies and institutions.

In accordance to the clusters' model success globally, it has already begun the formation of the scientific cluster titled, "nCPM – Network of Construction Project Managers in Greece". This cluster is part of the Operational Program "COMPETITIVENESS", of the Development's Greek Ministry. This effort aims on the development of cooperation and communication in between Academics, Research / Technology Entities and Enterprises with common Scientific Interests. Via this association the cluster is able to accomplish the diffusion of know how and novelty activities in the field and in the long run to improve competitiveness. This paper's framework incorporates the investigation of the project management's processes according to Greek reality and also the term's cluster assimilation in the Greek construction business.

During the participation of the authors in the above - mentioned program, the need of investigating the processes of the project management was created, as they are impressed in Greek reality and of how much it is acquaintance, and at extension, usable the term cluster in the Greek construction sector. Thus a questionnaire was drawn up, which was filled in from people involved in this sector.

This questionnaire has 15 questions separated in three sections. The first section investigates the existence and the use of the processes of project management from the corresponding companies. The second one is searching whether or not the sense "cluster" is acquaintance as well as the parameters that are related to it. Through the answers in the last section is investigated whether or not they are interested to participate in a cluster in the Greek constructional sector.

With the quantitative processing of the answers given through these questionnaires, a first approach towards clustering in the Hellenic construction sector is attempted.

KEYWORDS

Clusters, Competitiveness, Construction, Greece

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Paper Code : A1-3

VALUE FOR MONEY DRIVERS IN PUBLIC PRIVATE PARTNERSHIPS IN GREECE

A. Rouboutsos¹ & F. Striagka²

¹University of the Aegean, Chios, Greece

²Aristotle University of Thessaloniki, Greece

ABSTRACT

Construction industry worldwide is known for its adversarial working relationships, which exist between the involved parties. It has been acknowledged that the nature of the relationships within the industry and the culture within which the industry operates are seen as key issues, which hold back effective construction. Consequently, the focus has moved towards an effective method of procurement and the management of the value (or supply) chain and the process of alliancing and partnering has been identified as a mechanism of overcoming and anticipating such relationships, and its key elements such as trust and continuous joint evaluation help to improve productivity on projects. During the early 1990s, a solution was developed that espoused project partnering and a collaborative approach, that of the implementation of public-private partnership (PPP) schemes. However, there are barriers. The public sector has to accept that commercial business is essentially profit – driven and will want significant returns from the operation of infrastructure, whilst on the other hand, the private sector has to acknowledge that many features of operating public infrastructure are not profitable. In the UK this barrier was quickly overcome, but it has not been so straightforward for other European states like Greece.

The paper presents the findings of research through data collected by questionnaires addressed to all involved in PPP negotiations in Greece. The money for value drivers are identified and compared to the ones proposed in the UK. Finally, based on the findings a model is proposed for the facilitation of procedures and negotiations leading to PPP contracts in Greece.

KEYWORDS

PPP, Supply chain

Paper Code : A1-4

DEFINING RESEARCH AGENDAS FOR THE CONSTRUCTION INDUSTRY

S. Christodoulou¹ & A. Protopapas²

¹Department of Civil & Environmental Engineering, University of Cyprus, Nicosia, Cyprus

²Democritus University of Thrace, Xanthi, Greece

ABSTRACT

The paper presents an overview of currently practiced frameworks for defining research agendas for the construction management industry, with paradigms from Greece, Cyprus and the USA. The aim of the manuscript is to bring forward the pros and cons of each model, and to provoke a more active partnering of practitioners and researchers in defining future research agendas. Emphasis is given on distinguishing between the concepts of "networking vs. collaboration" and "active vs. passive partnering", as well as on efficient knowledge-transfer techniques for construction industry participants. The paper presents lessons learned from mechanisms currently in place nationally (Greece, Cyprus) and internationally (USA) and suggests ways to improve on such frameworks, so as to maximize the impact of the collaboration between universities, research organizations, public and private industry participants and institutions.

KEYWORDS

Framework, Research, Greece, Cyprus, USA

Paper Code : A1-5

A FRAME ANALYSIS OF MANAGEMENT TECHNIQUES FOR GLOBAL CONTRACTS IN CONSTRUCTION

E. Antonini¹, M. Masera² & S. Mecca²

¹ IUAV, Venice, Italy.

² TAED - University of Florence, Italy.

ABSTRACT

Projects of Public and Private Partnering (PPP) in construction projects offer a paradigmatic context of complexity to experiment management techniques finalized to organizational learning in temporary organizations. Heavy conditions are concerned in Global Contracts (GC): reduced capacity in public finance, precision of scope, detailed definition of expected service and adequacy of performance to user requirements, compressed duration of project and financial incentive for preventing construction delay, precision of budget, legal and financial competence, facilities management, rating quality of service. Nevertheless GC cause claims originating a vast international jurisprudence, require an intensive production of diffused knowledge and a relevant number of technical advice. The discussed research project aims at assessing the knowledge assets, the cognitive capital used, in relation to project risk, and develops mixed techniques, used to analyze transformation processes of knowledge. In concurrent tasks as well in negotiating procedures the mutual commitment of partners is based on intensive knowledge exchange.

KEYWORDS

Global contract, PPP, Project uncertainty

A-2 CONSTRUCTION PROJECT MANAGEMENT

Paper Code : A2-1

FULLY INTEGRATED AND AUTOMATED PROJECT PROCESSES (FIAPP) IN THE MANAGEMENT OF CONSTRUCTION

S. Christodoulou

Department of Civil & Environmental Engineering, University of Cyprus, Nicosia, Cyprus

ABSTRACT

The paper presents an overview of currently developed technologies for the management of construction, and an outline of an integrated system utilizing three-dimensional and four-dimensional (3D/4D) computer models coupled with integrated database management systems.

The paper also presents case study projects from New York City, on which the developed FIAPP-based system was used for the purpose of providing construction management teams with a both a visualization tool as well as related information for the management of time, cost and resources.

The aforementioned technology is utilized throughout project cycles for constructability reviews, project controls and procurement of materials, as part of an integrated and automated process for the management of time and cost.

As part of this effort, the research team has also developed a material-status monitoring system to be used in conjunction with the three-dimensional model that would enable the contractor and the construction manager to visually record and retrieve information related to the procurement of construction material. The case studies outlined herein include projects from the building construction and transportation industry.

KEYWORDS

FIAPP, 3D modelling, Integrated, Construction management

Paper Code : A2-2

ALTERNATIVE DISPUTE RESOLUTION: A SURVEY

K. P. Anagnostopoulos,¹ A. Roumboutsos² & J. Kouretas¹

¹Democritus University of Thrace, Xanthi, Greece

²University of the Aegean, Chios, Greece

ABSTRACT

One of the major risks involved in large infrastructure undertakings concerns disputes between the involved parties, which often lead to legal suits. This procedure is both costly and lengthy. In order to address the issue new methods of dispute resolution had to be developed and applied. These include arbitration procedures, mediation as well as dispute resolution committees. The status of these alternative dispute resolution procedures is attained through the participation of certified experts. To date, these methodologies for dispute resolution were mostly applied in countries such as the USA and the UK. In Greece, until recently all public infrastructure projects were carried out under the respective legislation, where precise procedures for petitions are defined, especially in connection to claim rejection by the "project owner". With the introduction of BOOT projects, whose implementation did not follow the respective legislative framework, as well as the development of international consortia, Dispute Resolution Committees made their way into the Greek scene. As more projects are to be implemented through private funds and public work legislation reformed, it is expected that alternative dispute resolution methods will be adopted and the need for objective methods and tools to address claims will prevail.

The paper presents and analyzes the principal available techniques and methodologies for evaluating project delays, their advantages and disadvantages are indicated and their field of application compared. This survey may provide a tool for addressing claims in connection to delays for position paper preparation of parties addressing dispute resolution committees.

KEYWORDS

Arbitration, Dispute resolution, Construction industry

Paper Code : A2-3

AN OVERVIEW OF THE EGYPTIAN ECONOMIC REFORM PROGRAM AND CONSTRUCTION INDUSTRY WITH A PROPOSAL FOR SUSTAINABLE DEVELOPMENT

G. K. Kavvouras, A. Awad & M.J. Mawdesley

The Nottingham Centre for Infrastructure, School of Civil Engineering,
The University of Nottingham, UK

ABSTRACT

Many developing countries are in the process of privatisation and of reorganising their economies to be market based. In the current global business conditions, the construction industry faces a need for intense change. Sustainable Development and its criteria need to be considered throughout this procedure. Although this is demonstrated in most of the developed countries, many developing countries don't seem to have the same aspirations. The construction industry and the governments need to undertake activities with the aim of achieving sustainable development. The commitment of developing countries in achieving sustainability is either unknown or questionable. This is mostly due to economic reasons.

