

INTRODUCTION

This document is the culmination of considerable effort by the Masters of Construction management students in the “project applications in building” subject. There are two chapters on customer satisfaction, two on strategic alliances, one on health and safety, two on information technology, two on trust and leadership and one on the construction industry’s future challenges.

The chapters on customer satisfaction are based around the challenge of maintaining customer focus by adding value through first class services. The challenge for construction companies is to stop thinking and operating in a linear fashion, producing internally efficient things (products and services) and to start thinking holistically by beginning with end users in mind, producing solutions for customers, of which value added services are increasingly the prime concern. In trying to discuss how this can be done, one of the chapters focuses upon the design phase and the other focuses upon the philosophy of Total Quality Management and its application to the construction process. The TQM chapter concludes that because the boundaries of TQM are not distinct, this allows it to be easily integrated with other new management concepts that seek to understand the customer’s needs.

The chapters on strategic alliances approach the subject from a globalisation, perspective arguing that the willingness and ability to form joint ventures etc will become increasingly important in the increasingly competitive global market-place. The first chapter uses a case study to conclude that successful strategic alliancing depends upon, equal strength, flexibility, corporate culture, management systems and strategies, dynamic management, strong commitment and effective communication. The second chapter makes much the same point and argues that companies must spend considerable time in adapting their systems, mastering the necessary skills and nurturing the appropriate cultures.

The chapter on health and safety studies an increasingly important issue within the construction industry and argues that safe working methods are good for business. It concludes that a safe working environment can be achieved by; focussing activities onto preventing accidents, creating a healthy and happy workplace and actively promoting the importance of health issues and a concern for the well-being of staff and society in general by pursuing waste management techniques through the reduction of emissions, effluents and discharges.

The two chapters on IT reflect an increasing interest in technology in a construction industry that is traditionally resistant to change. The first chapter reviews a range of IT applications within a construction and design context. The chapter predicts a sudden surge in IT usage within the industry because of its ability to speed up the construction process and to facilitate communication across international boundaries. The second chapter points to the problem of the millennium bug and proposes some strategies for the successful use of IT in the construction industry. Some proposed strategies are:

- Improving communication with networking systems (e.g. LAN, WAN, Internet);
- Facilitate data sharing with database systems and electronic payments, thereby promoting trust with sharing of information;
- Increase teamwork through sharing of resources of distant companies, where they are brought together through information technology;
- Facilitating strategic alliances with advancement in IT and “shortened” distances between companies through the Internet; and
- Produce efficient use of knowledge and information in data bank, thus increasing productivity and competitiveness.

The two chapters on trust and leadership are based upon Tom Crow’s road-blocks to success and consider ways of changing the confrontational culture of the construction industry.

The first chapter concludes that the six roadblocks that result in management and professional demarcation with project teams are:

- Focus on self preservation
- Thinking inside the “traditional square”
- Co-ordination across unnecessary boundaries of responsibility
- Having limited team work
- Creating formal systems which restrain creative co-operation
- Having institutionalized role

It argues that the behavioral challenge is to change attitudes and remove the “manmade” roadblocks to allow teams to:

- Focus on end user
- Be synergistic (whole greater than sum of parts)
- Form alliances with external teams (e.g. statutory authorities, utilities)
- Recognize interdependency of team members
- Adopt flexible roles
- Create a learning team environment
- Think “Outside the Square”
- Create informal systems, based on trust, to enhance co-operation and innovation.

The second chapter concludes with an argument for a paradigm shift in current management thinking towards leadership issues.

Finally, the last chapter considers, through a historical analysis, the future challenges facing the construction industry. It concludes that the Australian construction industry has not made the significant efforts of changes to business practises that many leading

overseas companies are making in order to achieve higher and higher performance. Findings of future challenges in the construction industry clearly fell into two different categories. The first being – Environment Challenge - namely Sustainable construction, Education, Technology, and Research and Development Roles, and secondly - Enterprise Challenge – as initiated by CIDA, it consists of Customer Satisfaction, People Involvement, Planning, Process, Supplier Relationship, Information Use and Leadership. There seems to be no other way for construction industry to survive doing business in this time and in the future without establishing appropriate efforts, for example, World Best Practise, in order to improve the performance.

CUSTOMER SATISFACTION

ABSTRACT

Customer satisfaction terminology applied in the project problem and solution method has been increasingly important in construction industry. The method presented is using design phase of project life cycle as the study case. The interaction process or input and output method developed is a process of combining a project life cycle and a customer-oriented process. The internal and external customers were introduced to define the strategic objectives and next phase objectives. The method has ascertained the customer requirements through the design phase of project life cycle. The final result are the output of the design phase, which are total quality managerial culture, design documentation quality performance and working procedures, quality plans checklist and control. The method can be effectively achieved the customer satisfaction if the method proceed throughout the phases of project life cycle.

Key words: Customer satisfaction, customer-oriented, total quality, design phase, project life cycle.

1. BACKGROUND

Nowadays, the states of the art of how companies do their business are Total Quality Management, Customer Service Excellence and Customer Satisfaction (Band, 1991). It has been a basic necessity to value the customers for just to survive. Customer pursues satisfaction in term of products and services, thus basically integration between managerial customer oriented and product or project customer oriented has to be implemented to meet the customer satisfaction. Quality is exactly a word what the customer requires, and in term of design phase the requirement may include reliability, cost effectiveness and delivery. The issue has to be addressed to how to meet or rather exceed the customer expectation and to include maximum value added to the customer.

2. CUSTOMER SATISFACTION IN DESIGN PHASE

Quality of design is a measure of how well the product or service is designed to achieve the agreed requirements (John, 1993). To meet the quality of a design, it is necessary to describe the design purpose or what it is to be used for. Most likely, the design has different interpretation in every entity involved in project life cycle. This happens because each entity that observed the design has its own perspectives driven by their objective approaches. This illustration can be seen in tree swing design bellow (John, 1993). The most important interpretation to be observed is what the customers wanted. The problem is how to satisfy the customer along with all the phases in the project life cycle.

In general term, the customers needs are quite simple (Ritz, 1994):

Need	Reason
1. The best facility for the money	To maximize profits or services at a reasonable cost.
2. On-time completion	To meet production or service schedule and financial goals.
3. Completion within budget	To meet financial plans for the facility and return capital
4. A good project safety record	To meet the owner's or end user safety standard

The design team goals are to:

Need	Reason
1. Make profit on each project	This applies only to Architect/engineer entities.
2. Finish on time	To satisfy the owner/client and meet contractual requirements.
3. Design within the budget	Ensure goal 1 and satisfy owner.
4. Furnish quality per contract	Ensure goal 1, satisfy owner and meet contractual requirements.
5. Get repeat business	Maintain company reputation and reduce selling expense.

The construction team goals are:

Need	Reason
1. Make a profit on each project	This applies to constructors and design-build teams.
2. Finish on time	To satisfy the owner/client and meet contractual requirements.
3. Build within budget	Ensure goal 1 and satisfy owner.
4. Furnish quality per contract	Ensure goal 1, satisfy owner and meet contractual requirements.
5. Finish the job safety	Meet company's, owner, end user safety goals.
6. Get repeat business	Maintain company reputation and reduce selling expenses.

Design must satisfy several definitions of quality that provides insight into the concept of quality and by inference customer satisfaction and value (Garvin, 1988).

- ☞ *Transcendent quality*: a beauty, aesthetic excellence as required by customer.
- ☞ *Product-based quality*: better quality is measured as having more of something (increased of quantities) of an un-priced element or attribute contained in design.
- ☞ *User-based quality*: the design consists of the capacity to satisfy wants. The quality depends on how well it fits patterns of consumer preferences and fitness for use.
- ☞ *Operations-based quality*: conformance to requirement. Quality of design can be measured to how closely the design meets the specifications set for it. For example, low quality of design in operation-based point of view is defined as deviations from predetermined quantified standard of performance.
- ☞ *Value-based quality*: by this definition, quality is expressed in terms of conformance to requirements including price and cost of meeting them.

Basically, to achieve a good quality, the process must be designed into the whole systems, which are quality planning, quality assurance and quality control. Quality planning is a process of identifying which quality standard are relevant to the project and determining how to satisfy them. Quality assurance is a process of evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standard. Quality control is a process of monitoring specific project results to determine if they comply with relevant quality standards and identifying ways to eliminate causes of unsatisfactory performances.

In design firm, a managerial function has two objectives, which are to support the firm's technical personnel, and to protect the firm from large financial losses. The technical staffs have duties to serve customer and the administrative staffs responsible for the firm continuous improvement. Thus it is obvious that each part works to achieve the main goal, which is to achieve customer satisfaction, both internal and external customer. In a design phase, client/customer is involved as a member of project team members.

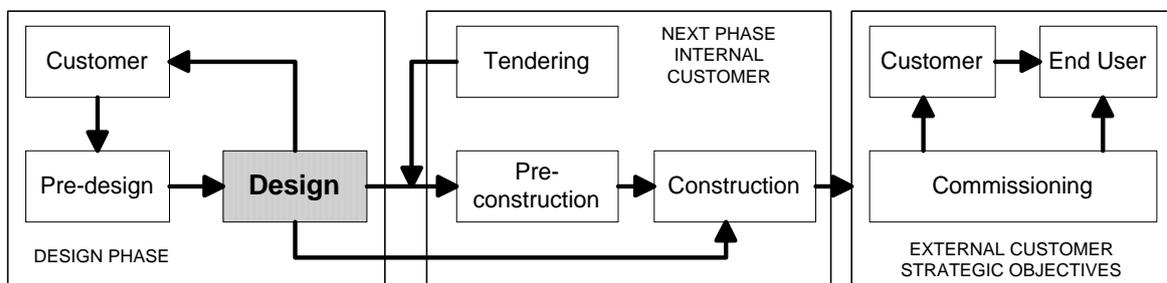
Customer requirements regularly tend to change as information to the customer steadily increases by the project delivery life cycle. Basically, the requirement change within the consideration margin can be considered as establishment, however the change should not exceeds the consideration stated in conceptual agreement, because it is difficult to always follow or satisfy an inconsistent customer requirement. If this happens the result is even greater damaging the project as the variation will be increased in all aspect, furthermore the design will be poor in quality. Therefore, it is significantly crucial to the planners or designers to involve the customer as soon as possible, even in pre-design stage. The brief presentation to introduce all the aspects of the design can be preferred strategy to prevent unneeded variations.

Feasibility study should be performed and introduced to the customer in the project initiation (John, 1993). To achieve the expected design quality, every entity in design interface must proceeding the tasks as follow:

- ☞ Determining who are the immediate and end user customers and how to find out what the requirements are?
- ☞ What are their true requirements and how to measure the ability to meet the requirements?
- ☞ Do we have the necessary capability to meet the requirements and what must change to improve the capability?
- ☞ Do we continually meet the requirements and if not, then what prevents this from happening?
- ☞ How to monitor changes in the requirements?

3. COSTUMER ORIETED IMPLEMENTATION IN DESIGN PHASE

Project life cycle comprises several phases including pre-design, design, tendering, pre-construction, construction, and commissioning. Internal and external customer can be applied within the project life cycle. Basically, Total Quality Management recommends that to achieve the best quality is to do thing right in the first place toward the processes. For the design phase the final customer expectations can be considered as the strategic objectives. The following phase (pre-construction, construction) can be considered as internal customers. Thus the design should satisfy the following phase requirements as the pathway to achieve the overall customer satisfaction that stated in the strategic objectives of the design. The strategic objectives should emphasize on future outcomes rather than results. Thus the expectation should exceeds the current customer requirement, which means that the design would add value to the customers or end users by considering the life span and operational cost.



Internal and External Customer

During the design stage, it is important to define the requirements of the project. In order to meet standard, improving the quality of a construction, it is essential to provide an appropriate design product and services. The design firms should be fully involve and responsible to the project. Furthermore, the design firms will be retained to keep an eye on the contractor to be sure that the works are being performed in accordance with the plans and specifications.

Design phase within the project life cycle produces several products, which are

1. Management, administration services.
2. Project design document product.
3. Project design services.

3.1. Management, Administration Services

Design phase started by handling all management, administration activities on providing their services to the clients. However, the regimented management system that most likely used in design firm has some negative point. The bureaucratic management system tends to lead the senior managers spend more of their time with other non-technical managers and ignore interaction with project managers or their clients. The administrative managers, who rarely deal with clients, tend to work by their own roles, policies and procedures. Furthermore, the technical managers, who are more spending the time on technicality, tend to have less access to senior managers and leads to reduce customer-oriented design values.

To avoid that condition, the commitment for customer-oriented from CEO should be dressed toward senior managers. Furthermore to ensure the program is succeed, everyone involved in

design phase must understand this commitment. The objective reconciliation between the client and those who involved in design and project has to be made. This harmonization is to bridge the gap of cultures as well as technical and contractual procedures. A role of design firm is to conceive, plan, and provide quality design solutions in responding customer's requirements.

3.2. Project Design Documents Product

There are four types of project documents produced during design phase. The documents include drawings, specifications, material documents, and manual (project books). The material documents refer to material take-off sheets (MTOs), data sheets, purchase requisitions (PRs), and purchase orders (POs). The project books refer to operation manuals, maintenance manuals, welding procedures, piling procedures, and so on. While the others are the critical documents, which have always taken most of man-hours in an A/E firm. This is particularly for drawings, which may require 50-60% of the total budgeted man-hours (Eldin, 1991).

Without an effective management system, these project documents have always caused the clients (contractors and project's owner) such a large number of problems as follows:

- ☞ Errors and Omissions (in particular drawings and specifications)
- ☞ Contradiction between drawings and specifications
- ☞ Incomprehensive project document

In this sense, the drawings and specifications mostly cause these problems; therefore the effective management system should focus more attention on these two documents.

3.3. Project Design Services

Defining the requirement within all entities involved to the project is very important to achieve mutual understanding. This begins with an agreement with the client as to the responsibilities of the design firm during construction. The answer to each question should be mutually agreed and documented so that there is no ambiguity. Each member of the project team must understand the requirements and know how it would satisfy the client and all parties involved. The agreement will be in many different definition based on the client's need, such as:

- ☞ The design firm's role should providing assistance not only on an "as requested".
- ☞ The design firms should be totally responsible for all aspects of construction including cost, schedule and quality.
- ☞ Considering the owner wants something in between.

Such differences in definitions can create disastrous misunderstandings between the design firm and the contractor. Therefore it is important to define precisely what services should be performed and how the design would be performed.

4. INTERACTION PROCESS OR INPUT AND OUTPUT METHOD

Design phase within the project life cycle linked to other phases by their inputs and outputs (Duncan, 1996). The input is items or documents that will be acted upon. The output is items or documents that are result of the process. Between those two links there is tools and techniques, which are mechanisms applied to the inputs to create the outputs. The input can be the result or outputs from the previous phase in the project life cycle.

4.1. Input for Design Phase

- ☞ **Project brief**

In client brief, the completely information of client needs have to be collected by management so that can easily be administrated. The client brief informs about:

- Project scope & specification (feasibility study)
- Project environment (environmental study)
- Project deliveries system (contract)

In this term, the management can be considered as consultant and is expected to assist the client by giving some suggestions of what procedures must be done and the project can environmentally be developed and also describing some alternatives which still according to client requirements.

The project description documents the characteristics of the product or service that the project was undertaken to create. In this stage the project description will generally have more detail as the product characteristics are progressively elaborated. The project description should also document the relationship between the product or service being created and the business need or other stimulus that gave rises to the project.

☞ **Quality planning strategy**

The organizational culture has to be considered to improved deliverables. Quality planning involves identifying which quality standards are relevant to the project and determining how to satisfy the client. It is one of the keys facilitating processes during project planning. The Quality Planning System requirement at this stage is compatible with and complementary to TQM.

☞ **Standard quality requirements and regulations**

Standard often begins as guidelines that describe a preferred approach, and later, with widespread adoption, become de facto regulations (e.g. the use of The Critical Path Method for scheduling major construction projects). Compliance may be mandated at different levels (e.g. by a government agency, by the management of the performing organization, or by the project management team). For many projects, standards and regulations (by whatever definition) are well known and project plans can reflect their effects.

☞ **Financial condition of client**

The client must honestly explain budget that is provided, in order to ease in designing that can be suitable to financial condition. The firm administrator has to check the customer financial institution to continuously inform the real status or condition of finance.

4.2. Tools and Techniques

4.2.1. Managerial Tools and Techniques

☞ **Good managerial organisation**

The ability of managing system to operate effectively depends upon an appropriately structured operating system and complimentary managing system. A role of managing system is to design the organisation through which it will work in seeking to achieve the client's objectives. The client involved in the process, is in order to avoid multiple objective which may be arisen because of individual aspirations of the sub-systems, which tend to develop their own purpose outside the main purpose of the system.

TQM should be implemented to develop teamwork, empowerment, communication etc. Establishment team structure can be done by nomination team structure. Training and education is one the strategy, which purpose on high quality of human resources to improve the culture toward quality cultures.

☞ **Coordination and Communication**

Effective coordination and communication within all participants is essential to achieve the best quality. The information such as drawings, specifications, procedures, contract details, throughout number of interfaces, such as client, contractor, sub-contractor, and consultant design are demanding to be treat efficiently. Coordination requires effective and frequent communication among project team members. Coordination and communication in design phase can be done effectively by creating the key contacts of team members from each party involved.

Communication must be done in two-way interactive process. Listening and seeking feedback have to be in balance with speaking and writing. The communication has to be up and down and also across the project organization. The designing progress information has to be reported to the owner and every party involved and proceeded to the next step.

4.2.2. Project Document Tools and Technique

☞ **The principle of single statement**

According to the principle of single statement, each dimension, coordination, elevation, callout and so on, must be shown only once in any set of drawings and specifications. This information should be shown where it could be most easily seen. There are a couple of reasons, why this principle is vitally important (Stasioswski et.al., 1994). Firstly, there is a tendency to show all these information at several places in a set of drawings, largely because the designers, architects and engineering designers, want to ensure that contractors will not miss them. However, as a result of nature of design phase in which changes often happen, it is easy for designers to forget to correct some of drawings and specification, where they have been shown. Secondly, changing all these information will consume a lot of time.

☞ **The clarity of intent.**

Like drawings, the specifications have an enormous impact on all aspect of the construction project. Due to the use of an indirect of means of communicating (verbal descriptions in stead of pictures), it is vitally important to carefully use the language in order to reduce the problems on the project (Jackson, 1990). In other words, the specification should be written to clarify the intent of project's owner and designers, not to play the word like a legal document. For instance, phrases such as “ to the satisfaction of the engineer” of “ to a reasonable....” are not clear enough to clarify the intent. However, if the designers still want to use these types of phrases, the interpretation of these terms should be clarified prior to bidding (Jackson, 1990).

☞ **Construct-ability review.**

Construct-ability review is the optimum use of construction knowledge and experience in planning, engineering, procurement, and field operations to obtain overall objective (O'Connor, 1987). In other words, this approach is to apply experience of construction management team to review nearly complete drawings and specification. The review look at these documents from the point of view of contractors, which are always in the different angle from the designers. Unlike design review, a construct-ability review focus on trade and discipline interfaces, a comparison of detailed and general drawings, a comparison of drawings and specification requirements, an analysis of the general conditions and requirements and likely effect on construction, and whether, or not there is sufficient information in the document to bid and build the project (James, 1995).

By the way, in order to make construct-ability review effective and efficient, design review is also important. Design review should be conducted properly in order to determine how much effort would be required for the construct-ability review (Stasioswski et.al., 1994).

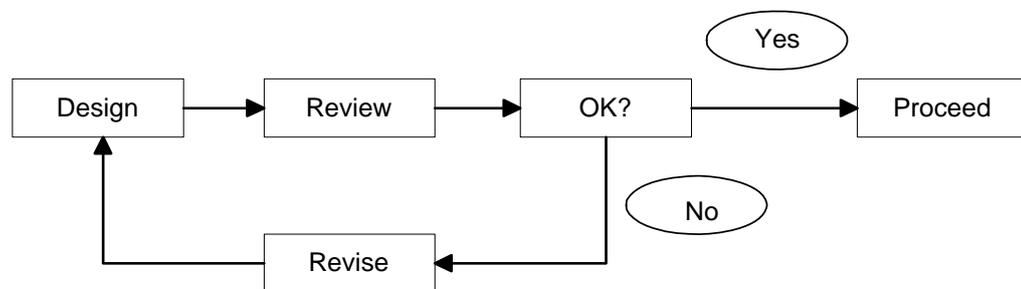
4.2.3. Services Tools and Technique

☞ Financial analysis.

The design stage process must consider benefit/cost trade-offs. The primary benefit of meeting quality requirements is less rework, which means higher productivity, lower costs and increased stakeholder satisfaction. The primary cost of meeting quality requirement is the expense associated with project quality management activities.

☞ Flowcharting.

A flowchart is any diagram, which shows how various elements of a system relate. One of the diagrams that appropriate for the design project stage is “system or process flowcharts”. This system in figure below shows how various elements of a system inter-relate.



Sample Process Flowchart, Source: Project Management Body of Knowledge, 1996

☞ Design of experiment.

Design of experiment is an analytical technique, which helps identify which variables have the most influence on the overall outcome. The technique is applied most frequently to product of the project issues.

☞ Benchmarking and performance measurement.

Benchmarking involves comparing actual or planned project practices to those of other projects in order to generate ideas for improvement and to provide a standard by which to measure performance. The other projects may be within the performing organization or outside of it, and may be within the same application area or in another.

4.3. Output of Design Phase

☞ Total quality managerial culture.

Effective teamwork, communication, empowerment, strategic alliances etc. will be created among all parties involved. This beneficial condition can enhances the quality of design, develops overall performance and also speed up the whole project.

☞ Design documentation including

- Preferred design drawings and specification which describes most effective design option relevant to the design brief and has a certainty of governing authority

- Design deliverables with Total Quality benefits: right first time, to program, to budget, to customer requirement.
- Elemental cost plan, which shows the cost of materials used in project
- Basic construction plan, which describe basic method and brief time schedule of project time and consistent with the design and cost plan

☞ **Working procedures, quality plans checklist and control.**

Total quality working procedure, quality standard and control definition describes, in very specific terms, what something is, and how the quality control process measures it. Checklist is a structured tool used to verify that a set of required steps has been performed. Standardization checklist to ensure consistency in frequently performed activities.

5. CONCLUSION

The Interaction Process or input and output method can be implemented as a control to achieve customer satisfaction in the project. The phases of project life cycle can be used in sequence term to determine the objectives of following phase, which considered as interrelation of internal and external customer. Doing right in the first phase results in achieving overall customer satisfaction, therefore can be concluded that this method is quite effective to be implemented.

Base on our study case, determination of what the customer requires in design phase, is the most crucial process to be done. The result of this process can be used as input of the method implemented. The input including managerial approach, document control, and services. By using appropriate tools and techniques the result is achieving the next phase requirement. The final result is the output of the design phase, which is total quality managerial culture, design documentation quality performance and working procedures, quality plans checklist and control. Furthermore if the method continuously proceeds then the overall achievement is satisfying the strategic objectives, which is satisfying the customer.

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CUSTOMER SATISFACTION

INTRODUCTION

The major impetus for change through out Australian industry has been the need to integrate into the world economy. However In the construction industry much of the impetus for change has come from the leading-edge private clients who themselves have to deliver world-class performances to survive in a global economy. Public sector clients are requiring improved industry performance to ensure taxpayers are getting value for money. (McGeorge, 1997)

Over the last decade, this pressure for change has lead to an increasing focus on customer needs and the philosophy of Total Quality Management. The proponents of T.Q.M. claim that focusing on customer needs is of strategic importance for an organisation as it leads to competitive advantage. This advantage is based on *excellence in the quality of an organisations' processes irrespective of whether they are producing either commodity-like products or differentiated products.* (Samson)

This report will examine the management theory of T.Q.M. and its recommendations for organisations to be enable them to satisfy their customers' requirements. In addition, other relevant theories and techniques will be examined to ascertain their contribution to satisfying customer needs.

Finally this report will present a brief case study on the Transfield Bouygues Joint Venture Project and how T.Q.M. strategies and Quality Assurance were implemented.

Before one can develop and implement a T.Q.M. system to meet customer requirements and be able to assess the effectiveness of these systems functional definitions for the customer, satisfaction, and perceptions are required.

DEFINITION OF CUSTOMER

In T.Q.M. the customer is defined as anyone who has the benefit of the work, activity or actions of another. Customers can be categories as:

Internal Customers, that is, customers of the processes and who are part of the organisation that is providing the product or service or the next person down the chain of production. For example, for designers, the products are plans and specifications, and the customers are the owner and the contractor responsible for the construction.

External Customers, that is, customers of the processes who are outside the organisation. For example, for the contractor, the product is the building and the external customers are the client and the final user of the facility.

Every party in this process has three roles, ie:

- Supplier
- Processor
- Customer

Juran defines this process as the triple role concept. These three roles are carried out at every level of the construction process. For example:

1. The designer is a customer of the owner. The designer produces the design and supplies plans and specifications to the contractor.
2. The contractor is the designer's customer, who uses the plans and specifications to carry out the construction process and supplies the completed facility to the owner.
3. The owner supplies the requirements to the designer, receives the facility from the contractor, and is responsible for the facilities operation.

CUSTOMER SATISFACTION

The term satisfaction is defined as the result of some comparison process in which expectations are compared with what is actually received. (Ahmed 1995). Perception is defined as the customer's impression and feeling about a service process.

Satisfaction and perceptions are intimately related in the service experience. Customers are most likely to be satisfied when their perception of the service matches or exceeds their expectations. However one bad experience can tarnish the customer's perception of a service or product.

Studies have shown that there is a sharp contrast between the customer's perception of services and the purveyor's perception of the same services. This indicates that businesses need to understand the elements of the service *that are attributes of quality in the opinion of the customer. Then determine how best to deliver in accordance with customer expectations.* (Ahmed 1995).

IMPLEMENTATION OF A T.Q.M. SYSTEM

The implementation of a T.Q.M. system can effectively determine the needs of the customer and provides a framework, environment and culture for meeting those needs at the lowest possible cost. To ensure that customer requirements are met the aims of a TQM system should be:

- Identify all of the organisations' customers and obtain data relating to the customer's perceptions of quality.
- To obtain a thorough understanding of what will provide customer satisfaction.

- To help your customer fully understand and agree on the specifications/requirements.
- Develop and implement procedures that should reduce the possibility of re-work, rejection, non-conformance or product fully satisfying the customer.
- Implement a monitoring, inspection, checking system that prevents any non-conformances. This can be incorporated into a self-checking system, provided there is an internal audit system.
- Implement a procedure for corrective action, so that any problems that do occur can be analysed and causes of error identified and eliminated.
- Incorporate a reviewing system that will continually monitor the performance of the Quality System. Ensuring that it is achieving the objectives set by all people involved in the system whether they are company people or customers.

The Standards Australia (Stepping Stones: 1992) proposes eight key steps to establishing a T.Q.M. system. These steps are:

- Measure customer satisfaction.
- Satisfy the internal customer.
- Manage improvement.
- Process improvement.
- Introduce quality management to the front line.
- Introduce quality management to support services.
- Introduce the quality management system.
- Establish a quality assurance system.

MANAGEMENT COMMITMENT AND LEADERSHIP

In the construction industry management commitment and understanding of the T.Q.M system to be implemented is essential for its success, it requires unwavering commitment and support of all levels of management. Top management must consistently and publicly endorse these principles and obtain commitment of every employee and team members.

The following sections will examine in more detail many of the factors highlighted in the above and the associated T.Q.M concepts that provide for customer satisfaction.

CUSTOMER SATISFACTION FACTORS

Accurately determining customer requirements is a key factor in T.Q.M. To date, there has not been developed a universal list of factors that identifies what will contribute to customer satisfaction. However, Ahmed in his surveys has attempted to develop such a list, his findings were:

- Time
- Cost
- Quality
- Client orientation
- Communication skills
- Response to complaints

This list is not comprehensive as can be seen by some of the different customers satisfaction factors that were identified in a survey conducted by the US Airforce (Zumbehl 1994). These factors were:

Tangible. Physical facilities, equipment, the general appearance of personnel with whom the customer comes into contact.

Reliability. The ability to perform the expected service dependably and accurately.

Responsiveness. The willingness of workers to help customers and provide prompt service.

Assurance. The overall ability of employees to convey trust and confidence.

Empathy. The service organisation's awareness of the customer's needs and feelings.

These studies also highlighted the fact that individual customer responses to these factors varied, ie. they are not universal. Therefore, any business responsible for services must continually measure to ascertain the particular responses of their customers to individual requirements and to identify any requirements that may be unique to the customer.

The results of these surveys enables businesses to focus their efforts on areas that the customer considers requires improvement. It is by this means that a business can determine its effectiveness in providing a high-quality service and continue to satisfy customer needs over time.

Over the last ten years a number of techniques have been developed to assist in identifying customers, customer needs, and the measurement of performance, these include benchmarking and value management. McGeorge considers that these techniques should be incorporated into a T.Q.M. programme.

THE CONCEPT OF PROCESS

The concept of process is central to T.Q.M., since it is believed that if all internal customers are satisfied, the product or service offered to external customers or end users will also be improved.

On a construction project there are usually several organisations involved and this is often the cause of major managerial problems. However, if the idea of business process is adopted it can cut across these boundaries as it is assumed that all the people, in all the companies are customers. This tears down the traditional compartmentalisation of organisations and enables them to move towards more integrated structures and project teams which can better meet customer requirements.

CONTINUOUS IMPROVEMENT

Organisations are faced with customers whose needs are changing and their expectations are ever increasing.

The T.Q.M. philosophy espouses that no matter how good a process, product or service it can be improved. Because of these factors T.Q.M. considers that process improvement essential in order that an organisation can continually delight the customer, ensure customer satisfaction and repeat business.

Process improvement and control involves:

- The breaking down of the construction process into stages through the use of flow diagrams.
- Introduce changes to each stage to improve procedures to better satisfy the customer at the next stage. including the introduction of major technological advances in the construction processes.
- The employees during each stage should communicate closely with their supplier and customer to optimise the work process for that stage. This requires that each employee recognise their place in the process and their respective supplier and customer.

Refer to figure 1 - The Quality Loop, it shows the continuing interaction between the two groups customer/customer and producer/supplier to achieve continuous improvements .

In addition Crosby (1979) and Juran (1988) consider that improving the process and thereby avoiding defects is usually less costly than the typical construction approach of attempting inspect out defects. The concept of the Cost of Quality was developed as a measuring tool to review the effectiveness of the T.Q.M. process, help select quality improvement projects and provide cost justifications for the implementation of process improvement programs.

CUSTOMER INVOLVEMENT

Joint Teams

Customer involvement is essential for the continuous improvement processes that ultimately provide customer satisfaction.

One method of customer involvement is the concept of joint teams to promote customer satisfaction. These joint teams are responsible for establishing joint goals, plans and controls. The teams provide a mechanism for listening and communicating with the customer and measuring the level of customer satisfaction.

First level partnering is one method that has been used with some success to establish a joint team between the client and contractor where the basis of the relationship is one of trust rather than the traditional adversarial relationship.

To ensure a successful quality management practice the entire project team should be selected on or near the same time period. The general contractor should be selected no later than the schematic design stage. This will ensure the formation of the project team at the stage when the quality programmes can be instituted most successfully.

Ownership of Quality

A contributing factor to the failure of the successful implementation of T.Q.M. programmes has been the frequent confusions as to who has the ultimate control of quality on a project. Typically in a construction project there a number of interested parties that have an input into product quality and process quality. However there is generally no one individual who has the overall responsibility for quality.

If the owner has no input in the selection of subcontractors, who inherently have a greater share in the control of quality of the constructed product, most of the control of the total quality programme is lost.

To ensure the success in the implementation of quality programmes in a project the owner should be represented by knowledgeable personnel who can properly represent their interests. Owners may delegate quality in which case the selected delegate must be responsible for quality management from the projects inception through to its completion.

The implementation of quality programmes in construction starts with the formation of project teams who have been prequalified by the owner. Partnering as one such teaming process is most effective in ensuring that the owner's interests become the interests of those involved.

To be fully effective, TQM practices need to be adopted throughout the whole project team and all the key parent enterprises. However as each building project is unique standardised programmes will not work for every project. The quality programmes for construction must be individualised for each new building, customer and project team. Such

individualisation however requires a common approach to the implementation of T.Q.M. programmes.

EMPLOYEE INVOLVEMENT

T.Q.M. believes that employees will do better if they are given the opportunity. Empowering employees is seen as one way to :

- Deliver what the customer wants.
- Develop an integrated project team.
- Make decisions and solve problems.
- Improve the system.

.T.Q.M. uses the concept of escalation to address problems, ie. problems are solved at the lowest level of the organisation within a given time limit (in order to avoid effecting project progress) or they are escalated up to the next level of management. This process is much quicker than the traditional approach of passing the problems up to the next level management to solve.

TRAINING

There is a Japanese axiom that states quality begins with training and ends with training. Under T.Q.M. quality becomes everyone's responsibility and the training plan must be targeted to every level of the company.

Training is essential to help develop the customer and quality focussed culture required in an organisation in order to meet customer requirements.

It is sometimes argued that the transient nature of the construction industry makes it difficult to institute effective training programmes. However the construction industry in the U.S.A. has had safety training forced upon them and it has proven to be effective. Consequently the implementation of quality awareness should be no less possible.

LIMITATION OF SUPPLIERS

The ability to produce a quality product in the construction industry largely depends on the relationship among the parties involved in the process, ie:

- The supplier
- The contractor
- The customer

Kubal (1994) notes the significant quality improvements have occurred in the manufacturing industry through the limitation of suppliers and second level

partnering. Consequently, he recommends the limitation of suppliers by contractors as this will raise the level of quality in the construction industry.

In addition, contractors should continually qualify and screen trade contractors for their abilities in quality and safety processes and team members, trade contractors and their employees should not be solely selected by price, but their ability to do the work.

Furthermore, contractors and the design team should begin to partner with their suppliers on an informal basis to help increase the quality of the finished product and limit coordination problems, general safety problems, scope and legal disputes.

CONTRACTS

Traditionally, in the construction industry, contractors, subcontractors, and vendors are all pitted against one another by the tender process. When profit margins become small contractors will lower quality and lose interest in providing customer satisfaction.

The fourth point of Deming's 14 point stresses that companies must:

***“....end the practice of awarding business on the basis of price tag alone. We can no longer leave quality, service, and price to the forces of competition for price alone.....without adequate measures of quality, business drifts to the lowest bidder, lower quality and high cost being the inevitable result.”
(Deming 1986)***

If one is to implement a T.Q.M. programme the implementation of a contractual system that is conducive to this strategy is essential. The basis of this new working relationship should be:

- Trust
- Sharing information and rewards
- The objectives of increasing quality, productivity, customer satisfaction, employee satisfaction and loyalty.

The development of more neutral forms of contract and trust is dependent on the leadership of the client and the willingness of both parties to develop a less adversarial relationship. Other key areas where the client can change current adversarial working practices and develop trust with the contractor are:

- Proper allocation of risk.
- The client reveals the company's business strategy to the contractor.
- The reward of performance rather than the current practice of penalising non-conformance.

- Change in the attitude of client's staff.
- Development of long term relationships, eg. partnering.

The following will review the current contractual arrangements that are most suited to a T.Q.M system.

T.Q.M. is more suited to negotiated contracts where a contractor because he is given sufficient remuneration is given an incentive to be interested in the project goals and the improvement of quality. Other financial incentives can be built into the contract to give the contractor further incentives to meet quality improvement goals and other project goals. Also the use of financial incentives can also make a tendered lump sum contract more suitable.

A construction management / guaranteed maximum price type contract can work successfully and make the improvement of quality during the construction phase possible if the following steps are taken:

- The construction manager becomes a team member during the design phase so that he/she can participate in budgeting, scheduling and contractibility reviews during this phase.
- The construction manager and the owner during the design phase establish common and uniform goals.
- The guaranteed price should not be established during the design phase without input from the construction manager. This prevents profit retention from becoming a primary goal as it is under lump sum.

Design and Build can produce a favourable environment for quality because the design teams become the internal customers to the general contractor. The owner becomes the only external customer. Design and build can be combined with various contract forms, including lump sum, GMP, reimbursible -with-fee- arrangements.

Owners can work with design-build contractors to establish clear scope definitions, after which budgets can be prepared that become guaranteed prices.

The contracting method that offers the greatest chance of implementing quality improvement involves the use of a project manager. In this method the project manager acting as a consultant for the owner, prepares the design concepts, including scope definitions, and selects the design team and contractor or construction manager.

In addition, the project manager may assist in the selection of trade contractors, and monitor quality and safety during field construction. Project managers can do constructibility reviews and review the value engineering changes suggested by a contractor, and make appropriate recommendations to the owner.

This process is made more suitable when combined with an award-fee process that is managed by the project manager ensuring that the contractor performs totally to an owner's expectations

QUALITY ASSURANCE

The implementation of a quality assurance programme is essential to lock in the improvements that have been made and to ensure that an organisation doesn't slip back to its former poor practices. Refer to Figure 2. for a representation of this process.

Quality Assurance also provides the customer with tangible evidence that the service provider has systems in place to ensure quality. However there is a danger that the rigidity of the QA system and the desire on the part of contractors merely to just obtain certification can work against T.Q.M. and the focus on the customer.

POST CONSTRUCTION PHASE

It is during the project closeout phase that a client's perception of the entire project's success is created. Therefore it is essential that the general contractor and the construction manager support the owner fully to ensure that the change over is successful.

During the post construction phase continuous contact with the customer should be made to ensure their satisfaction with the completed product. Further to this a member of the project team should make future scheduled contacts with an owner to review and discuss any concerns that might have arisen since the projects completion. Such contacts not only improve relationships but assist in developing repeat business.

CONCLUSION

The philosophy of T.Q.M. in the main is general and its boundaries are not very distinct. This presents a serious challenge to an organisation wishing to apply T.Q.M. to their industry.

