POTENTIAL FOR USING PROCESS APPROACH TO MANAGE CONSTRUCTION PROJECTS IN GREECE

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The Innovative Manufacturing Initiative (IMI) in the UK over the past decade has promoted the agenda of employing manufacturing sector principles in the execution of construction projects. Manufacturing management is founded on a process flow concept of the production activity. A notable development from the IMI programme, in this regard is the development of a Generic Design and Construction Process Protocol (GDCPP), based on the Cooper stage gate approach to managing the development of a new product in the manufacturing sector. The rationale for deploying the process approach to managing construction derives from the potential for replicating the step-change productivity improvements that has attended manufacturing projects that resulted from the adoption of such techniques. The possible gains in efficiency present prospective advantages for the application of the process approach to managing construction projects. In this paper the authors present preliminary stages of a qualitative investigation into the potential for employing the process approach in managing construction projects for "Egnatia Odos S.A.", one of the largest construction companies in Greece. The investigation was based on data collected through semi-structured questionnaires delivered through interview sessions with Egnatia's representatives. The study employs the GDCPP developed specifically for construction to explore the current constraints and bottlenecks that would have to be addressed to enable the practical uptake of the process approach by Greek construction professionals. Some early indications from the investigation are briefly discussed to provide an insight into the potential benefits and drawbacks of GDCPP's implementation in Greece and more specifically to one of the largest construction projects currently under implementation, namely that of the 680 Km Egnatia highway.

Keywords: construction, Greece, process, Process Protocol, projects.

INTRODUCTION

Over the last decade, construction has witnessed a gradual introduction of manufacturing management principles for the way projects are managed. The manufacturing management principles are founded on a process flow concept of the production activity. Within the UK, the process outlook has been spearheaded by the Innovative Manufacturing Initiative (IMI) set up to bring about accelerated improvements for industry. The emergence of construction as a manufacturing process from the IMI programme subsequently resulted in the development of a construction specific process for delivering projects (Kaglioglou et al., 1998). While its potential to transform construction has been acknowledged by industry and academia alike, the adoption of the developed process approach by industry has been slower than anticipated (Egan, 1998; Latham, 1994; Anderson and Tucker, 1994; Thorpe et al., 1998) . In this paper the authors present the initial phase of a study investigating the

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potential for adopting and applying the Generic Design and Construction Process Protocol (or Process Protocol for short), for implementing construction projects in Greece. The rationale for exploring the potential of managing projects in Greece by the process approach stems from the perceived benefits for UK construction in deploying such a bi-dimensional gated system (Cooper at al., 2005). The investigation was based on data collected through semi-structured questionnaires delivered through interview sessions with representatives from the Egnatia Odos S.A. The study employs the GDCPP developed specifically for construction to explore the current constraints and bottlenecks that would have to be addressed to enable the practical uptake of the process approach by Greek construction professionals. Some early indications from the investigation are briefly discussed to provide an insight into the potential benefits and drawbacks of GDCPP's implementation in Greece.

DELIVERING PROJECTS THE PROCESS-WAY

Currently, process modelling in Greek construction can be characterised as being at a stage where it is performed as part of the requirements of ISO 9000:2000. However, this would be the case where ISO certification is a requirement imposed by the project sponsor. Moreover any such process development would be limited to tasks and activities and often ignore the complex and related linkages and interfaces present in the delivery of any construction project (Cooper et al., 2005; Kagioglou, 1998).

The developments leading on to the Olympic Games in 2004 saw the Greek construction industry build up a substantial capacity to deliver major projects in an accelerated fashion. The increased capacity and accelerated delivery has helped to expose areas of strength such as technical competency, and also weaknesses such as procurement arrangements and project management, that need to be addressed. Following on from the Olympic Games, the construction industry in Greece has been in a state of reformation and reconstruction (Pantouvakis, 2004). The adoption of a process approach in the management of construction projects could provide an avenue for the restructuring of the project delivery system, as well as assist in improving the competitiveness of the industry as a whole. The research that underpins this paper also involves a comparative investigation between GDCPP and the ISO 9000 process modelling method implemented in the Egnatia Odos S.A. The next two sections of this paper are used by the authors to provide a background of construction as a process in both UK and Greece, which is deemed essential for appreciating the contextual differences between construction in the two countries.

