A review of "Project Management" & "Sustainable Development" for Construction Projects

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Abstract

During the time I have spent both studying and gaining practical experience in the fields of architectural design and construction it has become clear that these extremely resource intensive industries face serious problems. What at first seemed like a problem specific to my native Egypt now emerges as a global problem. Whilst the UK's construction industry differs a great deal from Egypt's the essential problems it faces are exactly the same.

The problems facing the construction industry are not simply *functional* but *cultural*. It is true that the system itself is in need of urgent reform but what is even more serious is the unwillingness of many people in the industry even to accept that there is a problem.

To me, the need for change is clear. The outcome of such change has to be an industry capable of delivering better value and better quality and to do so in ways which are radically more effective, more efficient and, above all, more sustainable. A vital starting point for reform is to make the *process* and not just the *product* of construction more sustainable. Seeking to make project management sustainable defines the core objective of my research.

Two primary questions have arisen. Firstly, how can sustainable development be made a key component of project management? Secondly, can project management be an instrument for delivering sustainable development?

There are three basic stages to my research. Stage one involves an extensive review of literature to ascertain the theories and practices of project management in the construction field and to discover where existing links to sustainability already exist.

Stage two involves the identification of case studies drawn from both UK and Egyptian contexts as the means of exploring similarities and differences.

Stages one and two are intended to define the problems facing construction from the perspective of sustainability and to make the case for a reform of the project management process to help solve these problems. These stages anticipate the development of new strategic tools. Stage three involves the development and application of such tools in order that sustainability can become an integral and effective part of the project management process.

Introduction

In this paper it is my intention to focus on the first stage of the research - the literature review. Set within an international context, the review covers some of the key documents and issues which are driving changes in the UK construction industry at the present time.

A common thread within many such documents is the recognition of the importance of identifying key performance indicators and employing these to drive reform in the direction of greater efficiency and better value.

Common ground is discovered and emphasis is given to the growing significance of techniques such as *value management* and *risk management*. The exploration of the potential of such techniques to address the concerns of sustainability will be a vital component of my research.

Seminal documents will be reviewed in some detail in this paper including:

Department of the Environment, Transport and the Regions, "Rethinking Construction", *The Egan Report*, U.K., July 1998
Integrating Sustainability and Rethinking Construction, prepared by ERM (Environment Resources Management) for the CRISP Sustainable to Construction Theme Group, U.K., 1999

A review of resources in the fields of project management and sustainable development identifies many sources of information concerning definitions, processes, goals, objectives, practices, advantages, disadvantages, techniques and ways of improvement.

Project Management

A study of project management case studies provides us with a wide variety of opinions concerning all aspects of the project management process in the construction industry. The starting point in all such studies is the description of the different scopes of the projects.

Organisations perform work that generally involves either *operations* or *projects* although the two may overlap. They both share many characteristics:

- They are performed by people.
- They are constrained by limited resources.
- The processes are planned, executed, and controlled.

Whilst *operations* tend to be ongoing and repetitive *projects* are characteristically temporary and unique.

A project can, thus, be defined in terms of its distinctive characteristics: "A project is a temporary endeavour undertaken to create a unique product or service."[1] Temporary means that every project has a definite beginning and a definite end. Unique means that the product or service is different in some distinguishing way from all similar products or services. Projects are undertaken at all levels of the organisation and come in numerous shapes and sizes.

A project can also be defined as: "a set of activities, linked over time, with a start and end point, carried out to produce a specific goal or goals."[2]

Projects involve a combination of: goals, people, skills and achievements. When thinking about projects in general it has to be acknowledged that projects can be about learning; at the end of a project we have the knowledge and wisdom which we sought at the beginning. This knowledge can be radical, incremental, operational and strategic. For it to benefit others it must be shared among the project's participants through a process of communication.

Projects also involve uncertainty. All aspects of a project are liable to change. A project will end safely and successfully by planning ahead, by anticipating problems and opportunities and by structuring future work into discrete pieces with clear and measurable objectives, people and organisations.

Projects are usually considered to be a collaborative effort. Even on a small project there is a need to blend complementary and often contrasting skills. There is tremendous awareness of the value of teamwork inside the process of any project. Transparency and openness nurture trust, which is a prerequisite of good teamwork and of a good understanding with the client.

Projects also involve investments in which people and organisations (client/stakeholder) invest time and money. All resources on a project are in competition with alternative uses for those resources. Therefore, the investment must be continuously assessed against other priorities not just at the beginning and the end of the project. Each project may represent a significant investment in time and energy for the project's sponsors or clients. Therefore, there is a continuous need to assess the return on the investment.

This translates into a need to measure the efficiency of each project's use of resources during its life cycle so that good investment decisions can be made.

Projects involve satisfying the need to introduce something new which the world or the client wants. Whatever their needs, they have to be accomplished by the project to meet the expectations of the client.

Finally, projects require focus and commitment. Projects concentrate means and energy in tightly focused, intense and deliberate effort. They are not about diffuse and random evolution. People are often prepared to commit huge amounts of time and energy to reach a certain target. Project methodologies stress the importance of assigning clear responsibility to tasks so that performance can be assessed and rewarded.

It is obviously desirable to bring all projects to a successful conclusion where both the client and the project team are satisfied with the outcome. *Project Management* is a tool that offers a way forward to improve outcomes and achieve successful conclusions. It is a way of structuring and organising change within projects that are, by their nature, all unique.