This paper presents an analysis of macroeconomic indicators related to the construction industry in developing countries. Significant elements that have an influence on the sustainability of the construction industry in developing countries will be investigated. Macroeconomic and sustainability indicators will be combined in order to investigate the role of macroeconomics in the sustainability of the construction industry.

Influences on the sustainability of the construction industry in the future will be forecast. Also, activities and measures that are available to stakeholders in the construction industry in order to develop the industry in a sustainable manner will be described and compared. Changes that have occurred in recent years in the context of Sustainable Construction will be described and discussed.

KEYWORDS

Sustainable development, Construction, Macroeconomics, Indicators, Developing countries

Paper Code : A2-4

SYSTEMATIZING THE CONSTRUCTION PROJECT EVALUATION AND MONITORING

Z.A. Memon, M.Z. Abd Majid & M. Mustaffar

CTMC, Faculty of Civil Engineering,
University Technology Malaysia, Malaysia

ABSTRACT

Present trend and proliferation towards multi-participant mega projects have heightened the need for effective and efficient evaluation and monitoring by stakeholders. Feedback from such evaluations helps improve the management of on-going projects. It also assists in the selection of suitable organizational and / or individual participants for future projects, based on their past performance. However a recent investigation indicated that there is a lack of systematic and automated evaluation and monitoring in construction projects. The need to develop the monitoring system and formulate an accurate as-built schedule from daily site records, engineer's diaries and other documents as well as pictures of construction activities, in which performance can be evaluated. A persistent problem in construction is to develop the as-built physical progress schedule of construction scene which shows the construction's actual performance. The aim of this paper is to identify techniques which are used in the construction industry for monitoring and evaluating the actual physical progress and to establish how the current computer technology can be used for monitoring the construction physical progress on site. Although the formulation of such a model may appear to be a formidable task, its feasibility and usefulness were demonstrated considering the Malaysian construction industry view point. The integration of photos and drawings will enable construction manager to develop progress reports in a more consistent and accurate way and more accurate as-built project schedule can be transferred to facility manager.

KEYWORDS

AutoCAD, Construction Management, Data base, Digital monitoring, Photogrammetry

Paper Code : A2-5

ECONOMICAL MATHEMATICAL MODELING OF THE DESIGNED DECISIONS IN EARTHWORK EXECUTION

A. Juodis & O. Viliuniene

Kaunas University of Technology, Kaunas, Lithuania

ABSTRACT

Major economic transformation processes are taking place in Lithuania since 1990. All the fields of economy and construction sector are readjusting to functioning under terms of free economy. Construction companies are competing in these conditions and this makes them strive for work effectiveness. Implementation of methodology of construction projects management systems allows investors and other participants of construction process to aim at their goals in a more effective way. Construction projects management is applied in Western Europe and other countries already for about 30 years. However, this method is new for Lithuania and other countries that have recently joined the European Union. For example, in Lithuania it is being used since 2000.

Methodology of construction projects management is being under improvement, which provides with additional possibilities to implement construction projects more effectively. The most numerous scientific researches in the field of construction projects management have been carried out in USA, UK, Germany, Australia and Japan. Such researches are carried out in various aspects. They include functional tasks within project management stages, improvement of construction projects management system and other issues.

Such researches are carried out at Kaunas University of Technology as well, and Lithuanian construction companies apply the findings in practice (Juodis, Janusaitis, 1998, 2001, Viliuniene, Juodis, 2002, Juodis, Apanaviciene, 2002, 2003). This article focuses on the issues of improvement of methods for solving tasks of engineering preparation of construction. Wide possibilities to develop rational designed decisions for construction processes are present in the course of engineering preparation of construction. Practical implementation of such decisions within the management of construction projects enables to reduce construction costs by as much as 30%, whereas construction time is decreased by as much as 50% by Juodis (2001) and Viliuniene, Juodis (2002). Methods of system engineering, operational research, knowledge in the fields of economics and informatics as well as modern methods are being applied for optimization of the designed decisions in construction processes.

Earthwork is an integral part of the construction process. The estimate costs for earthwork amounts to 5-20% of the total value of a building. Therefore individual discussion of earthwork is very important.

Aim of this research: to improve the methods for preparation of construction processes designed decisions and to apply them for solving practical tasks during engineering preparation of construction. Methodology of preparation of optimal designed decisions for execution of earthwork is presented in the article.

The suggested method for optimizing the designed decision in earthwork execution reduces the earthwork costs by 20 – 25%, and the time of earthwork by 25 – 30%.

The presented method allows analyzing complex probabilistic construction processes applying system engineering, correlation - regression analysis as well as operational analysis methods.

The theoretical research on optimizing the designed decision in earthwork execution and the practical appliance of mathematical models have proved the economic efficiency of the suggested method, the possibility to put the problems into algorithms as well as to employ the relevant software in order to optimize the problems in the construction business.

KEYWORDS

Economical mathematical modeling, Optimization, Engineering preparation, Designed decisions, Earthworks processes.

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Paper Code : A2-6

CHARACTERISTICS OF SUCCESSFUL BOT PROJECTS

A.H. Nassar

Higher Technological Institute, 10th of Ramdan City, Cairo, Egypt.

ABSTRACT

BOT (Build Operate Transfer) schemes projects which employ a particular form of structured financing. In an arrangement, the private sector designs, builds the structure, finances its construction, operates and maintains the structure over a predefined period of time.

Mismanaged events and contract disputes, among parties involved in the project, cause project inefficiencies, result in adversarial contract relationships and are very expensive in both time and costs.

A great number of these projects, especially in the developing world, faced problems and were terminated or cancelled. It is thus, necessary to face and solve these problems in order to find out the requirements and characteristics for successful BOT projects. Authorities should identify the characteristics for a successful project, before they embark on the BOT financing method. This should be useful for all parties' governments and promoter so they both can widely guaranty the successful of their BOT project.

The object of this study is the identification of necessary characteristics and requirements of successful BOT projects. In this paper, a survey for the different parameters and fundamentals that have been documented in different references for the construction of successful BOT projects is performed. A questionnaire for determining the percentage of agreement among individual references and the experts' opinions of BOT projects is developed. A questionnaire for determining the scale and ranking for the identified characteristics is also developed.

The paper outlines the results of both questionnaires interviewed by experts of BOT projects. Experts from Egypt identified these characteristics according to their experience in BOT projects; as Egypt was started the idea by Sues Canal project last century. A complete analysis of such results is also performed. Finally, the study identifies the necessary requirements and characteristics of successful BOT projects with no mismanagement to be used with the stats and governments' authorities who are planning to use the BOT scheme. There are 22 characteristics essentially required for successful BOT projects. Some characteristics depend on the two parties of the contract of the project; others depend on the project itself, its design and its method of construction and operating.

The paper suggested additional researches as: Using Fuzzy set theory that could be employed in dining the logistics variables used to measure the individual characteristics. A fuzzy information system could also be developed to evaluate the success level of any future BOT projects. Using the neural networks could be developed to extract underlying patterns imbedded in data resulting from the proposed methodology. Such networks should be capable of identifying the success level of any future proposed BOT projects. A case study should be used for previous BOT projects; this may approve a lot of these characteristics in the future researches

KEYWORDS

BOT, Construction, Financing of construction, Project management, BOOT

Paper Code : A2-7

A HOLISTIC SYSTEMIC APPROACH TO MODELLING SUSTAINABLE DEVELOPMENT

G. K. Kavvouras, M.J. Mawdesley & A.M. Awad

The Nottingham Centre for Infrastructure, School of Civil Engineering,
The University of Nottingham, UK

ABSTRACT

Ever since Sustainable Development was defined by the United Nations' Brundtland Commission in 1987, people have been attempting to explain its meaning further. The difficulties of understanding Sustainable Development can be traced to the lack of accepted methodologies, which could be applied to analyse complex issues and problems. Additionally, the complexity of the natural systems, which are impacted by humans and their activities, make the issue of understanding Sustainable Development very difficult. This paper proposes systems thinking as a method of understanding and modelling sustainable development.

The approach of systems thinking is fundamentally different from that of traditional forms of analysis. The defining characteristic of a system is that it cannot be understood as a function of its isolated components. First, the behaviour of the system does not only depend on what each part is doing but on how each part is interacting with the rest. Second, to understand a system we need to understand how it fits into the larger system of which it is a part. Third, and most important, what we call the parts need not be taken as primary. In fact, how we define the parts is fundamentally a matter of perspective and purpose.