Definitions

The Process Protocol describes a common set of definitions, documentation and procedures that provides the basics to allow the wide range of organisations involved in a construction project to work together seamlessly. It depicts the way in which the processes involved in the design and construction of a project are re-arranged so as to produce a more efficient, effective and economical way of undertaking the relevant procedures (Kagioglou et al., 1998).

PROCESS APPROACH IN UK CONSTRUCTION

The need for a process-based orientation

While the need to improve has been at the heart of any industry including construction, towards the end of the 20th century the efforts within the UK construction industry to improve its performance quickened. The efforts to improve

have at different periods culminated in government and institutional reports aimed at providing insights into, and direction for improvement (Philips, 1950; Emmerson, 1962; Banwell, 1964; Gyles, 1992; Latham, 1994; Egan, 1998). In all cases, the reports identified the fragmented nature of the industry, the lack of co-ordination and communication between parties, the informal and unstructured learning process, adversarial contractual relationships and the lack of client and occupier focus as factors that characterised the state of construction and inhibited the industry's performance (Cooper et al., 2005). To overcome these constraints in construction Latham (1994) suggested that the industry should adopt techniques, practices and theories of production from manufacturing in order to accelerate its improvement in performance. Egan (1998) subsequently, proposed that UK construction could improve its quality and efficiency by adopting and implementing integrated processes and process modelling methods for the delivery of projects.

The need to adopt a process orientation by practitioners to accelerate improvement was strengthened by the dramatic change in business climate and industry structure since the mid-1980s (Cooper et al., 2005; Katzenbach, 1996). On the one hand there was the increasing demand by clients and end users of facilities built that their projects are delivered on time (lead time criteria), without exceeding the budget (cost criteria) and satisfy specific quality requirements (quality criteria). On the other hand, the dynamic environment and intensifying competition in the market, lent support to the need for better management systems in construction. The process approach provides the backbone of a management system that ensures the streamlining of all tasks to achieve greater efficiency (Cooper et al., 2005; Kagioglou, 1998). The suggestions of both Latham (1994) and Egan (1998) in their reports have played a significant role in prompting the implementation of process approach and process modelling to deliver construction projects.

Cooper's "stage-gate" approach

The key driver that forced the manufacturers into setting up product development processes a few decades ago was the need to come up with an effective and efficient method to launch new products into the market. The first-generation scheme for product development was advanced by the National Aeronautics and Space Administration (NASA) in the 1960s. It was widely known as PPP (Phased Project Planning) model or Phased Review Process. In the PPP model the development process was broken down in phases and every phase began when all the activities related to the previous phase were completed. To overcome the rigid nature of the PPP model, Cooper (1990, 1994), proposed modifications to accommodate the need for flexibility within and between phases of the development process. Figure 1 shows Cooper's Third-Generation process model which developed to overcome the time delays that previous models presented.

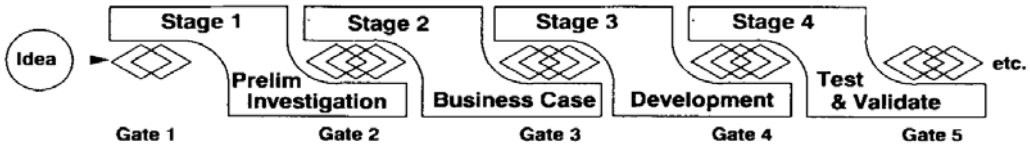

Figure 1: The Third-Generation Process model (Cooper, 1994)

The "Stages" represent sets of activities which are organized and executed in order to produce specific outputs for that stage, which will be evaluated and reviewed before

advancing to the next stage of the process. "Gates" are decision making points, where all the information provided by the previous stage is examined and valued according to a specified set of criteria. The Third-Generation Process model and the philosophy of Cooper's "stage-gate" approach in managing the New Product Development for the manufacturing industry influenced the development of a similar model in managing the delivery of construction projects, namely the Generic Design and Construction Process Protocol (GDCPP).

The Generic Design and Construction Process Protocol

The Generic Design and Construction Process Protocol (GDCPP) was developed by a group of individuals and companies, in response to the need for a more holistic and integrative approach for delivering construction projects (Cooper et al., 2005; Kagioglou, 1998). The Process Protocol (1995-2000) was undertaken by the University of Salford and Loughborough University with the participation of a large number of industrial and academic partners. The industry consortium was made up of clients, contractors, subcontractors, consultants, suppliers and IT specialists. The Process Protocol is widely accepted as a set of principles which helps in establishing a consistent and flexible process throughout the production cycle of a project. It also helps in facilitating good communication and co-ordination of the project participants.