Project Management is:

> ...the managerial task of accomplishing a project on time, within budget and to agreed technical and quality standards in order to meet or exceed stakeholder needs and expectations.[2]

Many definitions are given to describe the project management process, embodying the same general concept. A very significant definition is the description of project management as:

> ...the ART of planning, executing and controlling a project from start to completion with the appropriate quality standards, in a given time, at a given cost, within a given human and technical resources.[3]

General management definitions require amplifying before they can be used for defining project management, which can be said to be:

> The planning, control and co-ordination of a project from conception to completion (including commissioning) on behalf of a client. It is concerned with the identification of the client's objectives in terms of utility, function, quality, time and cost, and the establishment of relationships between resources. The integration, monitoring and control of the contributors to the project and their output, and the evaluation and selection of alternatives in pursuit of the client's satisfaction with the project outcome are fundamental aspects of construction project management.[4]

Another definition of project management is provided by: *A Guide To The Project Management Body Of Knowledge* which defines it as:

> The application of knowledge, skills and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project. Meeting or exceeding stakeholder needs and expectations invariably involves balancing competing demands among:
>
> - Scope, time, cost and quality.
> - Stakeholder with differing needs and expectations.
> - Identified requirements (needs) and unidentified requirements (expectations).

The term *project management* is sometimes used to describe an organisational approach to the management of ongoing operations. Generally, it involves a whole process of activities maintained to bring the project to its end point to meet the client's expectations on all levels.

The Project Management Process

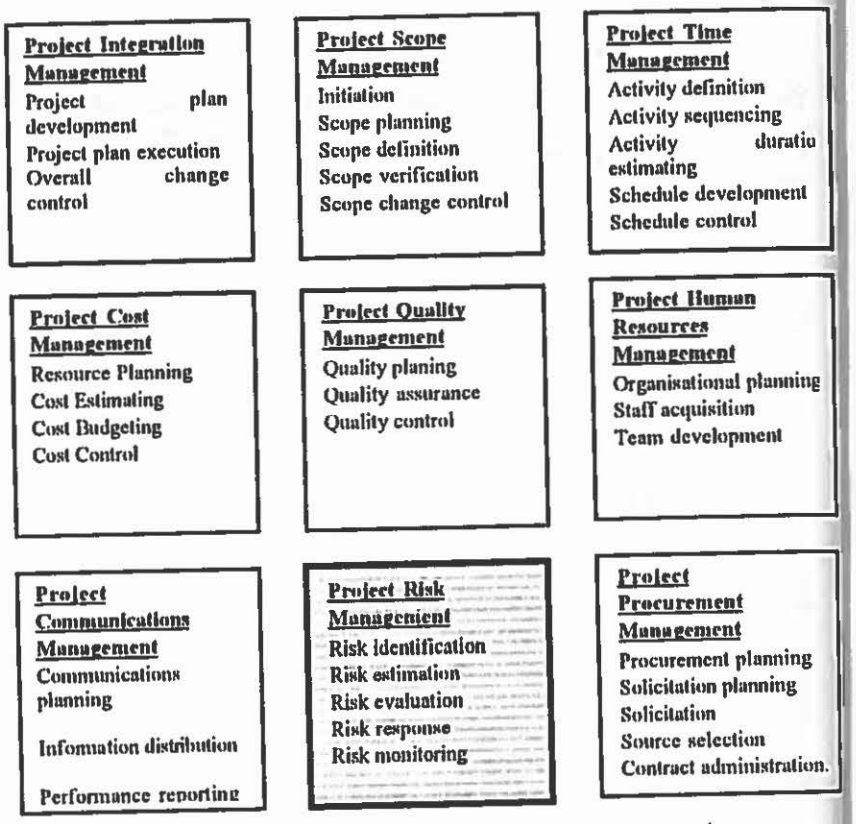

Figure 1: An Overview of the Areas of the Project Management

The above mentioned knowledge areas constitute the project management process. Figure 1 represents the elements of each knowledge area. A short description of Project Risk Management will be given later.

The reason why project management is gaining such importance in the construction industry, one of the largest in the world, is that the industry's performance does not reflect the amount of money invested in it. Clients are

investing a lot of money and they expect to get value for that investment. There is a direct relationship between value and money and value for money. Thus, *Value Management* is an essential tool for delivering successful projects.

Value Management (VM)

The use of *Value Management* (VM) is increasing as clients seek better outcomes from their investment in buildings and structures. In some cases the project is an outcome of strategic value management processes used in client organisations. By bringing together the widest possible range of project stakeholders in VM workshops, where different views and perspectives can be openly debated, many of the problems that typically arise in building projects can be avoided.

There are two particular advantages of VM. The first is the co-operative and inclusive nature of the workshops. They get people talking to each other and moving in the same direction. The second is the establishment of a formal process for considering and weighing the options available to a client for a building project.

Although the origins of VM lie in the manufacturing industry of the 1950s it is widely applied, in various forms, within most industries these days. For the building industry VM offers a technique to counter the perception of the industry as being essentially unconcerned about the client's business requirements or goals because it is essentially about clarifying what these goals are and how they can be met.

> The concept of Value Management (VM) and its application across all stages of the project life cycle relies on a challenge. A challenge to determine how the client can achieve best value from an investment in a building and how better buildings can result from a process that is based on good decision-making procedures being put in place before the design work actually commences.[5]

A working definition of VM from the Australian and New Zealand Standards:

> Value Management is a structured, systematic and analytical process, which seeks to achieve value for money by providing all the necessary functions at the lowest total cost consistent with the required levels of quality and performance.
>
> (AS/NZS 4183, 1994)

The structure is provided by the methodology, which comprises a five-stage creative problem-solving process known as the 'Job Plan'. The approach is systematic in that all five stages of the job plan are addressed in sequence. The process involves the identification and the analysis of function which makes

clear the objective, or purpose, as well as the means of achieving it. This analysis leads to the generation of creative ideas about achieving the function or purpose by alternative means at a lowest total cost whilst achieving specified levels of performance and quality.