This paper will describe attempts to use both hard and soft systems methodologies to model Sustainable Development. Several different levels of detail will be introduced which together will assist in the understanding of the complexity of sustainable development. The elements of the systems and their interactions will be described and the use of the models to improve sustainable development will be discussed.

KEYWORDS

Sustainable development, Systems analysis, Modelling, Component systems.

A-3 PROJECT MANAGEMENT CONCEPTS & FRAMEWORKS

Paper Code : A3-1

PROJECT MANAGEMENT CONCEPT: DEFINITIONS & EVOLUTION

G. Kalfakakou & K. Zapounidis

Department of Civil Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece

ABSTRACT

Full understanding of Project Management concept could lead to the creation of the required theoretical base through which every individual (Project Manager and not) could face a project in a way that succeeding is more possible. Moreover, this theoretical base could lead to new forms of Project Management in which Clustering is of great importance.

Before defining project management the main areas of activity which have to be managed in a project should be set out. There are several distinct areas, particularly related with construction, which should be given different emphasis through the project management process, along with a great number of functions, principles, distinctions, differences and possibilities that lead to a great number of definitions and analysis of the Project Management. Science.

The growth of project management has come about more through necessity than through desire. Its slow growth can be attributed mainly to lack of acceptance of the new management techniques necessary for its successful implementation. An inherent fear of the unknown acted as deterrent for those managers wishing to change over. Project management turned out to be a popular, influential and conventional approach to change implementation, through theories and models application that followed the wider historical evolution of management theory in general.

The efforts to focus on Project Management itself (and especially on Construction Management), could be achieved through the analysis of the main general management theories (Classical Management Theory, Scientific Management, Human Relations School, Systems View, Contingency Perspective) and their contribution to the sector of projects and construction. The theoretical base evolved through the analysis of the main general management theories in combination with refined, combined and integrated models, could be a useful tool for the success of accomplishing Project Management objectives nowadays and in the future.

KEYWORDS

Project Management definition, Project Management evolution, Project Management framework

Paper Code : A3-2

A FRAMEWORK FOR FACILITIES STUDIES IN LITHUANIA

A. Juodis & N. Varnas

Kaunas University of Technology, Kaunas, Lithuania.

ABSTRACT

Contracting authorities of construction projects wish the optimal implementation of their ideas with no deeper consideration of the implementation of the whole process. They are ready to give all necessary investments for this (Juodis, 2001). Such conditions determined the origin of a new field of activities – construction project management. This activity originated in Western Europe more than 30 years ago and currently is becoming more and more important.

The term *construction project management* appeared in scientific and practical terminology in Lithuania about 10 years ago. The term *facilities management* started to be used 5 years later. Currently, those interrelated activities have become particularly important in Lithuania. This might be explained by two reasons: 1) the amount of construction works is rapidly expanding and makes up 20-30% per year; 2) 70% of all investments are used for renovation, modernization and reconstruction of old buildings.

Thus, the demand for construction project managers is constantly increasing, and more attention is paid for the maintenance, modernization and reconstruction of existing buildings. Moreover, enterprises of different business activities are trying to develop their competitiveness by reducing the functional costs of their activities. Such cost reducing possibilities might be detected in the construction maintenance and management system. As the tendencies of the development of enterprises show, those functions are often transmitted to certain specialized companies, which results in cost reduction by 30% (Braun et al., 2004; Pfnür, 2002). The effective functioning of construction maintenance enterprises is mainly determined by the selection of an optimal construction technical maintenance model as well as efficient application of investments for the modernization of buildings. To solve those problems, scientific studies need to be performed and best practical recommendations are needed.

In Lithuania, the term *facilities management (FM)* originated in the scientific and practical activity not long ago. Each country has different level and scope of the development of facilities management activities. Therefore currently, the determination of the efficiency of FM activities under the conditions of Lithuania is a topical issue that requires the proper evaluation of current situation, determination of the best practical models and scientific tasks as well as consideration of the recommendations that would contribute to the development process of FM activities in Lithuania. The preparation of different specialists of this field in universities and other education institutions is particularly of great importance (Juodis and Varnas, 2003).

KEYWORDS

Construction project management, Facilities management, Facilities management models

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Paper Code : A3-3

FACTORS AFFECTING PM APPLICABILITY IN GREECE

K. Sirakoulis, P. Ipsilantis & V.C. Gerogiannis

Department of Project Management, Technological Educational Institute (TEI) of Larissa, Greece

ABSTRACT

Is there a gap between University teaching and research work on one hand and the practice of Project Management methodologies and techniques on the other in Greece? This is a question that has not been addressed till nowadays. This paper focuses on evaluation of the factors, which affect enterprises in applying PM methodologies and tools in their real work.

Empirical data were selected through a questionnaire-based research involving over 100 enterprises, most of them located in Thessaly region and results are presented in this paper. The paper includes a discussion on the results providing a picture of the current situation for the use of project management in Greece.

The paper answers questions like: in which of the enterprises the application of project management is appropriate? In cases where project management seems to be appropriate is it applied? What are the factors that affect enterprises in using or not project management? Are these factors qualitative or quantitative? The main body of questions is answered by the use of descriptive statistics, while principal components are determined by multivariate techniques.

Conclusions are derived from the evaluation of the results. The paper contains also propositions that are targeted to the propagation of PM methodologies for enterprises that would be interested in applying them. Developing networks between the universities and the industry is one of the interesting ways to achieve this target.

KEYWORDS

Project Management, PM Methods, Tools and Techniques, Clustering in PM

Paper Code : A3-4

USING AN EMPLOYEE PERSPECTIVE OF MANAGEMENT TO IMPROVE CONSTRUCTION PROJECT PERFORMANCE

K. Greasley, A.D.F. Price, A.R.J. Dainty, A. Bryman, R. Soetanto & N. King
Loughborough University, Leicestershire, UK

ABSTRACT

This study examines employees' perspectives of management approaches and the impact that these may have on employees' contributions to construction projects. Unlike many other studies that have emphasised the managers' viewpoints, this study focuses upon employee perspectives and provides an alternate view of how managers could improve construction project performance. The findings are derived from a longitudinal study of four UK construction and construction engineering case study projects. The sample consists of sixteen employees who are employed in various positions at an operational level. A total of 48 interviews were conducted with each employee being interviewed three times. Each interview was transcribed in full and thematically analysed using Nvivo software.

The findings from this analysis indicate that employees want to be recognised for their contributions and feel that they should be trusted and respected in their work. They believe that this can be achieved through many different approaches including, affirming operatives' actions, involving them in project and organisational issues and allowing them to influence how they conduct their work. When these features do occur employees feel more empowered, pro-active and motivated in their work because they view the working relationship they share with managers as reciprocal. However should operatives feel that they are not respected or feel excluded, they can withdraw goodwill and, at times, be deliberately obstructive. Thus, there is a dynamic, two-way relationship between managers and operatives which can influence how operatives approach their work. Hence, managers at all levels on construction projects should recognise that these 'soft' issues can significantly affect employee attitudes and reported behaviours, and are therefore an important component of construction project performance.

KEYWORDS

Employee, Recognition, Respect, Trust, Empowerment.

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Paper Code : A3-5

A FRAMEWORK FOR EVALUATING THE PERFORMANCE OF ENGINEERING CONSULTANTS IN HONG KONG

L.K. Chow & S.T. Ng

The University of Hong Kong, Hong Kong

ABSTRACT

Awarding a consultancy agreement by comparing the technical and fee proposals alone is not reliable enough, as the quality of services provided by the selected Engineering Consultant (EC) may not always satisfy the desired standard of the client. It is essential to establish the previous performance of ECs to unveil their true proficiency. Nowadays, many clients have already been gauging the performance of ECs at different project stages to compile a set of Consultant Performance Evaluation (CPE) data for used in prequalifying and selecting ECs. Should it be possible to exchange the performance data among different clients, it would inevitably improve the reliability of prequalification and selection decisions further. However, as different criteria are used for CPE, it may not be easy to come up with a collective view even if such data is available. More important, in the absence of a systematic guideline, appraisal of EC performance is likely to be conducted in a subjective manner. In this paper, a set of common CPE criteria for the design stage of a project is first identified based on previous research. With an aim to improve the objectiveness, quantitative indicator(s) for each criterion is established. Finally, a suggestuib for a more rational framework for CPE by making use of quantitative indicators is proposed.