Managers cannot just apply prescriptive rules but rather some thought and creativity is required in how to best apply T.Q.M. concepts to a particular industry. To date the rigid application of Quality Assurance by the construction industry has shown that many managers of not capable of this task.

The fact that the boundaries of T.Q.M. are not distinct allows it to easily integrate with other new management concepts and techniques that seek to understand the customer, customer needs and measure customer satisfaction.

Finally, the strength of T.Q.M. lies in its clear understanding that for an organisation to succeed it must provide excellence in its processes in order to be able to provide a quality product or service that meets customer requirements.

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12. CASE STUDY. TRANSFIELD BOUYGUES JOINT VENTURE.

What methods and systems does TBJV have in place in order to achieve customer satisfaction?

12.1. Introduction.

The Sydney rail network is being extended to link Central Station to the East Hills line at Turrella. Known as the New Southern Railway, (NSR), the link will include four new underground stations and one above ground station which also functions as an interchange station for the Illawarra/South coast line and the East Hills line. The link will be predominantly underground and will consist of a single twin track tunnel and the route length is approximately 10.5 kilometres.

The project is operating on two separate design and construction projects.

The track and tunnels contract is a lump sum contract with the State Rail Authority, (SRA). The works include the 10 kms of tunnel and all associated infrastructure with the tunnel which includes track and track support, mechanical and electrical services and the interchange station.

The design, construction and operation of the four underground stations is being carried out privately by the Airport Link Company, (ALC). After thirty years of operation, the ALC will hand ownership of the stations to the people of New South Wales.

The total value of the works for TBJV two customers is in excess of 750 million dollars.

12.2 ALC and SRA As The Customers

The ISO 9001:1994 certified Quality Assurance system of TBJV is the pivotal tool TBJV utilises in meeting the requirements of its customers. The results and process performance indicators used by TBJV to demonstrate its performance to its customers are described below.

12.2.1. Process

As TBJV is responsible for both the design and construction of the NSR, the design review process and involvement of the customer in the design development process is a fundamental element of the project's operations.

The customer has the opportunity to review the design at each stage of development,

- Concept Design.
- Detailed Design.
- Workshop drawings.

At the conclusion of each design phase, TBJV gives a formal presentation to its customers, highlighting the important elements of the design and advise on how it has addressed any concerns or queries the customers have raised during the design development process.

The design development process is shown on the attached extracts from the TBJV Quality Assurance Plan QSP 139, tables 4.4.1, 4.4.2 & 4.4.3

12.2.2. Results

Key element of the results indicators for TBJV's customer are project progress the quality assurance report. The progress of the project is principally reported to the customer by the monthly reports, which amongst other items contains the "marked up" and stasured project programme. The quality Assurance report includes the status and progress for clearance of the following items:

- Non Conformance Reports (NCR)
- Corrective Action Reports (CAR)
- Improvement Notices (IN).

To demonstrate its commitment to the satisfaction of its customers and as added incentive to TBJV, works which have been either designed or constructed that are not in conformance (ie NCR) can not and are not claimed for payment.

All quality assurance issues such as an NCR either raised by TBJV or its subcontractors are copied to TBJV's customers. Following the issuing of an NCR, a thorough investigation is carried out to obtain a detailed explanation of why the non-conforming product has been produced and what action will be taken to prevent the occurrence in the future. The proposed method to dispose or clear the NCR must be provided and submitted to TBJV's customers for their information..

12.3. TBJV AS THE CUSTOMER.

12.3.1 Supplier Selection

The works scope of the NSR projects has been divided into many smaller specialist supplier contracts. For the purposes of this case study a supplier is deemed to any individual or company that supplier either a product such as pallet of bricks or the hiring of a design consultant. The value of the supply contracts range from a few thousand to 70 million dollars.

The selection of suppliers follows the followings steps:

- Expressions of interest were requested from a selected list of suppliers. The list is based on TBJV's knowledge of the particular industry
- The response documents provided by the potential suppliers are reviewed by TBJV.

The selection criteria to determine the final tender list included:

- Size of projects already completed of a similar size.
- Time established and working within the industry.
- Existence of well structured organisation to support the project.
- The existence and the ability to demonstrate the company could implement and manage a quality assurance system that was acceptable to TBJV.

The TBJV objective of the selection process was to ensure only those companies or individuals bid on the project that were capable of achieving the necessary performance to the satisfaction of TBJV as the customer.

12.3.2. Design Review Process of the Contactors

All contracts for the mechanical and electrical works of the NSR were awarded on a design and construct basis and therefore is essential that the design review and verification process by established both by the contractor and monitored by TBJV.

The design development process is shown on the attached extracts from the TBJV Quality Assurance Plan QSP 139, “Review of E&M Contractors Design Submissions” figure 1.

12.3.3. Installation Document Review Process.

All works carried out by the contractors both at the factory and on site must be a carried out in accordance with approved technical procedure and inspection and test plans. The review and approval process of all technical procedure of the project is shown on the flow chart “EMChart1.PPT” and the release process and distribution of the documents to ensure the contents are implemented are detailed in “EM Chart2.PPT”.

It by the strict adherence to the approved technical procedures by the suppliers, that TBJV can be assured that its suppliers are providing the necessary customer satisfaction.

12.3.4. Contract Management

The process that TBJV implements to control its consultants and subcontractors is shown on the attached extracts from the TBJV Quality Assurance Plan QSP 139, table 4.6.8, “Control of Subcontractors/Consultants”.

STRATEGIC ALLIANCES

1. INTRODUCTION

In most global businesses, managers of many multinational companies are learning that they must collaborate to compete. They compete only in those precise areas where they have a durable advantage. Managers are beginning to see that the best approach is to find partners who already have the cash, scale, skills, or access to seek. This report is to provide managers and others with strategic and operational guide as well as a resource that can be used to think about whether, how, and with whom to approach alliances and to offer some insights into patterns followed by winners. In achieving this, there are some requirements for success that are common across the regions or companies. Equally important, companies from each of the regions bring different strengths, backgrounds, and objectives. Firstly, Successful collaboration requires flexibility, willingness to share ownership with, learn from companies much different from their own, gaining new technologies, reducing costs, or entering new market. Secondly, they must maintain a fair balance in the arbitrage of skills, market access, and capital between the companies. Finally, it is important for managers to develop a vision of international strategy and to see across border acquisitions and alliances as a flexible sequence of actions.

There are several strategies to form such collaboration, such as mergers (two or more companies join together voluntarily to form one new entity, where the identities of the former companies are fused), acquisitions (two or more companies join together , where one of them take over the others), and strategic alliances (two or more companies join together voluntarily, where each company is still keeping their own identity).

Finally, the new focus of a common objective gradually led to ideas for significantly broadening the scope of the relationship in which understanding was strengthened and trust established. A case study of a “win-win” construction project is chosen to critically analyze the applications of the strategic alliances.

2. AN OVERVIEW OF STRATEGIC ALLIANCES

2.1 Definition

The strategic alliances described in this report is a strategy which possesses the following three characteristics. These are:

- The partner firms share the benefits of the alliance and control over the performance of assigned tasks, perhaps the most distinctive characteristic of alliances and the one that makes them so difficult to manage.
- The partner firms contribute on a continuing basis in one or more key strategic areas, e.g. technology, products, and so forth (Chiyoko Yoshino, 1995).
- A particular mode of inter-organisational relationship in which the partners make substantial investments in developing a long-term collaborative effort, and common orientation (Mattsson, 1988).

2.2 Reasons for Forming Alliances

In this section, we will examine the reasons why companies form alliances. Such reasons fall into a number of strategic areas, as follows:

1. Innovation

The rapidity of the emergence of new technologies has caused a great deal of investment in innovating a more advance technology. Alliances assist innovation in a number of ways:

- Alliances allow the pooling of research and development resources.
- Alliances allow those organisations that are more efficiency-oriented access to entrepreneurial cultures and skills.

2. Balancing scale, specialisation, efficiency, and flexibility

For many companies, alliances offer an opportunity for sharing expertise, competencies and best practice. Alliances also enable firms to focus on the development of the firms' own distinctive competencies. Efficiency can be achieved by using the distinctive competencies of other firms. As a result, firms may reduce their costs on several activities. Furthermore, alliances allow an enterprise to get into new market and to meet customer needs by using the flexibility offered by partners, without losing its own strategic focus.

3. Access to global market

Alliances enable organisations to enter into global competition. For larger companies, alliances around their home bases create the expertise for innovation and lower input costs, making them internationally

competitive. Medium-sized companies can use alliances with larger companies for a host of global competitive advantages. For smaller firms, alliances provide a way of pooling expertise and resources, so that they may gain market share at the expense of well-established industry leaders.

2.3 Alliances Types

According to the intensity of potential conflict and the extent of organisational interaction, alliances can be classified into:

1. Procompetitive Alliances

These alliances are generally interindustry, vertical value-chain relationships, as between manufacturers and their suppliers or distributors. This type of cooperation requires low level of organisational interaction, the firm tend not to be rivals. The potential conflict in such alliances is low. With both interaction and rivalry at low level, the strategic objectives of protecting core competencies and learning take a back seat to those of maintaining strategic flexibility and adding value.

2. Noncompetitive Alliances

These alliances tend to be intraindustry links among noncompeting firms. The level of interaction in this cooperative effort is high; joint development calls for close contacts at different levels and in multiple function (e.g., design, engineering, manufacturing, and marketing, to name a few). The firms competitive universes meet, but only occasionally, and neither views the other as a major rival, so the possibility of conflict is low. Given the partners significant commitments of time and effort, neither is likely to seek to duplicate its efforts in another alliance.

3. Competitive Alliances

These alliances are similar to noncompetitive alliances in terms of the joint activity (and hence in the level of organizational interaction) but differ in that the partners are apt to be direct competitors in the final product market.

Such cooperation calls for intense interaction between the paired firms, even though they are direct rivals, with an implicit high potential for conflict. Maintaining strategic flexibility is unlikely to be important, adding values are likely to be important, but not the highest strategic priority.

In this alliance, leakage of information is apt to be detrimental, hence, protection of core strategic competencies are critical.

4. Precompetitive Alliances

These alliances typically bring together firms from different, often unrelated industries to work on well-defined activities such as new technology development. The joint activity involving only limited interaction between the firms.

High Conflict	Precompetitive Alliances	Competitive Alliances
Low Conflict	Procompetitive Alliances	Noncompetitive Alliances

Figure: Typology of Alliance (Yoshino, M.Y. & Rangan, U.S., 1995)

2.4 Alliance Process

The marriage analogy is used to describe the alliance process which will be summarized in five steps as follows:

1. Courtship

Two companies meet and discover their compatibility. There are three criteria for this step:

- *Self Analysis*: every company should evaluate their own company before doing an analysis whether they need to form an alliance.
- *Chemistry*: not strategic analysis and sound financial is important, but also the personal side of business relationship. This could happen only at the chief executive level.
- *Compatibility*: the compatibility of each partner on broad historical, philosophical, and strategic grounds: common experience, value and principles, and hopes for the future are tested. This could be done by an analyst, while their leader can assess the tangible compatibility of their partners.

2. Engagement

Close the deal and they draw up plans.

3. Newly wed couple

They could find any differences among them.

4. Managing the marriage

They devise mechanism for bridging differences and develop techniques for getting along.

5. Old marriage

Every company discovers that it has changed internally as a result of its accommodation to the ongoing collaboration.

It is said that these steps generally will create a successful alliance.

2.5 The Key to Successful of Strategic Alliances

The success or failure of the alliance is dependent on how the venture is structured, the kind of manager placed in charge, and how the responsibilities and strategic missions are divided among partners. The successful alliance, however, shares the following strategic characteristics:

1. Step by Step Development

In forming an alliance, the step by step approach is also very helpful to choose the best partner. It can be started from Licensing Agreement, Minority Share and then Alliance. It will be no guarantee if alliances are formed suddenly. Each company will not have time to know each other's characteristics and cannot evaluate each other's capabilities.

2. The Dynamic Management Structure

An alliance brings together distinct and separate corporate entities. Each company enters into alliance complete with its corporate culture, implicit or explicit behavioral systems, and management strategies. Therefore, a dynamic management structure must be created in order to:

- transcend both corporate cultures
- accomplish the strategic mission of the alliance
- bring expertise of the managers from both parties to work together
- harness the best attributes of each firm for benefit of the whole

3. Encouragement of Calculated Initiatives

The areas of expertise of the managers working in alliance must be taken into account. The managers are encouraged to develop their initiatives and to implement their strategic decisions.

4. Systematic Task Setting

Roles and responsibilities for each corporation in the alliance must be clearly defined. Detailed milestones must be established and deadlines determined. As a result, meetings must be conducted on regular basis to review and to monitor activities that are being done by each firm.

5. Equal Distribution of Authority

In the alliances, all firms should have the equal power in order to avoid breakdown in communication, an emergence of arrogance. Authority and responsibility should evenly divide among the partners. Instead of imposing power on each other, management must focus its energy and time to work together to create a sustainable competitive advantage. Policies must be established and agreed upon by all parties as to the method of conflict resolution to ensure that each party has an equal say in policy and strategy decisions.

6. Encouragement of Calculated Risk-Taking

Risk cannot be avoided in alliances. However, the minimum level of risk must be established in order to give the venture the best chance of success. An adequate analysis of market condition, forecasting, and strategic planning are all requisite before entering into an alliance.

Furthermore, during the lifetime of the alliance it will be necessary to modify strategies to keep current with changing economies or market share conditions. In new technologies, creating new markets, or even entering untested markets are the best chances for the alliance to success.

7. Streamlined Communication Channels

All partners are informed about developments without being overwhelmed by paperwork. The task of streamlining all channels of communication between and within each firm is imperative for the efficient transfer of information necessary for the successful alliance. The strategic importance to streamline the communication channels among the members of an alliance is to coordinate the management of the alliance. This kind of communication channel will eliminate miscommunications and redundant procedures.

8. Development of Multimanager Roles

The individuals responsible for the day-to-day functions of the alliances must be qualified, able, and possess the skills demanded by nature of the venture. The manager in the alliance must be capable of filling such distinctive and diverse management roles as being a leader, an administrator, a planner and an entrepreneur.

As a leader, managers must ensure that policies are being implemented and information is being communicated. Managers also function as administrator to control the project activities and to make necessary correction of the activities. The planner is devoted to monitoring the overall progress of the alliance and determining whether its goals are consistent with the goals for the firm's future performance. The entrepreneur seeks new opportunities within the scope of the venture and seeks ways to improve the implementation of its strategies.

2.6 Trust in alliances

Trust can be defined as a decision to become a vulnerable to or dependent on another in return for possibility of a share positive outcome. There are four different kinds of trust, which exist in any relationship. These relate to the following:

- *Objective credibility*: a personal characteristic that belongs to an individual or group. It relates to the truthfulness of that individual or group.
 - *The attribution of benevolence*: the motives of an individual's actions.
 - *Non-manipulative trust*: the perceived level of self-interest of the party.
-

- *Cost of lying*: the balance between the costs of deceit against the possible gains.

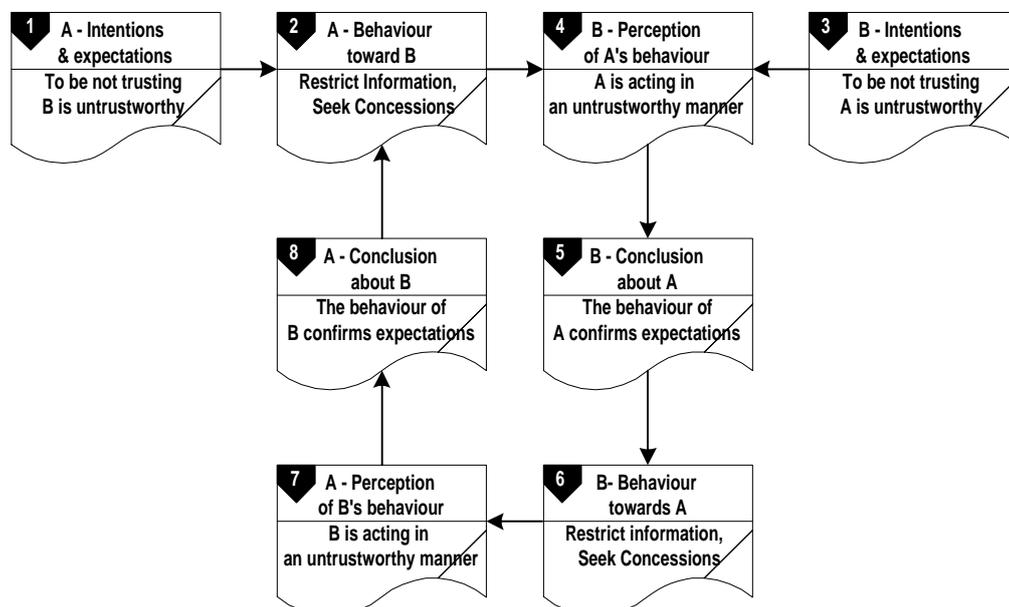
The temporary organisations formed in many construction projects create a situation in which trust between the firms is important to the successful completion of the project.

However, it has been pointed out the project organisation is temporary, there is not enough time to develop long-term trust interpersonal relationships. The way in which the firms enter an alliance is important in determining the final outcome.

There are two model of the development of trust, which are spiral trust and grit models:

1. Spiral trust

model presents a negative impression of trust based on two parties who start with pessimistic intention and expectations of a relationship. The reciprocity of trust tends to be concentrated on the positive aspects of a relationship. In context of construction project management, the final outcome is influenced by the initial intentions and expectation of the parties involved. If all the parties enter the relationship with intention of 'no trusting', the project will enter a downward spiral of dynamics, as a

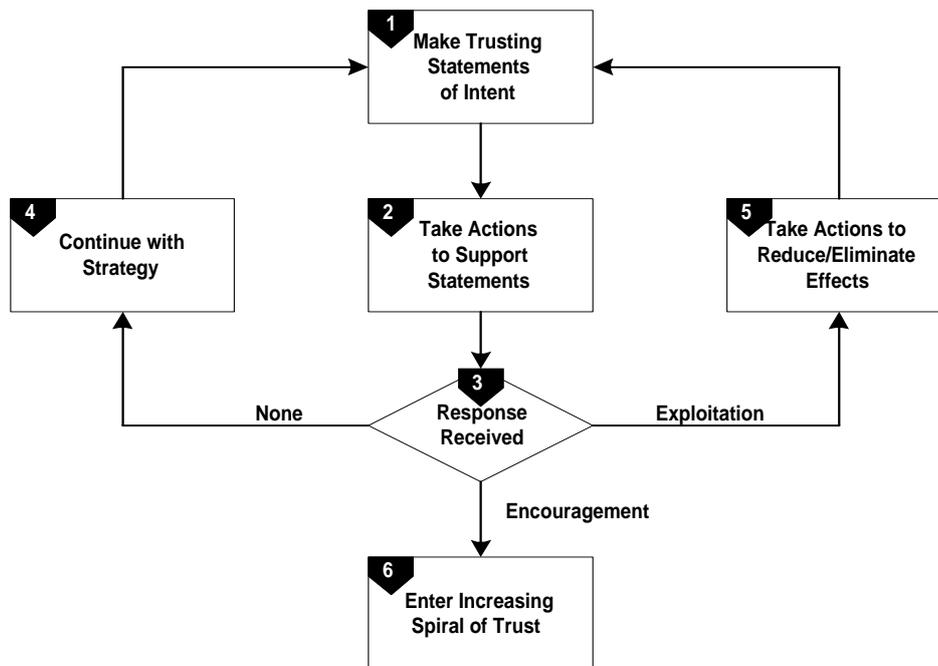


result, the final outcome of which will be 'unsuccessful' project.

Figure: Spiral of trust (Munns A.K., 1995)

2. Grit model

starts by that the parties making statement of intent, which clearly express their desire to trust the others. The statement must be followed by actions, which support and comply with the statements. Any failure to embark on supporting action will remove the objective credibility of the individual. The success of this model depends on the reciprocity of actions in a relationship, which includes ingratiation, sequence and



deprivation/saturation among the parties.

Figure: Grit model (Munns A.K., 1995)

The leaders of the alliance need to be aware of the intentions and expectation of the team members and how this will shape their behavior in the project. In addition, for project that tends to move unfavorable direction, can adopt a model based on the 'GRIT'. proposal.

3. CASE STUDY

3.1 An Overview of Transfield-Kumagai Joint Venture

3.1.1 Background:

The formal strategic alliance between Transfield and Kumagai Gumi co Ltd. was started in 1986 and completed in 1992. The project was initiated by the government. Due to fact that motor vehicle traffic in Sydney continues to increase and in particular traffic wishing to cross Harbour Bridge is becoming increasingly delayed. Therefore the government has recently announced the formation of a Task Force within the Department of Main Roads to prepare a detailed plan for the state programme to the year 2000. In fact the additional Harbour crossing in one of the most important “missing links” in the New South Wales road system today.

In seeing the need for a new Harbour Tunnel, the investigation team was then set up by the Transfield-Kumagai Joint Venture.

By negotiating with the government, Transfield- Kumagai Joint Venture together with Westpac as their financial adviser has successfully presented the project to the government.

The Joint Venture has arrived at a solution which it believes it has minimal environmental impact, is technically sound, satisfies admirably the traffic requirements and which, if Government so wishes, can be funded privately to overcome funding problems for the Government. The Joint Venture would welcome the opportunity of co-operating with the Task Force in order to develop this solution further.

The Government will enter into an agreement whereby the Joint Venture proceeds to design, construct, finance and operate the facility with a fixed lump sum construction price and guaranteed completion date.

3.1.2 Description of Work

The proposed work includes a twin two-lane carriageway tunnel linking with the Warringah Freeway in North Sydney with Hickson Road on the South Shore of the Harbour estimated capital in the cost of 3.29 million. Since linking with the existing Western distributor at Pymont since the land tunnel will link with a long “immersed tube” tunnel which is laid in a pre-dredged channel on the Harbour bed and across the bay, which involves high technical skill. This technique has been used extensively overseas in

the past 30 years and is the method used Kumagai for all three tunnels crossing of the comparable Hong Kong Harbour. Such innovative design with respect to the circular twin tube steel shell section was chosen based on the past successful experience as gained by Kumagai.

The preferred route has been chosen carefully by the Joint Venture as the optimum solution within a corridor of investigation as shown on the attached map. These other routes would be more fully studied in the proposed feasibility study in consultation with the Task Force. The Transfield has a better knowledge about commercial impact and likely impact on marine life and on the general acoustic impact.

The Joint Venture is confident that it can overcome any problems relating to the maintenance of shipping channels during dredging, sinking and jointing operations. In this respect, Kumagai has valuable experience in Hong Kong Harbour, which is at least as busy as Sydney Harbour.

Therefore the alliance was built on an unequal footing from its very inception. Kumagai had design strengths in the area where Transfield was weak, while Transfield had knowledge about the Australia's environment and local experience and is strong in project Management. Moreover, Kumagai's organization and its emphasis on efficient construction and advanced technology were seen by Transfield's executive as immutable and admirable.

Kumagai has an impressive core capability and a strong position in its home market and also in Asian countries such as Hong Kong. It could Joint Venture with an established firm and build a joint design and construction operation. In addition to the above reason, Kumagai is attracted in Transfield expertise in project management in the fabrication and erection of structural steel and local knowledge in which Kumagai was lack of. The nature of these independent factors had consequently force the two companies together toward an international alliance. In further development the two companies owned many successes to their Joint Venture.

Kumagai was the most dominant and was the driving force in the success of the alliance, for example, it influenced the issues of design of each option and could veto all decision concerning the performance and engineering aspects of the Harbour tunnel.

The Transfield did gain expertise in design capability and as a result its image with consumers was revitalized as a consequence of joint venture with Kumagai, a capability that will assist the future image of its company. On the other hand, Kumagai reach its objectives under its joint venture with Transfield in learning about Australian's market. It did gain greater depth in its construction base in Australia.

Unlike Transfield-Kumagai pursued its long term goals. The company is one of the top ten layers in world construction industry.

3.2 Analysis of Transfield-Kumagai Alliance

Having chosen a definitive strategy toward alliance, Kamagai has successfully and professionally implemented it. Possibly, the rewards should be given to the Transfield management team, which was at that time a driving force in bridging about the alliance. In addition to this, Transfield was aware of Japanese culture. Hence, the brilliant strategy had been chosen to meet it. However, Kumagai has significantly created a growing presence in the Australian market share.

3.3 Successful Transfield-Kumagai Alliance

There are many factors that are attributed to Transfield-Kumagai Alliance's success. These are:

1. Equal Strength

One of the important factors of the success of the Transfield-Kumagai alliance was the equal strength of both companies at the time of bringing about the alliance. Also they share the cost of the project on a 50/50 basis.

2. Flexibility

It should be noted that the Transfield-Kumagai alliance might have not been so successful if there were no flexibility of their strategy in their management and planning.

3. Corporate Culture, Management System and Strategies

Alliance is about bringing together distinct and corporate entities with different corporate culture, management systems and management strategies. In Transfield-Kumagai case, cultures between the two companies are very different. Transfield is in Australia while Kumagai is from Japan. Japanese work mostly group oriented while Australian are more individualism. The Japanese has been successfully applying quality system, which one of the features is emphasizing group task. They are fit into this system because of their paternalism culture, which they inherit from their ancestor. Such attitudes are important when they have to work together in a group task to continuously improve their work process. Australian used to apply carrot and stick management, where one person dominates other people, decision often taken by one person rather than by group. What happen is they succeed in overcoming this barrier. The Transfield side seems to adapt with the Quality System principles from Kumagai. However Transfield-Kumagai also learned from the project management's skill. Management systems of companies are

different to each other. Management system of the company brings up the personal behavior of its staffs. There are many forms of management system, to give some view the company, which adopts Quality System. The Australian companies still struggle to convert their conventional management system.

4. Dynamic Management Structure

By implementing a dynamic management structure will give benefits for the companies in order to achieve their objectives. According to Mr. Yamanaka of Kumagai commented that much endeavor and patience were needed to overcome many barriers such as language, culture, ways of thinking and sense of value to name just a few. By overcoming these barriers, the people of Transfield and Kumagai were able to generate mutual understand and trust, which eventually led to close friendship.

5. Good Communication

In this alliance, both companies had different background in the civil construction industry, such as management, technology, reputation, financial, market, culture, philosophy, etc. Despite these many differences Transfield and Kumagai choose to form an alliance to further expand their companies. One important aspect which needs more attention, is whether those two different companies are able to build good communication between each other, which is the foundation for the success of the alliance. With good communication between two companies, it will build and support for the good outcome of both companies. The role of a good communication is vital to create a pleasant, friendly working atmosphere, as well as it will develop sense of trust and respect between two companies. This criteria needs to be fulfilled especially when one realizes of the different background, different objectives and purposes of the alliance which was formed between Transfield and Kumagai. In fact Transfield and Kumagai has developed the sense of mutual trust, understanding and a good working environment long time before this joint venture project starts. Since they have previous experience of working together in some projects in Australia. The Transfield-Kumagai's example taught us precious lesson on the importance of having good communication between two companies In order to achieve good communication, both companies have to work and put effort on the matter.

6. Strong Commitment

The successful joint venture between Transfield and Kumagai is a result of strong commitment from both parties.

4. CONCLUSION

Inter-company relationship is different with the relation between a company and its employee. They seem work best when they are more family like. This means that more open mind in understanding specific individual, more frequent in communication, and interpersonal contexts are strongly needed. Further the best relationship intercompany in the alliance is involving feelings and trust. Therefore the best organizational relationship like the best marriage tends to meet certain criteria such as :

- **Individual excellence**, both partners (Transfield-Kumagai) must be strong enough and they must have something of value to contribute to making best relationship. In this case, Kumagai was very strong in some area like in high labor productivity, etc.
- **Importantly**, the relationship fits major strategy objectives of the partners so they want to make it work. Partners have long term goals in which the relationship plays a key role.
- **Interdependence**, they have to work together to be successful, because working alone in alliance will result in less in achievement their objective.
- **Investments**, the partners invest in each other to demonstrate their respective stake in the relationship and each other.
- **Information**, partner must share information in order to make the alliance work including their goals, objectives, technical data, knowledge of conflict or even changing situations.
- **Integration**, the partners develop linkages and share ways of operating so they can work together smoothly. They build broad connections between many people at many organizational levels. Partner then became teachers and learners.
- **Integrity**, the partners behave toward each other in honorable ways that justify and enhance mutual trust.

It is obvious that alliance made by Transfield and Kumagai had given both advantages and disadvantages for both companies. The alliance was successful in design and construction for the Harbour tunnel project. To sum up, in order to make the implementation of alliances to be success, the companies who are involved should increase sense of mutual trust between them and create a more open management system.

STRATEGIC ALLIANCES

I. INTRODUCTION

Globalization has engendered the rapid integration of heterogeneous markets, increased uncertainty in market information and also the complication of competitive dynamics. From construction industry point of view, competitiveness within the industry is increasing as market limits are being expanded through the use of broad telecommunications and transportation systems. In this competitive, uncertain environment, construction industry organizations must contemplate a type of strategies to establish new techniques and services, which are needed to acquire new projects and new incomes successfully. Cooperative strategies have come up as one way to accommodate these techniques and services. The need of cooperative relationships between nations or other organizations has established a close formation called alliance which has furthermore been defined as a long-term strategic association formed to advance common business interests. In cooperative alliances, the developmental elements of social relationships such as trust and commitment also become much more significant.

Since strategic alliance involves many dynamic aspects, agreements between partners need to be elaborated and sustained over time. The aim of this report is then to establish a formwork of strategic alliances, which is essential to successfully fulfil above needs. The report accordingly has two objectives: (1) to manifest the dynamic nature of cooperative relationships such as strategic alliances and its ability to sustain in terms of the important role of knowledge transfer. While explicit or codified knowledge can easily be exchanged or incurred through market transactions, tacit or implicit knowledge cannot easily be exchanged through market transactions. Thus, motivations (incentives) and enforcement mechanisms must be generated to secure effective transfer knowledge between corporations, to ensure the use of knowledge in meeting client's needs, and to facilitate their continuous

strategic change; (2) to present the importance of black-box protection as a mean to protect each partner's core competencies in strategic alliances. Just as an aircraft's black box protects flight data in case of emergency, the black box of a strategic alliance protects and maintains each partner's core competencies through formal contracts, integral disclosure of latent power, and managerial means. Black-box protection must then be well-defined not only to be effective but also to be dynamic to allow the evolution of knowledge.

II. BACKGROUND IN ALLIANCE

The rapid expansion of cooperative relationships such as strategic alliances, joint ventures, licensing, and information sharing between organizations has characterized the nature of international business competition in the 1990s (Lorange and Roos 1992; Kreiner and Schultz 1993; Yoshino and Rangan 1995). It has simply been due to current revolutionary changes in the global business environment, complexity in the industry and market structures, uncertainty of market information, and hyper-competition (D'Aveni, 1994). Similarly, globalization has engendered the rapid integration of heterogeneous markets, increased uncertainty in market information and also the complication of competitive dynamics. It also means that strategic alliances have become more international and often cross-industry based. The role of government to stimulate a conducive atmosphere for alliance has increasingly been demanded, especially in deregulation of industries and generation of free markets, as well as encouraging cooperative alliance between governments and corporations.

II.A. EFFECTS OF GLOBALIZATION ON CONSTRUCTION INDUSTRY

In the 1960s, international construction services were dominated by the United States. However, the situation has changed as the world market entered the era of globalization wherein the U.S. construction industry faced a decline in market domination. The fact showed that between 1982 and 1986, the amount of international construction contracts held by U.S corporations had decreased by more than 40%. On the other hand, during the time from 1978 to 1982 revenue of foreign construction corporations providing services in the U.S showed inclination at annual rate of 35% (Building, 1988). Moreover, according to Halpin (1993) the procurement of and ability to utilize new (information) technologies will become essential to future efforts of the construction industry.

II.B. DEVELOPMENT OF COOPERATIVE RELATIONSHIPS

Cooperative relationships are developed by voluntary, cooperative efforts of two or more corporations in a purpose of creating and maximizing their joint value. Figure 1 clearly shows a simple relationship of alliance while figure 2 pictures a bit more complex one. Moreover, according to Ring and Van de Ven (1994) there are four main stages of development in strategic alliance relationships: negotiation, commitment, execution, and dissolution, and they are not a sequential process, but probably a cyclical one.

- **Negotiation Stage.** The concept of alliance is initiated by the idea of two parties who expect to join their similar preferences through negotiation. In negotiation stage, parties make commitment to engage their action, and during this time a psychological contract is automatically established. A psychological contract is defined as a set of unwritten expectations and assumptions held by each party about each other's obligations and rights (Argyris, 1960).
- **Commitment Stage.** In this stage, the parties come to an agreement on the principles that will direct their future alliance relationship. The psychological contract built from the earlier stage is then consolidated by a formal contract in which the relationship is clarified. The necessity of formal contract is due to the fact that the formal contracts can contribute to a better market operation, as they can be intensified through the legal system (Choi and Lee, 1997). Thus, formal and psychological contracts are expected to reflect and support each other.
- **Execution Stage.** In this stage, the process of institutionalization (see figure 3) transforms informal relationships into habits and routines that will be very resistant to change. Also, the issues of opportunism, commitment, and trust are crucial in sustaining the relationship that has been built.
- **Dissolution Stage.** This stage is come up as a result of unfulfilled necessities of the partners. As well, the alliance relationship may also terminate as a result of exogenous factors: natural disasters, a shift in a political regime, or death or sickness of a party, and endogenous reasons which are seen to be related either to excessive formal structuring of the relationship or to excessive reliance on

informality. Excessive reliance on informality may result in an unfavorable chance for trust abuse, whereas flexibility of corporations may certainly be threatened when formal control is decreed.

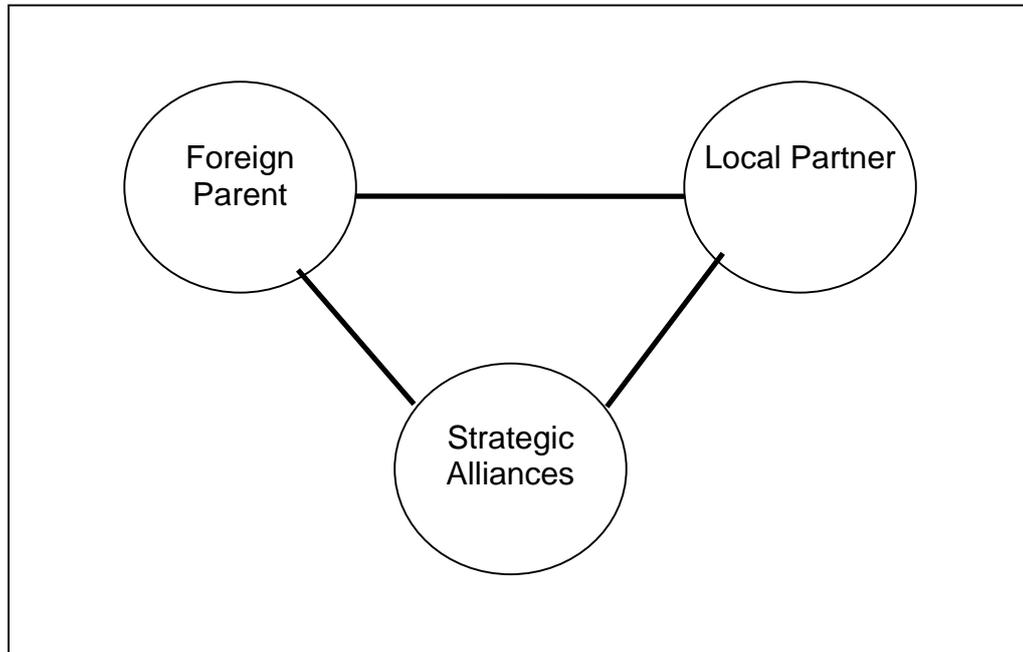


Figure 1. External Perspective on Performance Objectives.

Source: Beamish and Delios (1997).

Figure 2. Alliances in the automotive industry.
Source: Devlin and Bleackley (1988).

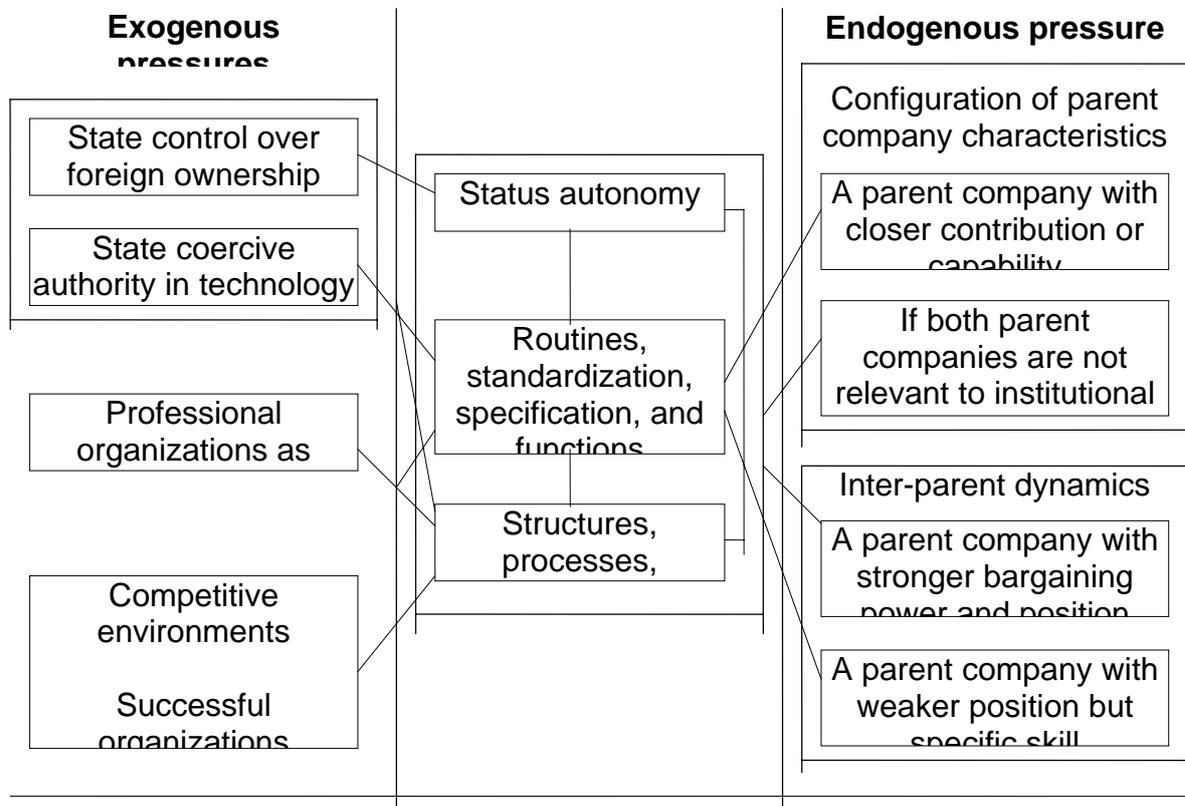


Figure 3. A Model of Institutionalization of Strategic Alliance.