The Value Management Study (VMS)

A *Value Management Study* is part of the procurement process that commences with the decision to build and ends just prior to the preparation of sketch drawings. A VMS is comprised of three separate stages each with its own purpose and objectives.

The stages are:

1. The Pre-workshop stage:

Involving the facilitator and the sponsor of the study to:

- Establish a VM timetable.
- Determine study objectives.
- Select study facilitation team.
- Gain stakeholder commitment.
- Select participants.
- Arrange venue.
- Brief participants.
- Brief presenters.
- Circulate information.

2. The workshop stage:

Involving a facilitated workshop comprising key stakeholders, in which the facilitator leads the group through the five phases of the job plan:

- Information phase.
- Analysis phase.
- Creativity phase.
- Judgement phase.
- Development phase.

  The outcome of the last of these phases - the development phase - may take several forms and be expressed as follows:

  - *Action Plan:* this would identify the findings and provide a timeline for ongoing development, evaluation and decision-making. Follow-up meetings for those involved in actioning items in the action plan are recommended to ensure that all value improvement opportunities are fully developed.

  - *Workshop Findings and Recommendations:* with longer studies, where time is available to evaluate options more thoroughly, firm recommendations may be developed. They may also be delivered as a formal presentation.
  - *Formal Presentation:* where possible, the recommendations should be formally presented to management and other stakeholders so that issues can be resolved before a final report is prepared. The process of preparing a formal presentation assists in clarifying issues and consolidates the commitments to, and ownership of, the recommendations.

3. The post-workshop stage. Including:

- Implementation of action plan.
- De-briefing stakeholders.
- Distributing study report.
- Evaluating study performance.

The Benefits of Value Management

Value Management assists in identifying and meeting the needs and interests of all the groups involved. The client is generally most concerned with achieving value for money from their investment, users are most concerned that the project meets their needs as closely and effectively as possible, designers are keen to meet the expectations of both client and users and to comply with relevant standards and performance criteria, project managers are keen to ensure that the project is managed within the constraints of time, quality and budget and contractors are keen to provide services at an adequate profit.

Value management enhances both an understanding of the project and the communication processes. Other beneficial outcomes from a VMS also include:

- Clarification of stakeholders needs, the separation of needs from wants, a refined definition of user requirements, functional clarification, definition of the project objectives and improved client brief.
- Rationalisation of outcomes.
- Identification of alternative designs, alternative solutions and alternative locations.
- Identification of alternative construction methods or modifications to construction time-lines.
- Enhanced client involvement with project development.

- Team building - leading to improved communication between stakeholders.
- Wider ownership of project outcomes and commitment to implementation.
- Identification of risk.

The potential risks associated with the value management process are minimal and can be effectively managed. They include:

- Improper application of the methodology by an unskilled facilitator or inadequate information leading to incorrect assumptions.
- Inadequate representation of stakeholders in the workshop group.
- Inadequate allocation of time, leading to less than optimal outcomes.
- Inadequate support by senior management and late initintion of study, within the project life cycle, which limits the potential impact.

A VMS may be initiated by:

- The client.
- The project manager.
- The design consultant.
- The project sponsor.
- The asset manager.

The decision to initiate a VMS will take into account: the perceived potential for a value-improved outcome, the stage in the project development life cycle, the need to have broad representation and involvement, the benefits that a workshop involving key stakeholders will return, the access and availability of key stakeholders and the cost of the study. The decision is generally agreed in consultation with management. Because of the potential for savings through value management studies may be initiated on projects where it is suspected that there could be savings. These may include options for developing alternative, more cost effective ways of achieving functions taking into account the total life-cycle costing.

A Value Management study may also be initiated for the purpose of developing the project brief. When conducted at an early stage in a project life cycle, maximum opportunity is available for value improvement. An added advantage is that the client, end user, designer and other key stakeholders are present and participating in a facilitated problem-solving exercise sharing their knowledge and understanding. Projects involving new ideas or new ways of doing things may be subjected to a value management study in order to develop and compare options.

The complexity of a project increases with the number of disciplines involved in the design, with the number of stakeholders, with competing interests and if priorities amongst a number of contentious items are not established. Value Management provides a methodology for addressing such complexities and for providing a range of potential solutions.

Such studies can be used to accelerate projects and also to audit capital works procurement programmes which can be utilised to achieve continuous improvement of standard products and used to check a project rigorously. Thus, Value Management is used to ensure that value for money is being achieved throughout the client's capital works programme.

What sets Value Management apart from other problem solving methodologies is that it is both informational (it systematically deals with all that is known about the project including underlying assumptions, givens, perceptions, etc.) and it is transformational (individual paradigms may be shifted and creativity may lead to radically different solutions).

This occurs because the workshop environment involves stakeholders in co-operative problem solving. Enhanced communication and networking are direct benefits of the workshop process and have a significant impact throughout the project. The workshop process forces information disclosure and explanations that might not otherwise emerge, thus, assisting the design team to produce a more appropriate solution.

For Value Management to be successful explicit executive support, the attitudes of participants, the methodology and workshop facilitation, and general management of the process are all extremely important.

Performance Measures

The two key aspects of a study that require attention in any form of performance assessment are process and outcomes. An assessment of the value management process is made on the basis of how effectively the facilitator managed the process as specified in the 'job plan', facilitated the group and liased with the client throughout the entire value management study.