KEYWORDS

Performance evaluation, Subjective judgment, Design stage, Quantitative indicators, Objective framework

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Paper Code : A3-6

RISK MANAGEMENT AS A PROCESS OF QUALITY STANDARD ISO 9001:2000

V. Leopoulos, K. Kirytopoulos & C. Malandrakis

Dept. of Mechanical Engineering, Sector of Industrial Management & Operational Research,
National Technical University of Athens, Greece

ABSTRACT

New model ISO 9001:2000, extends the aim of quality management of an organisation. Apart from the proof that the work produced maintains a standard quality, the increase of satisfaction of the customer via processes of continuing improvement is examined. Objective of the present scientific endeavour is to propose Risk Management as a process that may result to the benefit of the organisation itself, thus to the benefit of the customer, as well. Ulterior objective is the improvement of financial results of projects, which may lead, afterwards, to better offers to the customer.

In the particular study, risk surpasses the narrow limits of safety. It is extended in purely administrative subjects, such as the possibility of finding available subcontractors to be used in the project, the planning for the avoidance of bad weather that complicates concrete work or the retirement from the project of a key-person.

More specifically, the way-how a construction company may implement project risk management as well as the benefits that stem from that implementation and a short case study are presented. Furthermore, indicators which might be used by the company in order to measure the results that comes from the adoption of the proposed process, are proposed.

KEYWORDS

Risk Management, Quality, ISO

A-4 COST, PROCUREMENT & CONTRACTUAL ISSUES

Paper Code : A4-1

THE ALLOCATION OF OVERHEADS ON PROJECTS IN THE CARIBBEAN

T. M. Lewis,

Construction Engineering & Management, Department of Civil Engineering,
The University of the West Indies, St Augustine, Trinidad & Tobago, West Indies.

ABSTRACT

The construction industry in the Caribbean region is becoming more open as the region moves towards becoming a single market and economy (CSME). This means that firms are increasingly competing both within their local community and on an international basis. This has in turn meant that firms are preparing and submitting more bids than they used to and that their bids are for projects located in different economic and physical environments. For their overseas work, the tendency has been for firms to absorb their overhead and profit into the unit rates within the bills of quantities rather than as a separate bill item, and this practice is now becoming more common for local bids as well. There are good reasons for this approach to bidding on projects in different cultural settings, but it is a less transparent approach and may not be in the best interests of either the contractor or the client.

KEYWORDS

Estimating, overheads, International bids, Unit rates, Transparency

Paper Code : A4-2

AN INVESTIGATION INTO THE IMPLEMENTATION OF A PREDICTIVE MODEL FOR THE EARLY STAGE ESTIMATION OF ELEMENTAL BUILDING COSTS

M. Soutos & D. Lowe

Project Management Division,
Manchester Centre for Civil & Construction Engineering,
UMIST, Manchester, UK

ABSTRACT

The impact of high technology during the last century has been massive, affecting numerous sectors and the construction industry has been no exception. Recent research at UMIST has resulted in the production of "ProCost", an early stage cost estimation software, which is based on the technology of Artificial Neural Networks. ProCost considers a series of variables to predict the final cost of a proposed building. This prediction is given in the form of a single figure.

This paper analyses the results of a nationwide questionnaire survey, as well as the outcomes of a series of interviews with three major UK based Quantity Surveying firms. The results of this research show that the vast majority of early stage design cost estimators believe that a single figure cost estimate is insufficient to meet their forecasting needs.

Further, the findings of this survey validate the progression to the second stage of the research at UMIST, which investigates the means of breaking down building costs into elements. Research into the most popular methods of cost analysis has been implemented resulting in the adoption of a widely acceptable elemental format.

The use of this format, in order to produce a predictive tool that will provide the estimator with elemental costs is investigated and the feasibility of incorporating such a tool within ProCost is examined. In doing that, 120 completed projects from the Building Cost Information Service of the RICS have been used to build an elemental cost database. Regression analysis was used to develop a series of predictive models.

The results of one of these models are described in the current paper. The significance of the regression is analysed and the costs predicted by the model are compared with the actual values. An analysis of the variance between the two follows.

KEYWORDS

Cost estimation, Elemental cost analysis, Neural networks, Regression analysis

Paper Code : A4-3

FINAL CONTRACTOR SELECTION USING A MULTICRITERIA METHODOLOGY

K.P. Anagnostopoulos,¹ N. Giatsos² & A. Vavatsikos¹

¹Democritus University of Thrace, Xanthi, Greece

²National Bank of Greece, Komotini, Greece

ABSTRACT

Since the probability of construction failure is quite high, selecting a capable construction contractor is one of the most important tasks faced by a construction client who wishes to achieve successful project outcomes. However, despite a huge increase in the complexity of projects in the last few decades, the majority of current selection methods over-emphasize acceptance of the lowest bid, and the lowest tender price is usually described as being the key to winning a contract.

A systematic multicriteria decision analysis technique, the Analytic Hierarchy Process (AHP), is used for contractor selection and bid evaluation, which permits different types of contractor capabilities to be evaluated. AHP is a systematic procedure for dealing with complex decision-making problems in which many competing alternatives (projects, actions, scenarios) exist. This paper is concerned only with the client's view, i.e. the selection process identifies a contractor to whom the client can confidently entrust the responsibility to execute the project satisfactorily. The application of the multicriteria method was based on a systematic analysis of the contractor capabilities. The alternatives are ranked using several quantitative and/or qualitative criteria, depending on how they contribute in achieving the overall goal.

KEYWORDS

Contractor selection, Bid evaluation, Multicriteria analysis

Paper Code : A4-4

COST ANALYSIS FOR PETROL STATIONS IN LITHUANIA

A. Juodis & P. Stalioraitis

Kaunas University of Technology, Kaunas, Lithuania

ABSTRACT

Construction cost estimating, control and analyze are the main tools in construction project management. Construction cost estimating makes influence on the final project effectiveness. Construction cost estimating goals, methods and accuracy differ according to the stage of construction project. Systematically arranging construction preparation, contractor will know how to reduce construction direct cost before other competition. That is the main strategy of contractors that allows increasing competitiveness. The object of this research was implementation of project of petrol stations network of the same contractor in Lithuania. The performed researches and obtained results revealed that construction bid price of petrol stations in Lithuania depends on occupied area and land plot. The offered subordination of the mathematical expression can be used practically estimating construction bid price of petrol stations and adopting decision regarding contractor's participation in tenders.

KEYWORDS

Project management, Construction preparation, Cost estimation

Paper Code : A4-5

APPLICATION OF ANALYTICAL HIERARCHY PROCESS (AHP) TO EVALUATE BIDS IN CONSTRUCTION PROJECTS

S.M. Ahmed¹ & S. Azhar²

¹Department of Construction Management, Florida International University, Miami, FL, USA.

²Department of Civil & Environmental Engineering, Florida International University, Miami, FL, USA.

ABSTRACT

The Analytical Hierarchy Process (AHP) is a powerful and flexible decision making tool that helps decision makers to set priorities and make the best decision when both qualitative and quantitative aspects of a decision need to be considered. This study presents a conceptual model for evaluating construction bids using Analytic Hierarchy Process (AHP). The model incorporates the following bid-evaluation criteria: Cost, Quality, Safety, Site Management, Labor force, and Schedule. The model is verified by evaluating four bids submitted by the general contractors for a petrochemical complex project. The results showed that the developed model using AHP is capable to model the bid selection process in uncertain environments where multiple evaluation criteria exist.

The paper will first explain the fundamentals of the AHP process. Then a step-by-step methodology will be presented to show the various stages of the model development. The model verification will be done using a case study of a petrochemical complex bid process. At the end suitable recommendations will be made about the use of this model in construction projects.

KEYWORDS

Analytical Hierarchy Process (AHP), Bid evaluation, Project Management, Decision analysis

Paper Code : A4-6

USING MULTIPLE DECISION-MAKERS FOR VALUING VARIATIONS IN CIVIL ENGINEERING WORKS

M. Sutrisna & K. Potts

School of Engineering & the Built Environment,
University of Wolverhampton, Wolverhampton, UK.

ABSTRACT

One of the main reasons for conflict and disputes in construction project management has been acknowledged as the valuation of variations. Most of the rules for valuing variations are open to different interpretations among the project stakeholders. In order to eliminate or at least to minimise the conflict and disputes, it is necessary to develop a systematic approach on valuing variations. A robust mechanism to assist practitioners in valuing variations is needed. In attempts to develop such a mechanism, gathering knowledge from multiple experts as the decision-makers has been considered as one of the most appropriate approaches.

This paper intends to explore the potential of deriving a single decision from multiple decision-makers, investigated by considering several methodologies exist to aggregate different decisions that may arise from multiple decision-makings. Having established the most appropriate methodology to congregate the result of the decision-makings, subsequent stages to develop a decision-making model were explored including the feasibility of gathering the knowledge from the decision-makers in valuing variations. A decision-making model was then developed using fuzzy-logic principles, in which the justification of applying this methodology is presented by demonstrating its appropriateness and superiority to other modeling methodologies for this particular problem area. The expected final outcome of the research project, involving the development of a Knowledge Based System (KBS) in order to preserve the captured knowledge in valuing variations and enable an easier dissemination, is discussed.