Source: Lu and Lake (1997).

III. THE ROLE OF KNOWLEDGE WITHIN A GLOBAL NETWORK OF COOPERATIVE RELATIONSHIPS

A key source of competitive benefit in current business environment is an organization's proficiency to create, transfer, and protect knowledge within a global network of cooperative relationships (Kogut and Zander, 1992; Ross, von Krogh, and Yip, 1994; Nonaka, 1994; Nonaka and Takeuchi, 1995; Choi and Lee, 1997). The essential requirement of sharing and dominating knowledge has become distinct by the fact of today's dense population of various types of cooperative

relationships such as joint ventures, strategic alliances, partnerships, coalitions, franchises, research consortia, and other types (Contractor and Lorange, 1988; Oliver, 1990; Ring and Van de Ven, 1994). The increased use of alliance strategies nowadays, theoretically can be explained as a reflection of a new range of interests affected by current economic, political, technological and competitive considerations. A key driver of these interests are formed by a mixture of factors including acquisition and control of new (information) technologies, access of markets, financial support, political insurance, competitive reality and complementary skills (James, 1985; Lorange and Roos, 1992; Yoshino and Rangan, 1995). Powell (1987) and Contractor (1991) noted that the search for other benefits, such as risk sharing under uncertain, volatile environments, oligopolistic positioning, and reputation transfer effects can also motivate the formation of cooperative alliances.

Explicit (formal or codified) knowledge is a familiar concept, as is the specification and management of its inward transmission and can be easily exchanged or obtained through market transactions. Notwithstanding, implicit (tacit) knowledge is much more individual or associated with communication channels and cannot be easily exchanged. Therefore, it is necessary for corporations not only to incur and use explicit knowledge, but also to build a better understanding of tacit knowledge and its (open) communication in generating the process of continuous learning and change. Nanoka (1991, 1994) has summarized the core of Japanese strategy in creating a more effective corporation as being its focus on the generation and implementation of implicit (tacit) knowledge and learning: "The center-piece of the Japanese approach is the recognition that creating new knowledge is not simply a matter of processing objective information. Rather, it depends on tapping the tacit and often highly subjective insights, intuitions and hunches of individual employees and making those insights available for testing and used by the company as a whole. The key to this process is personal commitment, the employees' sense of identity with the enterprise and its mission."

Corporations have three choices in procuring knowledge: markets, hierarchies, and inter-organizational relationships. The benefits of each strategy are as follows:

- **Markets:** Provide various choices in terms of potential sources of explicit knowledge, which tend to be connected with global information technology.
- **Hierarchies:** Provide capacity for fully developing tacit knowledge, which tend to be connected with norms and values of an organization.
- **Inter-organizational relationships:** Combine the potential benefits of the market variety and organization-hierarchy of knowledge, whose effectiveness relies on the transfer of the knowledge and the process of communication as well as the protection of intellectual property.

The key point in knowledge procurement is how organizations can uphold their competitive benefits by strategically optimizing from the above three choices. One strategy for doing so is formation of alliances to apply the knowledge to get clients and to satisfy their needs. Sillars and Kangari (1997) interviewed some leaders in the Japanese construction industry toward their reaction to market changes and found that there are three methods of being survive through meeting clients' need: (1) being prepared to work globally through political awareness; (2) assembling required resources to meet client demands; and (3) providing the most cost-efficient and client-responsive technologies. Table 1 lists those considerations including their characteristics in order to determine the chances of success of strategic alliances in a global environment.

CONSIDERATION	CHARACTERISTICS
Political	<ul style="list-style-type: none"> • Governments often impose requirements that protect the interests of their constituency; • Foreign laws and customary approaches to the legal system may require special handling; • Dependence on legally drawn contracts to define performance criteria varies around the world. In The U.S, it is very tight, while in Asia, it is very loose since people would prefer to negotiate rather than claim for dispute; • Understanding of the capabilities and customs of subcontractors, sub-consultants, and the work force is essential.
Resource	<ul style="list-style-type: none"> • Broader services both in terms of construction technology and in the provision of full construction services for larger projects are demanded; • The contractor's financial ability often becomes a standard requirement for contractor to be selected by the client.
Technological	<ul style="list-style-type: none"> • The need to provide current technologies to overcome commodity-type, low-cost pricing is pointed as a problem.

Table 1. Three considerations of remaining viable in global environment.

Source: Sillars and Kangari (1997).

IV. CONFLICT

In a world of uncertainty and complexity, corporations depend on either development of internal organization or relationship in cooperative alliance for the transfer of knowledge (Choi and Lee, 1997). Although market transactions seemingly become inefficient strategies for exchanging knowledge, cultural fit may be a suitable strategy for doing so. In any type of cooperative alliances, a cultural conflict between partners is often occurred. Such conflict may certainly encroach

upon the formation and maintenance of the alliances. Hofstede (1980) has determined management cultural aspects that focused on the national differences in culture arising from various factors such as language, customs, tradition, and business-ethics. However, from strategic alliance point of view, cross-cultural conflicts may arise from other sources. According to Sohn (1994), recent research in cooperative alliances has shown that sharing a common national culture is less important than ability to share tacit knowledge in a common corporate culture. Choi and Kelemen (1995) and Willcocks and Choi (1995) have found that non-national sources of cross-cultural conflict may occur at three different levels: professional, organizational, and corporate. It is therefore necessary for these different levels of cross-cultural conflict to be clearly understood in order to achieve effective knowledge transfer between corporations and to avoid potential delays, The main characteristics of these cross-cultural conflicts are listed as follows:

- **Professional cultural conflicts:** Arise when managers come from different professional and educational backgrounds. For example, managers with engineering backgrounds may face cultural conflicts when working with those with a marketing background.
- **Organizational cultural conflicts:** Arise when corporations develop their divisions in foreign countries or in other parts of their home country. For example, since many Japanese corporations changed their markets to South East Asian countries such as Malaysia, there have been organizational conflicts between Tokyo headquarters and Malaysian subsidiaries.
- **Corporate conflicts:** Arise because of the different corporate cultures of the partners. For example, corporate conflict can be emerged when a traditional, bureaucratic corporation in the telecommunications industry established a strategic alliance with a younger entrepreneurial corporation.

Therefore, to enable organizations in relationship to transfer knowledge effectively, mechanism for dispute settlement, mediation of cultural conflict, and enforcement of agreement discussed herein after, need to be in place.

V. ENFORCEMENT OF AGREEMENT

Since explicit knowledge can be codified, it can then be capitalized, and thus subsequently exchanged or acquired through market transactions. Therefore, it is necessary to protect it by legal enforcement of intellectual property rights. Choi (1994) developed the analytical basis of enforcement mechanisms for cooperative agreements that concern different cultural contexts: contract, trust, and hostage. These three approaches to enforcement in cooperative relationships have the following characteristics:

- **Contract.** It is common in mature, stable business environments where alliances may rely on explicit, legal enforcement of contracts. In such environments, exchange basically happens on the case-by-case basis, and tends to be more explicitly and legally arranged.
- **Trust.** It is widely used in looming, changing business environments where industries may be in an infirm stage, or when their boundaries are blurred. In such environments, informal, long-term, trust-based relationships would preferably cover some contingencies on which alliances may consider.
- **Hostage.** It is very effective when either contracts or trust cannot provide satisfactory mechanisms for the enforcement of cooperative agreements. In such business environment, the existing motives for opportunism are reduced by mutual hostages (artificially created bonds and dependencies).

In addition, although the intensity of cooperative relationship can immediately be high from the early stages, the live of the relationship can still be questioned due to its terminable nature as explained earlier.

VI. BLACK BOX PROTECTION OF SELF-INTEREST AND CORE COMPETENCIES IN STRATEGIC ALLIANCES

Good executives always evolve their competencies by looking at their resources and knowledge as something that should be built on, extended, and made more powerful. This dynamic, open-minded attitude is a key to succeed (sjolander and Oskarsson 1995). As a result, it is prudent and feasible to protect self-interest or core competencies in strategic alliances, and this involves what Lorange (1997) call a “black-box” strategy. Just as an aircraft’s black box protects flight data in case of emergency, the black box protects each partner’s interests and competencies. Black-box protection should be seen as an open process, not as a defensive, static task. It must also be well-defined to be effective, yet dynamic to allow the evolution of knowledge. It is therefore very important that the black-box strategy have a support from the top of the organization. Notwithstanding, excessive focus may jeopardize the very purpose of a strategic alliance: success through cooperation. According to Lorange (1997), black box of a strategic alliance may protect each partner’s interest and competencies through evolutionary stage described as follows:

- **Phase One: Formal Contractual Arrangements during Strategic Alliance Initiation.** A strategic alliances must be based on a win-win arrangement so that each partner may perceive benefits that are more or less in proportion to what they have put in. As technology can be hard to define and tends to be shaped by evolutionary forces (Contractor 1983), there are questions how to develop a contractual arrangement that both protects the technology-donating parent and is flexible enough to allow the strategic alliance to flourish (Lorange, 1997). In developing contractual agreement during strategic alliance initiation, It is necessary to establish a mutual sense of trust between partners. Thus, the most important indirect black-box protection issue at this stage is partner selection: Select a partner that you feel you can trust and be comfortable working with!

(Lewis and Weigert 1985; Luhmann 1979). It may be particularly effective if the partners sense the value of strategic alliance (Buckley and Casson 1988).

- **Phase two: Strategic Exposure of Latent Power such as ongoing attractiveness as a partner.** Once the strategic alliance is working, the challenging and frustrating problem may surprisingly be emerged as a result of unexpected changes in environment coming especially from competitors or customers. Consequently, unexpected changes, that require a higher level of technological or marketing support from one or both parents, are perhaps necessary. At this stage, existing formal contract need to be revised and adverse attitude to terminate the contract can be occurred. To avoid such attitude, it is therefore necessary to establish a position based on latent power such that the partner may implicitly understand that breaking off or misbehaving creates the risk of being cut off from new information of future technology. A latent power position can be established by maintaining ongoing R&D activity to ensure that new developments come out of its laboratories on an ongoing basis. Signaling is thus key and has been proposed as an integral part of strategic management (Porter, 1980). Dynamic signaling must be based on facts and thus enhances an honest, open communication in the alliance.
- **Phase three: Maintenance of a Strong Managerial Influence on the Venture's Board.** As the alliance develops into a free-standing, self-contained organization, there is no further need for extensive direct technological input from the international parent or much additional market-based input from the local parent (Beamish and Inkpen 1995). As a self-contained corporation, the alliance can now feed itself. However, parent may slowly realize that its offspring is now a competitor. One way for the parents to protect themselves in such case is through managerial efforts. It requires the board to be actively involved in the planning and control process system of the strategic alliance. This managerial involvement/participation is then directed to avoid: (1) conflict with one or both of the parents' strategies; (2) strategic developments that could lead to self-competition; (3) creating over-capacity that can be dumped in a parent's market or new products that can challenge the parent's product line. Additionally, it is

essential that one parent maintain its influence through managerial participation even though the strategic alliance is dominated operationally by other parent.

VII. CONCLUSION

This report has attempted to show the dynamic nature of cooperative alliance relationships and its ability to sustain in terms of the important role of knowledge transfer, and to present the importance of black-box protection as a mean to protect each partner's core competencies in strategic alliances.

The influence of cultural aspect on team members is crucial issue in determining the success of the alliance relationship. Historic failures are associated to breakdowns of communication due to these cultural differences, in both language and values. As a result, to enable organizations in relationship to transfer knowledge effectively, mechanism for dispute settlement, mediation of cultural conflict and enforcement of agreement are certainly required. However, rectification by legal mechanisms usually leads to the termination of cooperative relationships. Therefore, trust-based relationships or the exchange of mutual hostages can alternatively be used as a supplement of the legal enforcement of agreement. From this view point, the key issue in sustaining cooperative alliance relationships is how to synthesize, transfer and share knowledge more effectively, while at the same time protecting the rights of intellectual property and core competencies, and preventing partners from exploiting joint assets without sharing the profits or other benefits produced by such assets.

Protecting self-interest in a strategic alliance can substantively practiced by developing a flexible, dynamically definable black-box position. Successful alliances also depend on involvement of contract negotiation that focus key issues that really substance, and appreciation that self-protection issues tend to change over time. Signaling core competencies is also important but must be based on the truth and willingness to openly communicate between partners. Black-box strategy thus is a

matter of creating an ongoing win-win situation in which both partners may perceive benefits from their alliance. Similarly, since the alliance evolves into a self-contained organization, the focus on protection may shift to maintaining adequate managerial attempts at the board level to secure one's original interests. From this standpoint, the important focus of the development of successful strategic alliances is on the alliance issues that alter over time, and the ability of corporation in mastering these issues.

HEALTH AND SAFETY

Abstract

In the past popular view, SHE (Safety, Health and Environment) issues were project's external issues where all parties do not put attention much on it. But today, the construction industry is demanded to improve their ability especially in cost, time and quality, if they want to win the competition. The process improving will not success without involving the SHE issues since it causes many losses for example; bad safety program will lead company into severe, where accidents, injuries even deaths will continue arise and cause the increasing of the cost.

In order to prevent their damage, the companies should have the good management system and involve all parties. The implementation of this good management should derive from commitment of CEO and through the each level of organization. It is also important that every worker aware of these issues and have the willingness of change from their previous cultures. The implementation of SHE management not just in one phase of the project but through all phases; pre-design, design, tendering, pre-construction, construction and commissioning phase.

Beside that the impact of SHE just not to cost and time but she also has relation to the quality. By improving the SHE, it will lead to the increasing of quality because we cannot say that high qualities project if there are still a lot of SHE problems. Therefore, the implementation of the better SHE issues is important in construction industry.

INTRODUCTION

With continuing development of construction industry, complexity of construction project is more and more obvious. All kinds of factor, no matter internal ones or external ones, which have been effecting the project, are increasing by times. In the past decades, safety, health and environment (SHE) issues have been drawing much project's stakeholders attention, manly including client, contractor, local council/government ect. In this paper, it will be discussed that necessities of SHE for a successful construction project. Also, it will be focused on how SHE plan is created, and its own works in each project stage. In addition, the relationship between **quality** and **SHE** will also be illustrated. It is hoped that SHE issue, as one of strategies of a successful construction project, would be understood clearly.

SAFETY, HEALTH AND ENVIRONMENT ISSUES IN CONSTRUCTION INDUSTRY

The past popular view among clients and contractors was that SHE issues were external to the construction projects and would divert capital investment away from productive uses, and also added nothing of value to company's construction and services thereof. But, at present, SHE issues have apparent necessity under the consideration of project managers. If not considered, it would lead to serious loss, even project failure. Now, let us look into respective aspects of SHE issues within construction industry.

Safety Issues

Why is safety issues necessary for the successful of the project ?

Safety has always been a major issue in construction job site because construction industry is identic with high rate of accident and the second unsafely industry after mining. Statistic indicate that construction employee account for approximately 6 percent of the total labor force, but they incur 12 percent of all occupational injuries and illness and 19 percent of all work related fatalities. In US, accidents occur daily on construction site with a frequency of approximately 1750 construction workers injured. Each year, as many as 2100 construction workers in US die annually of work related injuries and another 210000 lost time injuries occur annually in construction. Hong Kong also has the poor site safety record that approximately 66 construction workers in every 1000 suffer a major injury each year comparing to Holland (3,3), England (3), US (13 per 1000) Ontario (5,2) and Sweden (6).

Australia has record that there were 45 injuries for every 1000 workers with approximately 70% as a direct result of accidents and the remainder due to body stressing. The cost due to this accident amounted to \$60 million during the year 1992-1993 (Asmis) (see Appendix1).

Falls were the leading cause of death among the construction workers, who 10 times more likely to die from a fall at work than average workers. Some 40 percent of the falls were from building and another 46 percent of falls were from ladder or scaffolding and from one level to another. In 1995, US Department of Labor's Bureau reported that 1048 construction workers killed on the job with 32% or 335 resulting from fall. The second leading of death among construction workers was electrocution. Overhead power line accounted for 23 percent of death followed by industrial wiring and domestic wiring appliance. Of motor vehicle-related incidents is the third leading cause of traumatic death where 30% involved pedestrians, including workers who were struck by motor vehicle while work in zone. The fourth major cause is machine-related incidents, was lead by lifting machine and agricultural machine. The other common injuries are strain, cuts, sprains and lacerations. Strain and sprain are the most common type of injury, followed by cuts, laceration and punctures (see Appendix2). The body part that most often injured is back because lifting is the most common activity that performed on the site.

Many times construction accident result in lawsuit brought against the responsibility party which in addition to monetary losses and other losses. Not only are there costs associated with legal actions, but there are other direct and indirect costs. Direct costs such as; medical costs, premium for compensation benefits liability and property losses. Indirect costs are costs associated with: lost time of injured employee, hiring the new employee, lost time of other workers, accident investigation, etc. This also can lead into worst situation where the project should be stop and cannot continue.

Since the results of accidents are always severe, they would lead to large amount of accident compensation even to impact on the construction schedule. Thus, it would cause more loss to contractors and client so safety problems in construction process would be and important problem which can not be neglected, and it has direct relationship with win or lose of the project.

Some benefits of accident reductions are cost savings relative to injuries or property damage. Improving safety measures will help to reduce costs because accidents result in higher insurance premium. Saving in overhead costs and productivity can be realized when accidents are prevented if there are no interruption of work due to accidents, there are no lost work days and the project has a better chance of being complete on time. Therefore, company should have the safety program in their management and organization. In addition, safety program is increasingly important

and become condition in bidding tender for government projects and other project in Australia.

The implementation of the successful safety

One of the most barriers for companies in implementing the safety program is *unwillingness to change*. Changes should come and supported by government as initial stage by providing the safety regulation such as; Occupational Health and Safety 1983 in Australia, and *commitment* from the chief executive officer's level that should be continued throughout each level of organization. This commitment must permeate the organization and be embraced by all members thus, safety become everyone's responsibility (see Appendix3). However, management has to be committed by providing the best training, high quality tools, equipment and a safe healthful environment

Safety management should be implemented during all phases of every project so that it complies the requirement of safety law, codes of conduct and building codes (Terrero). In order to implement, it need the *role of every parties* such as; project management, superintendents, supervisors, architect, engineering and foreman which are important in defining safety performance in their projects (see Appendix4). Project manager usually performs project coordination. Coordination and adequate planning are important and help to avoid misinterpretation and confusion among workers. Supervisors can be the most effective promoters of safe working practices since he usually controls the way works and exerts the greatest influence employee attitudes. Architect also can reduce the accident by design for example; structure to minimize climbing, so more works are accomplished on the ground. In addition, the safety performances not just determine within organization level but also between client, project manager, contractors and subcontractors. They must show attitude and willingness to partnering/cooperate for the successful of the safety management programs.

Hazards on construction site can be controlled and accidents can be prevented through the implementation of basic safety practices leading to a sound construction management program. The cost for effective construction safety and health program is approximately 2,5 % of direct labor costs. To ensure program will success, it needs establishment of the objectives (policy), monitor implementation (inspections), provide feedback, and follow up with the additional inspection if necessary. This safety program should consist of:

- Safety policy statement
- Screening of contractors
- Constructibility reviews
- Prebid meeting explanation of safety program expectation

- Preconstruction meeting (Safety review); contractor safety policy, contractor safety program, contractor safety representative
- Training and reinforcement of safety objectives; employee orientation, weekly toolbox meetings, progress meetings, manager safety meetings (see Appendix5)
- Inspection; management safety walks, site safety inspection, contract enforcement
- Accident reporting and investigations
- Housekeeping

The successes of this program depend to a great extent on management involvement, not by dollar value on the humanitarian aspects of design. Without serious and persistent management commitment, merely adopting a safety program does not yield desired results. Once having a good program becomes a priority, implementation depends on good owner-contractor communication and active owner participation. If safety is given due importance by project management, it will receive proportionate attention from the rest of the organization. Motivation and recognition are also the key factors in a successful program. Because employees should be motivated and encouraged to promote and practice safety issues.

The construction industry should not just reduce the accident but place more emphasis on zero injuries. This concept derived from the Total Quality Management which related to the implementation of the zero defect. According to Minter, *zero accident programs* can reduce the injury rate dramatically. In 1993, 83% percent of company's projects worldwide have had zero accidents. The program can be implemented into every contractor organization and government.

Reaching for the zero injury goal has immediate inherent rewards such as; reducing cost and time. Performance will frequently improve soon after the zero expectation is communicated to the employees because employees begin to believe that the company is serious about safety. For zero injury to become reality, management's action must include employee safety education such as; propaganda, training and safety equipment.

Health Issues

Construction industry can be classified with the high risk industry related to health problems because workers are not afforded the same level of protection from health hazards as their counterparts in general industry (Rekus). People who work in construction tend to have an average of 8 to 12 years die earlier than white collar workers or people who work in office. Although the causes of death were not all directly work related, some construction trades seemed to have higher rates of certain diseases than the population in general and white collar workers in particular. For example: Most carpenters tend to have high standard mortality ratios

(SMRs) from lung disease, suicide, and some cancers. Painters and plasterers also have high SMRs from cirrhosis and other liver disease, cancer of throat and lung, and suicide. The others such as, roofers, laborers and helpers, operating engineering, drillers and other construction workers were in the top ten occupations with the highest SMRs. The reason for the high SMRs for construction workers were the workers life style that consume alcohol, smoking and some of them use drug, and the unhealthy place related to hazard chemical such as silica, lead asbestos and, the air contamination, etc.

Beside the effect of occupational disease often relate to reduce working life. More than 60% of older cost workers – who had worked on average of 30 years - are forced to retire because of medical condition. They rate almost 20% higher than that of the general work force. The results also found that musculoskeletal disorders were found were seems to unskilled workers assessed. Other major disability included deafness due to noise exposure, occupational dermatitis and lung diseases due to long term inhalation of dusts and organic solvents.

The health problem is not just the problem for the workers but also has an effect to their family. Smith stated that workers contaminated their homes by bringing lead dust home unknowingly on their clothes, or because they were just not aware of the danger of hazard material such as, lead, asbestos, and silica. Workers have also poisoned themselves by eating in an area where lead dust is present or by not washing their hands thoroughly before eating and by smoking while working around lead. They are sometimes not aware that they have been affected when they get symptoms such as, a headache or joint pains, which could indicate a high blood lead level.

Managing of work related and occupational disease is often that a cost to the community resources is used to treat such victims. The issue that remains subjective and unresolved is whether monetary value can replace the losses of ability and opportunity that workers faced or not. The inability to classify a monetary sum on a life, feelings or emotion means that compensation will never satisfy all workers who have been affected by occupational disease based on poor occupational health and safety management in the work place. Employee costs due to health problems include lost jobs, reduced earnings, reduced leisure and career opportunities, loss of self-esteem, and impaired family and social life. Employer costs include higher workers compensation, replacement, and training costs. Therefore it can be concluded that poor occupational health and safety will have many negative effect to the all parties including employee and community wide, and it is in the best interest of all to prevent or minimize such effects.

The Type of Health Hazard in Construction Industry

The health hazard in construction industry came from the pollution such as, dust, gases, and noise (see Appendix6). Radiation, thermal, and ergonomic are also the problems in construction industry. Their impact in short term sometimes are not clear or not really show the effect, but they will accumulated in the body so in long term they can damage the body or even cause death. For toxic materials to be hazardous, they must first enter the body through one of three routes: ingestion, inhalation, or absorption from skin (Rekus).

The management of occupational diseases based on avoiding distress suffered by the victim and eliminating the costs that are burden to the victim; employers and community (Yim) Therefore understanding of the source of the health hazard is essential step towards its management and prevention. The sources of health hazard are:

1. Airborne dust: solid particles and heavier than air which often accumulate on the ground and other surfaces (ash burner). The dusts are created by processes like sawing, grinding, sanding, cement or plaster are mixed (Rekus).
2. Depending on their chemical properties, they may either accumulate in lungs or dissolve and pass into the blood stream. Some of these fine particles such as, lead, asbestos, and silica can cause the death. By damaging the lung and may produce in allergic reaction with symptoms such as, breathlessness or excessive coughing which can last for hours, days, and months. Repeated exposures can lead to asthma, permanent lung damage and chest disease. The other types of dust are wood dust, fiberglass, cadmium, and coal tar.
3. Mist: liquid droplets that are formed by splashing, foaming, spraying, and mixing processes. During cleaning and paint spraying applications, the fine mists can be inhaled easily or even can enter the body as a result of drinking or smoking in or around spraying area, and lead into the damage of vital organs.
4. Vapor: is created during the gaseous phases of materials that usually exist in the solid or liquid state. It can be found in a wide variety of applications such as, varnishing, cleaning, and paint spraying. Once inhaled, vapors can be absorbed into the blood stream and as a result, can cause irreparable damage to the brain, kidney, and other vital organs.
5. Gases: are formless fluids that completely fill any container into which they are introduced. Ammonia, Phosgene, Ozone, Oxides of Nitrogen, Formaldehyde, and Asphyxiant gases are usually found in construction industry and they cause

irritating, asphyxiating, or toxic. Irritant gases principally affect the eyes and respiratory tract, but some can also irritate the skin.

6. Noise exposure: the workers in construction areas are surrounded by noise and they receive less protection than general industry. The loud and repeated noise can lead the workers into deaf, so industry noise standard requires employers to establish a hearing conservation program that includes provisions for exposure monitoring, annual audiometric and employee training. But no such of these provisions apply in construction.
7. Radiation sources: consist of two types, ionizing and non-ionizing radiation. Ionizing sources such as, radioactive cobalt is used to measure the density of soils and the thickness of cost materials such as, cement and asphalts. Non-ionizing radiation sources include lasers, radio transmitters, and ultraviolet light. Construction workers are exposed to both ionizing and non-ionizing radiation.
8. Thermal stresses: during winter, construction workers are at risk from hypothermia and localized cold disorder, and while summer, they are threatened by heat exhaustion and heat stroke.
9. Ergonomic hazards: it is caused by repetitive motion and poor material handling such as, turning while lifting, or trying to lift too heavy load.

Health Problems in Australia

Back damage and industrial deafness are the frequent occurrence and reoccurrence health problem in the Australia's construction industry (see Appendix7). Back injuries are the largest occupational health and safety problem in New South Wales because they account for one third of all work place injuries and worker compensation costs (see Appendix7). During 1993/1994, 9 of 1000 workers employed in the construction industry has suffered back injury which left them permanently disable or temporarily disable requiring time off work for 5 days or more. Two thirds of this injury are derived from manual handling. The most common form of back damage involves the combination of back pain and limitation of movement and strength (Yim). According to Johnson, W ,G. The workers with back pain are much less likely to return to work than workers with accidents/injuries and if they return, are much less likely to remain employed..

Since sound is important in term of communication with people, loss of the ability to hear certain sounds has many detrimental implications to life. It will effect on the victims' emotions which is most detrimental, rather than the actual deafness itself. Examples of such emotions include confusion, embarrassment, inadequacy, and

insecurity. Thus although the most obvious effects of hearing loss entail difficulties in communication, for more serious is the damaging effects of hearing loss on the individual's ability to function effectively in their social life. Because of these impacts, industrial deafness in Australia contributes to the highest workers compensation claims per year.

The impact of poor occupational health and safety performance and the occurrence of occupational diseases negatively affects productivity competitiveness and is seen as an economic cost to businesses in Australia. Because of these impact, in all Australia's states and territories, occupational health and safety legislation places and obligation on the employers to provide a safe system and place of work.

The occupational health and safety act in Australia are a state responsibility and exist performance based legislation. The act covers every place of work in the state, and covers employed people as well as employees and employers. In New South Wales there are also direct regulations (NSW occupational health and safety act 1983) concerning with workplace safety which meant employers who failed to provide safe workplaces for employees were financially penalised. Beside that NSW government try to encourage contractors in health and safety performance by insist them to improve their management in occupational health and safety if they want to bid for government contract.

Dealing with the Health and Hazard problems

One of the biggest occupational health and safety problems is the blindness of the society to the benefit of prevention (Smith). An issue of that is the failure to recognize that the human resources are the most expensive and most valuable resources. There should be a commitment to the idea of putting the workers first, which will have positive benefits on everything from health and safety to productivity and competitiveness.

The emphasis in the construction industry must be on the prevention of occupational diseases and work related to injuries through effective management techniques, rather than compensation and ineffective penalties (yim). If there is health hazard on the site, it should be eliminated or minimized with exposure controls. Sometimes the only way to control a hazardous chemical is to remove it from the job site and use a less toxic substance. In situations where hazards elimination or substitution is not possible, engineering controls should be used to remove contaminants from work area (Darnell)

The implementation of the effective management should begin with an understanding of the occupational diseases prevalent in the construction industry. For the successful of management, it need to involve all parties such as;

government, employers, and employees. In term of the regulatory authority, the government is in a good position in occupational diseases management and prevention because government can use legislative, education and promotion tools and financial such as; fines or penalties in order to insist or encourage the contractors/employers to improve their management system. The regulations should cover the duties of employers, the self employed and those who control the way in which construction work is carried out (Yim).

In term of general occupational health, safety and welfare, employers have specific obligations and duties which include;

- Providing or maintaining equipments and systems of work that are safe and without risk to health
- Making arrangement for ensuring the safe use, handling, storage and transport of equipments and substances.
- Maintaining places of work under their control in a safe condition and providing and maintaining safe entrance and exits.
- Providing information, instruction, training and supervision necessary to ensure the health and safety at work of employees.
- Making available adequate information about research and relevant test of substances used at the work place

For employees they must take reasonable care of health and safety of others, and they must co-ordinate with employers in their efforts to comply with occupational health and safety requirements. In addition, the familiarization with the site is crucial to the safety of the workers and being able to provide a virtual tour to the site for employees would be most beneficial in highlighting hazards and potential injury and damage that may occur.

Environmental issues

Environmental consideration is coming a critical portion of most major industrial and commercial development projects in the future. Some say the environment would be the fourth construction project objective besides time, cost and quality.

As the environmental movement matures, policy makers are embracing the new sustainable development paradigm for environmental management in construction industry. This concept refers to the ability to build a society whose activities meet today's needs while being designed to preserve the quality of human life for both present and future generation. The sustainable development movement has begun to affect policy and law in most environmentally related industries, such as construction industry, and should continue to have significant effects on the construction industry in a number of important ways—providing new sources for

more traditional work as well as opportunities. For example, construction firms can build facilities and treatment plants to convert hazardous waste to harmless materials. Also, builder might seek out alternate materials that preserve scarce resources and depend on more benign processing methods, or they might adopt techniques that produce less scrap.

Under this situation, construction companies (contractors) will have to prepare to meet the new demands this will entail. If any kind of waste or pollutants are involved in the specific project, there is almost certain to be demands for fresh approaches that reduce their generation or that treat any that are produced right at the source. Here, it is necessary to quote the following fact: *Most estimates place the amount of hazardous waste generated in the United States each year at 250-500 million tons, or between 1 and 2 tons for every U.S. citizen! Somewhat over three –quarters of this amount is generated by three industry groups: chemicals and allied products, primary metals, and petroleum and coal products—all traditionally major clients of the construction industry.*

So, apparently, there would be greater appreciation of the true costs of dealing with hazardous waste. Clients and contractors are eager to find out effective ways to reduce or eliminate it from projects or operations whenever possible, and try to find profitable reuses for many remaining materials in construction process. While most work considered and done by architectural plans and design, a contractor will still be responsible for ensuring that environmental requirements are properly considered. The trend toward elimination or minimisation of pollutants and waste at source will require greater collaboration between these different segments of the total construction project. A contractor will have to prepare to make useful contributions to his client from the beginning of the project right through every stage. There are four basic approaches to control waste at the source:

1. Change raw building materials used in construction.
2. Improve construction technology and equipment.
3. Improve design level and design concept. (e.g. “green building” design)
4. Recycle waste within the plant.

Obviously, in order to guarantee a project to be carried out smoothly, it is quite necessary for project manager to produce a SHE plan from preparation phase through to completion phase. It is now increasingly accepted that good condition of SHE is also good business. On the other hand, some governments and professional issued some relevant laws (e.g *UK construction regulation*) and manual (e.g *Total Project Management of Construction Safety, Health and Environment (CEI)*) to provide a framework and guarantee the development of proactive management of SHE. Moreover, the ECI manual decides a systematic approach to construct SHE management that promotes continuing improvement in SHE performance and defines the minimum SHE objectives to be considered in all construction activities.

Safety, Health and Environment in Project Delivery Cycle

Because the construction of a project involves a number of stages defined as pre-design, design, tendering, pre-construction, construction and commissioning, SHE has its own key works which should be completed in respective stages. (details see the figure in appendix8)

Pre-design stages

It may be first step and also most critical step for client to identify major SHE hazards and potential problems in consideration of SHE issues of the proposed on basis of project purpose, especially, environmental issues will be key points in SHE. In this stage, sometimes, forecasting of environmental impact on the proposed project will effect directly on development approval. The client has to consider environmental requirements in advance. e.g Whether the location of the building is proper or not. Will it impact on residents' normal lives? Will residents be against it? Will it impact on air and water quality and change climate around the site? etc. If the client has considered above issues and decided to develop the project, It would be quite beneficial for client to guarantee decreasing the impact and propose a set of effective managerial approaches and technical methods to achieve the project goal.

In addition, the client has to seek cooperation sector to utilise new technology and develop new process that either eliminate or substantially reduce waste. In this stage, safety and health issues are focused on identification of assessment of risk. According to project purpose and description, those residual SHE risks which cannot be confirmed directly by project objectives, could be determined through technical feasibility study and economic analysis. Thus all SHE issues can be identified further and SHE plan should be made out in the design stage.

Design Stage

The basic recognition of the general damage of SHE hazards gives rise to the need for a new form of construction project management. There is an imperative need for the integration of SHE solution within current project management practice in order to increase productivity and improve construction quality. Thus, all SHE issues identified basically, will be defined further, and then developed into SHE plan. SHE plan is a document that should include all relevant safety, health and environment information which include the necessary indicators for the reduction of accident hazards and protection of workers' safety and health during the construction stage,

measurement for protection of neighbouring residents and natural conservation during the project construction process and thereafter.

Such a plan should therefore include preventive measures designed to minimise risk factor and safety protection measures to attenuate effects of accidents. A SHE plan structure is therefore envisaged to comprise a set of elements that can be combined in the following three parts: plan resume, project characterisation, preliminary hazard prevention measures. (see table1)

Table 1

Plan Resume	Project Characterisation	Hazard Prevention Measures
<ul style="list-style-type: none"> - Definition of objectives - Advance information - Applicable regulations - Functional organisation chart - Industrial accidents and insurance - Construction methods - ... 	<ul style="list-style-type: none"> - General characteristics - Labour quantities table - List of especially hazardous works - List of especially hazardous and harmful materials - ... 	<ul style="list-style-type: none"> - Plan of actions with regard to site conditions - Most likely protection plan - Inspection and safety plan - Workers' health plan - Accident record and statistics plan - Emergency plan - Harmful materials disposal plan - ...

It is necessary to state that the content and scope of the SHE plan will depend on the nature, size and complexity of each project, and be built up on basis of detail design (this will be elaborated in the later part). In some large construction projects, the SHE coordinator as a new position is set by the client for the purpose of SHE issues during the project preparation phase, and he/she can go on work through whole project process. It is the SHE coordinator's responsibility to define the minimum SHE requirements for each project.

During the design stage of the project, SHE plan should be researched fully and possible SHE costs should also be assessed. Then all results, including all indications and requirement with regard to safety, health and environment, as a part of tendering document, ought to be taken into consideration by tendering contractors when preparing their bids.

Specifically speaking, designers of construction projects are required to be account of the effects of their design on the health and safety of contractors and environmental issues during the construction, maintenance and demolition of their projects. That is to say, through their detailed designs, designers affect construction of construction methods and processes. e.g, designers specify materials which may be heavy, large in area, rough, have sharp edges or are toxic, and consequently potentially harmful to humans or will pollute the environment. These all require designers to identify SHE hazards and take actions to modify their designs so that these hazards are avoided reduced and controlled. Designers' actions on these would be effective guarantee of project success.

In order to achieve above objectives effectively, following steps could be used by a designer to arrive at a more safety conscious solution to the design problems.

- The designer knows which elements of the project are currently being designed and how far he or she has progressed through the whole design process.
- The designer decides types of work and appropriate materials(e.g foundation or primary structure and safety & non-toxic materials)
- Identify the most common or significant hazards associated with relevant work.
- Finish the complete list of hazards, and consider how these may be avoided, reduced or controlled and what level of activity is appropriate according to the design.
- Judge which remaining issues are sufficiently serious to alert potential contractors and provide information accordingly.
- Choose solution with lest SHE issues as design evidence.
- Flag up the significant or unusual risks to be mentioned in plan and file.

Tendering stage

In this stage, having finished assessment of SHE costs, it is intended that those tenderers should be able to consider the appropriateness of SHE plan to the construction methods and processes to be used in the execution of the work. Their bids should include the necessary safety and quite effective measures required to prevent the most likely hazards associated therewith on the basis of SHE plan.