An assessment of the benefit to the workshop participants is attainable by ensuring that the study objectives were met and that there was an enhanced understanding of the project. For the client there should be an improvement in value and savings in cost where appropriate. Other advantages may include an improved client brief, reduced project development time-line and reduced project construction time.

Value Management is a tool that has advantages at all stages of the asset management life cycle - from the identification of service requirements to the

implementation of the resource and asset plans. It has advantages at all stages in a project life cycle - from strategy planning, concept development, design review to implementation and operation.

Value Management provides the manger with a tool that can:

- Ensure a project is cost effective.
- Resolve a complex problem.
- Identify a number of options and select a preferred one.
- Identify the means by which a service maybe provided.
- Review a brief.
- Identify the means by which a project may be delivered.
- Identify ways of providing functions at a lower total cost (life cycle cost).
- Identify additional functions that improve the outcome of the project.
- Separate needs from wants and establish priorities.
- Improve the standard of performance or quality of the project outcomes.
- Generate commitment to outcomes through structured participation of stakeholders.

The relationship between Value Management and Project Management is directly oriented towards the benefit to the client and the general outcome of the designated project. Project management can be included in the process of the Value Management as an important and vital element that ensures the expectancies of the client are achieved.

Different areas of knowledge have been identified within the project management process (Figure 1). Looking briefly into these areas of knowledge each element identifies itself as a contributing element to the outcome of the whole project. Among these elements *Risk Management* has the most direct impact upon a project and is the major influence on whether or not it gets the go ahead.

Risk Management:

> Risk is ubiquitous and no human activity can be considered risk free. [6]

'Risks' depend on the uncertainties of the future and their potential consequences. We routinely accept 'risks' and take measures to minimise them in our daily activities. We can define this as a simple form of *Risk Management*.

In the construction industry, whether on small scale or major projects, *Risk Management* has different dimensions and is dealt with in cautious, studied and organised steps.

> Risk is not necessarily a bad thing; in fact risk-taking is an essential component of a competitive economy.
>
> Anthony Carey

The importance of Risk Management in the construction industry has been growing and showing dramatic increase in affecting decision making in small scale and major projects. The following reasons probably justify this growing interest:

- Increases in technology.
- Tighter Financial constraints.
- Larger and more complex projects.
- Public demands to decrease risk and improve safety.
- Time and costs overruns.

Thus, highlighting the importance of Risk management within the context of the project management process will make it easier to identify the major role that it represents.

Figure 2 defines Risk Management and its' different steps and identify the way construction industry is currently dealing with this process.

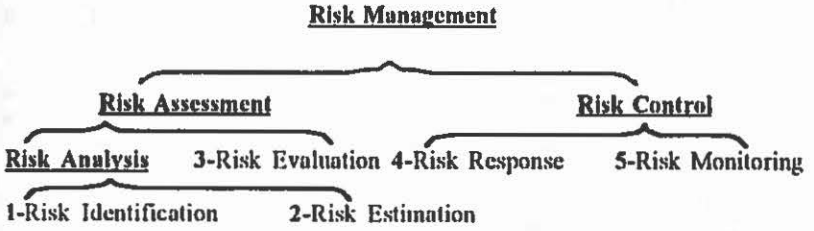

Figure 2. The Risk Management Framework [7]

The outcome of the five steps identified in figure 2 should be a *Controlled Risk Environment* in which those steps should be working in a continuos loop to retain a sustainable system.

Three basic elements should apply to this system as with any other control system:

- Goal setting (whether explicit or implicit).
- Information gathering and interpretation.
- Actions to influence human behaviour or modify physical structures or both.[8]

> Human beings will continue to interact, make choices and respond to those choices in unpredictable ways that are the ultimate sources of uncertainties. This is where the heart of risk management lies.[9]

> Virtually anything that people do has some degree of risk attached, whether it is something that is inherently dangerous in a physical sense or something that carries a risk of financial loss. People carry out simple forms of risk analysis in their daily lives when deciding. What we are doing when making such decision is actually risk management, we identify the costs and benefits associated with alternative choices, assess the likelihood of those costs and benefits being realised, and make a balanced decision on the basis of our analysis.
> Risk Management does not eliminate risk, but it does offer decision-makers a range of tools for identifying and assessing risk. Clients can select those tools, which are most appropriate to their particular project, with respect to other factors such as their general attitude to risk and prevailing economic conditions.[10]

By its very nature the construction industry is considered to be subject to more risks than other industries. Getting a project from the initial investment appraisal stage, to completion and into use involves a complex and time-consuming process. A variety of unexpected events may occur during the process of building procurement and many can cause losses to the client or other interested parties - these events are commonly called risks. The principle of risk management is widely used in the construction industry and applied at various stages during the procurement process.

Proper application of risk management techniques can significantly improve the investment performance of construction projects. The phases of a project during which risk management can be applied have been identified as follows:

- Initial appraisal.
- Outline or sketch design.
- Detailed design.
- Contract strategy.
- Construction.[11]

> In particular, it is widely accepted that risk management is most valuable during the initial appraisal phase as, at this stage, a great deal of flexibility in both design and planning remains and that allows consideration of ways in which various risks might be avoided or controlled.
>
> P. Thompson and J. Perry[12]

It is at this stage, however, that there is the greatest degree of uncertainty about the future yet the client must make decisions about such fundamental concerns as the investment budget, the size and quality of the project, financing strategies and so forth. It has been demonstrated by GCIS that risk management techniques can be an effective tool that clients can use to assist them in making allowance for future uncertainties.[13] Consequently, the clients can be more confident in their decision-making as they have information which identifies possible uncertainties and their likely impact on a potential project.