KEYWORDS

Decision-making, Model, Valuing-variations

Paper Code : A4-7

MULTIPLE CRITERIA EVALUTION OF COMPETITIVE ABILITIES OF THE CONSTRUCTION COMPANIES

A. Juodis & A. Šiškina

Kaunas University of Technology, Kaunas, Lithuania

ABSTRACT

The owner's task is to find the best and least costly contracting firm to build the project (Hendrickson, 2003). That is why often the construction contract is awarded to a contractor that submits low bid price. In world practice there are different types of competitive bidding: low bid, nearest to the average of all bids received, limited by average bids and owner's estimates and so-called Danish system. All of them are based on price solely. Therefore it is advisable to use a criteria system and adopt a method of multiple criteria decision making. This paper presents a criteria system for contractors' evaluation in Lithuania and method for selecting the winner based on the highest efficiency.

Many factors should be taken into account in the selection of construction project performer. It has been noticed that some owners make mistakes in selecting criteria and their weights for comparison of tenders. On purpose to determine criteria for contractors' evaluation in Lithuanian construction market the authors prepared a special questionnaire and made survey. Owners and construction managers of Lithuania were asked to indicate the importance of the proposed criteria. As the most important evaluation criteria they indicated the quality of product and reliability of the enterprise, bid price and experience of construction firm. On the basis of results of this survey owner and construction manager can establish a system of criteria, which are the most important in his/her opinion and adequately reflect the effectiveness of the construction enterprise activity and its competitive abilities.

Multiple criteria method presented in this paper enables owner and construction manager to evaluate the competitiveness of contractors' more objectively and properly. In our analysed example 10 proposed criteria were used to evaluate 12 competitive tenders of construction contractors. Competitiveness of construction firms was compared according to the multiple criteria decision making methodology. In this particular case was applied the method of determination priority of alternatives based on the criterion of proximity to an ideal point (Zavadskas, Peldchus and Kaklauskas, 1996).

Such selection can be easily substantiated, since it is based on applied scientific methods and researches. Well handled procurement procedures make the preconditions for the contractors' competition, increase effectiveness of owner's investments and decrease his risk of awarding the job for abnormally low bid or of hiring unqualified contractor. The suggested method can be applied in construction projects management for project executer's selection in Lithuania and other countries.

KEYWORDS

Multiple Criteria Evaluation, Procurement, Tender

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B-1 PROJECT MANAGEMENT APPLICATION & TECHNIQUES

Paper Code : B1-1

EARTHMOVING EQUIPMENT PRODUCTION EFFICIENCY

F. Inal & M. Radujkovic

Civil Engineering Faculty, University of Zagreb, Zagreb, Croatia

ABSTRACT

Cat 990 Loader is a high capacity equipment and very efficient for motorway construction earthworks. However, owning and operating cost is very high. Therefore, its operating and effective usage must be tracked closely not only for production point of view but also investment point of view.

In a selected project, Cat 990-loader production performance during one-month period was monitored. 990-loader production performance calculated and compared for each crew. As a result it is seen that 990 loader production efficiencies varies between each crew and average efficiency 76% is low compared to the planned theoretical production rate. The reasons for low efficiency and different production efficiency between crews are investigated and stated as idle time, down time, work location, night or day shift, haulage road and managerial factors. It can be said that the findings of this study will be helpful for project managers in motorway construction

KEYWORDS

Construction management, Construction equipment, Equipment performance, Equipment cost, Motorway construction

Paper Code : B1-2

A MICROSOFT PROJECT ADD-IN FOR CONSTRUCTING AN ACTIVITY-ON-ARC REPRESENTATION OF A PROJECT

K. P. Anagnostopoulos & L. Kotsikas

Democritus University of Thrace, Xanthi, Greece.

ABSTRACT

In this paper a new software application program is presented, which permits to construct an activity-on-arc representation of a project scheduled in Microsoft Project. The program is based on an algorithm for solving the dummy-arc problem, i.e. an activity-on-arc representation of a project that has the minimum number of dummy arcs given that it has the minimum number of nodes. The dummy-arc problem was shown to be NP-hard.

For this inherently difficult to solve problem, a Greedy Randomized Adaptive Search Procedure (GRASP) has been developed. The standard GRASP was enhanced by a learning mechanism and a bias function for determine the next element to be introduced in the solution, and by path relinking, an intensification strategy. The procedure has been coded in Visual Basic, and it was tested on randomly generated problems in order to find out suitable values of its parameters. The algorithm, tested also on a large set of randomly generated networks, has provided fairly good solutions at a small computational effort.

Developed entirely in Visual Basic, the program works as a Microsoft Project add-in, in which it creates a command menu, toolbars, a shortcut menu, and different means for inserting the time-cost combinations for each activity. This user-friendly program enhances Microsoft Project with an important aspect of project planning and can be used both as a support for educational purposes and as a management tool for real life projects.

KEYWORDS

Activity-on-arc, Dummy-arc problem, GRASP, Microsoft Project add-in

Paper Code : B1-3

A SIMULATION ANALYSIS OF "BULLWHIP EFFECT" IN CONSTRUCTION SUPPLY CHAINS

S.M. Ahmed¹, D.X. Zheng¹ & S. Azhar²

¹Department of Construction Management, Florida International University, Miami, FL, USA.

²Department of Civil & Environmental Engineering, Florida International University, Miami, FL, USA.

ABSTRACT

"Bullwhip effect", is a phenomenon resulting in bigger forecast errors or intense fluctuation in the upstream from slight change in the downstream. Although the existence of "bullwhip effect" has been widely documented in manufacturing industry, retail industry, etc., no effort has yet been made to investigate the influence or even existence of this effect in the construction industry. This study, hopefully, is going to fill this gap by distinguishing the characteristics of construction supply chains from general supply chains. The waste and inefficiency in construction practices will be analyzed step by step following the flows of material and information. This paper investigates the influence of performance/decision of upstream members to those of downstream members in order to remind us of this effect in construction practices. Comparisons have been conducted to indicate how much benefit the construction industry can achieve if it steps forward to realize and reduce this effect.

KEYWORDS

Bullwhip effect, Construction Supply Chains, Simulation, Project Management

Paper Code : B1-4

OVERVIEW OF LARGE SCALE CONSTRUCTION PROJECTS (LSCPS), DEFINITION AND DIFFICULTIES: EGYPT

A. M. Awad, M. J. Mawdesley & G.K. Kavvouras

Nottingham Centre for Infrastructure, School of Civil Engineering, University of Nottingham, UK

ABSTRACT

Many researchers have described LSCPs as projects marked by high value, long duration, and a high level of complexity characterised by high technology and multi-disciplinary inputs. They have used different approaches to identify LSCPs and to distinguish them from mega projects and ordinary projects. Consequently, it is difficult to find a standard definition for a LSCP.

A definition for LSCPs is investigated in this paper as a part of a research project that aims to investigate the possibility of modelling the interaction between project finance of large-scale construction projects, macroeconomic indicators and policies.

This paper describes a pilot survey that carried out in Egypt with the objective of providing information, which can be used in modelling LSCPs and the economy

Results of this survey will be presented showing the variation in the understanding of what a LSCP is. The information gathered is used to clarify LSCPs in term of value, duration, technology involvements, and multidisciplinary inputs from many organisations. Economic environment, international participation, and currency problems that face the construction industry are also discussed and their effects on LSCPs in Egypt are described.

KEYWORDS

Large scale construction projects, Egypt, Project finance economic environment, International participation, Foreign currency

Paper Code : B1-5

THE OPTIMIZATION OF A CONSTRUCTION TIME SCHEDULE*

D. Kallianis¹, C. Ripis², M. Mavroidi³, P. Moschovitis⁴ & C. Saridaki²

¹Department of Construction Engineering & Management, Faculty of Civil Engineering,
National Technical University of Athens, Greece

²Water Supply and Sewerage of the Greater Athens Area (EYDAP S.A.), Athens, Greece

³Athens International Airport, Athens, Greece

⁴associated with DIEKAT S.A., Athens, Greece

ABSTRACT

In the frame of nCPM program, which concerns the creation of a scientific network in construction project management, the participating members of various technical companies, were separated in three teams and for the same construction project each team created a time schedule using the software Primavera Project Planner. Then each team presented the created time schedule and followed constructive discussion with the members of the other teams. The timeschedule that was created by the first team was similar with the timeschedules that are usually created by the technical companies in the Greek area. After constructive discussion, including references to the Y.A. D17/01/117/fn332/16-11-89 of Ministry for the Environment, Physical Planning and Public Works titled "Time Planning Studies Specifications" the second team presented an improved timeschedule accompanied with a Technical Report. Following comments from the members of other teams the time schedule that was created by the third team can be considered an excellend work because it contains detailed information for the effective management of a construction project, which covers the whole project from the drawings, the required authority approvals, the supplies, the construction work, the inspection and testing and is completed with safety and health matters. Conclusively in this effort of collaboration of individuals from different companies in a common subject it was proved that reciprocal profit can result for all the participating companies.