Within the protocol, the design and construction aspects of a project process are mapped out by breaking them down into eight sub-processes (Activity Zones). The GDCPP activity zones are Development, Project, Resource, Design, Production, Facilities, Health & Safety, Statutory and Legal and Process Management. The Protocol also details four broad stages, as in Pre-Project, Pre-Construction, Construction and Post-Construction, which together are broken into ten phases (Cooper et al., 2005; Kagioglou et al., 1998). The development of the GDCPP was based on eight key principles, which at the same time depict the benefits that derive from its implementation: Whole project view, Progressive design fixity, Consistency of the Process, Process Flexibility, Customizable Process, Stakeholder Involvement / Teamwork, Co-ordination, Feedback (Cooper et al., 2005).

PROCESS APPROACH IN GREEK CONSTRUCTION

The Greek Construction Industry

Construction in Greece is often traced to its spectacular history. For example the construction of the Acropolis in the 5thc. BC and Eupaline's ditch in the 7thc. BC presented both engineering and managerial feats at their time. Construction as an industry in modern Greece can be traced to the late 19th century when the government of Charilaos Trikoupis funded the construction of big infrastructure projects including the railway network and Corinth Canal. Between 1928-1932, there was an upsurge in the demand when prime minister Eleftherios Venizelos, under the pressure of 2000000 refugees from Asia Minor, authorised substantial public development. The schemes included the construction of a great number of housing, infrastructure (roads, schools, hospitals) and land reclamation projects (Lampropoulos, 2003). Subsequently, the rural-urban migration wave of the 50's, 60's and 70's created a demand for housing on a quite unprecedented scale. This turned the industry's focus into mass production of apartment buildings for the growing population in the cities. Notwithstanding the growth in demand the nature of the construction industry remained fragmented, as the majority of the projects were small. The size of construction companies was equally

small with little demand for Greek constructors to undertake big construction projects (Pantouvakis, 2004).

The present wave of construction demand started in 1981, when Greece joined the European Union (EU), which served as a catalyst for a volte-face in the industry's nature. European funding facilitated the convergence of the economy to the EU norm and enabled the construction of thousands of projects (Lampropoulos et al., 2003; Kallianis 2003). Nowadays, a great proportion of these projects (1 out of 3) are directed towards modernising the country's infrastructure (Pantouvakis, 2004). These include new motorways, the upgrade of the railway infrastructure, the longest cable bridge in the world in Rio-Antirio, the new Athens International Airport and the extension to the Metro System. The impact from the realization of these projects was an annual increase of 4% in GDP of the Greek economy. Approximately one quarter of this GDP is attributed to construction. The construction EU agenda, the FOCOPE (Forum in the European Parliament for Construction) initiative supports the view that the construction sector has proved to be one of the driving forces of the Greek economy (Pantouvakis, 2004).

The Greek legislation system – a driving force in construction

The framework within which Greek projects are delivered is defined by a number of technical regulations and laws which together comprise the Greek technical legislative system. Its origins go back to the mid 19th century when the first regulations for the construction of public works were promulgated. It has since been revised and evolved constantly to accommodate changes in the industry (1932, 1972, 1984, 2001, 2003). The legislative system covers various aspects of the design, procurement, construction and management of projects (compensation of the participants, specific procedures to be followed throughout a project's life cycle, contractual relationships, quality assurance, documentation of the project's activities, and compliance with technical regulations). The existence of such a clearly defined technical legislation provides considerable clarity for the management of projects. However, it also presents a rigid system for how the industry should manage the delivery of its projects. While the technical legislation has evolved to accommodate EU guidelines, it still forms the backbone for delivering projects in Greece.

The industry's turn into process modelling – ISO 9000

The new economic environment presented by Europe places additional demands on construction firms that operate in such a deregulated market. The need to be competitive beyond national industry standards, by being more efficient and effective becomes essential. This is particularly so for Greek construction, which up until now has enjoyed considerable protection for its markets from companies outside of Greece. For example the current wave of large infrastructure projects and public works were co-funded by the EU, making them open to non-Greek companies in the EU. The use of the process approach should enable the move to become more efficient by Greek construction. Such a protocol can also facilitate the monitoring of projects to ensure compliance with both the Greek and European standards (Kallianis, 2003).