The proper application of risk management methods can also improve the effectiveness of other project management techniques. Risk analysis can improve the accuracy of the project's cash flow analysis by assessing properly and systematically the future uncertainties and risks.

The clients can make their decision to invest in a project on the basis of achieving the greatest value for money. It is during the initial project appraisal stage that the client will try to establish project parameters that will ensure that he or she realises this basic aim. At the very least they want to be certain that the potential returns from the project will balance the risks. If a project proposal includes a risk profile for various investment options this will be of great benefit to the clients in appraising the proposal, giving information such as the likely outcomes of all possible risk should they occur.

The analysis of risks during the initial project appraisal stage enables the client to make two important decisions:

- Whether to invest in a project, or reject it. This is clearly the most important decision as it determines whether the project proceeds at all. This decision will be based on the constructive analysis and evaluation of potential risks such as technical, economic, financial, political and legal.

- What the project objectives will be. The clients must decide their objectives in terms of budget, time scale, function, return on investment, quality standard, etc. These will be based on the client's investment expectations and their evaluation of various alternative investment options where such evaluation depends on projections of performance, cost and schedule with in-depth risk analysis carried out on those projections.

The concept of risk is related to the activities that flow from decisions made by the clients where the outcomes of those activities may differ from

expectations. These differences are the result of uncertainties that are inherent in the information on which the client bases his or her decision-making. This information includes historical data, predictions of the future and the decision maker's subjective judgement and, therefore, by its nature displays degrees of uncertainty.

Broadly, risk, as it applies to building, can be defined as the possible occurrence of an uncertain event or outcome which, should it occur, will cause significant variation or consequences such as extra cost or delayed completion.

Thus, the typical risks in a construction project include:

- Cost overruns.
- Time overruns.
- Poor quality.

These typical risks indicate the consequences commonly referred to as *risk effects*, which are the result of possible occurrences called *risk causes* or *risk factors*. Flanagan and Norman identify the *risk factors* which may affect construction projects as including:

- Failure to obtain approvals from relevant authorities within the time allowed in the project program.
- Unforeseen adverse ground conditions.
- Inclement weather resulting in delays.
- Industrial action.
- Unexpected price rises.
- Failure to let.
- Accidents on site resulting in injury or death, causing delays and/or extra costs.
- Latent defects due to poor workmanship or inadequate supervision.
- *Force majeure*.
- Late production of design information leading to claims by the contractor for loss or expense.
- Labour, material and/or equipment shortages.
- Disputes between project parties causing extra cost and/or project delays.

Generally, these risks, if they eventuate, will result in financial loss to the client and often to other team members. Clients' advisers at the initial project appraisal stage are expected to be able to identify all possible *risk causes*, to

analyse their implications for the project and to develop a risk management strategy to assist their clients in their evaluation of project proposals.

The nature and identification of risk displays three attributes:

- A range of possible outcomes. Three outcomes are considered; the optimistic outcome, the pessimistic outcome and the most likely outcome. All the possible outcomes may be in discrete or continuos distribution, however, only one possible outcome in the range will actually happen.
- Individual consequences. The consequences of each possible outcome can be assessed.
- Probability. The probability of the occurrence of each outcome can be assessed and allocated.[14]

Obviously the decision maker's subjective judgement will have a significant effect on the assessment of the nature of risks. In general, those risks with lower probability of occurrence will have greater impact on a project while those with higher probability of occurrence will have smaller impact.

The earlier that the client recognises the nature of the risks involved with a project the more confident he or she will be about his or her chosen investment option.

Risk analysis not only assists clients in decision-making but also provides other parties involved in the project, such as the contractor, with an appropriate framework for managing and responding to risk. It allows construction managers to identify not only the risk allocated to him or her in the contract but also those risks inherent in the nature of the construction work. A better understanding of the forward risk situation can improve decision-making for all project participants.

Risk identification is a diagnostic process in which all the potential risks that could affect a construction project are identified and investigated, thus, enabling the client to understand the potential *risk sources* at an early stage in the project.

Risk can be broadly grouped into the following categories:

- Business risk: indicates the probability that the expected level of investment return will not be achieved.
- Pure risk: (static risk, non-market risk or unsystematic risk) is related to physical and technical causes. Subsequent losses occur at random and are beyond the control of the decision-maker.

- Speculative risk: (dynamic risk, market risk or systematic risk) involves the possibility of either gain or loss should an uncertain event occur. These risks can cause variations in project development cost, operating cost or the value of built property, thus, changing the rate of investment return.
- Financial risks: relates to the loss of financial capital and increase whenever the amount of debt or related charges increase.[14]

From a management viewpoint risks are sometimes classified as *controllable* and *uncontrollable* risks.

Controllable risks are those risks that a decision-maker accepts voluntarily and where the risk outcome is, at least in part, within his or her direct control.

Uncontrollable risks are those risks that the decision-maker cannot influence. They usually emanate from the external environment: the political, social or economic spheres. However, the decision-maker can take precautionary measures if he or she identifies the risk properly.

A number of techniques have been developed for risk identification. The most common method involves compiling a list of risks for a particular project based on records of past projects (historical data). Other common methods for risk identification include brainstorming, tree diagrams and influence diagrams.