KEYWORDS

Project management, Construction, Time schedule.

* Abstract only – full paper not included in the proceedings.

B-2 CASE STUDIES

Paper Code : B2-1

MD 27 ON THE WAY TOWARDS A POO THE FIRST STEPS OF TRANSFERRING A MUNICIPAL DEPARTMENT (MD) INTO A PROJECT ORIENTED ORGANIZATION (POO)

G. Jakisch¹ & D. Zuchi²

¹Municipal Department 27, Vienna City Administration, Vienna, Austria

²Roland Gareis Consultant, Vienna , Austria

ABSTRACT

The Vienna City Administration (VCA) uses Project Management (Gareis 2003) since many years to handle complex undertakings mainly in the fields of construction and ICT but hardly for organisational projects.

Beginning of 2003 the Departments "EU-Promotion" and "Development of the economy and technology" were merged to form the new Municipal Department 27 "EU-Strategy and Economic development".

During the recent years VCA developed to one of the European Regional Development Fund (ERDF) implementation centre hosting the INTERREG III C EAST Joint Technical Secretariat (JTS) and one INTERREG III B-CADSES Contact Point (CP). It manages as Operative Assistance Authority (OAA) 3 Interreg III A PHARE-Cross Border Co-operation Programmes (AT-CZ, AT-H, AT-SK), the "Objective 2 Vienna" and the "Urban II Vienna" Programmes. It successfully applied for the INTERACT Project "Managing Transition". Beside these tasks MD 27 runs two important staff units "Public services" and Regional "Energy Matters". It acts as internal consultancy to the other departments in European Programme matters and is responsible for the financial flows from and towards EU.

The rise of personnel – roughly by 400% in 3 years – and the coverage of different content areas created the need to find a common basis and adopt the organisational culture. Recognising these developments Programme and Project management were identified as those that core competences were needed. The main challenges were to combine successfully the Organizational Development process necessary to consolidate the department and the department's transition into a POO, which also enables the handling of EU-Programmes and EU-Projects.

The Project (Jakisch 2004) goal is to transform the Municipal Department 27 into a Project Oriented Organisation (POO). It's main objectives are:

- develop Programme and Project Guidelines for both non- and European Programmes and Projects
- train the staff in Programme and Project management
- coach specific Programme and Project manager on running projects
- implement Programme and Project management structures
- prepare transfer the knowledge to relevant partners.

The main Milestones are:

- Programme and Project Management Guidelines including procedures, templates, standard project plans developed
- Programme and Project management training performed
- initial coaching of selected Programme and Project-managers completed.

It started with presentation of a the external expert & change manager during the Department's two day annual seminar.

The first version of the IPMA Standard based Programme and Project Guidelines were developed in several workshops by the project team consisting of programme & project experienced staff and the external experts.

The Programme and Project management training seminars (basic, advanced, management skills) laid the theoretically foundations and used four real programmes and projects to train on the job. 5 mixed training groups worked together on one project during all three seminars thus assisting the department's OD Process.

The first coaching project "Tech data" started already before the training sessions. Others including "Managing transition" afterwards.

Beside this IPMA Standard was implemented in two INTERREG Projects "UTN II" and "DonauHanse" by subcontracting Project Management and Project Management tools used in other activities.

In 2004 the department's Programme Managers start to request implementation of PM standards in the new projects of their programmes.

The next steps will be to standardize the Financial Management and publish all on the departments Intra and Internet Website.

KEYWORDS

Project Management, IPMA Standard, ERDF programmes, UTN II, Public Administration

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Paper Code : B2-2

CASE STUDY: LONDON HEATHROW TERMINAL 3 – PIER 6 PROJECT CONTROL

D. Antoniadis

Turner & Townsend Project Management, London, UK

ABSTRACT

A major process within Project Management, which supports the Project Manager (PM) and the Team to set up, coordinate and subsequently monitor the project is that of Project Control.

Standard structures, i.e. Work Breakdown Structure (WBS), Cost Breakdown Structure (CBS), etc., as described in the Project Management Book of Knowledge (PM BoK), and other project coding need to be defined from the very early project stages. Management of interfaces between Planning, Estimating, Cost Control, Commercial and Finance disciplines, as well as processes such as Change Control, Progress Monitoring / Reporting, level(s) of rolling up of information from Contractors, Suppliers, Designers, Consultants, etc. is the '*work arena*'/environment where Project Control performs its daily functions.

British Airports Authority (BAA) responding to developments in the aircraft industry, specifically the introduction of the Airbus A380 – the biggest passenger carrier – is constructing in Heathrow Terminal 3 a Pier (Pier 6) that will accommodate all its demands.

Pier 6 which is the second biggest project within BAA, with tight budgetary and time demands, health and safety, energy and environmental demands, a large number of interfaces, and the requirement for passenger segregation, follows the standard company wide Major Project Process.

A large number of parties, Construction Manager, contractors, suppliers, design consultants and suppliers are working together through the different project stages to deliver the project.

This paper will describe the approach taken by the Project Control Manager and the Project Management team in setting up, and rolling out the Project Control processes and systems. In doing so, this case study will point out the number of benefits, at project as well as company level, that are derived from having and performing proper Project Controls.

KEYWORDS

Project control, Project Structures

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Paper Code : B2-3

MANAGEMENT OF DESIGNS FOR A MAJOR MOTORWAY PROJECT

S. Lambropoulos¹, D. Konstantinidis² & F. Antoniou²

¹Department of Construction Engineering & Management, Faculty of Civil Engineering,
National Technical University of Athens & Egnatia Odos S.A., Greece

²Egnatia Odos S.A., Thessaloniki, Greece

ABSTRACT

Egnatia Odos A.E. (EOAE) was established to take over the responsibility for managing the design, construction, operation and maintenance of the Egnatia Motorway in Northern Greece. The management of EOAE has produced a structural organization capable of realizing a state-of-the-art motorway project that will accelerate significantly the development of Northern Greece.

Design issues are considered to be the key to the success of the Project, because design and tendering procedures have to be completed at unprecedented speed in order to ensure that funding targets are met. This paper presents the implementation of modern management techniques within the EOAE Design Department. The purpose of this case study is to present the benefits obtained from the design management techniques and innovations employed for accelerating the design procedures, while staying within time, cost and quality constraints.

The Design Department, in order to ensure that state of the art design is maintained throughout all sections of the project, is made up of eight functional units (disciplines) specialising in building, hydraulics, highway, electromechanical / telematics, structural, tunnel, geotechnical and environmental design. Throughout its nine year life, EOAE's design department's engineering staff was responsible for managing over 900 design contracts of total value over 190 M€ and carrying out over 12000 technical reviews. These figures alone demonstrate the necessity for developing acceleration methods for the award, design and checking procedure.

The methods developed for design management, including techniques and innovations for accelerating design procedures to meet limited time constraints are presented and the efficiency of these procedures has proven to be very satisfactory. The techniques presented are:

- The implementation of a matrix organizational structure within the Project Directorate which supports the Project Management Departments.
- The introduction of call up contracts for all disciplines of the Design Department.
- The award of call up contracts to geotechnical investigation contractors and the requirement for geotechnical designers to supervise borehole drilling and testing.
- The implementation of the EOAE's design guidelines, the OSMEO and the OSAT, as well as the standardisation of culverts and retaining walls.
- The employment of external consultants to carry out technical reviews, independent checking and management of designs.
- The project information system, in combination with Primavera Project Planner and the electronic Document Management System.
- The Quality Assurance System.

KEYWORDS

Design Management, Management Structure

Paper Code : B2-4

INTRODUCING THE "BALANCED SCORECARD" METHODOLOGY IN THE GREEK CONSTRUCTION INDUSTRY. PRESENTATION OF THE CASE STUDY AT EDRASIS C. PSALLIDAS S.A..

M. Mathioulakis & J. Novas

Edrasis – Ch. Psallidas S.A., Koropi, Athens, Greece

ABSTRACT

The Balanced Scorecard (BSC) is a concept and method used for managing more efficient a company. R. Kaplan and D. Norton 1992, introduced the concept and since then many companies have used it. In addition to the financial, the scorecard takes into account also non-financial factors such as customer relations, innovation, and the internal processes of the company.