The most common and widely accepted way to set up a process modelling system in Greece is taken as part of the ISO 9000 certification (Lampropoulos et al., 2003; Kallianis 2003). ISO 9000:2000 is a set of standards that target quality assurance and management by considering the production cycle as a process. It focuses on the satisfaction of the clients' requirements as well as the continuous improvement (CI) of the process system, by constantly measuring its effectiveness (Kallianis, 2003; ISO

9000). The ISO 9000 certification forms part of requirements imposed by the project sponsor on construction companies for most projects. However, the ISO 9000 certified companies have found out in practice that the implementation of the ISO 9000 standards substantially implies the creation of a process modelling system in the organisation (Pantouvakis, 2004; Kallianis, 2003). An ISO 9000 certified organization is bound to determine both the sequence and the interaction of the processes involved in a project and to commit to monitoring and controlling the whole procedure. The standard places responsibility to develop and revise the process model on the shoulders of the project management team. All the changes must be documented in an archive and communicated to every participant in the project. Finally, ISO 9000 provides for evaluation of all suppliers by defining an evaluation and technical specification archive, which all the products procured are compared to and are either accepted or rejected. Thus, the supply chain is being constantly improved. When implemented properly, the ISO 9000 standard not only leads to the establishment of a Quality Management System, but enables the generic mapping and effective management of the project's processes as well. One of the biggest and most experienced companies in the Greek construction industry, which has already developed a process modelling system based on the compliance with ISO 9000 and legislation standards, is Egnatia Odos S.A.

EXPLORING PROCESS POTENTIAL – EGNATIA ODOS S.A.

The organization

Egnatia Odos S.A. was created in September 1995 as a product of discussions between the European Community and the Greek Government to advance the implementation of the 2nd Community Support Framework. The company's sole shareholder is the State, but it operates by private sector economic and financial criteria, under the superintendence of the Ministry of Environment, Physical Planning and Public Works. Its aim is the management of design and construction, the maintenance, and exploitation of the Egnatia Motorway, its Vertical Axes as well as of other projects within or outside the Greek territory.

Egnatia Odos S.A. systematically controls the quality of all work done, from one end of the Motorway to the other. The Quality Management System employed complies with the requirements of ISO 9001:2000 and has been certified since May, 2001 for "Management of the construction of the Egnatia Motorway System (main axis, vertical axes, and service roads)".

Organisation Chart

The organisational structure of Egnatia Odos S.A. shown in Figure 2, follows the matrix management format, where authority and control are exercised both top-down in a functional sub-division manner but also from left to right in a geographical manner along the Egnatia axis (Eastern, Central and Western). The firm's organisation is divided into two broad sectors: the administration sector and the service sector (Lampropoulos, 2003).

The Project Manager helped in designing the organisational structure of the company and is responsible for the Quality, Health and Security assurance throughout the whole project. The Work Division is structured according to the "balanced matrix" organisational type (Pantouvakis, 2003). This includes the functions of Design and Construction Management. The construction management company is responsible for

the delivery and operation of the 500 miles Egnatia motorway in Northern Greece which forms the basis of this investigation.

The firm's organisational structure categorised into broad sections according to their responsibilities in the process (e.g. Works Division, Support Service Division) captures the broad range of participants that could feature in a process map. This reflects the most fundamental attributes of the GDCPP, namely basing the enactment of the process upon the primary responsibility required, expressed by the Activity Zones. Further details on the project can be obtained from http://www.egnatia.gr.