Risk analysis is used to evaluate risk quantitatively and to ascertain the importance of each risk based on an assessment of the probability and possible consequences of its occurrence. It assesses both the effects of individual risks and the combined consequences of all the risks on the project objectives. The major purpose of risk analysis is to provide a *project risk profile* that the client can use to look ahead at possible events and assess the probability of them occurring.

There is a need to have a measure of risk that incorporates the nature of risk. A risk probability distribution is a simple such measure that averages all risk outcomes. The value of the standard deviation of such a distribution has been suggested as a more effective risk measure as it describes the dispersion in all possible outcomes around the expected value. A small standard deviation indicates a small variation between all possible outcomes and graphically is indicated by a tighter probability distribution. A higher risk is indicated by a widening spread of the probability distribution which gives a larger standard deviation.

Having described the different aspects of risk management within the project management process. Risk management itself is typically defined as a sequential system consisting of: risk identification, risk analysis and risk response.

The most common actions in risk management include avoiding risks, transferring risks to other parties and minimising the effects of those retained should they occur.

During the early stages of project the client may take preventative action to reduce, avoid or transfer risks. Rejecting a proposal is an obvious way of avoiding risk, however, if the client wishes to proceed with a project then risks should be reduced wherever possible.

Different people have different perceptions of the value of alternative risk options and these differing perceptions are related to the *risk attitude* of the various individuals. Different people's *Risk attitude* can be classified into three main categories: risk-takers, risk-averse and risk neutral.

The benefit of managing risks during the initial project appraisal is to increase the client's confidence, to increase the possibility of success for the project and to maximise the value for money from investments. The importance of applying risk management techniques during initial project appraisal is that they allow flexibility in consideration of alternatives in design and planning whilst the greatest degree of uncertainty exists. Although risk management does not remove the risks attached to construction projects it provides assistance to clients in decision-making in an appropriate framework for understanding and responding to risks.

Sustainable Development:

Sustainable development embraces the three broad themes of environmental, social and economic accountability often known as the: 'Triple Bottom Line.' It is about ensuring a better quality of life for everyone, now and for generations to come, through: social progress which recognises the needs of everyone, the maintenance of high and stable levels of economic growth and employment, protecting, and if possible enhancing, the environment and using natural resources prudently.

> Sustainable development isn't outstanding environmental performance at the cost of a company, which goes out of business, nor is it outstanding financial performance at the cost of adverse effects on the local environment and communities. It does not demand the perfect solution. Sustainable development is essentially a goal or vision that forward looking organisations are working towards.[15]

The *M1* report links the improvement of the construction industry to sustainable development.

> Sustainable construction is generally used to describe the application of sustainable development to the construction industry. The industry is defined as all who produce, develop, plan, design, build, alter, or maintain the built environment, and includes building materials manufacturers and suppliers. [15]

Through its activities, whether the provision of buildings, infrastructure development or contaminated land reclamation, the construction industry has a major role to play in the delivery of sustainable development. The challenge for the industry is to play an integral part in providing a better quality of life through its activities whilst minimising impact on the environment and local communities.

The construction industry is central to the process of creating a sustainable environment and to economic and social development as a whole. Therefore, it should:

- Use energy more efficiently.
- Minimise mineral extraction.
- Protect the countryside.
- Regenerate housing, particularly in order to revitalise town centres.
- Plan communities to reduce transport impacts.
- Provide training through schemes such as 'Welfare to Work' and the 'New Deal'.

Rethinking Construction (The Egan Report), another very important report published by the DETR, discuss the problems facing the construction industry in UK more thoroughly.

The Egan Report

Rethinking Construction describes the current state of the construction industry in the UK simply thus:

> It has low profitability and invests too little in capital, research and development, and training...
> ...Too many clients are dissatisfied with its overall performance[16]

It then identifies five key *drivers* of change which are necessary to set the agenda for the construction industry at large:

- *Committed leadership.* Believing in management and being totally committed to driving forward an agenda for improvement and communicating the required cultural and operational changes throughout the whole organisation.

- *Focus on the customer.* The customer drives everything (what does he want exactly? When does he want it? How much is he willing to pay?).

- *Integrated process and teams.* The construction industry is not a series of sequential and largely separate operations. There should not be a fragmentation of the process. It needs to deliver value to the customer efficiently and eliminate waste.

- *Quality driven agenda.* Quality does not only mean zero defects but also: getting it right the first time, delivering on time according to budget, innovating for the benefit of the client and minimising waste in design, materials and construction.

- *Commitment to the people.* This means creating decent site conditions, wages, a commitment to the health and safety of the work force and a commitment to the training and development of committed, highly capable managers and supervisors.

The report identifies the need to improve the construction industry by stating the severe problems facing it which include:

- Low and unreliable rates of profitability.
- Weak investment in Research and Development (R&D) and in capital.
- A crisis in training. The number of trainees has decreased by half leading to a skill shortage in the industry
- A lack of a proper career structure for developing supervisory and management grades.
- Clients are undiscriminating, still equating price with cost, selecting designers and constructors almost exclusively on the basis of tendered price.

The report sets out a way forward to achieve an improved construction industry. Its targets include annual reductions of 10% in construction cost and time and 20% in defects. And suggests six ways for achieving those targets:

- The industry will need to make radical changes to the processes through which it delivers the project.
- These processes should be explicit and transparent to the industry and its clients.

- The industry should create an integrated project process around the four key elements of:
  - Project Development.
  - Project Implementation.
  - Partnering the supply chain.
  - Production of components.
- The industry must provide:
  - Decent and Safe working conditions.
  - Better management and supervising skills.
- Replace competitive tendering with long term relationships based on clear measurements of performance and sustained improvements in quality and efficiency.
- The industry must sustain improvements and share learning.