During the tender award phase, the successful contractor should submit all the details required to complete the SHE plan presented to the coordinator for his approval within a specified time period. Once these details have been incorporated into the plan, the construction site can be set up and the works can commence.

Construction stage

Since it is executive stage for SHE plan, there is a need to ensure that all areas of the SHE plan are strictly followed. Any areas where deviations are essential must be managed effectively by use of the principles of change control. What practical work should be done is supervision, measurement and control of contractor's SHE plan performance and monitor SHE plan. Therefore, the SHE plan should be adapted to the actual construction conditions. Alternations to the project should particularly be subjected to prior analysis by the SHE coordinator in order to foresee any potential hazards associated therewith on the basis of SHE plan and file. Whenever any of these situations arise the contractor should provide the necessary details to enable the risks to be identified, simultaneously, enable associated measures that need to be implemented in accordance with the construction methods and processes to be used in the works. The execution of these works may only take place once the details have been approved and incorporated the SHE plan.

In practical execution, e.g. in Europe, the framework directive for safety and health of workers and environmental issues also considers the client bears the duty to ensure safety, health and environment in every aspect related to the work.

Commission stage

In this stage, works on SHE matters are focused on review previous whole process on SHE administration, evaluation of SHE management and feedback to all stages in order to adjust and correct methods & strategies on dealing with SHE issues. e.g. correcting design; changing construction methods; improving operations and procedures; using new building materials; etc. Of course, ultimate goal is to reduce obstacle on SHE matters for improving construction project success.

Specific speaking, the definition of major SHE hazards and assessment risk would be re-adjusted. Then re-establishing or correcting SHE plan will be followed by re-assessment of SHE costs. Finally, in the construction stage, it would be necessary to adjust supervision method and key point on SHE performance to appropriate improvement of project.

Integration of Quality, Safety and Environment

Superficially, it seems that there is no relationship between SHE and quality. But, in fact, quality is "sole" of a project, discussion of this topic therefore would have realistic meaning for project success.

Client, designer and contractor have been continuing to develop a number of separate management systems to control the work done on construction projects.

Traditionally, these management systems remain independent from one another. But the integration of these management systems would be of significant benefit in improving the productivity and quality of the management of the construction process (see figure 1, figure 2)

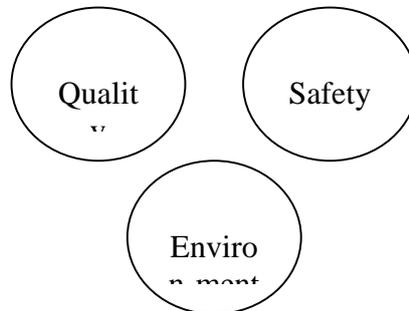


Figure 1 Traditional quality, safety and environmental systems

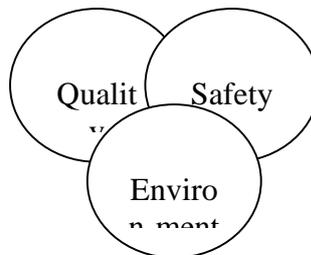


Figure 2 Idealised integrated quality, safety and environmental systems

Safety and quality management

In the construction activities, accidents causing personal, social and economical losses often occur in spite of the a lot of information and, in some countries, regulatory documents on accident prevention techniques. Generally speaking, the probability of getting injured as a construction industry worker is greater than that of all other industry. e. g in Hong Kong, it is on average 5.8 times greater than other. The high rate of accident reflects that both employers and employees are unconsciously working under risk with the need for additional safety precautions and measures at the construction sites.

As one of prerequisites for quality management, safety regulation and law has been set to control the safety environment and been reinforced with an increased level of fines and penalties. Furthermore, as an element of strategies of a construction project, safety has close relationship with quality management. The ISO standard

8402 (BS1, 1994) defines quality management as “the aspect of the overall management function that determines and implements the quality policy”. Safety management can be addressed in the same way as quality assurance. Safety management in term of loss control can cut down accident losses and achieve optimum cost, which is an essential element of modern quality management.

In order to ensure high quality in construction projects all time, not just for a specific project, construction companies can develop their own safety policies and procedures most appropriate to their workplace and modify in aligning with the changing circumstances. Essential frameworks for safety management system are:

1. A safety policy that suits the company goal.
2. A safety department for discussing and monitoring safety measures.
3. A set of standards and plans for policy implementation.
4. Measure performance by conducting regular safety audits.
5. Review audit result & corrective actions.
6. Provide safety training for all workers especially that engaged in hazardous trends.

On the other hand, a quality system built in a TQM perspective should address the set of requirements from the major stakeholders in order to attain business excellence. i.e quality management system is a key concern for successful construction project. At the same time, the focus of a construction company is changed from merely assuring to customers’ compliance with their requirements, to a wider approach taken. Comprising other stakeholders — the “umbrella” of TQM should cover a number of other requirements, among which occupational safety and health is in the front row.

Environment issues joining to safety & quality

Suppose that an industrial project is under construction or having been implementing and starting to operate, a great amount of waste is emitted and resulted in damage of surrounding environment. Can you say it is a high quality project? Definitely, NO. So, it has great necessity for integrating environment into safety and quality system. In recent years, one aspect of change in quality, safety and environment has been the development and a growth of environmental impact polices and control system.

It has been recognising that it is neither practical nor efficient to implement separate functional management systems of these three areas. This reaction is heightened by industry’s scepticism about presiding standards and legislation. Some believe that they can have a negative effect on the way their organisations operate. Pape (1993) believes that these deficiencies can be eliminated by one modular and integrated

management system capable of handling all three areas in a consistent manner. In addition, Dennison (1993) added that a single integrated management approach might even accelerate improved performance in the area of Quality, Safety and Environment management. There are several reasons why a single integrated QSE system would be effective in project:

- It represents the way in which organisations actually do business. In that, these matters are intrinsic to the performance of contractual, legislative and regulatory obligations described by the nature of their business practices.
- It minimises the volume, administration and maintenance of the documented management system.
- It provides a more use—friendly approach to the management of these elements in their application.
- It promotes the coordination and balance of these three elements.

Conclusion

Through above illustration and analysis, as one essential and important aspect of successful project strategy, SHE objectives should be achievable and must be achieved. She aims should be consistent with other project management objectives of time, cost and quality. Ultimately, in order to complete the project, following three aspects in SHE would be achieved:

- **Preventing** incidents that arise through company activities
- **Creating** a healthy work environment and actively promoting the health and well-being of staff.
- Pursuing in their operations progressive **reduction** of emissions, effluents and discharges of waste materials that are known to have a negative impact on the environment with the ultimate aim of **eliminating** the negative impacts.

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Abstract

In the past popular view, SHE (Safety, Health and Environment) issues were project's external issues where all parties do not put attention much on it. But today, the construction industry is demanded to improve their ability especially in cost, time and quality, if they want to win the competition. The process improving will not success without involving the SHE issues since it causes many losses for example; bad safety program will lead company into severe, where accidents, injuries even deaths will continue arise and cause the increasing of the cost.

In order to prevent their damage, the companies should have the good management system and involve all parties. The implementation of this good management should derive from commitment of CEO and through the each level of organization. It is also important that every worker aware of these issues and have the willingness of change from their previous cultures. The implementation of SHE management not just in one phase of the project but through all phases; pre-design, design, tendering, pre-construction, construction and commissioning phase.

Beside that the impact of SHE just not to cost and time but she also has relation to the quality. By improving the SHE, it will lead to the increasing of quality because we cannot say that high qualities project if there are still a lot of SHE problems. Therefore, the implementation of the better SHE issues is important in construction industry.

1 INTRODUCTION

With continuing development of construction industry, complexity of construction project is more and more obvious. All kinds of factor, no matter internal ones or external ones, which have been effecting the project, are increasing by times. In the past decades, safety, health and environment (SHE) issues have been drawing much project's stakeholders attention, manly including client, contractor, local council/government ect. In this paper, it will be discussed that necessities of SHE for a successful construction project. Also, it will be focused on how SHE plan is created, and its own works in each project stage. In addition, the relationship between **quality** and **SHE** will also be illustrated. It is hoped that SHE issue, as one of strategies of a successful construction project, would be understood clearly.

2 SAFETY, HEALTH AND ENVIRONMENT ISSUES IN CONSTRUCTION INDUSTRY

The past popular view among clients and contractors was that SHE issues were external to the construction projects and would divert capital investment away from productive uses, and also added nothing of value to company's construction and services thereof. But, at present, SHE issues have apparent necessity under the consideration of project managers. If not considered, it would lead to serious loss, even project failure. Now, let us look into respective aspects of SHE issues within construction industry.

3 SAFETY ISSUES

4 WHY IS SAFETY ISSUES NECESSARY FOR THE SUCCESSFUL OF THE PROJECT ?

Safety has always been a major issue in construction job site because construction industry is identic with high rate of accident and the second unsafely industry after mining. Statistic indicate that construction employee account for approximately 6 percent of the total labor force, but they incur 12 percent of all occupational injuries and illness and 19 percent of all work related fatalities. In US, accidents occur daily on construction site with a frequency of approximately 1750 construction workers injured. Each year, as many as 2100 construction workers in US die annually of work related injuries and another 210000 lost time injuries occur annually in construction. Hong Kong also has the poor site safety record that approximately 66 construction workers in every 1000 suffer a major injury each year comparing to

Holland (3,3), England (3), US (13 per 1000) Ontario (5,2) and Sweden (6). Australia has record that there were 45 injuries for every 1000 workers with approximately 70% as a direct result of accidents and the remainder due to body stressing. The cost due to this accident amounted to \$60 million during the year 1992-1993 (Asmis) (see Appendix1).

Falls were the leading cause of death among the construction workers, who 10 times more likely to die from a fall at work than average workers. Some 40 percent of the falls were from building and another 46 percent of falls were from ladder or scaffolding and from one level to another. In 1995, US Department of Labor's Bureau reported that 1048 construction workers killed on the job with 32% or 335 resulting from fall. The second leading of death among construction workers was electrocution. Overhead power line accounted for 23 percent of death followed by industrial wiring and domestic wiring appliance. Of motor vehicle-related incidents is the third leading cause of traumatic death where 30% involved pedestrians, including workers who were struck by motor vehicle while work in zone. The fourth major cause is machine-related incidents, was lead by lifting machine and agricultural machine. The other common injuries are strain, cuts, sprains and lacerations. Strain and sprain are the most common type of injury, followed by cuts, laceration and punctures (see Appendix2). The body part that most often injured is back because lifting is the most common activity that performed on the site.

Many times construction accident result in lawsuit brought against the responsibility party which in addition to monetary losses and other losses. Not only are there costs associated with legal actions, but there are other direct and indirect costs. Direct costs such as; medical costs, premium for compensation benefits liability and property losses. Indirect costs are costs associated with: lost time of injured employee, hiring the new employee, lost time of other workers, accident investigation, etc. This also can lead into worst situation where the project should be stop and cannot continue.

Since the results of accidents are always severe, they would lead to large amount of accident compensation even to impact on the construction schedule. Thus, it would cause more loss to contractors and client so safety problems in construction process would be and important problem which can not be neglected, and it has direct relationship with win or lose of the project.

Some benefits of accident reductions are cost savings relative to injuries or property damage. Improving safety measures will help to reduce costs because accidents result in higher insurance premium. Saving in overhead costs and productivity can be realized when accidents are prevented if there are no interruption of work due to accidents, there are no lost work days and the project has a better chance of being complete on time. Therefore, company should have the safety program in their

management and organization. In addition, safety program is increasingly important and become condition in bidding tender for government projects and other project in Australia.

5 THE IMPLEMENTATION OF THE SUCCESSFUL SAFETY

One of the most barriers for companies in implementing the safety program is *unwillingness to change*. Changes should come and supported by government as initial stage by providing the safety regulation such as; Occupational Health and Safety 1983 in Australia, and *commitment* from the chief executive officer's level that should be continued throughout each level of organization. This commitment must permeate the organization and be embraced by all members thus, safety become everyone's responsibility (see Appendix3). However, management has to be committed by providing the best training, high quality tools, equipment and a safe healthful environment

Safety management should be implemented during all phases of every project so that it complies the requirement of safety law, codes of conduct and building codes (Terrero). In order to implement, it need the *role of every parties* such as; project management, superintendents, supervisors, architect, engineering and foreman which are important in defining safety performance in their projects (see Appendix4). Project manager usually performs project coordination. Coordination and adequate planning are important and help to avoid misinterpretation and confusion among workers. Supervisors can be the most effective promoters of safe working practices since he usually controls the way works and exerts the greatest influence employee attitudes. Architect also can reduce the accident by design for example; structure to minimize climbing, so more works are accomplished on the ground. In addition, the safety performances not just determine within organization level but also between client, project manager, contractors and subcontractors. They must show attitude and willingness to partnering/cooperate for the successful of the safety management programs.

Hazards on construction site can be controlled and accidents can be prevented through the implementation of basic safety practices leading to a sound construction management program. The cost for effective construction safety and health program is approximately 2,5 % of direct labor costs. To ensure program will success, it needs establishment of the objectives (policy), monitor implementation (inspections), provide feedback, and follow up with the additional inspection if necessary. This safety program should consist of:

- Safety policy statement
- Screening of contractors
- Constructibility reviews

- Prebid meeting explanation of safety program expectation
- Preconstruction meeting (Safety review); contractor safety policy, contractor safety program, contractor safety representative
- Training and reinforcement of safety objectives; employee orientation, weekly toolbox meetings, progress meetings, manager safety meetings (see Appendix5)
- Inspection; management safety walks, site safety inspection, contract enforcement
- Accident reporting and investigations
- Housekeeping

The successes of this program depend to a great extent on management involvement, not by dollar value on the humanitarian aspects of design. Without serious and persistent management commitment, merely adopting a safety program does not yield desired results. Once having a good program becomes a priority, implementation depends on good owner-contractor communication and active owner participation. If safety is given due importance by project management, it will receive proportionate attention from the rest of the organization. Motivation and recognition are also the key factors in a successful program. Because employees should be motivated and encouraged to promote and practice safety issues.

The construction industry should not just reduce the accident but place more emphasis on zero injuries. This concept derived from the Total Quality Management which related to the implementation of the zero defect. According to Minter, *zero accident programs* can reduce the injury rate dramatically. In 1993, 83% percent of company's projects worldwide have had zero accidents. The program can be implemented into the every contractor organization and government.

Reaching for the zero injury goal has immediate inherent reward such as; reducing cost and time. Performance will frequently improve soon after the zero expectation is communicated to the employees because employees begin to believe that the company is serious about safety. For zero injury to become reality, management's action must include employee safety education such as; propaganda, training and safety equipments.

6 HEALTH ISSUES

Construction industry can be classified with the high risk industry related to the health problems because workers are not afforded the same level of protection from health hazards as their counterparts in general industry (Rekus). People who work in construction tend to have an average of 8 to 12 years die earlier than white collar workers or people who work in office. Although the causes of death were not all

directly work related, some construction trade seemed to have higher rates of certain diseases than the population in general and white collar workers in particular. For example: Most carpenters tend to have high standard mortality ratio (SMRs) from lung disease, suicide, and some cancers. Painters and plasterers also have high SMRs from cirrhosis and other liver disease, cancer of throat and lung, and suicide. The others such as, roofers, laborers and helpers, operating engineering, drillers and other construction workers were in the top ten occupations with the highest SMRs. The reason for the high SMRs for construction workers were the workers life style that consume alcohol, smoking and some of them use drug, and the unhealthy place related to hazard chemical such as silica, lead asbestos and, the air contamination, etc.

Beside the effect of occupational disease often relate to reduce working life. More than 60% of older cost workers – who had worked on average of 30 years - are forced to retire because of medical condition. They rate almost 20% higher than that of the general work force. The results also found that musculoskeletal disorders were found were seems to unskilled workers assessed. Other major disability included deafness due to noise exposure, occupational dermatitis and lung diseases due to long term inhalation of dusts and organic solvents.

The health problem is not just the problem for the workers but also has an effect to their family. Smith stated that workers contaminated their homes by bringing lead dust home unknowingly on their clothes, or because they were just not aware of the danger of hazard material such as, lead, asbestos, and silica. Workers have also poisoned themselves by eating in an area where lead dust is present or by not washing their hands thoroughly before eating and by smoking while working around lead. They are sometimes not aware that they have been affected when they get symptoms such as, a headache or joint pains, which could indicate a high blood lead level.

Managing of work related and occupational disease is often that a cost to the community resources is used to treat such victims. The issue that remains subjective and unresolved is whether monetary value can replace the losses of ability and opportunity that workers faced or not. The inability to classify a monetary sum on a life, feelings or emotion means that compensation will never satisfy all workers who have been affected by occupational disease based on poor occupational health and safety management in the work place. Employee costs due to health problems include lost jobs, reduced earnings, reduced leisure and career opportunities, loss of self-esteem, and impaired family and social life. Employer costs include higher workers compensation, replacement, and training costs. Therefore it can be concluded that poor occupational health and safety will have many negative effect to the all parties including employee and community wide, and it is in the best interest of all to prevent or minimize such effects.

7 THE TYPE OF HEALTH HAZARD IN CONSTRUCTION INDUSTRY

The health hazard in construction industry came from the pollution such as, dust, gases, and noise (see Appendix6). Radiation, thermal, and ergonomic are also the problems in construction industry. Their impact in short term sometimes are not clear or not really show the effect, but they will accumulated in the body so in long term they can damage the body or even cause death. For toxic materials to be hazardous, they must first enter the body through one of three routes: ingestion, inhalation, or absorption from skin (Rekus).

The management of occupational diseases based on avoiding distress suffered by the victim and eliminating the costs that are burden to the victim; employers and community (Yim) Therefore understanding of the source of the health hazard is essential step towards its management and prevention. The sources of health hazard are:

10. Airborne dust: solid particles and heavier than air which often accumulate on the ground and other surfaces (ash burner). The dusts are created by processes like sawing, grinding, sanding, cement or plaster are mixed (Rekus).
11. Depending on their chemical properties, they may either accumulate in lungs or dissolve and pass into the blood stream. Some of these fine particles such as, lead, asbestos, and silica can cause the death. By damaging the lung and may produce in allergic reaction with symptoms such as, breathlessness or excessive coughing which can last for hours, days, and months. Repeated exposures can lead to asthma, permanent lung damage and chest disease. The other types of dust are wood dust, fiberglass, cadmium, and coaltar.
12. Mist: liquid droplets that are formed by splashing, foaming, spraying, and mixing processes. During cleaning and paint spraying applications, the fine mists can be inhaled easily or even can enter the body as a result of drinking or smoking in or around spraying area, and lead into the damage of vital organs.
13. Vapor: is created during the gaseous phases of materials that usually exist in the solid or liquid state. It can be found in a wide variety of applications such as, vanishing, cleaning, and paint spraying. Once inhaled, vapors can be absorbed into the blood stream and as a result, can cause irreparable damage to the brain, kidney, and other vital organs.

14. Gases: are formless fluids that completely fill any container into which they are introduced. Ammonia, Phosgene, Ozone, Oxides of Nitrogen, Formaldehyde, and Asphyxiant gases are usually found in construction industry and they cause irritating, asphyxiating, or toxic. Irritant gases principally affect the eyes and respiratory tract, but some can also irritate the skin.
15. Noise exposure: the workers in construction areas are surrounded by noise and they receive less protection than general industry. The loud and repeated noise can lead the workers into deaf, so industry noise standard requires employers to establish a hearing conservation program that includes provisions for exposure monitoring, annual audiometric and employee training. But no such of these provisions apply in construction.
16. Radiation sources: consist of two types, ionizing and non-ionizing radiation. Ionizing sources such as, radioactive cobalt is used to measure the density of soils and the thickness of cost materials such as, cement and asphalts. Non-ionizing radiation sources include lasers, radio transmitters, and ultraviolet light. Construction workers are exposed to both ionizing and non-ionizing radiation.
17. Thermal stresses: during winter, construction workers are at risk from hypothermia and localized cold disorder, and while summer, they are threatened by heat exhaustion and heat stroke.
18. Ergonomic hazards: it is caused by repetitive motion and poor material handling such as, turning while lifting, or trying to lift too heavy load.

8 HEALTH PROBLEMS IN AUSTRALIA

Back damage and industrial deafness are the frequent occurrence and reoccurrence health problem in the Australia's construction industry (see Appendix7). Back injuries are the largest occupational health and safety problem in New South Wales because they account for one third of all work place injuries and worker compensation costs (see Appendix7). During 1993/1994, 9 of 1000 workers employed in the construction industry has suffered back injury which left them permanently disable or temporarily disable requiring time off work for 5 days or more. Two thirds of this injury are derived from manual handling. The most common form of back damage involves the combination of back pain and limitation of movement and strength (Yim). According to Johnson, W, G. The workers with back pain are much less likely to return to work than workers with accidents/injuries and if they return, are much less likely to remain employed..

Since sound is important in term of communication with people, loss of the ability to hear certain sounds has many detrimental implications to life. It will effect on the victims' emotions which is most detrimental, rather than the actual deafness itself. Examples of such emotions include confusion, embarrassment, inadequacy, and insecurity. Thus although the most obvious effects of hearing loss entail difficulties in communication, for more serious is the damaging effects of hearing loss on the individual's ability to function effectively in their social life. Because of these impacts, industrial deafness in Australia contributes to the highest workers compensation claims per year.

The impact of poor occupational health and safety performance and the occurrence of occupational diseases negatively affects productivity competitiveness and is seen as an economic cost to businesses in Australia. Because of these impact, in all Australia's states and territories, occupational health and safety legislation places and obligation on the employers to provide a safe system and place of work.

The occupational health and safety act in Australia are a state responsibility and exist performance based legislation. The act covers every place of work in the state, and covers employed people as well as employees and employers. In New South Wales there are also direct regulations (NSW occupational health and safety act 1983) concerning with workplace safety which meant employers who failed to provide safe workplaces for employees were financially penalised. Beside that NSW government try to encourage contractors in health and safety performance by insist them to improve their management in occupational health and safety if they want to bid for government contract.

9 DEALING WITH THE HEALTH AND HAZARD PROBLEMS

One of the biggest occupational health and safety problems is the blindness of the society to the benefit of prevention (Smith). An issue of that is the failure to recognize that the human resources are the most expensive and most valuable resources. There should be a commitment to the idea of putting the workers first, which will have positive benefits on everything from health and safety to productivity and competitiveness.

The emphasis in the construction industry must be on the prevention of occupational diseases and work related to injuries through effective management techniques, rather than compensation and ineffective penalties (yim). If there is health hazard on the site, it should be eliminated or minimized with exposure controls. Sometimes the only way to control a hazardous chemical is to remove it from the job site and use a less toxic substance. In situations where hazards elimination or substitution is not

possible, engineering controls should be used to remove contaminants from work area (Darnell)

The implementation of the effective management should begin with an understanding of the occupational diseases prevalent in the construction industry. For the successful of management, it need to involve all parties such as; government, employers, and employees. In term of the regulatory authority, the government is in a good position in occupational diseases management and prevention because government can use legislative, education and promotion tools and financial such as; fines or penalties in order to insist or encourage the contractors/employers to improve their management system. The regulations should cover the duties of employers, the self employed and those who control the way in which construction work is carried out (Yim).

In term of general occupational health, safety and welfare, employers have specific obligations and duties which include;

- Providing or maintaining equipments and systems of work that are safe and without risk to health
- Making arrangement for ensuring the safe use, handling, storage and transport of equipments and substances.
- Maintaining places of work under their control in a safe condition and providing and maintaining safe entrance and exits.
- Providing information, instruction, training and supervision necessary to ensure the health and safety at work of employees.
- Making available adequate information about research and relevant test of substances used at the work place

For employees they must take reasonable care of health and safety of others, and they must co-ordinate with employers in their efforts to comply with occupational health and safety requirements. In addition, the familiarization with the site is crucial to the safety of the workers and being able to provide a virtual tour to the site for employees would be most beneficial in highlighting hazards and potential injury and damage that may occur.

10 ENVIRONMENTAL ISSUES

Environmental consideration is coming a critical portion of most major industrial and commercial development projects in the future. Some say the environment would be the fourth construction project objective besides time, cost and quality.

As the environmental movement matures, policy makers are embracing the new sustainable development paradigm for environmental management in construction

industry. This concept refers to the ability to build a society whose activities meet today's needs while being designed to preserve the quality of human life for both present and future generation. The sustainable development movement has begun to affect policy and law in most environmentally related industries, such as construction industry, and should continue to have significant effects on the construction industry in a number of important ways—providing new sources for more traditional work as well as opportunities. For example, construction firms can build facilities and treatment plants to convert hazardous waste to harmless materials. Also, builder might seek out alternate materials that preserve scarce resources and depend on more benign processing methods, or they might adopt techniques that produce less scrap.

Under this situation, construction companies (contractors) will have to prepare to meet the new demands this will entail. If any kind of waste or pollutants are involved in the specific project, there is almost certain to be demands for fresh approaches that reduce their generation or that treat any that are produced right at the source. Here, it is necessary to quote the following fact: *Most estimates place the amount of hazardous waste generated in the United States each year at 250-500 million tons, or between 1 and 2 tons for every U.S. citizen! Somewhat over three –quarters of this amount is generated by three industry groups: chemicals and allied products, primary metals, and petroleum and coal products—all traditionally major clients of the construction industry.*

So, apparently, there would be greater appreciation of the true costs of dealing with hazardous waste. Clients and contractors are eager to find out effective ways to reduce or eliminate it from projects or operations whenever possible, and try to find profitable reuses for many remaining materials in construction process. While most work considered and done by architectural plans and design, a contractor will still be responsible for ensuring that environmental requirements are properly considered. The trend toward elimination or minimisation of pollutants and waste at source will require greater collaboration between these different segments of the total construction project. A contractor will have to prepare to make useful contributions to his client from the beginning of the project right through every stage. There are four basic approaches to control waste at the source:

5. Change raw building materials used in construction.
6. Improve construction technology and equipment.
7. Improve design level and design concept. (e.g. “green building” design)
8. Recycle waste within the plant.

Obviously, in order to guarantee a project to be carried out smoothly, it is quite necessary for project manager to produce a SHE plan from preparation phase through to completion phase. It is now increasingly accepted that good condition of SHE is also good business. On the other hand, some governments and professional issued some relevant laws (e.g *UK construction regulation*) and manual (e.g *Total*

Project Management of Construction Safety, Health and Environment (CEI) to provide a framework and guarantee the development of proactive management of SHE. Moreover, the ECI manual decides a systematic approach to construct SHE management that promotes continuing improvement in SHE performance and defines the minimum SHE objectives to be considered in all construction activities.

11 SAFETY, HEALTH AND ENVIRONMENT IN PROJECT DELIVERY CYCLE

Because the construction of a project involves a number of stages defined as pre-design, design, tendering, pre-construction, construction and commissioning, SHE has its own key works which should be completed in respective stages. (details see the figure in appendix8)

12 PRE-DESIGN STAGES

It may be first step and also most critical step for client to identify major SHE hazards and potential problems in consideration of SHE issues of the proposed on basis of project purpose, especially, environmental issues will be key points in SHE. In this stage, sometimes, forecasting of environmental impact on the proposed project will effect directly on development approval. The client has to consider environmental requirements in advance. e.g Whether the location of the building is proper or not. Will it impact on residents' normal lives? Will residents be against it? Will it impact on air and water quality and change climate around the site? etc. If the client has considered above issues and decided to develop the project, It would be quite beneficial for client to guarantee decreasing the impact and propose a set of effective managerial approaches and technical methods to achieve the project goal.

In addition, the client has to seek cooperation sector to utilise new technology and develop new process that either eliminate or substantially reduce waste. In this stage, safety and health issues are focused on identification of assessment of risk. According to project purpose and description, those residual SHE risks which cannot be confirmed directly by project objectives, could be determined through technical feasibility study and economic analysis. Thus all SHE issues can be identified further and SHE plan should be made out in the design stage.

13 DESIGN STAGE

The basic recognition of the general damage of SHE hazards gives rise to the need for a new form of construction project management. There is an imperative need for

the integration of SHE solution within current project management practice in order to increase productivity and improve construction quality. Thus, all SHE issues identified basically, will be defined further, and then developed into SHE plan. SHE plan is a document that should include all relevant safety, health and environment information which include the necessary indicators for the reduction of accident hazards and protection of workers' safety and health during the construction stage, measurement for protection of neighbouring residents and natural conservation during the project construction process and thereafter.

Such a plan should therefore include preventive measures designed to minimise risk factor and safety protection measures to attenuate effects of accidents. A SHE plan structure is therefore envisaged to comprise a set of elements that can be combined in the following three parts: plan resume, project characterisation, preliminary hazard prevention measures. (see table1)

Table 1

Plan Resume	Project Characterisation	Hazard Prevention Measures
<ul style="list-style-type: none"> - Definition of objectives - Advance information - Applicable regulations - Functional organisation chart - Industrial accidents and insurance - Construction methods - ... 	<ul style="list-style-type: none"> - General characteristics - Labour quantities table - List of especially hazardous works - List of especially hazardous and harmful materials - ... 	<ul style="list-style-type: none"> - Plan of actions with regard to site conditions - Most likely protection plan - Inspection and safety plan - Workers' health plan - Accident record and statistics plan - Emergency plan - Harmful materials disposal plan - ...

It is necessary to state that the content and scope of the SHE plan will depend on the nature, size and complexity of each project, and be built up on basis of detail design (this will be elaborated in the later part). In some large construction projects, the SHE coordinator as a new position is set by the client for the purpose of SHE issues during the project preparation phase, and he/she can go on work through whole project process. It is the SHE coordinator's responsibility to define the minimum SHE requirements for each project.

During the design stage of the project, SHE plan should be researched fully and possible SHE costs should also be assessed. Then all results, including all indications and requirement with regard to safety, health and environment, as a part of tendering document, ought to be taken into consideration by tendering contractors when preparing their bids.

Specifically speaking, designers of construction projects are required to be account of the effects of their design on the health and safety of contractors and environmental issues during the construction, maintenance and demolition of their projects. That is to say, through their detailed designs, designers affect construction of construction methods and processes. e.g, designers specify materials which may be heavy, large in area, rough, have sharp edges or are toxic, and consequently potentially harmful to humans or will pollute the environment. These all require designers to identify SHE hazards and take actions to modify their designs so that these hazards are avoided reduced and controlled. Designers' actions on these would be effective guarantee of project success.

In order to achieve above objectives effectively, following steps could be used by a designer to arrive at a more safety conscious solution to the design problems.

- The designer knows which elements of the project are currently being designed and how far he or she has progressed through the whole design process.
- The designer decides types of work and appropriate materials(e.g foundation or primary structure and safety & non-toxic materials)
- Identify the most common or significant hazards associated with relevant work.
- Finish the complete list of hazards, and consider how these may be avoided, reduced or controlled and what level of activity is appropriate according to the design.
- Judge which remaining issues are sufficiently serious to alert potential contractors and provide information accordingly.
- Choose solution with lest SHE issues as design evidence.
- Flag up the significant or unusual risks to be mentioned in plan and file.

14 TENDERING STAGE

In this stage, having finished assessment of SHE costs, it is intended that those tenderers should be able to consider the appropriateness of SHE plan to the construction methods and processes to be used in the execution of the work. Their bids should include the necessary safety and quite effective measures required to prevent the most likely hazards associated therewith on the basis of SHE plan.

During the tender award phase, the successful contractor should submit all the details required to complete the SHE plan presented to the coordinator for his approval within a specified time period. Once these details have been incorporated into the plan, the construction site can be set up and the works can commence.

15 CONSTRUCTION STAGE

Since it is executive stage for SHE plan, there is a need to ensure that all areas of the SHE plan are strictly followed. Any areas where deviations are essential must be managed effectively by use of the principles of change control. What practical work should be done is supervision, measurement and control of contractor's SHE plan performance and monitor SHE plan. Therefore, the SHE plan should be adapted to the actual construction conditions. Alternations to the project should particularly be subjected to prior analysis by the SHE coordinator in order to foresee any potential hazards associated therewith on the basis of SHE plan and file. Whenever any of these situations arise the contractor should provide the necessary details to enable the risks to be identified, simultaneously, enable associated measures that need to be implemented in accordance with the construction methods and processes to be used in the works. The execution of these works may only take place once the details have been approved and incorporated the SHE plan.

In practical execution, e.g. in Europe, the framework directive for safety and health of workers and environmental issues also considers the client bears the duty to ensure safety, health and environment in every aspect related to the work.

16 COMMISSION STAGE

In this stage, works on SHE matters are focused on review previous whole process on SHE administration, evaluation of SHE management and feedback to all stages in order to adjust and correct methods & strategies on dealing with SHE issues. e.g. correcting design; changing construction methods; improving operations and procedures; using new building materials; etc. Of course, ultimate goal is to reduce obstacle on SHE matters for improving construction project success.

Specific speaking, the definition of major SHE hazards and assessment risk would be re-adjusted. Then re-establishing or correcting SHE plan will be followed by re-assessment of SHE costs. Finally, in the construction stage, it would be necessary to adjust supervision method and key point on SHE performance to appropriate improvement of project.

17 INTEGRATION OF QUALITY, SAFETY AND ENVIRONMENT

Superficially, it seems that there is no relationship between SHE and quality. But, in fact, quality is “sole” of a project, discussion of this topic therefore would have realistic meaning for project success.

Client, designer and contractor have been continuing to develop a number of separate management systems to control the work done on construction projects. Traditionally, these management systems remain independent from one another. But the integration of these management systems would be of significant benefit in improving the productivity and quality of the management of the construction process (see figure 1, figure 2)

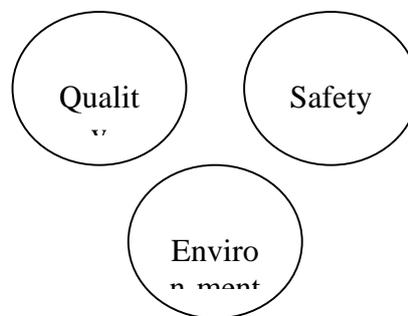


Figure 1 Traditional quality, safety and environmental systems

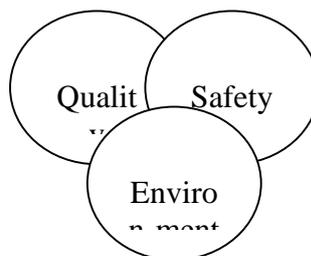


Figure 2 Idealised integrated quality, safety and environmental systems

18 SAFETY AND QUALITY MANAGEMENT

In the construction activities, accidents causing personal, social and economical losses often occur in spite of the a lot of information and, in some countries, regulatory documents on accident prevention techniques. Generally speaking, the

probability of getting injured as a construction industry worker is greater than that of all other industry. e. g in Hong Kong, it is on average 5.8 times greater than other. The high rate of accident reflects that both employers and employees are unconsciously working under risk with the need for additional safety precautions and measures at the construction sites.

As one of prerequisites for quality management, safety regulation and law has been set to control the safety environment and been reinforced with an increased level of fines and penalties. Furthermore, as an element of strategies of a construction project, safety has close relationship with quality management. The ISO standard 8402 (BS1, 1994) defines quality management as “the aspect of the overall management function that determines and implements the quality policy”. Safety management can be addressed in the same way as quality assurance. Safety management in term of loss control can cut down accident losses and achieve optimum cost, which is an essential element of modern quality management.

In order to ensure high quality in construction projects all time, not just for a specific project, construction companies can develop their own safety policies and procedures most appropriate to their workplace and modify in aligning with the changing circumstances. Essential frameworks for safety management system are:

7. A safety policy that suits the company goal.
8. A safety department for discussing and monitoring safety measures.
9. A set of standards and plans for policy implementation.
10. Measure performance by conducting regular safety audits.
11. Review audit result & corrective actions.
12. Provide safety training for all workers especially that engaged in hazardous trends.

On the other hand, a quality system built in a TQM perspective should address the set of requirements from the major stakeholders in order to attain business excellence. i.e quality management system is a key concern for successful construction project. At the same time, the focus of a construction company is changed from merely assuring to customers' compliance with their requirements, to a wider approach taken. Comprising other stakeholders — the “umbrella” of TQM should cover a number of other requirements, among which occupational safety and health is in the front row.

19 ENVIRONMENT ISSUES JOINING TO SAFETY & QUALITY

Suppose that an industrial project is under construction or having been implementing and starting to operate, a great amount of waste is emitted and resulted in damage of surrounding environment. Can you say it is a high quality

project? Definitely, NO. So, it has great necessity for integrating environment into safety and quality system. In recent years, one aspect of change in quality, safety and environment has been the development and a growth of environmental impact polices and control system.

It has been recognising that it is neither practical nor efficient to implement separate functional management systems of these three areas. This reaction is heightened by industry's scepticism about presiding standards and legislation. Some believe that they can have a negative effect on the way their organisations operate. Pape (1993) believes that these deficiencies can be eliminated by one modular and integrated management system capable of handling all three areas in a consistent manner. In addition, Dennison (1993) added that a single integrated management approach might even accelerate improved performance in the area of Quality, Safety and Environment management. There are several reasons why a single integrated QSE system would be effective in project:

- It represents the way in which organisations actually do business. In that, these matters are intrinsic to the performance of contractual, legislative and regulatory obligations described by the nature of their business practices.
- It minimises the volume, administration and maintenance of the documented management system.
- It provides a more use—friendly approach to the management of these elements in their application.
- It promotes the coordination and balance of these three elements.

20 CONCLUSION

Through above illustration and analysis, as one essential and important aspect of successful project strategy, SHE objectives should be achievable and must be achieved. She aims should be consistent with other project management objectives of time, cost and quality. Ultimately, in order to complete the project, following three aspects in SHE would be achieved:

- **Preventing** incidents that arise through company activities
- **Creating** a healthy work environment and actively promoting the health and well-being of staff.
- Pursuing in their operations progressive **reduction** of emissions, effluents and discharges of waste materials that are known to have a negative impact on the environment with the ultimate aim of **eliminating** the negative impacts.

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IT IN CONSTRUCTION

Abstract

This project report is focused upon the development and Role of Information Technology in the present day Construction and Design Industry. This report acts as a reference for softwares and programs introduced by the Information Industry giants towards the Design and Construction Industry.