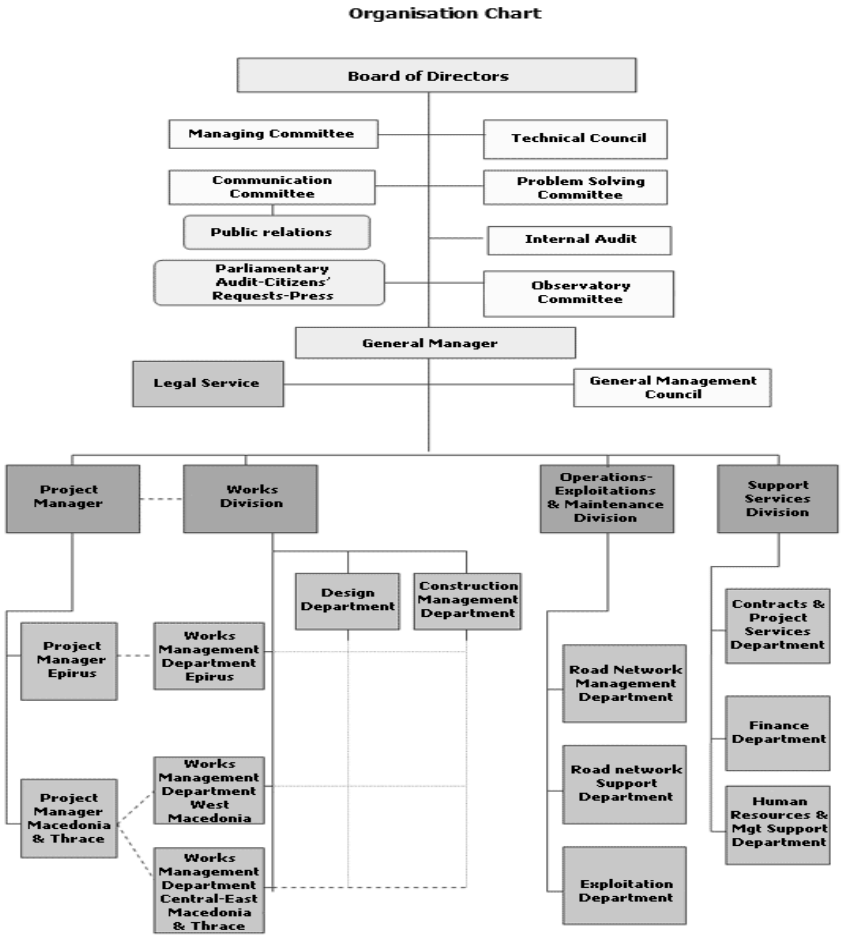

Figure 2: Organisation Chart of Egnatia Odos S.A.

INVESTIGATION METHOD

The GDCPP presents a new opportunity to examine and benchmark the management systems adopted for implementing the all the scheme being implemented by Egnatia Odos. As a single organisation responsible for the total delivery and subsequent management of the projects, the use of a process system should avoid the interface constraints that attend other procurement arrangements. The study of the potential to incorporate a process protocol in managing Egnatia project would provide insights on the feasibility of adopting a process approach for managing projects in the Greek construction industry. The investigation explores the perspectives of key staff on the project to identify the possible benefits from the incorporation of a formal process protocol in managing the development. The GDCPP is employed as a useful vehicle in this regard. It also investigates the common areas to both the Greek system of managing construction (reflected by Egnatia Odos scheme) and the process approach

(depicted by GDCPP) to unearth options for developing and implementing a Greek protocol. The study also tackles the bottlenecks and constraints which could hinder the effective implementation and wider application of the process approach by the Greek construction industry.

Research strategy

The investigation adopts a qualitative method to explore the applicability of the GDCPP to a Greek construction project. Data was collected through a semi-structured questionnaire which was distributed to engineers within the Egnatia Odos S.A. organisation. The essence of having a semi-structured instrument in a qualitative investigation was to enable the different respondent to address the same issues, while retaining the benefit of their independent input. The aim was to determine the current condition of Process Management in the Greek construction industry and to appreciate if and how the adoption of the GDCPP by the Greek constructors would contribute towards the improvement of Process Management in Greek projects.

Structure of the questionnaire

The questionnaire used two types of question format: open ended questions, when it was needed to encourage the respondents to provide free responses and closed ended questions when explicitly-worded questions demanded short, specific answers. In all cases the open ended questions provided a means for verifying the veracity of the closed questions. The closed questions employed different types of scales (Likert Scales and Semantic Differential Scales) and Checklist. The instrument was administered through an interview technique.

The questionnaire instrument consisted of five parts. The first part was aimed at eliciting background data and details of the respondents (including profession, position, experience, duties discipline). The second part explored the process model used by the participants. This involved a series of close-ended questions aimed at identifying the fundamental attributes of their employed process model compared to the GDCPP. In the third and fourth part the subjective opinion of the respondents towards the GDCPP for a number of attributes was explored. The third part consists of closed ended questions, whereas the fourth part gives the opportunity to comment on the GDCPP in a freer and more flexible way through a combination of closed and open ended questions. The fifth part enables the respondents to provide optional personal contact information where there is an interest for a follow-up enquiry.