These changes in the construction industry will lead to a radical improvement in the construction process. However, it must set itself targets for improvement with clear, measurable objectives and then give them focus by adopting quantified targets, milestones and performance indicators. It must target improvements in terms of predictability, cost, time and quality.

A means of measuring progress, towards its objectives and targets, must be created and in addition the construction industry must produce its own structure of objective performance measures agreed with clients. If this is done clients will then be able to recognise added value and reward companies that deliver it.

The report then goes through the different ways of improving performance on different scales, however, it omits the issues of sustainable development and sustainability. Therefore, it is necessary to highlight another report: *Integrating Sustainability and Rethinking Construction*[17] which does include these criteria in the context of improving performance in the construction industry.

Integrating Sustainability and Rethinking Construction

The starting point for this study was the process initiated by the Construction Task Force and in particular its report, *Rethinking Construction*, for improving the quality and efficiency of the UK construction industry.

> In commissioning this study, the Theme Group recognised the need to ensure that those involved in taking forward *Rethinking Construction* are aware of the principles of sustainability most relevant to the construction sector. The aim of the work therefore is to identify those aspects of sustainable construction which are readily incorporated into the performance improvement agenda set out by the Construction Task Force, and to highlight those areas of sustainable construction which are outside the Task Force's current agenda.[17]

Their specific objectives were: to review the contributions that a consideration of sustainability can make to performance improvement in the construction industry, to identify the opportunities, offered by the agenda for change set out in *Rethinking Construction*, for achieving a sustainable construction industry, to identify the barriers that need to be tackled in order to achieve sustainability and to identify the research and innovation initiatives required to help overcome those barriers.

A review of key papers identifying the issues of sustainability facing the UK construction industry indicated three common factors:

- A general consensus on the industry's main environmental impacts and agreement that these extended beyond the construction phase to include supply chain issues and the effects of post construction activities such as operation, maintenance and re-use of buildings.
- Less emphasis on the social component of sustainable development and the industry's influence on it. But some agreement among those that did consider it that the industry had an important role to play in shaping viable communities.
- Differing views on the scope of the industry's influence on sustainable development. Some considered only the direct impacts of construction activities while others included the industry's wider role in shaping patterns of development.

A mixture of external pressure, market sensitivity and corporate philosophy has driven these moves. Increasingly, business is realising that addressing sustainability issues can also enhance its bottom line. Many companies are taking systematic measures to improve their environmental and social performance in order to ensure their long-term competitiveness and license's to operate. The scale of the UK construction industry, its immediate environmental and resource use impacts, coupled with the influence of its products on the nation's quality of life, make it a key player in achieving sustainable development.

The first stage of the analysis in *Integrating Sustainability and Rethinking Construction* examines how, and to what extent, the current performance improvement agenda addresses sustainability issues.

In *Table* 1, each of the drivers identified in *Rethinking Construction* for improving the quality and efficiency of the UK construction industry is assessed for its potential contribution to the economic, environmental and social objectives of sustainable development.

Issues of Sustainability	Possible Actions	Relevance to Egan Drivers				
		Leadership	Customer	Integration	Quality	People
Efficiency/ productivity of the construction process	Process Integration. Product Development Improved Customer focus. Training. Supply Chain partnering. Quality management systems.	***	***	***	***	***
Minimisation and/or recycling on construction and demolition waste	Use of reclaimed materials. Waste segregation and recycling. Use of standardised components/durable materials. Extending product life through durability or adaptability.	***	**	***	***	*
Decent working conditions for employees & contractors	On site facilities. Health and safety measures. Use of local employment.	***	*	**	***	***
Business relations with sub-contractors, customers, suppliers and partners	Long term partnerships. Non-confrontational contracting. Codes of conduct. Quality assurance Environmental standards.	***	***	***	***	***
Responsiveness to customers, end users and other stakeholders.	Involvement of communities / end users in project planning & design. Dialogue with other affected by development projects. Environmental reporting.	***	***	***	***	***
Energy efficiency of buildings / completed developments.	Use of energy efficient construction technologies. Planning to reduce car dependency.	***	***	**	***	*

Table 1. Key Linkages between Issues of Sustainability and Egan report's ' Agenda for Change.'

This analysis suggests that each of these drivers *could* help improve the industry's contribution to sustainable development although, for this to happen in practice, performance improvement needs to be redefined to incorporate sustainability as a key objective.

Mapping Egan 'Drivers' On To Sustainable Development:

Committed Leadership is very important to sustainable development on both economic and environmental levels and moderately important on social levels. Strong commitment from senior management is widely recognised as a key factor in improving the environmental performance of major companies and is also necessary for driving through the changes required to make a company more responsive to stakeholders on ethical, social and community issues.

Focusing on the customer is very important to sustainable development on the economic and social levels and moderately important on the environmental level. Customer focus in the construction industry is that likely to result in lower running costs - and environmental impacts - associated with energy consumption and maintenance. Providing the best deal for customers is also a key issue in corporate social responsibility. Customer demand will be a key influence on other aspects of environmental and social performance.

Integrating the process and team around the product is very important to sustainable development on the environmental and economic levels and with minor importance on the social level. Improved links between planning, design and construction will reduce waste and facilitate use of more sustainable materials and building methods through better understanding of their benefits and the sharing of knowledge and skills. Co-operative working environments are likely to increase social interaction and job satisfaction among employees. Partnerships also form the basis for improving environmental and social performance of the supply chain and provide for fair, long-term business relationships.