Initially, the report gives a brief introduction about the Information Technology. Characteristics of Design and Constructional Organizations are derived later. Impacts of Information Technology implemented in the Design and Construction Industry are also stated. A general overview of the Software available for the Design and Constructional Industry are written and discussed. These include Information Management Software's and Systems along with focus on Cost Planning Analysis Softwares.

Later part of the report deals with the Electronic Communication software available in the market, for example, Internet and Intranet. Advantages and Disadvantages are covered and future development in computing for the Construction and Design Industries are discussed.

After that it also throw light on the future trends and the interoperability of the softwares in the construction industry. The report ends with a conclusion, which states that Information Technology is moving fast and is becoming increasingly user friendly, it is also supporting and speeding up Traditional Manual Procedures into more informative and accurate procedures.

introduction

This report focuses our attention towards the adaptability of the concept of Information Technology in to the Construction Industry. The Report focuses its purpose on looking towards what Information Technology could do to improve the ways in which information is handled and reported. According to Crow, Information Technology is the amalgamation of those technological systems, which transmit, exchange and display information status. This encompasses 'Computers' and advanced 'Communication Systems'. Computing today covers all aspects of Information Technology, Office Automation and all Communications. Here, application includes Data Processing, Word and Text processing, Information Storage and Retrieval, Decision Support Systems, Financial Modeling and Computer Aided Drafting and Design.

It has been observed in recent years, that, many Projects, big or small, have been dealt to their extremes with the help of Information Technology offered. This only proves that in due course of time, people are becoming more dependent on to its existence. Specialists are employing computers in al phases of the Design and Construction process. However, each organization uses its own computer tools to the advantage of its particular aspect of the project.

Change is occurring elsewhere assisted by new forms of procurement which removes the constraints of archaic methods of working. For example, On Line database are on the increase, an indication that more information is shared.

The rate of change of computer products and services is extremely rapid, often with the result that current systems soon become outdated. This rapid development of computer based technology is having a profound effect on the way people communicate. Super Computers, the Inter Net, E- Mail, Electronic Data Interchange, 3D Graphics with virtual reality, Artificial Intelligence, Stereoscopic Interactive Television, Telecommunication, Video Conferencing and Cellular Phones are amongst the many communication developments made possible by ever increasing technological capacity.

In the following part of the report, we try to throw light on the present and the future developments in Information Technology and its use in the Construction Industry with respect to their role in Project Completion. Also we try to examine the present and future needs and the abilities of IT to support the construction industry because the development in IT is very rapid and if one do not try to improve him with time he can be obsolete after some time.

The rate of change of computer products and services is extremely rapid, often with the result that current systems soon become outdated.

The rapid development of computer-based technology is having a profound effect on the way people communicate. Supercomputers, the Internet, E-mail, Electronic Data Interchange, 3d Graphics With Virtual Reality, Artificial Intelligence, Stereoscopic Interactive Television, Telecommuting, Video Conferencing And Secular Telephones are amongst the many communications developments made possible by ever-increasing technological capacity.¹

¹ "INFORMATION TECHNOLOGY AND THE EVOLUTION OF THE QUALITY SERVEYING PROFESSION – FUTURE DIRECTIONS", by R. Best, G.de Valance, C. Langston and P. Smith

ch- 1:Information Technology in Construction

Computers have become the most significant factor that is present in almost every aspect of lifestyle and influencing all the fields like specified workings, commerce, industry and communication etc. Computers have some packages for all sorts of people and industries and the use of computers are becoming more and more as time passes by. In construction industry Information Systems have a very important role in it and computer is being used in each featured item of construction. Now it is impossible to think of achieving the same results as without the help of the computers. From the client to the contractors of the project every body is dependent on this technology.

1.1: CHARACTERISTICS OF DESIGN AND CONSTRUCTION ORGANIZATIONS

Design and construction organizations function in an atmosphere that is characterized by certain features, which lend themselves to successful applications of IT. Some of these characteristics are outlined below. The corresponding potential IT advantages is also pointed out with each of these features.

- **Dynamic process:** the work atmosphere is continually changing both at the project and at the organization level – automation and quick communication enabled by IT can be extremely helpful, analyses can be performed and decisions can be made quickly with the help of IT.
- **Process is based on the complex inter-relationship among the various participating entities** – IT can reduce the need for bureaucracy and hierarchy of interaction and can enhance integration of organizational activities.
- **Team-work is required to construct a facility successfully:** organization involved in the construction industry are project oriented and networks can be very effective – IT can be employed as a facilitator to build teams overcoming the barriers of time and distance.
- **Operations in the construction industry are people intensive and cannot be completely automated or mechanized** – IT will allow people to communicate in a flexible atmosphere by relieving them from routine work. IT can also be employed to coordinate the activities of many participants typically present in a construction project.

- **The solution of construction project problems are highly dependent upon the experience and judgement of professionals and also involved uncertainty** – IT will be helpful in dealing with a high level of task uncertainty usually involved in design and construction operations.

1.2: THE IMPACT OF IT IMPLEMENTATION IN CONSTRUCTION

The most important issue in the implementation of IT, which distinguishes construction from other sectors, is the integration problems: that is how to exchange information among different designers and also between designers, clients, and contractors. This problem has been the subject of study of national level projects in Finland (Bjork, 1985) and other countries, but is far from being resolved. A relatively easy approach to solving this problem would be for all participants to use the same information systems and share their central database. It is also now becoming technically feasible to exchange data between dissimilar systems and therefore the use of the same information system is not imperative, though it is desirable.

At the design stage, information used is diverse and includes details of the emerging design of a building. To illustrate the obstacles to the strategic use of IT and the limitations of current approaches, the emerging design is used as an example. On the other hand the

discussion of the construction stage concentrates on the integration problem as well as the impact of various forms of IT application.

1.2.1: Design

Architectural design is very much an intuitive activity with the creative abilities of the architect playing an important part. The architect needs to confer with the client, engineers, contractors and maintenance managers. These communications, which should take place frequently, are at present limited to a few meetings to resolve major design or construction problems, and rarely, to discuss perceived maintenance problems.²

The current CAD systems are design aids that allow predefined components or parts to be assembled, in two or three dimensions. As such, these are well suited for engineering design activities such as electrical circuits or mechanical systems. The only components in building design that have some standard sizes are doors and windows and to some extent, panels for external cladding and internal partition. Architectural design is not, and will not be in the immediate future, a process of assembly parts. An architect and other members of the design team, views a building as a 3-dimensional object, but a builder perceives it as an assemblage of walls, beams, floors, and so on. Therefore, the current CAD systems not suited to early sketch design stage. Current CAD systems are mainly useful as drafting tools, at detailed design stage, for generating production information or working drawings.³

The drawings produced manually or on a CAD system are used exactly in the same form in later stage. CAD systems used in engineering design are different; information from a CAD data file can be fed into a Numerical Control machine for production operations. The use of CAD system at present time does not provide any benefit at later stage in construction industry. It only provides saving in drafting manpower. Architect offices in many countries around the world have recognized this. It must be noted that we are simply talking about transporting drawing from the architect to, say the structural engineer, or to the government agency responsible for building control. This will no doubt speed up the process of transporting files, but the use of CAD system neither speed up the structural engineer works. The structural engineer has to generate the data needed for analysis and design, and feed this into the computer. It should be noted that if changes were made to drawing at this stage, the engineer would have to go through the same tedious process once again.⁴

The above example illustrates quite clearly the problems in using current CAD systems. If we consider the other design aspects (the mechanical and electrical system, and so on) the current use of IT in construction is only the tip of the iceberg. We must also remember that information about the emerging design is only one part of the information use by the design teams overall.

1.2.3: Construction

One of the activities that potentially use IT in construction stage is the translation of the design into a constructed building. The final working drawings and corresponding

² Applegate, L. M., Cash, J. I. And Quinn Mills, D. (1988) INFORMATION TECHNOLOGY AND TOMORROW'S MANAGER. Harvard Business Review, 66(6), 128-36.

³ Gerstain, M.S (1987) *The Tchnology Connection: Strategy and Change in the Information Age*. Addison-Wesley.

⁴ Betts, M., Cher, L., and Ofori, G. (1991) *Strategies for the Construction Sector in the Information Technology Era*. Construction Management and Economics, 9, 509-28.

specification for material and components are given to the main contractor for construction on site. Two of the main activities of construction operations (project activity planning and resource planning) do not fully benefit by current IT tools. The scheduling activity could be done using advanced software known as Project Management system, widely available for use on PC. The information needed for this has to be generated from drawings. This however, does not diminish the merits of project management software as stand alone system and the benefits they provide in planning and controlling construction activities. Nevertheless, IT has yet to solve the communication gap between designers and contractors. The variety and sophistication of software available for post tender stages of construction project makes one wonder about the possible reasons for contracting firms not using this technology. Indeed, the variety may cause selection problems, and in order to use sophisticated software contractors may require training and other services from vendors. The large number of sub contractors working for the main contractor would require that all of them either use the same project management system, or use systems that can communicate with one another. This is far cry from factory production of engineering artifacts, which are on an assembly line where every operation can be controlled. It would require a highly interactive system operating all contractors and sub contractors resource and activity planning programs in a network. This maybe technically feasible, but will it ever be a reality? This again illustrates the specific integration problem faced in construction and the difficulty we have in implementing IT.

Chapter 2: Software used in Construction Industry

Following are some packages that are being in use heavily in the construction industry:

2.1: Design Softwares

The design stage of any project has the most important factor on which all the other strategies and the planning is being made. Architects and Engineers use different types of Cad systems to develop the design. There is a rapid change in the technology by the time and the software is improving with the demands and the, after that some of the software are included in this list, which shows the future trends of the industry. These future trends and the abilities can change the whole concept of the designing and the implementation of future usage of IT.

2.1.1: CAD Systems

CAD is used in amply in project Designing and construction. Documenting drawings within CAD systems will be much simpler while consultant inserting an amended excessively in their existing CAD document. In addition, sharing CAD data is beneficial to all members of design team; that everyone is coordinating in the same information; which is more accurate and easier, also the need to redraw information is eliminated. Designing and drawing in three dimensions is also available within this system and we can have a clear view of our imaginations even before the reality. Advantages using CAD systems within Computer Integrated Manufacturing (CIM) and Computer Integrated Construction (CIC) systems are:

- CAD has stimulated awareness of the new potentials of networking and shared databases,
- Better productivity in the production of detail-rich drawings and in the handling of design changes.
- CAD could offer flexibility throughout the whole process of design manufacturing and construction process.

Nowadays we can find many kinds of CAD software some of them are:

2.1.1.a: AutoCAD

It has become apparent in the CAD industry that the need for designing in three dimensions exists, therefore Autodesk has developed AutoCAD with the latest versions: release 14. AutoCAD in 3D is easy to read, and effectively designing and drawing 3D models. Engineers are now able to design computer generated prototypes to check sizes, fits and tolerances. And architects will be able to draw 3D floor plans and have their clients view them from any angle.

2.1.1.b: 3-DS

This is also a program from Autodesk, which allows you to render the 3d image of your drawing, and we can also make animations with the help of this program. The latest version of this program is 3-d Max.

2.1.1.c: MiniCAD

The latest version of this software is MiniCAD 7.0. This software will automatically create 2D and 3D framing plans and fully dimensioned elevation plans. For more detail of MiniCAD please see Appendix 1.

2.1.1.d: MicroStation

This is also a Cad oriented program that allows you to draw any kind of design drawing. This program is in use, in the registration offices of New South Wales for any submission drawings.

2.1.1.e: ArchiCAD

The latest release of ArchiCAD is ArchiCAD 5.0. By using this release we can draw and make the rendering in the same software and also we can make animation without importing our drawings to any other programs. For more details please see Appendix 1.

2.1.1.1.f: Collaborative 4D-CAD

4D-CAD is a tool in modeling a 3D CAD model with an associated construction schedule included in the animation sequence⁵. This tool encourage a higher level of communication between the client and other project members, where timed construction animation sequence served approval and improvement of construction manager clients, designers, subcontractors and community members.

2.1.2: CorelDraw

The latest version of CorelDraw is release 6. CorelDraw 6 is a comprehensive 32-bit package that should fulfil all but the most demanding graphics, image-editing, 3D-rendering and multimedia tasks⁶. Please see Appendix 4 for more details of CorelDraw.

2.2 Management Softwares

2.2.1 Project Management Software

Where the problem is to handle and manage all the informations about the project then the simple answer is to use some management software. Organizations currently use PM OfficeTM to help by attaining the goal in term of project collaboration and communication. PM OfficeTM is the project management institute's secure Internet enterprise solution. It is accessible from anywhere in the world using either Netscape NavigatorTM or Microsoft ExplorerTM. This software integrates with all the popular scheduling tools, including Microsoft ProjectTM, PrimaveraTM Scitor Project SchedulerTM, OpenplanTM and ABT WorkbenchTM.

Many of software are being used in implemented project Management includes:

⁵ CIFE Seed project, *Collaborative 4D-CAD*, Stanford University, 1996.

⁶ Anonymous, *CorelDraw 6, Reviews*, zip.com/rocket/draw, 1998

SOFTWARE	PURPOSE
Novell Netware™	Network communications
LAN for Workgroups™	Terminal emulation, file transfer, network and printing support
Microsoft Windows™ 3.1	PC Operating system
CLIENT™	Project information management
WORDPerfect OFFICE™	e-mail
WordPerfect for Windows™	Word processing
Lotus™/Excel™	Spreadsheets
Graphite™	Transfer of CLIENT™ data to a third party
HP UNIX™	Operating system
UNIVERSE™	Post-relational database used for CLIENT™ application development

Table 1: Project Management Software

Source: Archer, Et all, Multi-Participant Project Information Management System, Crow Maunsell Management Consultants Ltd. P.7

3.2.2: Project 98

Project 98 is the latest Microsoft effort for project management software. One of the main benefits of Project 98 is its close affinity with the rest of Microsoft Office. The user will instantly recognize and feel at home with the way in which menus, toolbars and options are organized. If the user also use Outlook they will recognize the layout of information on screen and find it relatively easy to navigate and cope with designing custom views⁷.

The user can even point a link to a particular place in a document, and also can send email from within Project 98.

2.3: Computerized Project Administration (CPA) Softwares

2.3.1 CPA Software

The objectives of develop computerizing in project administration are to provide a Project Manager with a complete information tool, to create a main project data file which could be held on a network server and have other data files containing a Project Manager's personal information. For case study, it can be overviewed here a successful project team of Colin and Parters designed, coded and implemented a software package designed specifically for Project Managers. Please see Appendix 2 for more detail of the capabilities.

2.3.2 Cost Management

Computer based systems for managing costs involve estimating systems, cost management systems, production control systems and accounting systems.⁸

⁷ Journals, *PC Advisor*, Project 98, April, issue 31, 1998, p.173

⁸ Greste. O, Hand Out, Cost Managemet, Computer in Construction Management, School of Building, UNSW, 1998.

Most commercial accounting software is designed for retail or manufacturing firms and may not be well suited to the needs of the larger construction organization. But some low-cost and mass-market programs are fine for small and medium-size firms.

Regarding application and limitation of accounting and engineering software mostly have to do with the scope and the capacity of the software, versus the need and the abilities found in a given company or project.⁹ The computer system provide these capability as an integrated set of modules in a package. Some computer systems which is becoming familiar among the user such as;

- Prolog Manager; provides information & cost management integrated with WinEst estimating.
- Timberline with CSSP software (*Everest* estimating + *Cheops* cost accounting).
- Software Shop Systems; make accounting systems design for construction contractors.
- Peachtree Software; makes a range of accounting products for both Macintosh, for PC DOS and Windows Systems.
- West: is the cost planners software to assist them to prepare the cost plans.

2.4 Information Management systems:

Information management as a discipline can still be carried out with manual systems, however current business technology demands computer based information systems, specifically for the procurement strategy, and the system specification. BCAider is now being used on regular basis for simplifying design and approvals. Integration with the widely used AutoCAD system and the ABSAC appraisal system has further enhanced its usage.

The use of multimedia including virtual reality for computer is now being familiar among users. Additionally, interactive video and image is also being implemented in construction industry. Information management system implementation occurs in the following phases:¹⁰

- System evaluation and specification
- System modification, implementation and training
- Establishment of the project data base
- Operation
- Transactional entry
- Monitoring
- Reporting

The software can be used includes:

2.4.1: Microsoft Access

Access is “relational data base” development tool. It is used to develop comprehensive data base applications for multi-user usage in which many data base tables are related to each other. The latest version of this software is Access 98. Access 98 is the powerful database program that comes with Microsoft office 98 Professional.

⁹ Paulson, B C & M'graw Hill, *Accounting and Cost Engineering*, Computer application in Construction, p.450, 1995.

¹⁰ Darren, et all, *Practical Information Management in Development Project Management*, unpublished paper, 1993

2.4.2: Microsoft Excel

Spreadsheet programs such as Microsoft Excel provide simplified operations of the type usually associated with databases, namely data entry, sorting, searching and reporting. The latest version is Excel 98. This software is the bean counter of Microsoft Office. It enables us to create spreadsheet that can perform meticulous calculations with uncanny accuracy.

2.4.3: CAD Frameworks

CAD frameworks play a role in building construction administration as well as in operating design. The advantages using this software are:¹¹

- Help the engineer to maintain an overview of his design descriptions.
- Tell the design engineer which tools are available for which design tasks and give information on their usage.
- Make design projects manageable
- Allow teams of engineers to cooperate effectively on design project.

¹¹ Pieter Van Der Wolf, CAD Frameworks, Principles and Architecture, London, 1994, p.2.

Ch-3: Networking and Communication

History of communication has started from the birth of human being and from that day man is trying to invent the more comprehensive and quick way to communicate to each other. Networking has been using starting from there to make a good link between the information and knowledge. In construction industry networking has a very important role for comprehensive and updated communications. Net works are collection of connected devices, e.g. computers, printers, PCs etc, and it is to make the communication easy and faster among them. Hardware devices and software packages are needed to install the networking in order to join any system. Sharing programs, data files, messages, printers and any other expansive devices are the basic need to have networking. Following are types of networking that is necessary to know for the better workability and communication:

3.1: Local Area Network (LAN)

This network is used for a local office, an office building or any sharing buildings nearby.

3.1.1: Advantages

- To share the data, software programs, all the expanses recourses like printers, plotters, scanners and other systems related to computers.
- We can develop our system to our way of working or any data base program so all the computers and PCs can be formatted and controlled accordingly.
- We can share data file via file server (client server) and also directly from other users.
- It comes in “bus”, “star”, and “ring” formation so we can chose according to our needs.
- We can have backup all user files to server.
- The sharing is fast as speed is 100 Mbps so it can easily use for sharing.
- Every person can easily connect to it with easy Logan no and password.
- We can communicate with each other but not with outside the network.

3.1.2: Disadvantages

- Though we can share the software but 10 users are the limit for one registration.
- We need some extra cost and hardware to connect our systems to network.
- We cannot communicate with people outside of network.
- Maintenance cost is also required.

3.2: Wide Area Network (WAN)

Wide Area Networking can link all the people to each other who have the connection. This kind of networking provides a server (program) which fulfills the client request by forming the task requested. Server program generally receives requests from client programs, execute database retrieval and updates, manage data integrity and dispatch responses to client requests. The server process acts as a software engine that manages shared recourses such as databases, printers, communication links or high power processors.¹²

3.2.1: Advantages

- We can link it with our private LANs and other systems prior to distance.
- This can link anyone in the whole world.

¹² Ravi Kalakota <kalakota@uhura.cc.rochester.edu>

- Through WAN we can communicate with other branches and we can share our work with other consultants, which is the most recent development in the entire field and most of the softwares are designed according to that. With the help of World Wide Web an opportunity can be provided for worldwide people to know any organization and it might be helpful to increase our projects.
- We can give the bids from the Internet to different projects and can have the opportunity to expand our business.
- We can communicate with all others with the help of Internet services through WAN.

3.2.3: Disadvantages

- Speed of data converting in WAN is lower than LAN.
- We have to take the link on lease from any communication careers or we can make a private physical link, which will add to our cost.

3.3: Integrated Services Digital Network (ISDN)

This is an advance formation of WAN, which provide the transmission of all types of data (text, voice and images)

3.3.1: Advantages

As the most of new researches in both the software and hardware are going toward multimedia with texts, sounds and videos then this type of networking is very necessary to have for the better communication.

It is much faster than WAN as its data transfer speed is 64 Kbps.

3.3.2: Disadvantages

All the software and running programs should be upgraded to achieve the high standards of communication.

Cost is a miner factor but with reference to time and advantages it is not that much.

3.4: INTERNET

It is the enormous global WAN connecting many hosts or servers and client computers. It is the fastest growing communication resource on earth, as in Aug 1981 it had 213 hosts and in July 1995 it has 6,642,000 hosts and after that God knows.¹³ It provides the following types of communication:

- Electronic mail (e-mail)
- World Wide Web (www)
- File Transfer via FTP
- Connecting to other computers via Telnet
- News Groups
- Internet Relay Chat (IRC)
- Intranets
- Electronic Commerce (EC)
- Security of Electronic Transactions

3.4.1: Objectives of Internet

The objectives of the establishment of Internet are

- To link geographically distant research team

¹³ Journals, *PC Advisor*, Networking, May, issue 31, 1997

- To allow rapid exchange of research result
- To document the research process
- To facilitate collaboration on national and international scale
- To allow access to information on remote systems

3.4.2: Role of Internet in Construction Industry

In construction projects, a project based data network is used for providing any relevant information about that project to the residents on that network. It can be divided into the pre-construction and construction phases. In each stage any project participant can access any relevant system or database whenever necessary. By using some clicks any information can be called up with the help of networking and databases along with sounds or videos.

3.5: INTERANET

The Intranet is a closed private network, which is not accessible by the public but, can be freely used only by its members. Information is available in Intranet only to people inside the company. Intranet can be used with the same hardware and software as the Internet but the difference is as Intranet exists within the organization. The information can be blocked for outsiders but only members can approach it.

The share of information can be illustrated by the following figure:

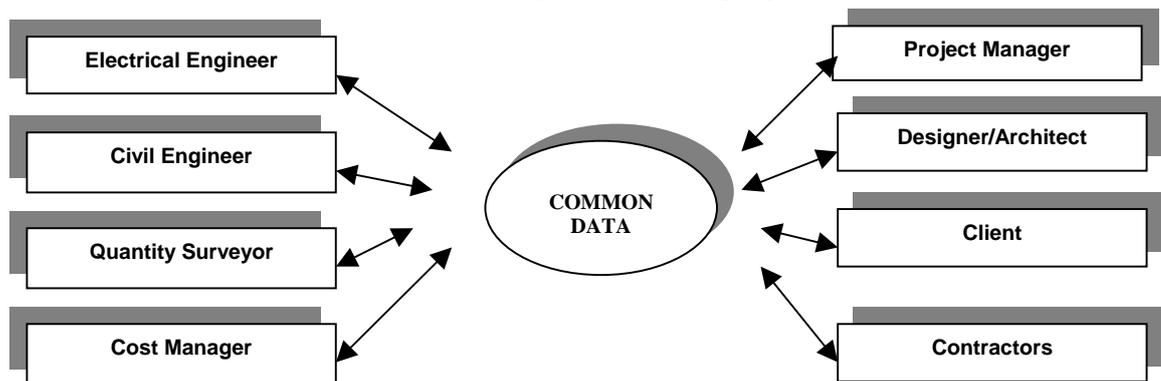


Figure: Today's Fractured Information System.

Source: IFC End User Guide. WWW.Interoperability.com

3.5.1: Advantages

- All members of the project team can share data for faster and more direct communication.
- Eliminated errors of interpretations.
- Eliminated large paper files.
- Enforced standard methodologies of input.
- Reports are standardized and current as the last input.
- Dated and registered documents showing transmissions, recipients and actions will minimize the disputes and claims.¹⁴

¹⁴ Building Engineering Services Technology Journal, *Construction Networks and Project Intranets*, vol.1 No.3 March 1996, p.15

ch-4: FUTURE DEVELOPMENT IN COMPUTING

4.1: Future of IT in Construction

The computing in future will be entirely different than the running pattern of it. The multimedia and latest developments have given the advantage to the architect, with the help of digital cameras they can see the actual situation at the site and make necessary changes if they want. They also can talk and see the progress of the project and make the necessary decision with the help of all concerning consultants by sitting in their own office. The future software would be sensitive enough to recognize the environment and the logical needs of the concerning design.

The future development in Cad Systems allows the user to be more sensitive for the concerning object and the objects around it. For example, let's assume a designer wanted to place a door in the wall, that door would be sensitive enough to know the user's requirements and can help him by choosing the right place where it can be fixed. It will also be aware of columns or on going ducts for air conditioning or any other objects that can affect that move. This gives the need for interoperability among different players of the process so that the information cannot be wasted but every information can be utilized in a proper way.

IAI International Alliance for Interoperability¹⁵ is working on this charter and trying to help in making the standards for all the software to be compatible with each other. Followings are some recent researches that are being in consideration:

4.2: Computing For AEC/FM Industry

AEC/FM industry is comprised of a large number of small (often less than five persons) businesses. Now days the whole computer technology is going towards the best networks and effective design databases. It is considered, as the good networking is also a computer and the help of this computing technology would manage all the businesses in future.

Initially on any architectural projects survey data was sent to the civil and electrical engineers and documentation to architect for design and document the site works. Preliminary sketch designs were prepared by the PWD project architects (working on Microstation) and translated for the documentation architects (MWA). Next to this, a third firm of architects was commissioned to develop the design. This firm produces manual drawings, which were drawn on CAD by MWA and developed into construction drawings. Changes can be added to these drawings and by the stage of final construction all the consultants won't be having the same kind of information about the same project on which they were working. The situation is defined by the following figure:

¹⁵ Web Site = <http://www.interoperability.com>

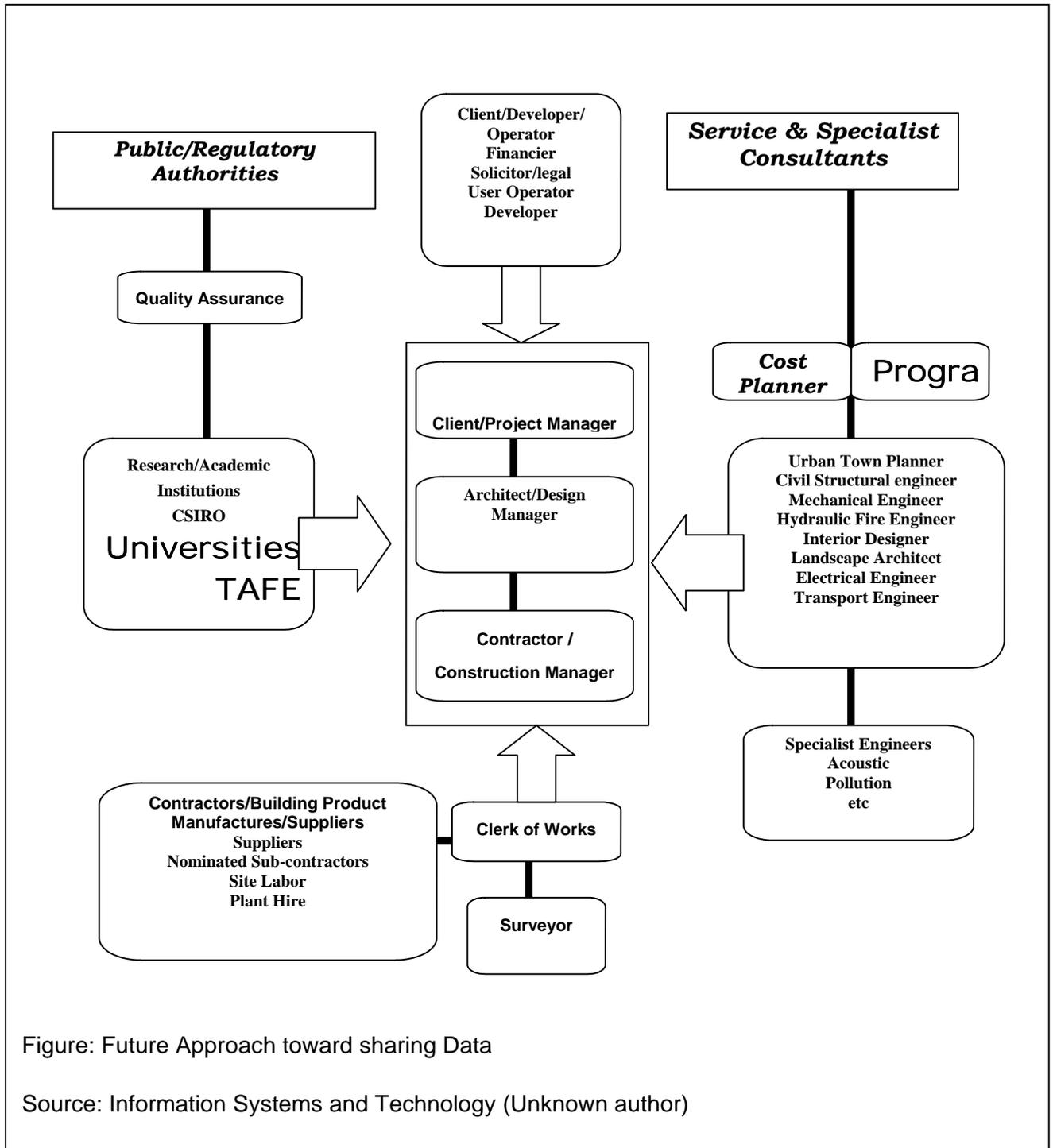


Figure: Future Approach toward sharing Data

Source: Information Systems and Technology (Unknown author)

Traditional technique of CAD sharing the file with DXF or IGES of BET focus group is replaced by new technique in which design discussions are recorded in one or more databases, from which documents can be extracted on demand. The above two figures are showing the difference of basic idea.

4.3: need for International Alliance for Interoperability

International Alliance for Interoperability (IAI)¹⁶ is working for common working grounds to enable software interoperability in the AEC/FM industry. Its mission is to define, promote and publish a specification for sharing data through out the project life cycle, globally, across disciplines and across technical applications.¹⁷

Interoperability requires that concepts that are common between different software applications be understood as common and declared accordingly. This understanding needs to be present within the computer systems running interoperable software and not just by their human operators. Since computer systems do not have the power of interpretation expected of a human user, development of the necessary understandings means that

- Names given to classes correspond between applications;
- Meanings assigned to class names are consistent between software applications;
- Sharing of classes between applications is unambiguous;
- Relationships defined between the objects (including inheritance relationships) are compatible

Concepts of interoperability must be developed in collaboration. End-user and software developers must work together in development. It is for these reasons that Industry Foundation Classes¹⁸ are being developed by IAI.

4.4: ifc model architecture

The IFC Architecture has been developed using a set of principle governing its organization and structure. These principles focus on basic requirements and can be summarized as:

- Provide a modular structure to the model
- Provide a framework for sharing information between different disciplines within the AEC/FM industry
- Ease the continued maintenance and development of the model
- Enable information modelers to reuse model components
- Enable software authors to reuse software components
- Facilitate the provision of upward compatibility between model Releases

The IFC Object Model Architecture provides a modular structure for the development of model components. The scope of IFC Object Model is “enabling interoperability between AEC/FM applications from different software vendors”. The whole concern is given to the development of sensitive software that can understand the process and can be able to understand different information.

¹⁶ Web Site = <http://www.interoperability.com>

¹⁷ IFC End User Guide, Industry Foundation Classes – Release 1.5 p3

¹⁸ The intention of the IAI is to specify how the ‘things’ that could occur in a building (such as doors, windows, walls and so on) should be represented electronically. These specifications represent a data structure supporting an electronic project model useful in sharing data across applications. Each specification is called a “CLASS”. The classes defined by the IAI are termed “INDUSTRY FOUNDATION CLASSES” or IFC.

appendix 1

MiniCAD

The latest version of this software is MiniCAD 7.0. This software will automatically create 2D and 3D framing plans and fully dimensioned elevation plans. MiniCAD 7.0 will use QuickDraw 3D 1.5's interactive renderer and lighting capabilities.¹⁹ MiniCAD presents models as colored stills or as movie along a path. We can choose between AutoCAD's DXF (Drawing Interchange File) and DWG formats for file transfers. MiniCAD arcs appeared as wavy polygon in AutoCAD. MiniCAD outputs in AutoCAD Release 11 and 12 format, and reads release 11,12 and 13. Hits of this software are:²⁰

- Smart cursor
- Work with more graphical constructs
- Rectangular dual-snap grids rotate any angle
- Associative hatching
- Automatic Framing

And the hang-ups are:

- 3D interface
- tools still neglected
- glitches in DWG file transfer

ArchiCAD

The latest release of ArchiCAD is ArchiCAD 5.0. If you are comfortable doing most of your design in plan, you'll find that ArchiCAD a winner. Most of its new tools are unique among CAD systems.²¹ Some excellent tools are provided such as

- The Complex Pitched Roof Tool,
- The Arc tool,
- The new Barrel Vault tool
- The Dome tool
- The new Zone tool
- Etc.

These roof tool can import and exports shapes from and to other CAD packages includes PICT, AutoCAD DWG, DXF formats, 3D information to Strata Vision, RenderMan, topCAD, Atlantis, Wavefront and Electric Image Formats.

ArchiCAD also always been good at managing project ²², by the new Zone tool takes ArchiCAD into the field of facilities management. The hits of this software are

- New roof tools excel at enclosing spaces quickly
- New textures for the fast Phong Renderer
- Facilities management feature generates useful reports
- Smarter cursor

On the other hand, the hang-ups of ArchiCAD are:

- Limited graphical editing in 3-D

¹⁹ Gulic R. *MiniCAD 7 to refine 3D, Smart Cursor*, MacWeek online, March 21, vol 11, issue 12, 1997.

²⁰ Johnson, T.E, *MiniCAD 7.0 rises above pack*, MackWeek Reviews, June 6, vol 11, issue 23, 1997.

²¹ Johnson, T. E, *ArchiCAD 5.0 raises roof with enhanced productivity tools*, The Newsweekly for Macintosh Managers, August 26, vol.10, no.33, 1996.

²² Ibid. p.3

- Rudimentary texture parameter control
- Awkward database importing

Appendix 2

CPA Software's capabilities

The objectives of develop computerizing in project administration are to provide a Project Manager with a complete information tool, to create a main project data file which could be held on a network server and have other data files containing a Project Manager's personal information. For case study, it can be overviewed here a successful project team of Colin and Parters designed, coded and implemented a software package designed specifically for Project Managers.

The software's capability includes:²³

Project Initialization

Contains details of all operational names, addresses, telephone, Fax numbers etc. also contains general information about each operative such as the date of last contact, details about the operatives business, detail of project opportunities etc.

Correspondence

The aim is to have information created, edited, printed and faxed in most cases by the one individual and on average within a few minutes. It allows the manager to create correspondence in a standard format quickly and easily.

Information request

The RFI is logged in with days and details sufficient to track its progress.

Site Instructions

Contains all instructions given to the contractor at site.

Design Instruction

Instructions issued to consultants are logged and tracked in a similar way to RFI's.

Memorandums, Letters and Fax's

All information can be retrieved by using key words, correspondence number, or by scrolling through subject lines quickly from any computer station.

General Correspondence

All word-processing are arranged in the file server's directory using the same codes as hard copy filing.

Meetings

An individual minute of each meeting is available. This allows direct updating of related files.

²³ ColinGing & Partners, CPA Management proposal, An Overview of the Software's capability, p.15, 1998

Design Briefs

It is designed to provide management information for the preparation and progressive control of an initial project brief.

Quality Management

This system has all the convenience and interaction with other files to allow quick and accurate recording of quality defects.

Documentation Control

A regular report are distributed to the project team within minutes of a request, including monitor-drawing details and produce accurate forms and reports to guarantee the accuracy and distribution of design drawings, shop drawings and samples.

Cost Management

It is designed from the original feasibility budgets all revisions, transactions, claims, commitments and variations are recorded so that 5 years down the track every dollar can be accounted.

Tendering

This system element allows the input of drawings, specification and contractual information and combines it with Contractor information from the project initialization file.

Time Management

Critical Path Methods (CPM) are included in this system element, the manager has the ability to monitor the progress of activity and generate reports both numerically and graphically.

Construction Management

This system element Include any special information of the Construction Manager.

Action Diaries

This “action list” include information from more than one project, also list all Memo’s, Site Instruction, Non Conformance Notices, etc.

It is important to understand that accounting and cost control are becoming the most basic management functions on today’s construction project, that is why among those software’s capability above, it will be described further about Cost Management.

CONCLUSION

Information Technology is already been widely used in Manufacturing and has fully adopted by the construction industry as to save time and cost. To achieve the absolute advantage from the industry, softwares and other complementary packages are developed and being in the process of development as time is passing.

Information Technology in the Construction Industry is moving fast and is becoming increasingly user friendly. It is also supporting and speeding up Traditional Manual Procedure. Unfortunately, a small usage of IT is in use till now but due to the development in Electronic Communication it is predicted that this would change the concepts of working in all the industries of the world. It is much easier to have the ultimate achievements by creating databases that could generate both graphical and non-graphical data and use this information regardless of the distance and the time.

By the use of future concepts of computing it will be much perfect for the players of the construction industry to perceive and implement the project. The support of the IT to the construction Industry is very strong and the usage is incredibly increasing day by day. It is possible now to design the project in USA, prepare the Drawing in Australia and implement those doings in Malaysia.

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IT IN CONSTRUCTION

ABSTRACT

IT is used traditionally in construction to replace manual activities previously performed by man. However, in the light of the advancement of information technology, IT can be used strategically in construction to support and facilitate the various construction activities from design, planning & control to general office administration. Daily computer based activities can also be enhanced with properly chosen composition of complementing and integrative applications. The report will look into an outline of the current applications of information technology (IT) in the construction industry followed by recommendations and the strategic uses of available or new technologies towards better project success. Some implications of IT to construction include improved communication, data sharing, sharing of resources, improved productivity and competitiveness. Through the proposed strategies, the construction industry can operate on a more effective and efficient manner, without unnecessary waste of resources. Consequently, the collaboration of parties in the industry will promote trust, teamwork, and strategic alliances, while ultimately improving & upgrading the industry together in its progress into the next Millennium.