Due the framework of "continuous improvement" and that is a fundamental requirement of the ISO9001:2000 standard, the methodology of BSC was chosen in order, not only to deliver customer satisfaction in the short-run but also to asses the strategic objectives set by the management board of Edrasis C. Phallidas S.A..

In order to facilitate the implementation of the BSC methodology, members of the top management were questioned with the purpose to identify the critical success factors that will enchase the realization of the firm strategy.

The Dept. of quality & safety management evaluated the results of the questionnaires and reached to the critical success factors that will compose the initial balanced scorecard for Edrasis S.A. Group of Companies.

According to Kaplan & Norton Methodology the next step is to assign the proper indicators for each of the critical success factors and find how they interact with the organizational processes.

The expected benefits of the implementation of the BSC is to develop a management tool for continuous monitoring and improvement of all critical processes that affect the strategic objectives within the organization.

KEYWORDS

Balanced Scorecard, Performance Measurement, ISO 9001:2000, Process improvement, Strategic Management

Paper Code : B2-5

TRADITIONAL AND ONLINE DELIVERY OF A POSTGRADUATE DISTANCE EDUCATION PROGRAMME IN CONSTRUCTION PROJECT MANAGEMENT

M.J Hills & P.W. Fox

The Hong Kong Polytechnic University, Hong Kong, SAR, China

ABSTRACT

This paper considers the differences between traditional distance education programmes, based almost entirely on print materials, and online distance education programmes that rely heavily on the web for delivery of the material. The study reflectively analysed qualitative data gleaned from teachers, students, and professional on-line educators involved in the development and implementation of a Master of Science degree programme in project management for construction and real estate offered by the Department of Building & Real Estate at The Hong Kong Polytechnic University. The aim of this paper is to raise pedagogical issues in relation to teaching construction project management subjects over the Internet and generally stimulating further debate over online distance learning education.

KEYWORDS

Web-based, Construction, PM, Postgraduate, Distance education, Pedagogy

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Paper Code : B2-6

PROJECT MANAGEMENT SOFTWARE SYSTEMS: THE CASE OF THE GREEK CONSTRUCTION INDUSTRY

I.G. Kinias¹ & D.M. Vlachos²

¹Department of Systems Engineering, Brunel University, West London, UK.

²Department of Mechanical Engineering, Aristotle University of Thessaloniki, Greece.

ABSTRACT

Project management software (PMS) already has a few decades of continuous evolution. Construction Industry is one of the major sectors where PMS is widely used. The main goal of this work is to investigate PMS systems used by the Greek construction industry. Although, PMS may generally include various modules from costing to human resources planning, we concentrate on the modules for project planning and control which are the most important. We systematically evaluate some of the major software packages and provide guidelines for the proper selection according to the construction firm needs. Finally, we present trends in related research

KEYWORDS

Project Management, Software evaluation, Construction Industry.

Paper Code : B2-7

PROJECT CONTROL SYSTEMS ON THE EGNATIA MOTORWAY

A. Maravas, Z. Papasiopi, V. Giorspiros & A. Kallantzis

Egnatia Odos S.A., Thessaloniki, Greece

ABSTRACT

The Egnatia Motorway is one of the most significant infrastructure projects currently under construction in Europe. It is 680 km long and the total cost of works amounts to €5 bn. The main objective regarding the planning and management of this project is the completion of the motorway in accordance with predetermined technical and qualitative specifications without cost overrun and within the approved time schedule. This paper presents the systems and business procedures applied by Egnatia Odos AE, the company responsible for the realization of the project, in order to track and control project costs and time overruns. Particular reference is made to how collaboration with other companies has improved corporate knowledge and know-how on issues of project monitoring. Finally, the expected benefits from participation in the network of Construction Project Managers are analyzed.

KEYWORDS

Project Controls, Cost Control, Planning, Scheduling

ADDITIONAL PAPERS

Paper Code : AD-1

A CONCEPTUAL MIX-INTEGER MODEL FOR EVALUATING THE LEANNESS OF CONSTRUCTION SUPPLY CHAIN

D.X. Zheng¹, S.C. Wong² & S. T. Ng²

¹Department of Construction Management, Florida International University, Miami, FL, USA

²Department of Civil Engineering, The University of Hong Kong, Hong Kong

ABSTRACT

The introduction of lean philosophies to construction has proven to be successful with numerous examples of improvement programs and best practices. The core of lean construction is to reduce non-value adding flow activities (i.e. inspection, waiting, moving). As a matter of fact, in a case study of supply chain for pipe supports used in power plants in the USA, data obtained from industry to support this study illustrates that more than 96% of the time in construction supply chain is non-value-added. While there is so much opportunity to reduce waste, it is obvious that a project can never be completed within the remaining 4% value-added time. This paper presents a working-on research to transfer the evaluation focus from time to cost and from non-value-added tasks to value-added tasks. A conceptual mix-integer model is introduced to unveil the leanness of supply chain on the utilization of project resources by value-added activities to ensure profit.

KEYWORDS

Conversion, Lean construction, Supply chain, Value-adding activities

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Paper Code : AD-2

THE INFLUENCE OF THE ENVIRONMENTAL EFFECTS ON THE COST OF LARGE SCALE ROAD CONSTRUCTIONS

E. Christakos & G. Kalfakakou

Department of Civil Engineering, Aristotle University of Thessaloniki, Greece

ABSTRACT

During the last years the rapid growth of the technology brought on the one hand a clear improvement in the life quality in the developed countries, on the other hand it caused a distortion of the relation between human and environment, a fact that caused inevitable the need of differentiating the general philosophy of the development. Consequently nowadays development and environment are parallel concepts and any kind of development must step with the effort of protecting the environment.

Specifying the above mentioned on the road construction sector, we can observe an important action in the direction of the environmental protection in the stage of the study as also in the stage of the construction. The influence of the environmental measures on the constructions is very important and is expressed by the enforcement of specific binds such as the construction of bridges and tunnels when the embankments and the ditches correspondingly exceed some specific limits, etc. The alteration of the originally estimated constructions causes significant modifications at the cost as also in the internal rate of the investment with direct consequence the transfer of the greater part of the burden to the users of the project.

The estimation of the initial construction cost, as the total cost after the imposition of the environmental measures, as also the analogy of the aggravation, due to the increase of the cost, of the users are parameters which are necessary to be estimated before starting any kind of work and which define the necessity and the attractiveness of investing on a project

KEYWORDS

Construction cost, Road works, Environmental effects, Investment attractiveness, Road users

Paper Code : AD-3

RESULTS OF CLUSTERING ATTEMPTS IN SUSTAINABLE CONSTRUCTION

O. G. Manoliadis

Technological Educational Institute (TEI) West Macedonia, Koila, Kozani, Greece

ABSTRACT

To create, maintain and operate the products of the construction sector requires huge quantities of raw materials (by some estimates 6 tonnes for every person annually) and energy (around half of European consumption). Construction activities have large environmental impacts, both temporary (noise, dust, water pollution) and permanent (land use, greenhouse gas emissions, resource consumption). Indications of the environmental impact from construction include: 13-30% of all solid waste deposited in landfills comprises construction and demolition waste, 17-50% of all natural resources are consumed by the construction industry, which includes 40% of raw stone, gravel and sand and 25% of virgin wood, and buildings account for 16% of the water consumed annually.

A more sustainable construction, maintenance and operation of the built environment is to be regarded as the biggest potential single sector contribution to achieving sustainable development. The last decade a large number of construction related parties such as practitioners providers owners and users profit to the full extent from the relatively large amount of research undertaken in the area of sustainable construction, including the various research projects as funded under the EU.

Many national R&D programmes in EU and EU Associated countries, has been a focus in relatively many Thematic Clustering and other programmes that received EC funding Sustainable Construction in the context of the Fifth and Sixth Framework Programme and has been addressed in the earlier mentioned international programmes and initiatives. This – amongst others – has resulted in various international expert commissions in which members exchange information and collaborate.

The results from clustering attempts in Sustainable Construction during the last decade are presented in this work. International expert commissions in which members exchange information and collaborate are examined. The components of the Clustering's network structure are summarized as well as the scientific domains, in which the international inventory in sustainable construction of available knowledge, tools, concepts and technologies are concentrated .

KEYWORDS

Sustainable construction, Sustainable development, Scientific networks, Clustering

Paper Code : AD-4

PROJECT MANAGEMENT AND ADMINISTRATION TECHNIQUES AND THEIR APPLICATION.