PRELIMINARY RESULTS AND DISCUSSION

The comprehensive data analysis is currently underway from the questionnaire instrument administered to 30 engineers. These cover four broad divisions of the company Egnatia Odos S.A. Further interviews are being scheduled to minimise any biases that could arise from dealing with a sample size of 30, and these and would be completed in due course and analysed together with the data already on hand. The preliminary results from the investigation achieved provide a descriptive assessment of the data so far gathered and the emerging advantages as well as the bottlenecks that the GDCPP presents as perceived by the Egnatia engineers. So far, the participants appear to come to the crucial conclusion that both models share the same principles regarding their structure and inherent process philosophy. Regardless the division they worked for, 90% of the respondents agree with the project's structural breakdown into the broad stages and phases presented in the GDCPP, whereas another 60% identifies the Activity Zones of GDCPP to be more or less inherently included in

Egnatia's structure as well. This would seem encouraging, as it implies that the process model implemented by Egnatia has more or less the same main advantages as the GDCPP. Further analysis would justify or counter this view once the set of interviews have been completed and analysed. However, the investigation has brought up some points where the contribution of GDCPP towards a better process modelling method could be crucial. For example, the fact that the GDCPP can be implemented as a framework for benchmarking and continuous improvement was found to be profoundly appealing by the participants. Even though ISO 9001:2000 demands the development of a process improvement procedure within the organisation, GDCPP was acknowledged to be very useful for the further improvement of the ISO improvement system itself. It is characteristic that over 90% of the engineers admitted that the process management system in use neither measures the process performance nor is self-improving, in the meaning of providing for process review and feedback mechanisms. Consequently, taking advantage of its inherent flexibility, GDCPP can be implemented partially or as a complete process, whenever a flaw is identified in the process' performance, thus restoring the process' efficiency and leading to a continuous improvement agenda for Egnatia. Equally, the potential for benchmarking the employed procedure system can contribute decisively in improving the company's competitiveness in the market. 70% of the respondents considered GDCPP to be particularly useful for establishing a framework for benchmarking and improving the company's performance. Additionally, the participants in the investigation acknowledged, among others, the main benefits of the potential implementation of GDCPP to be the efficient and comprehensive way the GDCPP communicates its principles to the participants of a project (80%), along with the fact the fact that within the framework of the GDCPP different task teams work in close collaboration and communication with each other, allowing for information to be well discussed and thought out before proceeding to the next level (60%). Finally, the fact that there is a standard process procedure followed throughout the project, understood and comprehended by all the project participants thus avoiding any ambiguity or misunderstanding regarding one's role in the process was thought by the 75% to be one more advantage of the proposed model.

However, the respondents thus far also expressed their worries and concerns regarding GDCPP's partial compatibility with the ISO 9000 standards as well as the Greek and European legislation. 65% of the respondents opposed the view that the Greek legislation framework for the design, construction, procurement and management of projects is very strict and rigid. Thus, they suggested that, if implemented, GDCPP should be absolutely in accordance with the existent Quality Management System of Egnatia as well as with the procedures imposed by legislation. This means that the effective implementation of the GDCPP would greatly depend on its ability to effectively transform the strategic and operational level activities within Egnatia. Another issue that seems to trouble the respondents is the increased cost that the implementation of the GDCPP might require (70%) and the unwillingness that senior management might have to adopt a new method, given the fact that the Greek construction industry does not yet consider process management improvement to be a necessity (55%). However, these are early prognosis emerging from the study, and a fuller picture on the potential for implementing the process approach for Egantia projects would be known on completion of the study.

CONCLUSIONS

The Greek construction industry has changed radically over the last 20 years. The need to implement process modelling techniques for the effective management of projects, which was promoted by the Latham and Egan reports in the UK, is now acknowledged by the Greek construction participants as well. This prompted an investigation into the applicability of the GDCPP to Greek construction projects. Engineers working in Egnatia Odos S.A., one of Greece's leading construction companies, were asked to evaluate the GDCPP on a qualitative basis. The early indications emerging show that there is considerable potential for implementing a varied form of the GDCPP approach to accommodate the Greek context. Any such implementation would, however, have to ensure compliance with Greek standards of practice set by the legislation and ISO 9000. The investigation is still ongoing and a fuller picture, especially on the constraints would emerge on completion.

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