<h1 style="text-align: center;">STRATEGIES FOR SUCCESSFUL CONSTRUCTION PROJECTS</h1>
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INTRODUCTION

The construction industry faces problems today on a scale it has not encountered before. With the increasing demands of modern projects, their sizes and complexities, the speed at which any information needs to be communicated is receiving higher expectations. As Harris (1995) pointed out, most work today without computers is now rare [3]. He thinks that the key attraction to construction and project managers is the speed of processing and the manipulative power available. Peters (1984) mentioned that the use of computers can reduce the drudgery and time involved in handling large quantities of data [11]. For example, a microcomputer could perform a forward and backward pass on a program network of some 1000 activities in approximately 15 minutes. The most experienced planning engineer is likely to take over 50 times that duration. In addition the computer can act as an excellent store of project data. It can retrieve and use a multitude of data in a fraction of the time taken by equivalent manual systems.

Other than the technical abilities of information technology application in construction, they do support the overall functioning of construction activities and may facilitate the development of trust in the industry, achieved through improved communication and sharing of information. It is hoped that, with information technology, the construction industry can move forward to better construction project success.

Objective

The objective of this report is to look into how IT can be used strategically in construction for the support and facilitation of the various topics in the previous chapters (Trust & Teamwork, Leadership & Paradigm Shift, Strategic Alliances) for better project success. The report will look into an outline of the current applications of information technology (IT) in the construction industry and the adequacy of this technology. This is then followed by recommendations and the strategic uses of available or new technologies towards better project success. These strategies will hopefully provide construction companies/projects with better productivity and competitiveness, while facilitating their progress into the 21st century.

THE CONSTRUCTION INDUSTRY

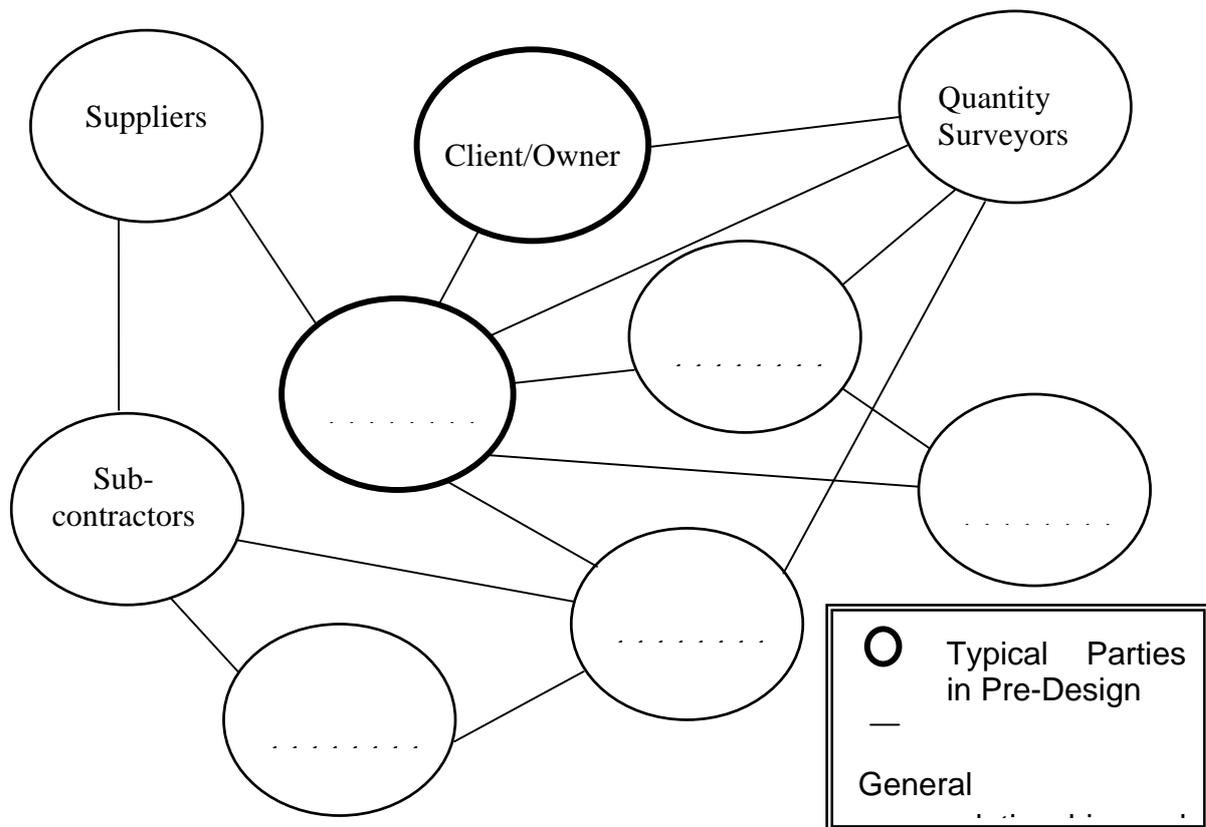


Figure 1: Relationship & Information Flow Between Parties In

There is a need for an overview of how the construction industry works. The nature of the parties involved and the nature of the work/information flow will provide an understanding and determine the extent of IT usage in this industry.

The construction industry was traditionally structured in a sequential manner of events from conception to maintenance of the building. Each of these stages is undertaken by different individual or company and is non-integrative. There is also a huge amount of data & information to be exchanged throughout these projects via architect's instructions, facsimile, letters, drawings and payment vouchers/receipts.

Apart from the key parties of the construction project like the client, consultants and building contractor, there is an array of sub-contractors, suppliers and workers who are also participants to the project. This inevitably adds on to the complexity of the work relationship and flow of information throughout the project. This complexity coupled with the amount of information/data makes any coordination among the participants to the project, a difficult and onerous task.

This industry is also made up largely of small and medium sized companies (SMEs). Since each company have different nature of work/business, the nature of IT application to these various parties will depend on their needs. As many of these companies may be operating on

a smaller scale, they may rely largely on manual processing of documents instead of using computer-based software.

The next section provides a general perspective of the current IT applications in the construction industry.

CURRENT IT APPLICATIONS IN CONSTRUCTION

Before recommendations can be proposed to support & facilitate project activities and improve project success in construction, a basic understanding of the current IT technology and its use in the construction industry is needed. Presently, IT's application in construction includes its use in development work, design, estimating, constructing, project management and general administration (accounting, data storage, word processing, etc.).

Computer is becoming a cheap and good investment for any company for general office administration activities like word processing, spreadsheets/database applications and accounting and taxation uses. However, special software applications are needed for more specific activities like design, estimating and project management.

These special applications arise from the segregated/segmental nature of the construction activities in the industry. Some examples of these software applications are shown in the table below:

STAGE	IT APPLIED
<i>Pre-Design</i>	Design Software: AutoCAD, ArchiCAD, MicroStation
<i>Design</i>	Design Software, Estimating programs (Timberline, WEST, Build-Soft)
<i>Tender</i>	General Applications (Word Processing, Spreadsheets)
<i>Construction</i>	Project planning and management software, Automation/Robotics
<i>Maintenance</i>	Property Management Applications

Figure 2: Current IT Applications Used In The Construction

Since most of these special applications are developed very much towards specific areas, there is little consideration put into the applicability of the information generated from these softwares onto computer systems of a different platform. The integration among these applications was also neglected. Notwithstanding these negatives of current construction computer applications, some general applications like e-mail and data storage/backup systems are still being applied generally.

The next section will propose some strategies for IT in the current environment and the near future.

PROPOSED STRATEGIES OF IT IN CONSTRUCTION

Having an overview understanding of the applications of IT in the construction industry, some proposed use of technology and strategies for better project success can be divided into the following sections:

Facilitating Communication, Networking & Information Sharing/Transfer

Within an organisation, a network should be in place to support the various functions or software needed. This network allows software and data information to be shared and accessible by the users of the network system [2]. This allows information to be shared efficiently without duplication and extra expense spent on collecting the information.

On a wider scale, different organisations can post or store their information that they find useful to others in the industry onto a database network via the internet. This process of sharing information improves the standard and quality of such information through open and encouraged discussion. It also promotes trust between participants to the system. Cooperation between companies in different continents can also result from the internet infrastructure, where a second company from a different time-zone can continue a piece of work when the first company is closed for the day. This reduces the time taken to complete an item of work and is also a form of teamwork & strategic alliance between companies for increased competitiveness.

Networks can range from a local-area-network (LAN) for a company (e.g. within an office or building) or a wide-area-network (WAN) if the communication required spans over a greater distance. Local Internet-Service-Providers (ISP) also provides leased lines for access into the internet with competitive costs. While using LAN and WAN have relatively limited spans of

distance, serving and storage capacity, using a leased line has the advantage of catering to future expansions or needs.

Moreover, the business can also be placed on the internet for advertising and promotions in the hope of generating more business. This trend in conducting business over the Internet is termed as “e-commerce” and has increasing popularity. A company may also post their annual reports into the internet allowing more “transparent” access into the information of the company, while sale of consultant services or goods can be transacted too. The internet web site can also be a forum for public participation, discussion or generation of ideas for professionals or general layman.

The increased use of the internet can also facilitate submissions of applications for development approvals. Electronic payments of monthly work completed will also be easier and faster with the current levels of information technology. Hence, networks can facilitate communication, while enabling information sharing for efficient dissemination of information, data and use of resources.

Nevertheless, an open approach to information sharing should not be done at the expense of a lack in security. Good security measures should be in place to secure the transfer of information and protect the system from potential hackers. The security of the system should be sound with usage such as a firewall. Several companies like Network Associates and Check Point are among the more prominent establishments in the field of security [12]. Not only do they provide the traditional function of preventing unwanted invasion of the computer system, they are also providing authentication of the sources and messages. These prevent and identifies unauthorized users from storing irrelevant information garbage into the database, but allow participants or members to the database network to transfer quality information in a safer environment.

Facilitating Work Activities & Management Integration

In 1995, Harris examined all the modern computer systems that allow exchange of data between the planning system and other systems [3]. Now that the construction industry is mainly computer literate there is a reluctance to do much, if anything, by manual calculation. At a minimum the computer planning systems are able to pass data files to spreadsheet packages where the users can generate their own calculation routines for other purposes such as cash flows. The planning system, itself, could be the recipient of data from other systems. For example, the estimating system may hold details on resources and resource costs on a bill item by bill item basis. By allocating these bill items to activities in the plan, the resource details are passed from the estimating to the planning system.

In the current age of project complexity, the project manager’s volume of work and responsibility is also steadily growing to include:

- project data (drawing, specifications, job files, cost estimates);
- company information lists, accounting, and market information (mailing lists, accounting, and market, including client, billing, and project histories);
- communication (e-mail), internally and with clients;
- the client’s database; and
- external databases (code requirements, new materials, bidding information).

Such information is usually generated using separate software and the transfer of the information to other computer work packages may encounter problems due to incompatibility of systems. To facilitate such transfer of data, appropriate software should be used.

Currently, there is still not many comprehensive software that can be used for all categories of construction management. However, a combination of these applications can be used if they are compatible. Microsoft is one such platform where a number of software can be complementary. Presently, there is already on going research in the area of integrated software for all parties in the construction industry from architects, engineers to quantity surveyors and project managers. All these people can use computer applications that are complementary to each other, where data can be stored in format recognizable to every application (e.g. exchangeable across CAD & other applications) [6, 9].

To meet the proposed paradigm shift in IT from segmented to integrated management of project activities for the construction industry and to prepare for future challenges, more flexible application packages should be developed. In fact, some software developers have already started to create interfaces with other industry related packages to support the way of change. Two examples of available applications that provide a limited range of integrated functions for management of project activities are the Prolog Manager and Timberline applications.

- The Prolog Manager is an effective project management software on the market today that tracks and manages project information [2]. It's ease of use streamlines the paper shuffle, and controls cost and while keeping you organized. It performs functions from site control, recording, reporting, documentation, contract administration to cost controlling functions. The huge amounts of daily construction project information this program handles includes comprehensive project budget information, variation orders, payment invoices and logs of drawing amendments. It can even sifts through the above data, pulling out, organizing, totaling and summarizing it for printing in a wide variety of reports according to any needs.
- Timberline is a computer-integrated construction software [13] that streamlines communication and productivity from a building's conception through occupancy. It consists of several components for the handling of design drawings, cost estimating functions, information & project management activities and even accounting and project management functions.

These applications can integrate and manage the various activities of construction, they can also be used in conjunction with Autodesk, Primavera Systems and Microsoft applications [13]. This compatibility to other applications and interfaces makes it a comprehensive package for general project administration of construction project activities and allows better-informed decisions, increase productivity and improve profits.

The Next Lap in IT

The future will see more advanced uses of computers from the simple programming of activities up to a complete time, resource and cost modeling system used in analysis of 'what-if' situations and in making forecasts [1]. As the use of the planning system becomes more complex the data required increases and the computer system required becomes more sophisticated.

The future will also have an increased focus on the virtual world and how it can facilitate the operation of every aspect of our life. Some of the implications of these on the construction industry includes:

Improving Visual Appreciation and Communication

4-Dimensional CAD

AutoCAD is traditionally developed around the 2D and 3D environment. Further development for AutoCAD is proposed and planned for the near future to link the actual design of the project together with the time parameter (the fourth dimension now allows the project managers to review the entire construction process and identify possible limitations in resources or time). Clients, project managers and architect will then be able to step through the construction sequence on a daily, weekly or monthly basis, which will provide extensive visualization of the construction process.

Virtual Reality & Video Conferencing

Virtual Reality (VR) creates a compelling experience, which draws the user's attention, imagination and senses so they believe that they are somewhere – 'immersed' in the virtual world [7]. The reality of VR today is less idealistic and is basically about creating tri-dimensional environments the user can interact with as freely as possible. The facilities are the gloves and goggles version, a conventional monitor as output device and head-mounted stereo displays. People can also use telephones with built-in screens to communicate across continents via video-conferencing too.

Virtual walkthroughs also can be generated from completed designs of buildings. The visual display of interactive tri-dimensional environments enables the designers and builders to reconcile any disparities between the designed drawings and the actual structure to be built on site.

Virtual Design Studio

The advent of virtual electronic spaces will also provide a flexible environment for remote communication. A visual communication environment consists of human objects that represent people in the virtual space. Because

they can introduce representations with a 3D perspective, 3D computer graphics are very suitable for creating an understandable and imaginative virtual space.

A combination of computer graphics (CG) based virtual spaces and objects results in an extremely flexible and interactive environment for remote human collaboration offering a new dimension in daily communication activities [14]. Therefore, the combination of computer-graphics based virtual space is very suitable as a virtual space architecture design studio[14].

Professions will be greatly influenced by these technologies and the boring tedious chores will disappear, particularly in the design areas. With better computer-aided design and manufacturing tools, the virtual environment is allowing two or more parties to work on the same project in real time, even though they may be based hundreds – or even thousands – of miles apart.

Combining the abilities of these technologies, simulations and virtual buildings can be viewed simultaneously from distant places encouraging discussions and creativity without the segmented approach faced in the design stages of traditional project delivery.

SOME LIMITATIONS OF IT TODAY

Maturity of IT in Construction

Currently, the construction industry is at different stages of IT development and maturity [8]. Smaller companies are not fully utilizing the capacity of information technology, and not every company is interested in investing in IT. Moreover, there is little commitment from the senior management of companies to consider new uses of IT for assisting effective or efficient use of resources. Neither do they want to participate whole-heartedly into sharing of resources and information. Therefore, the capabilities of the network and the information sharing are not fully exploited by all the participants in the industry. Every party in the industry should be aware of the potential benefits of such IT developments and the potential results from the use of such technology. Although IT does have a significant impact on improving overall management of construction activities, the full extent of IT is still not utilized.

Millennium Bug (Y2K)

Another limitation of IT is the Millennium bug that has struck like a lightning bolt to the world. This glitch will leave computers all over the world unable to recognize dates after December 31, 1999 [11]. Many companies are already in the process of resolving this problem and investment into its research has chalked up into huge sums. Yet any resolution to it will

inevitably increase the cost of operations when firms try to sell their products at anticipated high prices. The resolution of this problem at best will relieve the world of the glitch but at a price. At worst, it will create disaster to the planet at an even higher cost.

CONCLUSION

Notwithstanding the issue on the Millennium bug problem, several items were still proposed in the earlier sections, to help support and facilitate communications, networking, data & information transfer, work progress and integrated management functions for better project success. Some proposed strategies are:

- Improving communication with networking systems (e.g. LAN, WAN, Internet);
- Facilitate data sharing with database systems and electronic payments, thereby promoting trust with sharing of information;
- Increase teamwork through sharing of resources of distant companies, where they are brought together through information technology;
- Facilitating strategic alliances with advancement in IT and “shortened” distances between companies through the Internet; and
- Produce efficient use of knowledge and information in data bank, thus increasing productivity and competitiveness.

It is hoped that through the proposed strategies, the construction industry can operate on a more effective and efficient manner, without unnecessary waste of resources. Consequently, the collaboration of parties in the industry will promote trust, teamwork, and strategic alliances, while ultimately improving & upgrading the industry on a wider scale into the next Millennium.

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TRUST AND LEADERSHIP

Forward

This report is developed based on the ideas of Tom Crows, as the guest lecture in the Master of Construction Management course. His paper "*Trust and Trustworthiness – Motherhood or Strategies for Successful Construction Projects*" reveals his ideas about leadership as an essential element that can affect the overall performance of the current construction industry towards new paradigm shift.

Client involvement for this paradigm shift will provide positive environment to all team building members (contractors, designers, engineers, suppliers, etc.) to improve productivity, quality, and customer focussed outcomes.

Abstract

In the environment that always changing and always on fire, construction industry needs figure of perfect leaders (strong leadership). Unfortunately, there are no such “*perfect*” style of leaders that can be swap around the construction project, due to the nature of construction industry that very complex and always changing from time to time - from one project to another. “*It all depends*” (environment, culture, person, organisation, relationship, etc).

The systematic way to approach that situation is to developed the basic role of the leaders, what the leaders should do to make the “*wheel of progress*” running smoothly to achieve paradigm shift. There are 3 basic essential roles of the leaders:

- Lead the organisation towards the customer satisfaction through strategic approach. This approaches comprises articulating the vision, knowing the mission, and having the enterprise plan.
- Generate the leadership inside the top management (leading the leaders) and organisation member, especially for the person that standing on the “*front line*” of the project. This role will create the synergistic relationship among the construction parties.
- Support and reinforce the “wheel of progress” so that it will not fall down again to the old paradigm or old culture.

All of those role should based and bolstered by **trust** among every member of the construction organisation, including client and customer.

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Introduction

Construction Industry is one of the major global industries. All parties in the construction must be well organised to achieve the project goal, which mean client (consumer) satisfaction. Making the better “*symbiosis mutualisma*” among client, contractor and consultant is necessary to avoid misunderstanding and create the synergy. One issue that believed to overcome this situation is through leadership.

It is said that any changes or improvement processes start with leadership, which enables to eliminate roadblock to success (see Trust & Trustworthiness, Tom Crow-1997). With the world of work in transition, to improve the construction process such leadership requires managers (of all parties) to transform the work environment through people, beginning with their own self-development, especially the client who should shown semaphoring trust and the contractor who should focus on servicing the customer. Due to the fact that many top managers unaware of “what the clients’ need or will need”, leading the leaders by convincing and educate them is needed to open opportunities. Therefore, leaders on leadership; who generate strategic development that consists of articulating the vision, knowing the mission, and having the enterprise plan; have to align the people to achieve the mission statement by generating commitment, motivation, power and empowerment. Effective leaders (strong management and strong leadership) have to be persistent leadership to continuous improvement as well as create a learning organisation and have to cope with complexity and change towards organisation. As Tom Crow (1997) mentioned “the paradigm shift is not a technical challenge, but a behavioural challenge”.

Nature of Construction Industry

The construction industry is said as “*the least developed industry*” among others (e.g. manufacturing), and it is true. Although the recent development in technical and systems can lead to construction of many amazing things (the largest dome in Greenwich, the highest twin tower in Malaysia, etc.), the overall performance just remain the same. More than 40% of effort makes no contribution to the end customer service or the industry profitability (Crow, 1997), which is almost endemic such as:

- 12% rework
- 30% drawings not used by suppliers
- 2% cost to administer progress payments
- 5% post completion defects
- 50% ineffective meetings

To overcome these conditions, the paradigm shift is required to change the construction industry from self-service to customer-service (customer satisfaction).

Construction industry is a project base, which mean that it is specific and has finite task to be accomplished (usually varying from three months to five years). “Unfortunately”, the construction industry is very complex project, which involves many parties and very complicated relationship among them. They usually involve several departments of a company working together and in the majority of cases more than one company is involved in the work on any one project. Often these departments and companies are working on several projects at the same time, each at different stages in the project life cycle. Project work is therefore necessarily complex with respect to interactions and interdependencies between the groups, departments, organisational units and companies involved. This necessitates a complex organisation structure, which includes people form many different professions, background, departments and companies. An added complication is that these relationships and interactions are dynamic and never static. Typically at the start of a project, work emphasis may be on research and development; it then changes to design, procurement, to construction, to testing and commissioning, and finally to operation. No single functional department or company is thus the most important over the whole life of the project and thus no individual departmental manager can assume the leading management role for the complete project (Harrison, 1995).

Furthermore, the organisation of construction industry has been transformed as prime contractor provides the primary construction management and for the execution of construction works by subcontractor. As is widely recognised that the environment of the construction industry has changed dramatically and competition is harder than before. Due to the changing construction environment, the construction companies must be improve quality, raise productivity, reduce costs and reduce all wastes.

The nature of leadership

What is leadership?

Many different definitions of leadership can be found in the literature. Researchers usually define according to their individual perspective and the aspect of the phenomenon of most interest to them. Some representative definitions are as follows:

- Leadership is “ the behaviour of an individual when he is directing the activities of a group toward a shared goal.”(Hemphill and Coons, 1957)

- Leadership is “interpersonal influence, exercised in a situation, and directed, through the communication process, toward the attainment of a specified goal or goals (Tannenbaum et al., 1961)
- Stogdill (1974) gave the definition of leadership as “the initiation and maintenance of structure in expectation and interaction”.
- Leadership is “the process of giving purpose (meaningful direction) to collective effort and causing willing effort to be expended to achieve purpose (Jacob and Jaques, 1990).
- Stoner et al. (1997) defined a leadership as “the process of directing and influencing the task-related activities of group member “.

Although, leadership has been described in many ways. It can be said that most conceptions of leadership imply that at various times one or more group members can be identified as a leaders according to some observable difference between the person(s) and other members, who are referred to as “*followers*” or “subordinates” (Junnonen, 1996).

However, Harris (1995) argued that the definitions of leadership is much more “ getting followers to follow” as traditional thought, it involves the following factors:

- A mission, or vision of a future state of nature, or set of goals, normally involving change.
- A high personal commitment and drive by the leaders to these goals.
- Actions to achieve these goals, normally involving a conceived strategy.
- Mobilising, inspiring and maintaining commitment by others to the achievement of these goals.

It can be said that leadership has been numerously studied, however most of them are conducted in permanent organisations rather than in temporary organisations as frequently found in construction industry (Junnonen, 1996).. Therefore, human issues in construction have become key variable that affect the pattern of leadership which are challenging traditional models of leadership and suggesting a new paradigm that broadens the scope for leadership in construction.

The role of leadership

Leadership, which is one of essential element towards paradigm shift, represents the general consensus rather than dictation of term and direction for achievement of superior performance (Zairi and Mohamed, 1991). As the leaders, manager who has strong leadership should create the vision, trust and support his teamwork to work together to get there. Commitment is generated starting from top management downward to under him to work as a team. The most important thing that effective leaders does is empower his subordinates (both the authority and responsibility) to create a synergistic relationship in order to make decision at lowest possible level. Furthermore empowerment brings the whole organisation on line to achieve the common goals. Leadership can synergies the energies and talents of a work force (follower) (Wilsey, 1995). From a perspective of psychological as stimulus-response approach, a relationship between leadership style (stimulus) and emotion (response) is applied to see the result of their leadership on followers’ intrinsic values in the workplace and the direction of their motivation. Chris Argyris said that “ it is necessary for everyone to move along a maturity continuum: from passive to active, dependent to independent, few behaviours to many behaviours, shallow interests to deep interests, subordinate position to superordinate and little self-awareness to self-awareness and control”. Charles (1998) said that to get people to cohere is an important leaders’ job that is done by establishing and maintaining trust –by enhancing a context in which people’s truth are honoured: where their intelligence, wisdom and experience are valued: where people take turns being the leaders of the group.

Leading the Leaders (Contractor and Client)

As can be said that any changes for example partnering, TQM or any new approaches to achieve the best practice is started with leadership mainly from Top management or CEO from both client and contractor.

To achieve success of new paradigm, leaders (anyone) need the support from other leaders both as subordinates and top management who enable to give an opportunity to implement change which would lead to success. The effort for paradigm shift has to be supported from the boardroom, otherwise it will be failed. Although, leadership of the boardroom is sometimes difficult to be expected, it is necessary to convince them (see generating commitment, leadership & improvement).

According to Zairi, Mohamed (1991), the primary role of a top management leaders consists of strong basic convictions, clear strategic vision, intellectual capability, management experience and political skill. Bemowski(1996) in "*leaders on leadership*" described that "*leadership of CEO as the theatre*" and a good leaders, a CEO, at any point must play as the following roles :

- *Studio executive*: the CEO must analyse market data; assess industry trends; evaluate risk and opportunities; develop a vision; and set strategies.
- *Executive producer*: the CEO must establish goals; hold other accountable; organise and enable work; and evaluate people and performance
- *Director*: the CEO must lead and coach teams; motivate and channel work; translate strategy into action; and train and develop employees
- *Actor*: the CEO must work on the front line; know customers; deliver products and services; and receive feedback from customers

Leadership as previously explained in term of leading the leaders, can be divided into two complementary roles related to the following functions:

1. *Corporate governance and direction: (the function of the chairman and the board)*
2. *Implementation: (the function of chief executive and the management team)*

	Today characteristics	Role to achieve paradigm shift	Tomorrow characteristics
Corporate governance and direction	Bottom-up "operations push" strategy or no clear strategy at all	Formulate a clear vision and strategy	Clear top-down "vision-driven" strategy
	Ineffectual "custodial" board	Compose and lead on effective board	Strong board capable of helping the chairman to set the drumbeat for the company
	Unclear basic policies and weak "cultural value" signals	Set a new "drumbeat" of basic values, policies and priorities.	Cultural values are visibly and constantly enacted by the chairman and all board members.
	Benchmarks and standards are internally set and aim for incremental improvement	Appoint an MD with a clear mandate to develop new business strategies and operating plans with demanding targets and standards	Benchmarks capture the best external practice and aim for order-magnitude improvement
Implementation	Organisation structure is out of date, not matched to tomorrow's business structure	Restructure the business portfolio and the management organisation. Redefine the strategies and operating plans for each business, setting demanding targets and standards	Market-based organisation structure
	Control is by systems		Control is through people
	Recruitment and development are seen as staff jobs	Establish a new cultural climate in which the quality and motivation of people are given the highest value and priority	The managing director is the chief recruiter and development is a priority for managers at ALL levels
	People are protected		People are respected
	Uncompetitive performance, poor financial results	Monitor the operating and financial results against new targets and standard and insist on their achievement	Winning performance

Table 3-1: The role to achieve paradigm shift related to two functions: Corporate governance and direction; Implementation (Zairi, Mohamed, 1991)

Strategic Development

The strategy is used to achieve complex, long-term results. In construction industry the strategy is built on an understanding of the importance of the alignment of construction and technology strategies. The leaders must have a vision of a future in which the two strategies are fully integrated, make that vision a part of their mission between principal, client, contractor and designer, and then put in place on company plan to carry out the strategy successfully (Beverly, 1993).

Articulating the Vision

In the strategy, the vision is leadership's view of what things will be like in the future, what is the trend in construction industry, given the direction in which the construction style is moving. The vision need not be specific to the company. A vision that held by one leaders is not sufficient. It must be a shared vision. And the vision must not be so far into the future that is no progress toward it.

Knowing the Mission

The mission statement has often been around from the time of the founding, contains many components of the construction strategy. A mission statement consists of the following five key elements (Zairi, Mohamed, 1991):

- The organisation's history, its ethics, its philosophy, its culture and its policies
- The current preferences of the owners and management
- Environmental considerations
- The organisation's resources

The organisation's distinctive competencies aiming to do what which it can do best

The first skill of knowing the missions is in *expressing the vision*, which is behaving in a way that advances the goal of the vision. In construction industry, leaders must consider to whom wishes to create a plant-level operation to involve all employees in the project. The second thinking skill necessary is in *explaining the vision* to others, making the nature of the vision clear in terms of its required action steps and its aim. Explaining involves more than mere restatement of the vision's nature of aim. The visionary leaders must be able to describe how the vision required for the vision link together to attain its goal. The third required thinking skill is in *extending the vision*, applying the sequence of activities to a variety of situations so that the vision can be implemented in several ways and places. The fourth thinking skill involves *expanding the vision*. The true visionary leaders will have the conceptual skill needed to look at the overall plan and effect of worker involvement in the organisation. The visionary leaders will think through the spread of the worker involvement vision throughout the organisation, consider different ways the planning may be spread and think how to revise the entire construction organisation (Robert, William, 1989).

Having an Enterprise Plan

When deciding which tactics and tasks to put in place to achieve the strategy, it also must be considered all members must commit to the process. Consulting, advising, making recommendations to the principal on all aspect of planning and design, reviewing all drawing and specifications are being developed to achieve the goal. The leaders must communicate the vision in a way that reaches out to people, griping them and making them want to get involved in carrying out to that plan. Another important think is about focusing on the importance of people, concerns one's consistency and trustworthiness. As leaders, he must

show that he can be trusted to lead the whole project, even employees may not agree. Leaders must make commitment for what he has done and for what he is going to do.

There must be only one plan. The plan must articulate and define the strategy for the entire construction sectors. Although there can be multiple plans and strategies for different divisions, there can only be one statement of strategic direction; the other plans should be subordinate to, as well as a supportive of that strategic direction.

Every company has its own mission statements (corporate objectives) known by all employees in the organisation. The mission statement has to be followed by another task that leaders have to undertake. Another task of identifying the critical success factors and the critical processes has to be analysed and controlled to achieve the objectives. According to Daniel (1961), Critical success factors were defined as *“The limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organisation. They are the few key areas where “ **things must go right**” for the business to flourish. If results in these areas are not adequate, the organisation’s efforts for the period will be less than desired.”*

Critical success factors (performance indicators) are important to reflect the strengths and weakness of process and give management better control. The achievement of the objectives depends upon the effectiveness of leadership/leaders in aligning people and generating commitment.

Aligning the people

Generating commitment and motivation

As can be said that commitment to any changes, such as partnering, TQM. and so on, must come from top management because requirement of additional effort, new behaviour and up front cost so that leading the leaders as previously explained needs to be re-emphasised. Furthermore, it needs commitment from all people in organisation that is importance work of leadership/leaders. To generate all commitment, motivation is substantially needed. In many researches, motivating theories and factors have been suggested to dealing with different people and situations. Early efforts by Taylor to use money and the human relations (school of management) to use attention to workers and group dynamics as motivators on extremely routine, specialised jobs met with only limited success. Therefore, more approaches have focused on several major elements in the motivation process such as needs, cognitive activities, and reward and reinforcement issues (Kathryn, 1991). In Maslows' hierarchy of need, for example, argue that we have behave the way we do because we have internal needs that we are attempting to fulfil. According to this theory, the easy way to generate commitment is to convince boss, all employees and ourselves that the results of change, which they will do, are good for them. For example, the result of implementing partnering is good (Win-Win culture which is everyone need).

Zairi, Mohamed (1991) suggested that there are three pillars essential for the generation of high level of commitment as shown the following:

- Creating a sense of belonging in contrast to alienation caused by previous eras.
- Making workers feel excited about their work and proud of their achievement thus they start to realise that they are trustworthy which will also lead to them accepting accountability more readily.
- Creating confidence in management leadership and leading by example.

The way can help leaders generate high commitment using the three pillars and their methods of implement is illustrated as Table 5.1

Pillar	Method of implementation
How to produce a sense of belonging to the organisation	<p>Inform people by :</p> <ul style="list-style-type: none"> team briefing open disclosure simple language and examples <p>Involve people by :</p> <ul style="list-style-type: none"> single status conditions consultation visits and company celebrations <p>Share success with :</p> <ul style="list-style-type: none"> share option schemes productivity gain sharing local lump sum bonuses
How to produce a sense of excitement in the job	<p>Create pride by :</p> <ul style="list-style-type: none"> responsibility for quality direct identification with output comparison with competitors <p>Create trust by :</p> <ul style="list-style-type: none"> abolition of piecework peer group control removal of demarcation <p>Create accountability for results by :</p> <ul style="list-style-type: none"> pushing decision-making down the line

	challenging assignments quality circles
How to produce confidence in management leadership	<p>Exert authority by :</p> <ul style="list-style-type: none"> no abdication to shop stewards willingness to discipline maintenance of standards and objectives <p>Show dedication by :</p> <ul style="list-style-type: none"> reduction of management overhead seeking productivity through people attention to commitment <p>Display competence by :</p> <ul style="list-style-type: none"> establishing mission and objectives new management initiatives professional standards

Table 5-1: The three pillars of generation commitment (Zairi, Mohamed, 1991)

Influencing the people

The construction industry consists of many parties - people, groups, or organisations - and has a very complex interdependent relationships one among the others, start from the client, designer, engineer, constructor, subcontractor, supplier, government, society, etc. According to Kotter (1986) today, *“executive work involves managing complex interdependencies among diverse groups of people so that destructive conflicts and power struggles are minimised, so that inevitable conflict leads to creative solutions that serve the interests of as many legitimate stakeholders as possible, and so that all conflicts are resolved with a minimum waste of scarce resources”*.

Srivastva (1986) approach the condition above with two kind of paradoxes: using the leaders' power or/and empowerment.

Power

Power has been defined by Price (Zairi, 1991) as: *“...the force which gets things done. without it all the foregoing is nothing more than potential and its actualisation cannot happen without the exercise of power...power could be defined as the imposition of the will of one individual upon the actions of others”*.

The success of power implementation according to Burke (1986) should has a balance between amount of power with the need of achievement. The extreme unbalance will cause longer period of delegation (high achievement but low power), conversely the leaders may spend a lot of time in politicking and plotting rather than achieving (low achievement but high power).

According to Bartol and Martin (1991), there are 6 source of leaders' power, which can generate the specific outcomes.

Source of Leaders Influence	Basis for Power	Type of outcome		
		Commitment	Compliance	Resistance
Referent power	Admiration and liking by others	LIKELY* If request is believed to be important to leaders	POSSIBLE If request is perceived to be unimportant to leaders	POSSIBLE If request is for something that will bring harm to leaders
Expert power	Possession of valued expertise	LIKELY* If request is persuasive and subordinates share leaders's task goals	POSSIBLE If request is persuasive but subordinates are apathetic about task goals	POSSIBLE If leaders is arrogant and insulting or subordinates oppose task goals
Legitimate power	Hierarchical position and authority	POSSIBLE If request is polite and very appropriate	LIKELY* If request or order is seen as legitimate	POSSIBLE If arrogant demands are made or request does not appear proper
Information power	Access to important information	POSSIBLE If request is substantiated by data	LIKELY* If request is reasonable	POSSIBLE If leaders is arrogant, secretive, or manipulative
Reward power	Capacity to provide valued rewards	POSSIBLE If used in a subtle, very personal way	LIKELY* If used in a mechanical way	POSSIBLE If used in a manipulative, arrogant way
Coercive power	Ability to punish	VERY UNLIKELY	POSSIBLE If used in a helpful, nonpunitive way	LIKELY* If used in a hostile or manipulative way

Table 5-2: Type of outcome as a result from different source of power (Bartol and Martin, 1991)

Basically, the broader the base of one's power – the more one's source of power stems from multiple bases – the more powerful one is. And the more there are multiple sources for the power holder, the more he or she is likely to exercise power but with less reliance on coercion.

Empowerment

According to Lorsch and Barnes (Neilsen, 1986), the key of leaders task is not so much to acquire power as to deliver power to followers, who might otherwise experience a sense of powerlessness. There exists “the ultimate paradox of social leadership and social power: to be an effective leaders, one must turn all his so-called followers into leaders”.

Neilsen (1986) points out that empowerment involves giving subordinates the resources, both psychological and technical, to discover the varieties of power they themselves have or/and can accumulate, and therefore which they can use to help the leaders to fulfil the responsibility for the welfare of the organisation.

To increase the interaction among leaders and the members, Nielsen establishes a group development model. The role and the influencing behaviour of the leaders in every step always change to comply with the changing the structure and requirement of the group.

Stage	Nascent Structure of Group	Relational Issue	Needed Leadership Style	Needed Influence Behaviours
1	Each person for him or herself	Inclusion	Directive	Commanding, prescribing, legitimizing
2	Dyads	Inclusion and influence	Coaching	Instructing, debating, bargaining
3	Coalitions and cliques	Influence	Participative	Involving, committing
4	Connected coalitions and cliques	Influence and intimacy	Appreciative	Nurturing, applauding
5	A single integrated group	Intimacy	Inspirational	Innovating, challenging

Table 5-3: Empowerment of group development (Nielsen, 1989)

The empowering process is not a simple process because involve the sharing of a precious commodity: power, especially for those who have a strong need for power. Another reason is the complexity of the process itself. The leaders should learn again and although for some it is quite easy, but the learning is necessary nevertheless (Burke, 1989).