S. Yfanti, C. Milonakis, G. Pahakis & A. Rammos

Dept. of Mechanical Engineering, Technological Educational Institute (TEI) of Heraklion, Greece

ABSTRACT

The sector of constructions represents a significant part of Greek economy. In a time, where many are written for constructions and contractors the need for confrontation of the dangers that arises from unforeseen events, via Project Management and Administration techniques becomes more imperative.

Factors as the time, the cost and the quality constitute the main axes for the wise and precise project management and planning. Meanwhile it is absolutely essential the director or manager of a construction project to preserve under control not only the critical situations that result from the development of various factors of uncertainty, but also the management of the procedural and formal administrative part of a project, particularly if these are public construction projects.

Questions as the knowledgeable level of contractors concerning the existing project management techniques, their opinion in regard to the effectiveness of certain methods, their ability to use project management tools, the cross-correlation of quality in constructions with the application of international models of quality etc, are examined throughout this presentation.

Object of the proposal is an approach of the subject firstly theoretically through the International bibliography and the presentation of researches in Greece concerning the constructional sector, and secondly through initial, small scale, research in the island of Crete.

The level of knowledge of contracting society in the island of Crete in regard to the Project Management and Administration techniques is also investigated. In the same time a first attempt is made to record the difficulties that the contractors are called to face for the successful completion of their projects, as well as their opinions for the course of the constructional sector.

We consider the present proposal as a start point for further study of the problems that the constructional society of islander Greece faces, with final objective the determination and the exploitation of the critical factors that will result to the reduction of situations of uncertainty.

KEYWORDS

Project Management, Greek Constructional Sector

Paper Code : AD-5

MEASURING CUSTOMER SATISFACTION IN CREEK CONSTRUCTION INDUSTRY. FROM UTOPIA TO DAILY PRACTISE.

J. Novas & M. Mathioulakis

Edrasis – Ch. Psallidas S.A., Koropi, Athens, Greece

ABSTRACT

One of the fundamental principals concerning the implementation of quality managements systems, is the continuous effort of the organization to satisfy customers.

In order to follow such a customer oriented policy in a project level as well as in a corporate level, the organization has to define who is considered to be as a customer and in which stages of the project, has the effort of measuring customer satisfaction needs to take place.

Customer satisfaction can be monitored with the help of a questionnaire that aims at the quantification of different parameters that are considered to be crucial for both the organization and the customer. The given answers are examined in order to come out with the first conclusions.

During the framework of the paper, it will be presented firstly the method that describes how the questionnaire has been designed, followed by the effort of the Dept of Quality & Safety management at Edrasis C Psallidas to monitor customer satisfaction by using the above-mentioned questionnaire under the continues effort for improvement.

KEYWORDS

Customer Satisfaction Index, Performance measurement, ISO 9001:2000, Process improvement, Customer Relations Management

Paper Code : AD-6

QUALITY ASSURANCE IN TECHNICAL PROJECTS AND THE ROLE OF PROJECT MANAGEMENT

A. Hatzigeorgiou

Thessaloniki, Greece

ABSTRACT

Technical projects of all categories are important infrastructure projects, contributing drastically to the progress of a country and to the improvement of its standard of living. They are products of a special industry, the construction industry that differs from any other common industry sectors, like manufacturing or services, mainly due to the unique products that produces. A technical project contains a multiple chain of exchanges between a customer (the public sector or an individual) and many suppliers (designers, constructors, contractors etc.). These exchanges require some specific rules which have a negative or a positive impact. In the case of technical projects the basic rule is quality. An indispensable tool for quality assurance in technical projects is Project Management. Project Management is a dynamic tool, especially useful for the sensible management of various factors that affect the progress of a technical project. The aim of the present paper is to discuss the role of Project Management in the issue of quality at technical projects. The classical meaning of the term "quality" differs in the case of technical projects, in relation with other products. In the case of technical projects, "quality" is defined having a three-fold meaning: The completion of the project within specific time limits, according to the required technical specifications and within its budget. The basic motives for the introduction and implementation of quality in the construction industry are: cost reduction, improvement of working conditions/safety and on-time completion of projects.

The two basic approaches used in quality management are the Classical Approach and the approach of Quality Assurance System. These two approaches of quality management focus on different aspects of the process of a technical project. As a result, they follow different cost distribution between the various stages of the project and consequently have a different effect on the whole cost of the project. Compared to each other, the Quality Assurance System proves to be more efficient than the Classical Approach in quality management. Having as basic motto: «prevention instead of cure» a Quality Assurance System succeeds in a bigger reduction of the cost during the stage of repairs and replacements and thus in a bigger reduction of the total cost. In the case of a technical project, the user is out of the production procedure, as the Project Master controls the whole process, coming in direct or indirect touch with the main participants of the project. In addition, decisions taken in the early stages of a technical project are determinant for its final quality level, in spite of the fact that these stages have a much less impact in the formulation of the final project cost. Consequently, the role of the Project Master in the formulation of the project's total quality level is crucial.

The basic concept of Project Management considers that the four characteristics of a project, which are Object, Cost, Time and Quality, are placed in the four corners of a solid tetrahedron. Approaching of a single side of this tetrahedron means optimization of the respective characteristics but at the same time aggravation of the opposite site's ones. The methodology of Project Management treats each one of the above four characteristics of a technical project separately, following different approaches and considering that they are all of equal importance for the successful completion of the project. For the administration of a project's scope, all the affected by the project (stakeholders) should be defined, together with the recognition of their demands or their needs (stakeholders analysis), the transformation of those needs into activities and finally the allocation of these activities (work breakdown). The basic tool for cost management is the «conventional budget», although it is not always capable by itself for the monitoring of cost changes. For that reason the project's revenues, the cash flows, the completion level of separate tasks and the predicted cost at the end of the project should also be monitored. Time programming is the most common of Project Management's methods, mainly used for the management of the

project's completion time but also for resource and cash flow management. Its basic applications are performed by the use of charts, divided into to major categories: linear charts, also known as Gantt charts, and cross charts, the most common of them known with the names CPM (Critical Path Method) and PERT (Program Evaluation and Review Technique). As for quality, the aim of a technical project should be to respond to a total measure of the primary needs which the project was designed in the first place for. Quality in technical projects consists of both objective (technical) features, for example strength, resistance, safety, credibility et al, as well as subjective features, for example functionality, usability, aesthetics et al.

Since the simultaneous optimization of the four characteristics of a project is impossible, the achievement of all the project's goals at the maximum level is unobtainable. Therefore, the role of Project Management is to compromise these competitive goals in order to achieve the best possible relation. Two of these contradictory goals are construction cost and use value, demonstrated with two examples: a) design quality and b) completion time. In the first example, an improvement of the expected quality level, during the design stage, increases both construction cost and use value but the rates of these increases are not respective in the two situations. Consequently, an increase of design quality has as a result an increase of the use value of the project, but with a disproportionate rate to the exponential increase of construction cost, especially after a critical point. Finding the optimum solution is not an easy task, since the choice of the desirable design level is actually made by the designer, while the cost of the implementation of these decisions burdens the constructor or the Project Master. In the second example, the completion time affects reversibly the construction cost of a project than the benefit from its exploitation, i.e. its value. As a result, the minimal construction cost appears at the optimum completion time, while the use value of the project, for this specific optimum time, is not the highest possible. From the two examples above, design quality and completion time, the inability of ranking the multiple and conflicting characteristics of the term "quality" in advance, becomes obvious.

The large number of phases in the production procedure of a technical project, from its conception to its completion, makes it almost impossible for the use of a generalized quality model. Project Management's philosophy takes into consideration the fact that during the various phases of a project, it is being managed by different groups of people, with different cultures and targets. These groups are put on a scale in a hierarchical pyramid and the order in which they are involved is: i) sub-contractors and suppliers, at the bottom of the pyramid, ii) the main contractor, iii) the design group and iv) the Project Master, at the top of the pyramid. For Human Resource Management, the philosophy of Project Management segregates the members in a technical project into two major groups: The Primary Group, consisting of all those which participate in the process of the project and the Secondary Group, consisting of members which although do not take part in the actual completion of the project, they can strongly influence its progress at the same time.

KEYWORDS

Technical projects, Project Management, Quality Assurance

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- **Prof. Ronald McCaffer**, Deputy Vice-Chancellor and Leader of the Construction Management Group, Department of Civil and Building Engineering, Loughborough University, Loughborough, UK.
- **Mr. Miles Shepherd**, President of the International Project Management Association (IPMA) & Associate Lecturer at Open University UK & USA, UK

Important Dates

- **Submission of Abstracts:** 15 November, 2004
- Acceptance: 30 November, 2004
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