A quality driven agenda is very important to sustainable development on the economic and the environmental level and moderately important on the social level. It includes environmental performance of building components and materials linked with improvements in quality and process efficiency, e.g. standardised components reducing waste; durable materials maximising product life, energy efficient materials reducing running costs, etc. Approaches to quality management are also applicable to environmental (and social) performance and in parallel with policies, targets, monitoring and reporting.

A commitment to people is very important to sustainable development on the social level, moderately important on the economic level and with minor

importance on the environmental level. Working conditions, training and development opportunities for employees and contractors is a key issue for companies wishing to demonstrate corporate social responsibility. Training at all levels of the industry is also important in order for sustainability considerations to be integrated in design and construction.

This stage of the analysis also indicates clearly that the scope of *Rethinking Construction* is insufficient to embrace the full extent of the industry's potential contribution to sustainable development. The Egan agenda is limited to the construction process and falls short of addressing the industry's broader influence on the built environment through linkages with other groups such as planners, building managers, clients/users, and government (the regulators).

Improving the Industry's Contribution to Sustainability

The second stage of the analysis in *Integrating Sustainability and Rethinking Construction* aims to identify the sustainability issues which might also contribute to performance improvement, as defined *in Rethinking Construction*. This is done by firstly listing the actions or processes the industry would need to implement in order to meet key sustainability objectives. Then these are then matched against the five 'drivers' in order to identify how, and to what extent, consideration of each sustainability issue might also contribute to performance improvement.

The analysis indicates a clear synergy between several of the key sustainability issues (e.g. waste minimisation, decent working conditions and good business relations) and performance improvement (see Table 2). This conclusion is supported by the fact that the same issues are mentioned explicitly in *Rethinking Construction*. However, in each case at least three of the drivers for performance improvement, most notably committed leadership and a quality-driven agenda, need to be in place for this win-win result to be achieved.

A larger number of sustainability issues have less contribution to make to performance improvement - as it is currently defined - and so are less likely to be tackled effectively by the process outlined in *Rethinking Construction*. These are sustainability issues for which there are fewer matches between the actions required and the processes for performance improvement. The analysis indicates the sustainability issues least likely to be addressed are use of sustainable materials, renewable energy and brown-field vs green-field development.

Issue of Sustainability	Possible Actions	Relevance to Egan Drivers				
		Leadership	Customer	Integration	Quality	People
Contribution to safe, viable and cohesive communities.	Ensuring access from housing to employment areas and local services. Providing for community diversity through a mix of housing. Measures to improve quality of built environment (healthy buildings, safety)	**	***	*	**	***
Use of sustainable materials (reduced embodied energy, recycled, renewable, locally sourced)	Green specification. Supply chain management.	**	*	*	**	*
Use of renewable energy in buildings.	Passive solar; photovoltaic etc.	**	*	*	**	*
Promoting water efficiency.	Uses of water efficient fittings. Water recycling infrastructure.	**	**	**	**	**
Prevention of surface and groundwater pollution from construction & completed developments.	Environmental management systems (EMS).	***	**	*	**	***
Use of Brownfield instead of Greenfield sites.	Choice of development location.	***	*		*	*
Protection of local landscape and ecological value.	Mitigation measures including landscaping, habitat restoration.	**	*	*	**	**

Table 2. Secondary Linkages between Issues of Sustainability and the Egan Report's 'Agenda for Change'

There are several issues around which there is clear scope for integrating sustainability with *Rethinking Construction*. The main areas of potential synergy are waste minimisation, process integration (including supply chain

importance on the environmental level. Working conditions, training and development opportunities for employees and contractors is a key issue for companies wishing to demonstrate corporate social responsibility. Training at all levels of the industry is also important in order for sustainability considerations to be integrated in design and construction.

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partnering), a commitment to people and a quality-driven agenda (including reduced cost in use).

Leading companies in other sectors (and a very small number of leading UK construction companies) are already measuring - and taking systematic steps to manage - their sustainability impacts. These companies recognise that a reorientation towards sustainable development is essential for ensuring their long-term viability. However, most companies within the UK construction industry appear to be missing opportunities for taking a more pro-active role, within their broader sphere of influence, in helping to provide a sustainable built environment.

An urgent need – and a considerable opportunity - exists to include sustainable development as an explicit objective of these initiatives. This could be facilitated by including indicators of sustainability (such as those being developed by CIRIA, BSRIA and others) into the framework of Key Performance Indicators put forward in *Rethinking Construction*.

Conclusion:

The primary objective of this paper has been to review the performance of the construction industry in the UK over recent years and to seek to explain some of the reasons for its under achievement. The emphasis has been upon selected aspects of project management and the essential role these can play in determining the efficiency, effectiveness and value of the construction process.

A central issue that has emerged from the study is the significance of performance indicators and the role these can play in delivering a more sustainable industry. What emerges is a recognition that the importance of embedding issues of sustainability as integral parts of the project management process. There is now ample evidence from Egan and other key policy analyses that the question that confronts the industry is not whether it can afford to take on board the sustainable development agenda but how it can afford not to.

The key to progress and reform lies in the identification and application of appropriate sustainability indicators. This progress will be attained by the analysis of case studies of current experiences in the industry, which will be the next stage of my research. Applying key sustainability indicators will lead these case studies to a better performance and will also lead my research to its third stage, which will involve identifying new tools that can help improve performance.

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Acknowledgements

Figures 1 and 2: from *A Guide To The Project Management Body Of Knowledge*, PMI, USA, 1996

Tables 1 and 2: from *Integrating Sustainability and Rethinking Construction*, CRISP, U.K., 1999