Sustainable Development

The research conducted by Arie de Geus, former planning director of Shell, reveals that “*a full one-third of the Fortune ‘500’ industrials listed in 1970 had vanished by 1983*”, and today the average lifetime of the largest enterprises is probably less than half the average lifetime of a person in an industrial society. Only small number of the company that can survive for seventy-five years or longer, and its secret is the ability to run “*experiments in the margin*”, to continually explore new business and organisational opportunities that create potential new sources of growth.

Learning Organisation

Fortune magazine mention those organisation above as a learning organisation. Senge (1996) reveals that this kind of learning requires new ways of looking at the world. The simple example for this is the involvement of serving the customer.

“In the early years of total quality, the focus was on “fitness to standard”, making a product reliably so that it would do what its designers intended it to do and what the firm told its customers it would do. Then came a focus on “fitness to need”, understanding better what the customer wanted and then providing products that reliably met those needs. Today, leading edge firms seek to understand and meet the “latent need” of the customer – what customers might truly value but have never experienced or would never think to ask for.”

Leaders’ role in the learning organisation differs dramatically from the charismatic decision-maker, especially in today’s condition where the organisation tends to be more complex and larger. Nadler and Tushman (1996) suggest that the change should be institutionalised throughout the management system where every person in every level owns and involved in executing the change efforts. During that time, leaders should perform as (Senge, 1996):

- **Designer:** Designing the governing ideas of purpose, vision, and core values by which people will live.
 - **Teacher:** Helping everyone in the organisation, oneself included, to gains more insightful views of current reality.
 - **Steward:** Serving the others first.

Those roles require new skills: the ability to build shared vision, to bring to the surface and challenge prevailing mental models, and to foster more systemic patterns of thinking. In short, leaders in the learning organisations are responsible for building organisation where people are continually expanding their capabilities to shape their future – that is, leaders are responsible for learning.

Leadership for continuous improvement

Building a leadership through improvement is very important for surviving of doing business in competitive environment. Quality and management experts, from W. Edwards Deming to Tom Peters, agree that leadership for improvement must come from the executive level. However, Juran, quality expert, wrote in article of Cocheu (1995), “An obstacle to participation by upper management is their limited experience and training in managing for quality. They have extensive experience in management of business and finance, but not in managing quality”. The false starts and frustrations many organisations experience in their quest can be avoided by first develop a solid leadership foundation for improvement.

Leadership is an executive responsibility that can't be delegated. Senior managers, who should learn on their own about quality and their leadership roles, or should be facilitated their quality education, must understand where the organisation is, where they want it to go, and how they want it to get there. CIDA(1993) presented the typical progress milestones and typical development activities in leadership as seen in Appendix 1. T. W. Crow, guest lecture in international practices, MCM. Course, UNSW, 1998 suggested that to achieve paradigm towards the best practice, effective leadership is needed more than other imperatives. He offers the construction industry continuous improvement plan in term of leadership for clients, consultants and contractors as shown in Table 6-1.

Imperatives	LEADERSHIP
Level	Our leadership creates environment and culture for change
5 ROBUSTNESS creating and sustaining best practice	Enterprise/project is seen externally as committed to continuous improvement Leadership focussed on world best practice Challenges welcomed to current management style
4 BREAKTHROUGH Continuous Incremental Improvement to minimise variation	Leadership at all levels is focussed on continuous improvement Managers and staff are rewarded for their actions in leading continuous improvement Performance assessment emphasises a continuous improvement approach to all business activities
3 STABILISATION consistent reliable performance of enterprise best practice	Managers makes personal changes to their leadership style to support ongoing continuous improvement Regular enterprise board and project reports on quality improvement concepts and attainment of project process standards Continuous improvement concepts are actively addressed and underpin all enterprise and project initiatives
2 STANDARDISATION Defining, documenting and certifying	Enterprise and project managers encourage and reward process improvement efforts There is agreement among project team managers and staff of the overall objectives, function and scope of the project Authority is delegated to natural level decision maker
1 AWARENESS Accepting need to change	Enterprise and project managers understand their leadership roles Customer CEO commitment to continuous improvement culture and waste removal Project team managers and functional managers: understand the basic concepts of continuous improvement recognise need to develop and manage enhanced skill
0 UNINFORMED No appreciation of need for change	Enterprise and project managers say "do as I say, not as I do" No understanding of continuous improvement No credit is given for improvement effort No leadership of the change process

Table 6-1: The construction industry continuous improvement plan for clients, consultants and contractors

According to Demings' cycle (PDCA) for process improvement, (CIDA,1993 and Zairi, Mohamed, 1991), the role of leaders as the followings has to be reflected in the whole PDCA cycle that enable to achieve paradigm shift (from typical current enterprise towards best practice enterprise)

- **Plan:** commitment to plan and implement change intend to meet customer requirement in a better way (see Turn organisation upside down (customer satisfaction))
- **Do:** communicate effectively through teamwork and better employee involvement and maintain consistency of words and actions
- **Check:** investigate process using analytical tools and techniques to eliminate waste and streamline operations through planned actions and a commitment to improvement
- **Act:** conduct measurement of results and performance thus continuous improvement of the process, out put is achieved and utilizing double loop learning, which does not just compare between objectives and process/activities but also learn to answers these following(CIDA,1991):

- *Are the objectives valid?*
- *Is the process necessary?*
- *Are the policies and strategies clear and appropriate?*
- *Does the “culture” support or work against the objectives?*

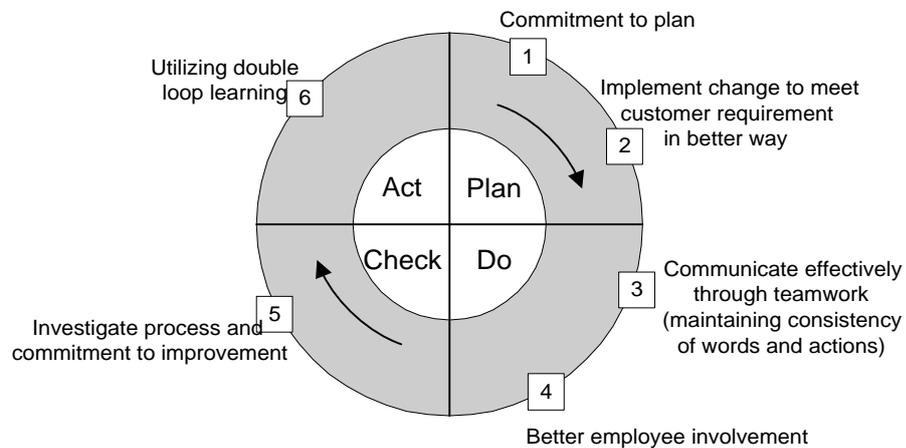
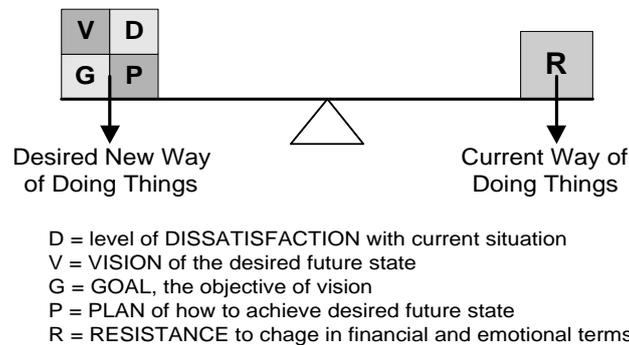


Figure 6-1: Paradigm shift through P-D-C-A (developed from Crow, 1997)

Leadership Toward Changes

Figure 7-1: The forces for and against change, developed from Crow, 1997

The figure above simply describes about the changes that triggered by the strategic



development to comply with the future changing. To make the desired new way of doing things happened, the dissatisfaction, vision, goal, and plan product should overcome the resistance. According to Tom Crow (1997), this kind of paradigm shift is “*not a technical challenge, but a behavioural challenge*”. This paradigm shift evolves inside the construction industry organisation and bolstered with the transformation of leaders’ role from managerial to leadership.

Construction Organisation Changes

In this post-industrial period of human development, traditional organisational models; such as functional and product type; and managerial styles are gradually being replaced due to difficulties in achieving effective communication, collaboration, co-ordination, and control with several different departments and companies. They can not handle the dynamic, ever-changing relationships, and the complexities involved in the construction. The forces for the changes can be derived from external forces (technological innovations, new government policies and legislation, environmental factors, etc) or internal forces (new strategies, changing technologies, new systems, etc) and they often linked each other (Stoner, 1994). Therefore, a major transition is underway in social systems from “disappearing bureaucracies” to “emerging ad hocracies”. To handle this transformation, the leaders facilitate the transcendence from past to futuristic operations by promoting a suitable organisational model.

According to Harris (1991), the nature of construction industry compel the work is organised around a “temporary” group that involves permanent (functional) and impermanent lines of authority, which make the Matrix system becomes the most suitable one. But the implementation of the matrix organisation is not the final answer of the changing. The organisation structure will change through the life of the project, as the number of people, groups and companies involved changes (Harrison, 1995). In effect, Yukl (1994) argues that transforming or revitalising the organisation are unlikely to succeed unless the organisation culture is changed.

Changing the organisation likely will be useless unless the culture as its bond is changed. Zairi (1991) emphasises that the corporate culture is the heart of any organisational system that has history, a past and a present, and furthermore it is affected by management systems, people, structures, processes, and externally by society and the wider environment. Culture itself by Schein (1992) is defined as the basic assumptions and beliefs (may be unconscious) shared by members of a group or organisation. The culture “*win or lose*” makes the construction industry always on fire with finger pointing is standard habit and litigation is

standard resolving process. The espoused values such as thrust base and openness sometimes still not consistent with the underlying belief that other parties will take advantages of the situation. To overcome this condition Bass (1996) reveals that “rather than work within the organisational culture, the leaders challenges and changes that culture”.

Culture Changes

According to Burke-Litwin model (Zairi, 1991), there are two categories of cultures or models of behaviour:

1. **Transformational dynamics:** These represent areas, which are mostly influenced by environmental factors (mission, strategy, leadership). These variables shape the corporate culture of the organisation.
2. **Transactional dynamics:** These represent the short term organisational changes. They include variables such as structure, management practices and systems (policies and procedures).

The best thing to distinguish between transformational and transactional cultures is the unit of time. While the transactional change can happen overnight and can last as long as it still needed, the transformational change is more difficult and can take 3-15 years – which reflects the total corporate culture. These difficulties due to justification of the past and the matter of pride or success, and in general it is more difficult to change the culture in a mature organisation than to create it in a new organisation, furthermore if the changes are incompatible with the existing culture (Yukl, 1994).

It has mentioned before that to make the changes of the transformational culture has effect, a sustainable and a long time is required. In this sense, for the construction industry, it seem not possible for the project organisation to has its own transformational culture due to its organisation life span. Therefore its transformational culture is refer to its main corporate culture, while its transactional culture can be different with its corporate transactional culture – depend on the requirements of the project. The transactional corporate culture still can influences the transactional project culture, but its conversely likely will not occur.

Transforming the Culture

The critical thing to understand about cultural dynamics according to Schein (1996) is that *“leaders cannot arbitrarily change culture in the sense of eliminating dysfunctional elements, but they can evolve culture by building on its strengths while letting its weaknesses atrophy over time”*. He suggests 2 characteristics of leaders as a change agent:

1. The leaders have to have the emotional strength to be supportive of the organisation while it deals with the anxieties attendant upon unlearning processes that were previously successful, that is, the ability to create for the organisation a sense of “psychological safety”.
2. The leaders need a true understanding of cultural dynamics and the properties of their own organisational culture.

That model is developed by Tichy and Devanna (1986) with a sequence of several phases beginning with recognition of the need for change, followed by creation of a new vision and then institutionalisation of change.

1. **Recognising the need for change:** An important role of the leaders is to persuade other key people in the organisation of the seriousness of the threat and the need for major changes rather than incremental adjustments. This can be achieved by:
 - Challenge current assumptions by critiques and dissenting opinions or proposals.
 - Improve monitoring of the environment by developing better external networks.
 - Encourage members to examine other organisation.
 - Measure performance, benchmarking.
2. **Managing the transition:** The leaders is hoped to help people deal with the emotional turmoil of rejecting old beliefs and values, create a climate for change, and learning of new behaviour pattern.
3. **Creating a new vision:** The core of the vision is the organisation's mission statement, which convey an intuitive, appealing picture of what the organisation can be in the future. This vision mostly the product of a participate process involving member in the organisation who must embrace the vision for it to be successful.
4. **Institutionalising the changes:** To implement major changes in a large, complex organisation, the leaders needs the help of top-level executives and the co-operation and support of other member in the organisation.
5. **Attributes of transformational leaders:** At this stage success will depend in part on the leaders's attitudes, values, and skills.

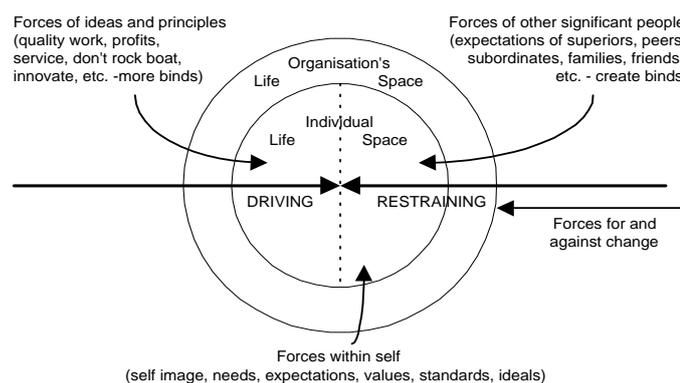


Figure 7-2: Forces affecting human behaviour (Harris, 1989)

Management to Leadership

There is some debate over whether there is a difference between management and leadership or between managers and leaders as seen in Table 7.1. Both of management and leadership are often considered as the same thing. Strong leadership with weak management is no better than strong management with weak leadership. Due to construction organisations dealing with the various complexities and frequent change, strong leadership to direct the organisation forward accompanied with strong management to pull the strings together is needed.

Management	Leadership
Coping with complexity	Coping with change
Risk avoidance	Risk taker
Involves deciding what needs to be done, creating networks of people and relationships that can accomplish an agenda	Involves deciding what needs to be done, creating networks of people and relationships that can accomplish an agenda
Manage complexity first by planning and budgeting – setting targets or goals for the future –establishing steps for steps for achieving those targets –allocating resources to accomplish those plans	Leading an organisation to constructive change begins by setting a direction –developing a vision of the future along with strategies for producing the changes needs to achieve the vision
Achieve plans by organising and staffing – creating an organisational structure and tasks, staffing the jobs with able people, communicating all plans, delegating responsibility and devising systems to monitor the implementation of various plans	Achieve plans by aligning people communicating the new direction to people who understand the vision and are committed to its achievement
Ensure plan accomplishment by controlling and problem-solving monitoring results compared with set plans – identifying deviations and solving problems	Achieving a mission requires motivating and inspiring – keeping people in the right direction by appealing to basic human potential often untapped

Table 7-3: A comparison of management and leadership role (Zairi, Mohamed, 1991, Kotter, 1995)

It is probably not unreasonable to consider both management and leadership under the same umbrella. This has been very important since new paradigm of construction industry requires people with vision and who have strong desire to want and make things happen. In order to achieve paradigm shift, it requires resoluteness and urge to see things happen, big transformations using people as the powerful means. The ability to combine both roles effectively of management and leadership as shown in Table 7-4 will undoubtedly lead to strong paradigm shift leadership.

Characteristic	Description
Decision maker	Most important tool for effective management
Listener and communicator	Must learn how to sense group dynamics and be sensitive to moods and attitudes. This is important for fulfilling employees' needs for recognition and appreciation
Teacher	Training everyone with potential to become a manager
Peacemaker	Knowing how to minimise conflict
Visionary	Setting goals which are firm and meaningful
Self-critic	Ability to admit own mistakes and learning how not to repeat them
Team captain	Consensus decision making
Leaders	Must have drive and determination Must have qualities such as trust, modesty, politeness, patience, and sensitivity Appreciate people, do not just manipulate or command but lead
Managing by walkabout (MBWA)	Surviving organisation is the adaptive organisation. Four variables: two external (customers and innovation) and two novels (people and leadership). Leadership is about focusing on sensing change and adapting to it with people involvement. MBWA is about listening, empathising, staying in touch
Challenging the process	Searching for opportunities Experiment and take risks
Inspiring a shared vision	Envision the future Enlist others
Enabling others to act	Foster collaboration Strengthen others
Modelling the way	Set the example Plan small wins
Encouraging the heart	Recognise individual contribution Celebrate accomplishments

Table 7-4: Effective management (strong management + strong leadership) styles are suitable for new paradigm.

Leaders In Effective Managing The Project

As mentioned above, the role of a new supervisor or a leaders quite changes from whatever they have done in the recently years. The purpose of the job and viewpoints of solving the problem are different and the way to reach the project's goal is quite different between one leader to another leaders. However, they are part of a group, part of the managing effort. As leaders, their job is to get work done through others, not by themselves. It becomes a test of maturity as leaders and need to be careful in building royalties. All members as a group are working for the same project with the same long-range goals. Co-operation is the key to getting the job done satisfactory. The best way to learn is to communicate between members in the group.

Management Role

Basically every leaders in construction industry has four main functions to perform. These control panels are planning, organising, directing and controlling (Broadway, 1990).

1. Planning

How and what must be done as leaders. To consider whatever alternatives are available and choose the right answer, many leaders have plan as deciding to do - or not to do -. Leaders must form the plans by making four basic decisions:

What is to be done.

Who is to do it.

How is it to be done

When is it to be done.

In the process of planning, leaders decide where they are going (objective, destination) and how to get there (policy). The more leaders take people into the planning effort, the better chances of reaching the objective.

2. Organizing

This part includes two things: the people that are involved in the construction project and the structure of the construction project that have been set up to do the job. Since higher management usually handles the structure of the construction project (Broadway, 1990), another part of construction project that is about people will be discussed below.

A group of people has joined together to get something done because they could not get done by themselves. These fits for small work group in one location as well as it does an entire construction project of thousands of people scattered many states or country. However, as a leaders, part of organising includes staffing the project, must realise that when it comes time to fill a vacancy in the group. A leaders must look forward to meeting and finding out as much as possible since one of the prospective employees will be working as a part of group. The whole project of the staffing phrase of organising is to try to match up the potential of the employee with the requirements of the job.

There is another phase of organising that leaders must deal with it. It is training. It is not sufficient to try to get employees and their jobs match as well as possible.

Leaders must still make up the difference between the employees' present and the job requirements. This can best be solved by training and organising (Vecchio, Hearn, Southey, Australia, 1992).

3. Directing

Of all the function leaders perform, by far the hardest is directing. Directing involves people and people are complex, often differing from one another and even changing themselves from one day to the next. People need vary, as do their ambitions, and as these things change, so does the way people react in given situation. But, there are some common grounds on which people react the same way all the time, and even different people react the same way to certain things. This means there are some things that as a leader can do that will give a predictable result, even though these people are otherwise quite different from one another. There are three facets of directing: leading, communicating, and motivating (Broadway, 1990).

4. Controlling

While directing the most difficult function, controlling is probably the most critical. When leaders plan, organise, and direct, there is still a problem of controlling all of what leaders have planned, organised, are directing. Without the proper controls, all the effort may be wasted. Essentially, leaders control three things or combination of them. There are money, material, and people. The problem is that each is handled differently, each takes different skill. Some leaders find it easier to control money and material because they are usually quite constant. But people are not easy to control because even for single individual may show different quality from one time to another. When leaders start to control people, they have to consider that they work at different speed in the morning than in the afternoon, their attitude and behaviour may be lots of different during working time. (Newman, 1975)

In today's competitive construction business environment, strategic planning that focuses only on the business side is no longer sufficient to guarantee survival. When leaders formulate strategy using "conventional wisdom," leaders are relegating technology, particularly information technology, to the role of an adjunct to the various functional areas of the business. Until they make information technology part of their strategic thinking, they will not realise the competitive advantages that advances in computers and telecommunications can bring.

Turning the organisational pyramid up side down (customer satisfaction)

According to Frances et al, there are two different roles exist in organisation. One has been called the leadership role-*doing the right thing*. This has been said to do with vision and direction. The other is the management role, which is *doing the thing rights*, or implementation. As a top managers in the construction industry have to create the vision and the direction of the organisation. They get the behaviour or implementation of a vision lined up with that vision. The leaders of the future has to manage the journey of the effectiveness and efficiency to create an ultimate organisation that knows where it is going and in which everyone is committed, organised, and ready to implement an agreed-upon vision.

Saying the vision and implementation are both leadership roles makes some leaders direction nervous. They know that something is going to have to change. Most organisations are typically pyramidal in nature. Who the top of organisation -chief executive, director- or who at the bottom -all the employees – is nothing wrong with having the traditional pyramid for certain tasks. The paradox is that the pyramid has to be right side up or upside down depending on the task.

It is absolutely essential for the pyramid to stay upright when it comes to setting the vision, values, mission and major goals. Nobody objects to vision, direction, and values coming from the top organisation. But if the pyramid remain right side up when vision and goals are implemented, all the energy and attention continues to flow back up the pyramid, away from the customer. When it comes to a choice between responding to a customer need or pleasing a person at higher position, your future depends on your political skills up the hierarchy. The leaders of the future, realizing that vision and implementation are both leadership roles. As a result she or he will be willing to turn the pyramid upside down to implement a vision.

Who at the top of the upside down organisation, are the customer-contact people. Who at the bottom, are top management, leaders. When it is turning a pyramid upside down philosophically, top managers will work for people (customer) in implementing visions and goals. The different is between who is responsible and who is responsive. In a traditional pyramid, the top managers are always responsible and the subordinates are supposed to be responsive to the top managers. When the pyramid is turned upside down, those roles are reversed. The people become responsible, and the job of management is to be responsive to them. This created a very different environment for implementation. The implementation job of leaders is to help people win by supporting them and removing barrier so that they can accomplish the goals that will make the vision become reality.

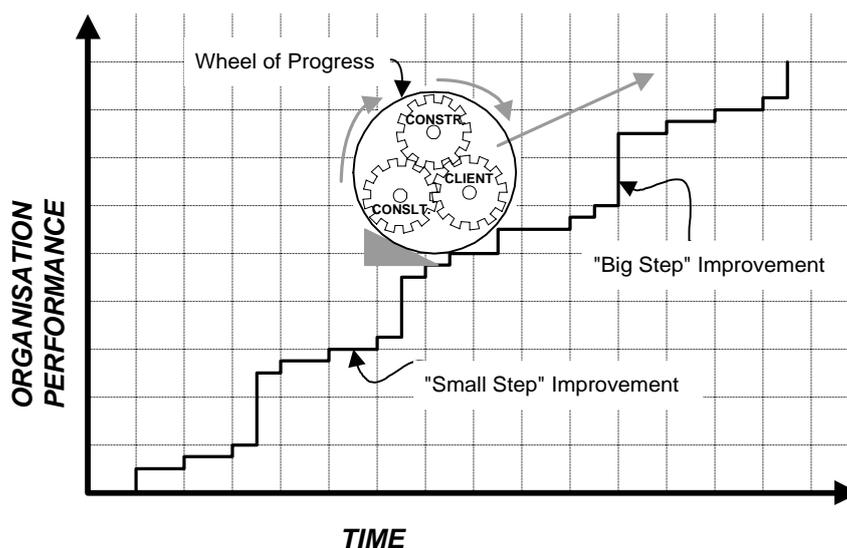
To help people win, the leaders of the future must be able to manage energy and change people's physical state of being. Setting the vision will focus people's attention and provide direction. Once that vision is set and people are committed to it, the role of the leaders is to turn his or her attention to physiology, how people are acting and performing within the organisation, and to align their performance with the vision. Here is where the future leaders will excel as a cheerleaders, supporter, and encourager rather than as a judge, critic, or evaluator. Helping people align their behaviour with the organisation's vision will solidify the attaining of desired goals and move energy in the desired direction.

Conclusion

Leadership, which is one of essential element towards paradigm shift, is very important to be dealing with human element to create environment and culture of change. Due to the fact that require of additional effort and new behaviour and up front cost for training to create the culture of change, commitment from top management is needed. Leading the leaders (if need) is applied to get opportunity to create/set strategic development (Corporate governance and direction: the function of the chairman and the board) of the organisation focused on the customer satisfaction. The role for setting strategic development comprises articulating the vision, knowing the mission, and having the enterprise plan. Next is implementation step (the function of chief executive and the management team). During implementation step, getting people to commitment is important leaders' role. That is done by using the three pillars with establishing and maintaining trust by enchanting as following contexts in which people's truth are honoured; where their intelligence, wisdom and experience are valued; where people take turns begin the leaders of the group. Leadership style accompanied with power and empowerment need to be adopted depending on situation, environment, culture, etc. For surviving of doing business in competitive environment, sustainable development consisting of building a leadership through improvement, the learning organisation is substantially needed. The construction industry continuous improvement plan for all parties (see in Table 6-1, Crow, 1998) is offered as the benchmark towards the best practice in imperative leadership.

Changes in construction organisation (culture changes and transforming the culture) are considered to apply the transactional leadership (management) toward transformational leadership. For new paradigm, effective management (strong management + strong leadership) is broadly described in figure below:

First, the leaders are figured as person that will give the direction of the organisation through strategic development towards customer satisfaction.



Second, the leaders establish the organisation that can perform as one collaboration unity and develop by itself. The last one, the leaders perform as the bearing wall that prevent the organisation from falling down again to the old paradigm.

Leadership roles toward customer satisfaction, developed from Crow (1997)

Appendix 1: Typical Progress Milestones

<p>5 Enterprise / projects are seen externally as committed to continuous improvement.</p>	<p>We have ability to question underlying values and discuss alignment issues at all levels. Managers and other employee actively promote Strategic Management for Continuous Improvement at both internal and external events. We are strong enough to challenge the balance of leadership styles within the senior team.</p>	1	2	3	4	5
<p>4 Leadership at all levels is focused on continuous Improvement</p>	<p>We are comfortable with our substantial coaching and enabling role. We continuously demonstrate our commitment to Strategic Management for Continuous Improvement We work cohesively as a management team, allowing situational leadership to occur.</p>	1	2	3	4	5
<p>3 Manager make personal changes to their leadership style to support ongoing continuous improvement.</p>	<p>We define responsibilities and competencies required for managers and supervisors involved in continuous improvement, and openly assess our current position. We try out coaching and enabling styles and seek feedback from employees and peers. We start to explore ways to improve the effectiveness of our management team.</p>	1	2	3	4	5
<p>2 Enterprise and project managers encourage and reward continuously improvement efforts</p>	<p>We begin to realize there is something in this different management approach. We have intentions of changing things and some managers act as champions of change. Some people speak up about problems and concerns face-to-face. Some of us begin to increase the level of delegation and communication.</p>	1	2	3	4	5
<p>1 Enterprise and project managers understand their leadership roles.</p>	<p>We are being told that we are a major part of the problem and we feel uncomfortable. We start to realize the impact of common-special cause thinking. We start to observe the impact of our</p>	1	2	3	4	5

	management approach.					
0 Enterprise and project managers say "do as I say, not as I do"	<p>People hide problems and errors from us We don't know the impact we have, and no one tell us. We communicate on a strictly needs to know basis.</p> <p>WE / US = Management</p>	<p>Achievement 1= some small 2= minor 3= moderate 4= substantial</p>				

Appendix 2: Typical Development Activities

5 Enterprise / projects are seen externally as committed to continuous improvement.	<p>Encourage senior managers to undertake training to enable them to stimulate and foster creativity and learning throughout the enterprise. Actively seek out the best practice enterprises and managers (not necessarily in the building and construction industry) to learn how to improve ways to lead change.</p>
4 Leadership at all levels is focused on continuous Improvement	<p>Explore the relationship between the performance of the enterprise and its ability to stimulate learning and creativity. Seek direct feedback from employees about consistency of management words and actions – there is sufficient trust for this feedback to be honest and meaningful. Provide senior managers with specific training to enable them to develop, support, and communicate the enterprise's values and vision.</p>
3 Manager make personal changes to their leadership style to support ongoing continuous improvement.	<p>Explore within the management team the concepts of values and assumptions. Provide senior managers with specific training to enable them to adopt a more coaching and enabling approach where appropriate. Encourage senior managers to review each others' management and leadership styles and give open feedback.</p>
2 Enterprise and project managers encourage and reward	<p>Encourage senior managers to develop an understanding of the alternative management/leadership approaches and begin to attempt to see different approaches in different situations</p>

<p>continuously improvement efforts</p>	<p>(situational leadership). Explore within the management team (with outside help if necessary) their critical role as a leaders of change. Encourage senior managers to use a more open approach in the way they manage and to see feedback from employees. Use outside resources to survey the gap between managers' words and their actions.</p>
<p>1 Enterprise and project managers understand their leadership roles.</p>	<p>Attend TQM seminars and workshops to understand that management is responsible for the root causes of problems at least 85% of the time. Consider and discuss the enterprise's management style and approach and the impact it has on employees. Encourage senior managers to see feedback from the people that work for them even though they are likely to be reluctant to give open and honest feedback.</p>
<p>0 Enterprise and project managers say "do as I say, not as I do"</p>	

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TRUST AND LEADERSHIP

3 Roadblocks to success

Experience has shown that there are six major roadblocks, all of which are behavioral, to removing the 40% wasted effort and creating a win-win project outcome. It has been found that these roadblocks apply to all types of project delivery approaches from alliances (risk/reward sharing) to traditional lump sum contracts.

3.1 Lack of Trust

In today's business world, for a business to become successful, a winning competitive strategy and superb organisational execution are most required. Trust is a major criterion in both of these requirements.

Behaviorally, many people live in a state of chronic suspicion. At best, people would be indifferent to others. At worst, they would be fearful of each other. In a world without trust, leaders are seen as self-serving and manipulative and people are unwilling to follow. People are individualized and they are often doubtful about others' abilities. Only the foolhardy or desperate seek advice or support. In such a situation, people prefer to work alone or in small family-like groups. They are afraid to depend on people who they do not know. A commitment to a project or goal becomes meaningless since it might, or might not, be fulfilled.

Trust exists in two levels – internal one which is within its own organization and external one which is associated with external organizations in an joint effort. A lack of trust simply cannot perform the synergy of team work and possibly leads to failure. Lacking in trust can also result in poorly designed and implemented change initiatives. Organizations with high levels of lack of trust are actually at a competitive disadvantage. It can permeate through an organization and undermine its ability to adapt to a changing competitive environment.

As an characteristic of the construction industry today where the majority is basically project based, teams members are drawn from different organizations to perform the task - project managers, architects, engineers, contractors, tradesperson and the like. These people perhaps have not work or even see each other before, and all of them represents their own parent organizations and have their individual objectives. Without sufficient time to know or get along with each other, a lack of trust is seemingly a definite result

Externally, the level or amount of trust (or lack of trust) in the industry exists in different relationships:

- Trust between Client and Consultants (including superintendents)
- Trust between Trust between Client and Contractor
- Trust between Contractor and sub contractors

Generally speaking, there is trust between Client and Consultants under normal circumstances. As Clients engaged professional consultants, they rely on their expertise to perform the job and the consultants are deemed to act on the best interest of the Client. However, the trust is based upon an “employer” and “employee” relationship, the relationship ceased as the project completed unless there is some indication of future engagements. Client’s knowledge and experience is important in contributing to the trust among consultants by understanding the scope of consultants but not over expected for services that they have not engaged for.

The trust between Client and Contraction is a fatal factor in the roadblock to success. As with individuals, teams cannot act effectively unless trusted to the degree necessary to fulfil their responsibilities. Moreover, a culture of trust within each group is essential if it is to take full advantage of the benefits of teamwork.²⁴ Violations of trust, which are more likely when controls are completely lacking, can result in a rise of chronic and debilitating distrust and, ultimately, in organizational failure.²⁵ Even though attempts had been made to reengineer to make the process more efficient and effective, the real issue is not just re-engineering as people universally fear a win-lose result. The issue is creating trust that allows a win-win result from re-engineering and continuous improvement. Under the traditional contractual arrangement, the client and contractor are standing in opposing positions and the situations cannot be changed without a significant paradigm shift from this contractual arrangement. The use of partnering arrangement attempts to eliminate the tension between Client and Contractor by establishing a common goal in order to achieve a win-win result

Internally, different groups within an organisation tend to distrust one another. Thus in many firms, functional, product, and regional groups work in self-serving, if not outright antagonistic, ways. Despite the importance of trust, in the construction, trust is not something traditionally proclaimed among the team members.

The trustworthiness of an individual is an important consideration in providing that person with the authority to make key decisions. If, for example, the senior leader of an organization is viewed as being untrustworthy, sub-coordinates will actively or passively resist what he or she is trying to accomplish. Thus, a leader’s options are severely limited by excessive and ongoing distrust among sub-coordinates.²⁶ By the same token, trust of junior staff by senior management is important so that empowerment can be given to avoid the long chain of communication. It is particular true at site situation where immediate resolution of problems on

²⁴ Shaw P.8

²⁵ Shaw P.15

²⁶ Shaw P.8

the spot can avoid delay and later dispute by the senior level, provided that the site staff are suitably empowered.

Trust among organizational members can assist implementation of changes. That is, if employees and management trust each other, people become faithful in new changes and people are likely to abandon past practices in favour of new approaches. Trust is a resource, a form of “collaborative capital” that can be used to create great advantage.²⁷ Without trust, it is a major roadblock to produce an efficient product that required a whole group effort.

3.2 Tribal Turf Protection

It is probable that whenever individuals are involved in any undertaking or operation, there is a potential for conflict. This is due to the variations that exist in human nature and there will always be differences among different people. They may originate from the bring up of individuals and the artificial separation of disciplines through education. If both the project team and construction team do not realize the difference nor do not know how to handle these differences, it will give rise to arguments and conflicts for sure. In addition, specialisation and functionalisation with different sets of values and objectives become one of the basic reasons for the existence of boundaries across the team.²⁸ In construction industry, many of these kind of boundaries exists.

In the project and construction teams, they are made up of people with different professional backgrounds, based in different geographical locations and who make their contributions at different times.²⁹ These people are highly interdependent and brought together to form a team, but unfortunately, because of the conflict of interests in the process, they are often highly insensitive to the needs of others around them and thus single common goal seldom exist.

The division into several disciplines that have led to these widespread conflict of interests have evolved over hundreds of years as the construction industry has adapted to the increasingly complex world around it. This natural response to increased complexity in building works has increased specialisation, fragmentation and thus competition. Further reasons relate to the professions who have evolved and centralised to such an extent that they are highly protective of their member’s interests and also highly resistant to change.³⁰ The industry has also been guilty of creating conflicts of interests by its employment and contractual practices, which encourage people to confront each other rather than work together.

²⁷ Shaw P.3

²⁸ Harrison P.350

²⁹ Walker

³⁰ Bowley

The obstacles to useful intercommunication between the various experts created by the system do not prevent all acquisitions of knowledge outside individual specialisms in the course of day-to-day practice. Moreover, the training of all parties to the building process necessarily include a common core of knowledge without which none of them could have operated at all. Naturally each group tends to develop a vested interest in a particular field which becomes sanctified and strengthened by custom; this made adaptation to changing circumstances more difficult. As each group establishes its own association or associations these, inevitably, acts as trade unions and includes the immediate economic interests and prestige of their members among their objectives.

As buildings become more complex, the expertise are unable to do all other specialised tasks. This leads to the development of specialist contractors who merely assist in one small aspect of the construction process on site. The increasing complexity of the construction process is leading to a fragmentation of the construction industry. The fragmentation of the building process leads to communication and co-ordination problems that have hitherto not existed. So the specialists try to solve these problem in starting the professional institutions. And the manual workers also form unions. Unfortunately the formation of unions merely reinforce the divisions that have built up within the industry as each profession develops its own separate identity, working practices and language. The development of specialist languages is a deliberate act to restrict membership and in turn makes their clubs more prestigious. They seek to protect their interests by demanding certain requirements for entry and instilling in their members a high resistance to change. This rigid structure which arises as a result of a response to increasing technological complexity actually restrict the industry from adapting any further to the changes going on around it. As a result the industry becomes increasingly inefficient.

Many believe that the professions are one of the greatest problems, which the industry faces today in that they have become institutionalised to such a degree around the standard RIBA standard roles – architect, engineer, surveyors, contractors.³¹ Moreover, professional associations basically have more or less the same aims as labour unions, that is, to represent their members in obtaining better incomes and working conditions. These associations are often even more effective than labour unions in controlling entrance to the occupational fields.³² In addition, the professional bodies in particular are also active in trying to improve the proficiency of their members in their chosen fields and their ethical standards of practice. Moreover, the more rigidly any group defines its own qualifications, the more clearly it can demarcate its special field against encroachments by other groups. By a process of attrition also each group tended to rid itself of talents or acquirements relevant to other groups. Thus modifications of the demarcations have gradually become more difficult for the practical reason that the individuals available have ceased to be qualified to make use of such changes.³³

³¹ RIBA

³² Davis P.316

³³ Bowley P.353 354

As a result they have vested interests in the standard system and it is natural to expect that these people will do anything to protect their traditional roles and professionalism even at the expense of the industry. Many ask the question of whether the industry can afford to entertain institutions that engender such a sense of protectionism and rigidity and resistance to change in the highly uncertain environment which exists today.

3.3 Focus on Development, not the End User

When we first talk about a project in construction industry, we commonly refer to the stage starts from where the Client has a conceptual idea of a project to the delivery of a product (building) to the Client. Traditionally what is happening after the handover seems not to fall into the realm of the “project”. Usually not even a handful of the project team members will still remain after the handover. Property management or Estate management picks up the rest of the product life cycle of the building but yet the property management is seen as a separate discipline to the construction industry, nor to the original project team.

However, the building life span depends on the initial consideration in the planning & designing stage, and on the quality of the works done during the construction stage. Whether a building enjoys a long project life or suffers from a high maintenance cost is a direct result from the above two factors.

It can be observed that the construction industry is highly trained and structured to produce the most capital cost efficient facility but not to produce the most cost effective service to the end user or customer over the life of the project. Different professions such as project managers, architects, engineers and surveyors emerge to take part in the industry. Each of them structured itself to perform its role in a most effective manner. But all of them do not extend their professionalism into the life cycle of a building. Perhaps as a project initiator, the Client has to engage itself to a more fundamental concern of the project life cycle.

Clients can be classified into 3 main types: first, developer whose objective is to develop the land and make profit from his investment, his prime concern is the time and cost for the project construction. Second, facility users such as a factory owner whose objective is to build a building to facilitate the production of his goods; his prime concern is the functionality of the building whether it can facilitate his production efficiently. Third, end user such as homeowner whose prime concern is the building itself, thus the quality of the building is in the top of the list.

Whilst the majority of the projects lies in the hands of the developers, projects are established in the objective of shortest time and lowest cost. With the concept of “Time is Money” in mind, once the project is practically completed, the developers sell the properties to the end users and the maintenance cost are transferred to the end users. With little or no responsibility to the maintenance of the building from the client, it is difficult to expect that the consultant team or even the construction team will have much attention in producing a cost effective service to the end user over the life of the project.

Very often, the quality of building is barely minimal to satisfy the statutory requirement; and in most cases, the recurrent cost does not form any part in the budget. Life cycle cost management simply does not exist among the short term investment developers.

For the second type of clients, the recurrent cost is an issue but not as significant as their production in business. As long as their business is good, the urge for low maintenance is not of paramount importance.

Perhaps the third type end user clients suffer the most impact from the inconsiderate project planning and construction. However, without client's financial support, the project team still cannot perform satisfactorily. It is usually the case that this type of clients do not possess either the knowledge on long term recurrent cost including the customer's staff cost or simply do not possess the long term financial backup for a capital intensive but low recurrent project. As a result, they simply focus on the capital cost of the project.

The separation of project team and the later property management team leaves a behavioral gaps in the construction of the project; whereas each party concentrate on their own turf and fulfill their individual responsibility as the ultimate goal in the project. A true life cycle cost management will only have true meaning if the facility designers and constructors have joint responsibility for satisfying the users of the facility over the life of the facility. This requires a fundamental breakthrough of the iceberg among the project team members with consideration of total recurrent cost in operating the facility. The client initiation of considering higher capital cost but lower maintenance cost must be considered, and to make it effective, the consideration must be made right at the earliest stage of the project.

3.4 Traditional Processes

As construction possesses a long history, it has evolved with human activities and developed into a highly structured sector in the society. With this long history, no matter good or bad, there exists a culture in the construction industry. Cultural attachment to established ways of doing things is really two faces of a coin. To the good side of it, there are practices which have been consolidated into highly efficient ways that every practitioners is familiar with the process and cannot go wrong. Whereas on the bad side of it, these traditional processes present a barrier to the industry from seeking continuous improvement.

For the consultants, Loosemore³⁴ raised an excellent example with the problem in the traditional process - the tradition method of organizing construction activities in the UK is typified by the RIBA Plan of Work (1980) which itemizes the stages of evolution of a building project. Essentially the process of the activities is highly sequential and separates design and construction into distinct phases of activity with distinct production teams. At a result, buildings produced using these traditional practices faced numerous

³⁴ Loosemore, M., To be forewarned is to be forearmed, p.1

criticism. The rigidity of the traditional system and its inability to adapt to the increasingly demanding requirements of clients failed to put the projects on time and to budget, particularly to the relatively complex buildings.

For the constructors, the development of trade union yet set up another set of practical rules for their own that is nearly unable to challenge if a contractor wants to stay in business. The established rules governing cannot be easily changed without a dramatic paradigm shift in the industry as a whole. People under such situation tend to follow what has been established without challenging the effectiveness and validity of such rules. People are simply reluctant to change, and fear to change.

It has always been considered that as each of the construction projects is unique in technological and managerial challenges, this makes it very difficult to learn from previous projects and thereby refine systems of work; learning from other industries is utterly out of question. However, it should be noted that one important impact had happened in the industry, which is the advancement in the technology, both in terms of information and the construction. New materials are available and more complex building can be designed. The change in the overall working situation however is less able to be picked up by the traditionally driven mentality. For example, a building project in UK needs to produce the construction of a homogeneous, complexly curved seamless, aluminum structural shell, only the yacht manufacturing industry got the experience and skill and to handle the job³⁵. Traditional process relying on architect to produce design and contractors to produce buildings is certainly insufficient to deliver the project and thus a merge of a completely different industry is necessary. In the marine industry, a different culture was adopted where closer client / builder relationship and simpler contract terms, all of which are indifferent to the construction industry. Despite the difference in the industry nature, the experience can actually be learned from the other industry and the project is a great success.

Another reason for contractors to remain in their established practices is because a project involved large sums of money, thus people are reluctant to test new ideas because they are afraid of failure and its following consequences. Clients are also afraid of being the guinea pigs in the industry and wait for others to try it first. The contractual relationship is a good example.

The use of tradition contract is a common practice due to the fact that it is an off-shelf document and the clauses have been tested judicially and supposingly contain no faults. Previous contract disputes set a lot of examples and become the precedence of many other following projects. Having understood such dispute may prevent the same dispute happening in the next projects. Clients are afraid of any hidden risks involved in any new sort of arrangement and are more skeptical on other thing outside the traditional practice. However, the blind reliance on the tradition yet at the same time presents its own problem – every party thinks they understand every clause as they are traditional and standard, without really looking into the conditions of application and the suitability on their project. But the project is inherently uncertain and unexpected problems are a fact of life.

³⁵ Building, UK, 02/10/98, p58

Thus problems are bound to be present somewhere down in the contractual relationship. It is not difficult to see that traditional contracts are based on a win-lose situation which discourage the trust between the two parties, whenever problems arises, both parties accuse the mistakes from the other party to protect their own benefit or prevent themselves from getting into contractual disadvantage position. The majority of the effort lies in the accusation and defense warfare, the objective of solving the original problems become secondary. Fundamentally, traditional contracts are drafted based on the idea of “what if something goes wrong” principle and clauses like Liquidated Damage define the actions against the wrong doings, which forces the offended party into a defensive mode for its own survival.

The reliance on the accepted traditional contracts however at the same time hinders the exploration of alternatives in the process and becoming a roadblock to the system. Some evidence show that partnering is a new co-operative contractual arrangement enables the trust among the parties. Trying to break through the square of traditional process, many organizations such as the Government now has their own self drafting contracts emerged to replace the inefficiency in the traditional contracts

3.5 Reluctance for Multi-Disciplinary Team Work

There is an underlying assumption of behaviourists that “individuals are well balanced human beings who work unselfishly together towards a common objective”. The human behaviour approach to management is a highly moralistic approach and it would be too ideal if all individuals, groups, companies and even nations behaved as it assumes. Unfortunately, the reality is often disappointing³⁶, particularly in construction industry where teamwork is essential.

When individuals and groups are interdependent, there must always be some degree of co-operation between them. However, the nature of this co-operation can vary considerably and this to some large extent determines the performance of the team. At one extreme, the nature of this co-operation or the relationship between individuals and groups, can be very friendly and supportive, generating, teamwork. At other extreme, it can be very hostile, generating conflict.³⁷

Conflict between individuals and groups in the team prevents participation. It becomes impossible to create or maintain an effective team. However, an effective team is the only way of achieving the ultimate performance potential. Conflict leads to a lack of respect and trust between groups, a lack of harmony and co-operation, and a breakdown in communication, with information being distorted, censored or withheld. Each group will tend to reject ideas, opinions and suggestions arising from the other groups, and feelings or emotions will run high, with a greater chance of mistakes being made by people whose judgement is clouded by stress. Groups will tend to have unspoken

³⁶ Harrison P.276

³⁷ Harrison P.268

objectives, different from those of the organisation, such as to ‘get’ the other group, block anything they propose, achieve dominance over them and show them in a poor light to senior management. Individual organisational objectives will be subordinated to the group goals, which concentrate on achieving dominance or victory over the other groups. This accelerates the breakdown of communication between groups, and creates unfavourable attitudes and images of other groups.³⁸

There will be a polarisation into a “we/they” attitude, instead of “all for one and one for all”. Decision-making and problem-solving will be slow and difficult, differences will not be worked through in an open manner and there will be win/lose situations leading to more hostility and conflict, lowest common denominator compromises, or submission of disputes to higher levels of management for arbitration. In general conflict is detrimental to overall performance and will make it impossible for a commitment to the organisational objectives to develop.³⁹

When there is interaction and interdependency between individuals, groups and companies involved in a joint undertaking, such as a project, co-operation is essential to efficient working. The more co-operation in teamwork, the more effective the organisation is likely to be. However, the more conflict in this co-operation, the less effective the organisation will be. Therefore one of the objectives of the project manager should always be leading individuals, groups and companies towards total teamwork.⁴⁰

The existence of high level languages and the step-by-step nature of professional work often enable multidisciplinary teams to be creative. Combination of knowledge and skills are the building blocks to new answers. However, very often specialisation of skills builds up the boundaries to problems. Thus, organisations must break through these language barriers. For example, an electrical engineer can spot an answer to a difficult architectural problem, simply because he does not know the conventional wisdom and sees the problem in a different way. Time is required to achieve this high level of creativity in building a common language and allowing a step-by-step process to bring to openness.

Multidisciplinary teams having worked together on several projects begin to develop a kind of team instinct for the next move. Each member of the team can, to some extent, anticipate the actions of the others. Gradually a good team begins to achieve the effortless confidence of the individual professional. When it does so, of course, it is able to draw on a much richer set of patterns than can ever be available to any one individual. However, there is rarely sufficient time or resources to build a new and creative team within one construction project. This is why wise customers allow the key members of their project organisations to bring their own networks of professional collaborators with them.⁴¹

³⁸ Harrison P.277

³⁹ Harrison P.277

⁴⁰ Harrison P.269

⁴¹ Bennett P.101-102

3.6 Reward Equity

Most disputation and causes of low quality work on projects can be traced to inequitable reward for the resources involved and risk undertaken. This major roadblock to success lies in the existing tendering system which the client requires a number of tenderers to tender on the same set of document. The tenderer who submitted the lowest bid tender wins the contract.

Through tendering, client expects the lowest price to complete the job while at the same time expects the highest quality they can ever made. Loosemore pointed out that the industry has created guilty of creating conflicts of interest by its employment and contractual practices which encourage people to confront each other rather than work together. We commonly ask contractors to take on enormous risks but at the same time reduce his ability to charge for those risks by placing them in competition with other contractors⁴². As a result, competitive tenderers have to submit to client at a successful rate of one in eight to get the job⁴³. It would be commercially unwise for any contractor to put too much effort in to producing a perfectly accurate bid each time they compete for a project since abortive tendering costs would be information. Besides, as the tendering process involves a bundle of tenderers bidding for the job, effort in producing an accurate cost is rare. The overall cost for producing the tendering is high. Interesting enough, the initial response of a contractor when they win a bid is to look to see where they have made their mistakes in the tender.

For tenderers, in order to win the bid, they tend to put underestimated figure in their bids. This competitive approach forces the profit margins down to such a degree that when contractors enter the project in a defensive mode from the very start of the project. This becomes a situation that contractors are tempted to look for any places in the contract documents where they can offset the underestimates or to make profit. The low profit margin not only demotivates the contractor to complete the job satisfactorily and at the same time passed the profit pressure onto the subcontracting level. Lowest subcontracting contract are sought and most of the cases the quality of the project is going to suffer. Ultimately, it is the clients' loss. The situation tends to be worsen when the contract is a lump sum one where it is harder for contractor to claim for additional costs. Whereas the cost for the construction is "fixed", there is no more motivation for the contractors to do the job in a proactive manner rather than to complete it in the bare minimum requirements as specified. The low profit margins also leads to the falling investment in Research & Development and a poorly trained and led workforce which also contributes to poor quality of the construction industry.

Reward equity shall be a function of risks involved. The higher the risks, the more the client have to pay if he wants the contractor to be transferred the risk. As the construction process is inherently uncertain and unexpected problems are a fact of life, managing construction successfully is much about managing risks as anything else. Without reward equity support to the uncertainty and risk, contractors lodge in large

⁴² Loosemore, M., The challenge of Managing Construction Projects p.2

⁴³ Loosemore, M., The challenge of Managing Construction Projects p.2

claims when problems arise or try to turn away from the risk as much as possible. Both ways will not ensure a good co-operation with the client and eventually prevents the success of the project.

Another problem is the uncertainty of risks that caused by the innocent ambiguity of contract clauses, whenever the unexpected problems occurs, dispute arises on who is responsible and to what extent. Once dispute begins, contractors complaint the changing nature of the design that cause them delays, the low margin from the lowest tender and the uncertainty of conditions during the construction. One interesting point for the slack of the builders is that from history they are notoriously difficult to sue if anything goes wrong. In other words, contractors are more in an advantageous position in the tug games or having a more bargaining power. Whilst the client is more concern with the progress of the project in time overcast whoever while the contractor found that they might find an easier way out. Again, the client has to pay the price ultimately.

Integration of the entire design and construction processes, putting an end to competitive tendering and the phasing out of formal building contracts is crucial to realizing the revolution in program management.

Conclusion

These six roadblocks result in management and professional demarcation with project teams:

- Focus on self preservation
- Thinking inside the “traditional square”
- Co-ordination across unnecessary boundaries of responsibility
- Having limited team work
- Creating formal systems which restrain creative co-operation
- Having institutionalized role

The behavioral challenge is to change attitudes and remove the “manmade” roadblocks to allow teams to

- Focus on end user
- Be synergistic (whole greater than sum of parts)
- Form alliances with external teams (e.g. statutory authorities, utilities)
- Recognize interdependency of team members
- Adopt flexible roles
- Create a learning team environment
- Think “Outside the Square”
- Create informal systems, based on trust, to enhance co-operation and innovation.

The above requires a construction industry wide paradigm shift.

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FUTURE CHALLENGES IN THE CONSTRUCTION INDUSTRY

ABSTRACT

This report tried to identify the future challenges in construction industry. The challenges have been obtained by adopting and analysing the history of construction itself, Australian manufacturing industry improvement and the Japanese approaches.

It was found that the Australian construction industry, has not made the significant efforts of changes to business practises that many leading overseas companies are making in order to achieve higher and higher performance.

Findings of future challenges in the construction industry clearly fell into two different categories. The first being – Environment Challenge - namely Sustainable construction, Education, Technology, and Research and Development Roles, and secondly - Enterprise Challenge – as initiated by CIDA, it consists of Customer Satisfaction, People Involvement, Planning, Process, Supplier Relationship, Information Use and Leadership.

There seems to be no other way for construction industry to survive doing business in this time and in the future without establishing appropriate efforts, for example, World Best Practise, in order to improve the performance.

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INTRODUCTION

It is indicated that, in fact, the past and current productivity and performance of construction industry is failing behind the major competitors in the international competition. The need to increase the performance, as a major objectives of this report, is to be established, therefore a framework of future challenge is also needed as a guide.

First, the history of the development of the Construction Industry itself clearly indicates the need to meet the requirements of the industry both internally and externally.

Environment factors that are likely to pose as future challenges for the Construction Industry will be discussed. Such factors are in the areas of firstly, Sustainable Construction, Education, Technology, Research & Development and secondly, Enterprise Challenge, as internal factor, particularly in the context of customer satisfaction, people involvement, planning, process, supplier relationship, information use and leadership.

The focus of this report will, however, be in the analysis and identification of areas within the Project Delivery System of the Construction Industry. Some obvious but currently overlooked and take-for-granted issues will be assessed, discussed and recommendations made. These issues are looked at mainly in the context of the Australian Construction Industry with particular reference to the CIDA Survey of 1993, comparisons to the Construction Industry of other countries, particularly Japan and comparisons to Australian manufacturing industries. An attempt to illustrate basic areas which the Enterprise Challenges can be particularly met with the view of Continuous Improvement as the one-off nature of construction industry distinguishes from the nature of other industries.

HISTORY OF BUILDING INDUSTRY

The history of building is as old as man himself. Understanding of the history of building is necessary to provide a base for the future development of the construction industry. Investigation to Medieval & Renaissance and Industrial Revolution to 19th century, was carried out to acquire understanding of changes within the industry.

Medieval & Renaissance Period

The building industry in the Medieval Period (1066-1485) - particularly in England - was mainly carried out for the church and for the state. The middle class becomes a new customer, as they get more significant as the result of the flourishing trade.

As architects did not exist, the idea of design was already existent when the building started, without much conscious thought (Andrews, 1993, pp. 8-9). The building process itself was conducted based on trust without any written contract between the parties involved. Control was carried out by the ranks of educated gentlemen, appointed by the landlords. Andrews (1993) discussed about the characteristics of the Medieval builders where he argued that good workmanship dominated everything else. This type of attitude started to change in later times, where the builders started to demand some financial reward until finally in the Renaissance he became a “*professional*” man.

The emerging of the new market for building industry in the Renaissance period, created increasing demands to customise and elegant designs, and in the end gave birth to the first professional architects (Williams, 1968, pp. 79-81). As it the case for the design, the building construction had become more complex and the first building contractor appeared towards the end of 16th century, mostly from the master masons and the material suppliers (Williams, 1968, pp. 68).

Industrial Revolution to 19th Century Period

The industrial revolution in the 18th century is used to describe the transformation of Britain from agricultural to an industrial country. In the arrival of the industrial revolution there were increasing demands for factories and factory-towns with all the supporting facilities. The market was expanding rapidly, accompanied with by accelerating growth of population, wealth, urbanisation and internal migration. Pressure was put to the construction industry to provide all of these facilities in the most economic and efficient way.

In this era, other specialised work like quantity surveying and engineering emerged due to complexity and the demanding nature of the work. Higgin (1963, pp. 38-48) clearly spell out the organisation changes during this time and shows the complex pattern relationships and the divisions of functions and argued that these two factors have direct relationships with communication problems.

In the early boom of construction industry, the main contractor sought to increase their profitability by providing most of the services in-house. This shift was made possible by the high demand brought by the Industrial Revolution and for the post-war development. By the end of 19th century there was a resurrection of subcontracting due to the challenge

of economics and technological development, and it became the common practice up to now.

Finally, to conclude this section, it is interesting to sum-up some of the changes that had significant effect to the industry. These changes did not come individually, but they are connected and influence each other.

- ❑ **Change of attitudes and interpersonal relationships;** Renaissance had change the attitude become more individualistic and “professional”. The change in the attitude affected the interpersonal relationship between the participants, where it lost the trust-based relationship, and become more adversarial.
- ❑ **Change in construction industry structure;** pressure was put by the changing environment, namely the technology development, the complexity of the process, and the inconsistent market make the construction industry to be highly fragmented.
- ❑ **Change in demand;** demand is probably the most important external factor that affects the industry (Cooney, 1993, pp. 72-73). Looking at the development of construction industry, there were undisputed evidences that show how the industry adapted to demand.
- ❑ **Change in public opinion;** public opinion had change since the Medieval era. Then, good workmanship was above anything else. In time, this opinion changes to favour open competition which give way to tendering for fixed sum, penalty for delay and other arrangement which is become the standard practice.

Observing the background of these changes, it can be seen that the construction industry reacted to the environmental forces that propel the shift in the industry. Even though there is little we can do about the environment, it is important to watch the changing trend around the industry.

LESSONS FROM AUSTRALIAN MANUFACTURING INDUSTRY – A CHALLENGE

Based on a study of continuous improvement which have been working since 20 years ago in manufacturing industry in Australia, this result showed us that “*new workplace culture*“ that has initiated and permeated in that industry has improved dramatically in the both productivity and performance. Therefore, regardless to the differentiation of the nature of both industries (construction and manufacturing), we might learn something about this incredible improvement.

Basically, the element of “*new workplace culture*” covers continuously improvement approaches to productivity and quality, more team-based approaches to problem solving, flatter organisation structure, more flexible processes, increased involvement of suppliers and human resource policies based on multi-skilling, retraining and a generally more co-operative approach to work. It is illustrated by the “*best manufacturing practise jigsaw*“ which contains of manufacturing strategy, benchmarking, technology, people practise, quality, and leadership.

According to the Australian Manufacturing Council (AMC, 1994), the “ *new workplace culture* “, which is described as fundamentally a state of mind that drives constantly for “ *best practise* “ has proved the facts that:

- ❑ Average sales growth in Financial Years 1991 – 1993 in Australian manufacturing industry has been increased by around 38 % p.a
- ❑ Increase in average export by \$1.26 million per site over two-year period (1991-1993)
- ❑ 90 % of manufacturing companies that were running under continuous improvement program had positive cash-flow and significant increased profit.
- ❑ There was a significant reduction in time consuming for disputes and conflicts in the industry, which is approximately by 30 %.
- ❑ Another fact, customer satisfaction has also been increased by 20%.

To some extent we might be aware of the challenge we face in responding to the development of performance of construction industry enterprises. If, as stated in Building Best Practise (CIDA, 1993), “ *improvements in construction can have a greater effect on the economy than improvement in any other industries* “ (research indicates that a 10% lift in construction efficiency will translate into a 2.5% lift in Gross Domestic Product), the challenge here is, why we still could not get out from “ *traditional way* “ and try to build a new direction to improve the industry’s performance.

Due to the nature of the industry, of course, it will have different manners and approaches as manufacturing industry has. However, there are still particular practises in management that we can adopt as our best practise in order to achieve higher performance such as improving leadership, willingness to change, and customer focus.

LESSONS FROM JAPANESE CONSTRUCTION INDUSTRY – A CHALLENGE

The question might arise is why we need to learn from Japanese construction industry. As it was reported by Geoff Haley, 1994, as Japan has created the mightiest manufacturing force that the world has yet seen. Japan’s 3% of world population working on 0.3% of the world’s land area produce 10% of the world’s total annual products, Japan’s construction industry produces about 16% of the country’s massive gross national product, making it as large as the construction industry of the USA or the EC. Again, Frens P, 1995 in their article argued that often Japanese enterprise (and especially the so-called Big Six¹) is used reasonably as examples of the ideal construction firm.

These are conglomerates of various horizontal and vertical industrial connections, grouped around a bank or business house. The Japanese construction industry can be characterised as:

- ❑ Dominated by only a few large companies with close contacts with other industrial sectors and the financial sector,
- ❑ A high degree of subcontracting (in fact informal integration),

¹ In Japan, Shimizu, Kajima, Taisei, Takenaka and Ohbayashi are the five largest companies, and the Kumagai Gumi operates mainly outside Japan.

- ❑ Many long term relationships between suppliers (contractors, subcontractors, supplier, etc)
- ❑ A high degree of integration eg integrating firms in design, construction, finance, and supply.
- ❑ Existence of a high degree of trust relationship
- ❑ Total Quality Management and Customer satisfaction
- ❑ A strong and direct connection with government

In fact, this Japanese model is completely different from the European or Northern American market. In Japan, as Pries 1995 discussed, a uniform system of regulations exists and enterprises compete on a technology (quality) basis instead of severe price competition as is the case in North America and Europe. If, as we are facing in our industry, there was little **mutual trust** and the competition being based solely on price and fragmented regulation, how we might be able to copy Japanese Construction Industry in order to improve our overall industry performance? It is impossible to just simply copy from the Japanese model as we have different circumstances here. However, as we discussed in previous discussion about lessons from manufacturing industry, we still can learn from some of their practises namely the customer orientation, the efficient Research and Development, long-term relationship between supplier and the importance of **TRUST** in project team (including client).

THE CHALLENGE AHEAD – THE FACTS AND IDENTIFICATION

The Facts

The previous studies and researches, from a report of the *Australian Manufacturing Council* in 1990 on the international competitiveness indicated briefly that the average Australian company, including construction company, lags total productivity levels of the world's best companies by up to 25%. While construction companies may not have been operating in international markets, many of their key clients do. Indeed, the costs, quality and scheduling of construction activity is an important determinant of many clients' total life cycle costs and international competitiveness.

The Industry Commissions' report “ *Construction Cost of Major Projects* “ (1991) also highlighted that in a number of areas, clients faced construction cost disadvantages of around 20% in Australia compared to the lowest cost developed nation. Compared to Singapore and Hong Kong, the situation was even worse with cost disadvantages of 50% and higher being fairly common. These are considerable cost barriers for clients wanting to win export market. The report of the *Overseas Study Mission on International Best Practise (1991)* also stated the fact that commonly Australian companies have not made the same sort of changes to business practises that many leading overseas companies are making to achieve world best practise.

According to those reports above, it seems that the major impetus for facing the future challenge of Australian construction industry has been the need to improve performance, efficiency, reduce costs and wasted effort. Therefore, the integration with the world economy as a result of mobile capital is increasing in the globalisation era is absolutely needed.

The study based on CIDA's survey¹ in 1993 (questionnaires were mailed to 517 Australian construction company) concluded several important issues to be tackled by managers in the industry. They are as follows:

- ❑ Lack of a long-term vision and where this exists, the lack of appropriate strategies to achieve it. e.g. only 42% of firms have a five to 10 year vision,
- ❑ Customer focus and quality in fiction, not in fact e.g. nearly all of the firms surveyed do not have formal systems or procedures to identify the client or customer issues, problems and possible improvements.
- ❑ Employees, an undervalued resource e.g. only 17% of firms indicated one-fifth or more of their training efforts are targeted towards problem-solving skills.
- ❑ Behaviours dominated by cost minimisation e.g. 85% of subcontractors, 73% of contractors and 15% consultants considered lowest cost services to be important to their competitive strategies.
- ❑ Innovation and process improvements sourced from a narrow base e.g. only 28% of firms considered their firms to be innovative.
- ❑ Un-realistic notions and complacency as to how firms compare to best practise e.g. only 21% of firms show there is “ *some interest* “ in best practise amongst firms in the industry.
- ❑ Traditional construction chain of command a barrier to efficiency e.g. only 24% of firms were usually involved in the development design and specification stages – three-quarter of these firms are consultants. This fact shows us that there is minimal involvement of contractors and subcontractors early in the construction process.

To sum up, in order to improve our performance as an industry, we must challenge the way we operate, not just the technical aspects, but also the fundamental behavioural aspects.

Identification

In this report, as shown in the Figure 1, we also divided the future challenges of construction industry as 2 types, namely **Environment Challenges and Enterprise Challenges**.

The environment challenges as future challenges in the construction industry particularly Australian construction industry covers several issues namely Sustainable Building, Education, Union Rationalisation, Government Involvement, Technology and Research and Development Roles. On the other hand, Enterprise challenges, as we have described earlier that we need to have imperative strategies to meet the challenge by improving the way the enterprise internally doing business. Seven key elements as initiated CIDA earlier is used as the future challenges of enterprise itself in order to achieve higher performance, efficiency, reduce the costs and wasted efforts. They can be categorised as Customer Focus, People Involvement, Planning, Process, Information Use, Supplier Relationship and Leadership. However, this report provided a little attention of proposed strategies to meet the environment challenges as it can be viewed as external factors of

¹ “Two Steps Forward, One Step back “ CIDA

enterprises and there is no significant strategic efforts can be practically implemented in order to meet those future challenges.



Figure 1 : The Future Challenge of Construction Industry

A PATH TOWARDS THE FUTURE: CONTINUOUS IMPROVEMENT

Probably we might argue that the construction industry is so different from other industries. In order to meet the better way of doing business, many industries recognise the need for substantial change. They are relying on workplace reform and looking for “quick fix” solutions in one of latest management approach and associated crash training programs namely quality assurance, total quality control, re-engineering and benchmarking. The question is, what is appropriate approach to meet the construction industry’s future challenges, in other words, how can the construction industry implement the better way of doing business?

As a result of the one-off nature of construction industry, we believe that the strong process-orientation of the approach is less applicable to the construction industry. As the products are different from one project to another, there is too little time for participants to apply the best way and meet the challenge. However, we should not ignore the fact that those participants are involved regularly in repeated processes in spite of the one-off nature of the industry (project management, estimating, tendering, design, etc). As an example, if a subcontractor improves the way it pours concrete on a multi-storey office building, it will incorporate those improvements on the next multi-storey project. A consequence of that, a gradual process orientation, which maintains step by step long-term success, needs to be taken. As a series steps, every step’s performances should be sustained and broadened to achieve the higher and higher performances.

CONTINUOUS IMPROVEMENT, as CIDA has initiated earlier, is about “changing the traditional performance of an enterprise and its project teams to achieve, sustain and eventually lead world best practice”. What is needed now is a step by step significant cultural change, starts at the every CEO of company and spreads to all employees and project partners. It is not a dramatic change or quick solution as other industries have, but, it is a continuous change that maintains improvements at every step. To sum up, by Continuous Improvement, we might simply say, “we are creating the future !”.

There are three types of improvement activities are required in Continuous Improvement, which is described as figure below.

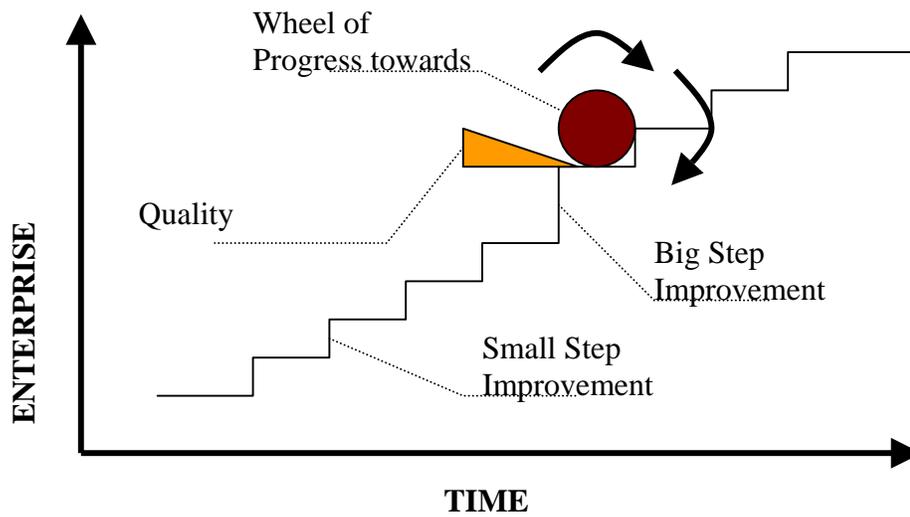


Figure 2 . Progress Toward Future By Continuous Improvement
(Adapted: CIDA, 1993)

- ❑ **Advanced Concept** : *Big Step Improvement* encompassing strategic initiatives, major projects and key business process innovation.
- ❑ **Incremental Improvement** : *Small Step Improvement* undertaken continuously by cross-functional or natural work teams as a part of their normal day to day activities and job function.
- ❑ **Quality Assurance** : Establishing a sustainable base and standardising process improvement, by rewriting procedures and conducting training in the new way of operation so that any improvements that are made to the system are not lost over time but remain as standard operating practise.

CIDA has also identified four prerequisites of successful Continuous Improvement in order to meet the “*future challenge*” of construction industry, which are:

- ❑ **Clear Strategic Direction:** Long-term plans are formulated, shared, by all employees.
- ❑ **Working Together:** employees work in internal teams and in project teams to measure, analyse and improve their work processes to better serve all customers.
- ❑ **Performance Management:** system are in place to ensure that the right information gets to the right people at the right time so as to make the right decisions with an emphasis on forecasting outcomes and highlighting variances for corrective action.
- ❑ **Effective Leadership of Change:** all managers and team leaders are required to commit and lead continuous improvement by providing support to employees and project team members and by setting a personal example for action.

MEETING THE FUTURE

Environment Challenges

SUSTAINABLE CONSTRUCTION

The Construction Industry is a one of the leading contributors to the global environmental degradation and diminishing natural resources. This is being realised by its very need for materials to undertake its activities in response to the rapidly growing world population and its subsequent demand for infrastructure. This is characterised by the mass destruction of forests, vegetation and energy sources.

In order to alleviate the environmental degradation and diminishing energy and material sources, global attention has been focused on the derivation of appropriate government and industrial policies for research, development, experimentation and establishment of viable alternative solutions. For an industry that is often reticent about publicising its achievements, the signs are there and begging to be accorded attention for a significant change of heart and attitude. Waste minimisation requirements in contractual documentation must now begin to focus on the re-use or recycling of materials and renewable energy. This should confirm that the Construction Industry's commitment on environmental issues is serious. Some means by which this can be done are suggested as follows:

- ❑ Project Managers must sit down with project teams, main contractors, subcontractors and clients to devise strategies for each new project. Contractors and Subcontractors must draw up their waste minimisation plans,
- ❑ Statutory requirements must now be made as compulsory requirements for environmental friendliness in all contracts.
- ❑ Contractors and subcontractors must demonstrate the range of best practice solutions to waste reduction.

Waste minimisation, recycling and re-use of construction materials cannot only be viewed as environmental issues but monetary savings as well. For example, it has been reported that the NSW Government has dramatically increased costs for land-fill dumping - most recently by \$17 per tonne.⁴⁴ If Contractors, subcontractors and demolishers are keen to save money, then they should take a positive attitude in recycling, re-use and waste minimisation.

EDUCATION

There is a need to improve co-operation and collaboration between industry, higher education and professional institutions. Integration of undergraduate education to the professional role in the construction industry needs to be considered as continuing professional development. They need to work much more closely with contractor. As management in the construction industry will increasingly become more professional, the need to complete undergraduate education with the managerial knowledge, leadership practise, and “ trust - culture “ as organisational culture have been identified as essential

⁴⁴ Building Australia Magazine, June 1998.

requirements for future challenges. For the postgraduate education, they are more required to lead to deeper involvement between industry and education as research establishment.

GOVERNMENT INVOLVEMENT

The environmental regulations have played a major role in construction industry. In the future, the influence of government as subject of regulations is becoming more and more important. The government and its financial regulations lead to a strict financial range for the products of the industry and their quality. Besides that, business-licensing conditions, procurement and working conditions are also increasingly determined by government's influences.

As government is a very dominant client in Australia construction industry, this, combined with the regulations mentioned before leads to a minimal variation in the quality of products. Subsequently, the existence of increasingly government involvement can create a filter between clients and enterprises. This will enforce construction companies to seek their competitive advantages and survive in this industry. Industry's practitioners are becoming aware of innovative potential of the customers and users and to improve their company's performance.

TECHNOLOGY, RESEARCH and DEVELOPMENT

The need to integrate technology and R&D more deeply in the way construction companies doing business seems to be a powerful weapon to survive in the market. The investment of R&D in components, manufactured products, raw materials, Computer Aided Design, material handling, process techniques, and design process are expected to ensure the performance of the industry is becoming higher and higher.

It seems that the environment issues will enforce the technology and R&D to work along friendly environmental conditions such as the introduction of new materials as well as greater use of recycled materials.

Enterprise Challenges

CUSTOMER FOCUS

The Construction Industry must face the fact that the very needs and expectations of its customer(s) necessitate its existence as does most other industries. Consequently, the Project Manager and the general Construction Industry's performance must now, and in future, begin to be measured by the satisfaction that is generated from the customer's viewpoint. As such the need to properly understand Customers is paramount and treat it as a challenge. (Oakland & Sohal, 1996)

Customer relationship and awareness

Current tendencies seem to indicate that there is a gap between the Customers and the Construction Industry. This is perhaps caused by some of the following factors:

- Taking into account the perceptions that Customers have about the industry matched with their expectations, their knowledge of what they want (rather than need), their

efforts of relaying information and ideas of their needs and preferences as best as possible to the Construction Industry are on many occasions thwarted by the industry.

- ❑ Customers are often seen and treated to be all the same.
- ❑ The possibilities of establishing long term relationships with customers have not been given much consideration.

In order to narrow or eliminate the gap that exists, the Industry must work towards establishing good relationships and mutual systems acceptable by all. Such relationships could include the application of Project Management techniques of information technology inter-operability.

Such systems will permit open two-way dialogue, encourage feed back in all stages of a project and for the Project Manager to properly establish the sort of customer being dealt with for every project, etc. in order to be able to structure its project delivery and decision-making processes flexible enough to respond to the expectations of the customer.

Attitude towards Customers

All participants in the Construction Industry must recognise the fact that all work and efforts in the entire process of project delivery is to serve and satisfy the needs of the customer.

Barda et al (1993) indicates that it is imperative to have the triangle of project delivery inverted such that the customer is placed at the top. The customer must be seen to be the "boss" in the project delivery cycle in much the same manner as a boss being positioned at the top of an organisational structure.

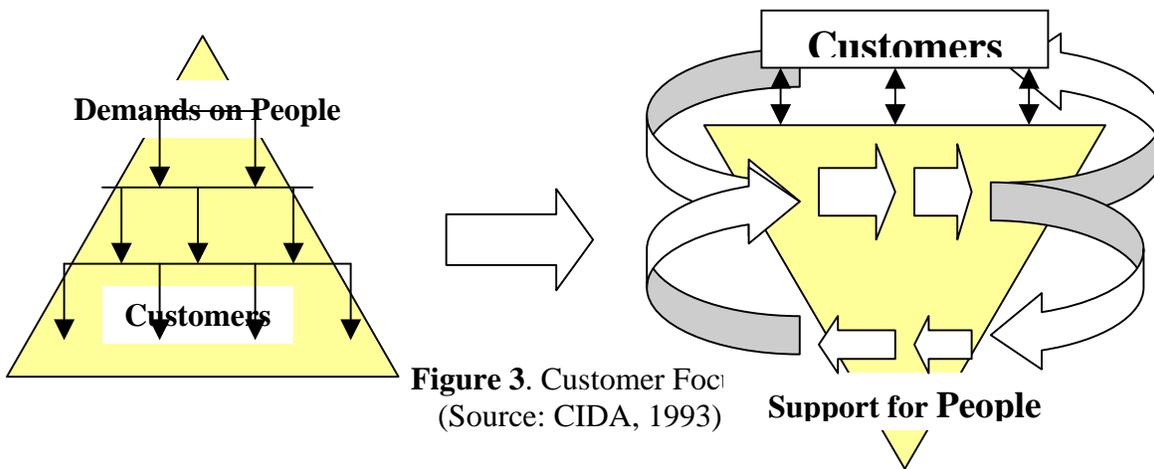


Figure 3. Customer Focus
(Source: CIDA, 1993)

Since the existence of the Construction Industry is made possible by the needs and expectations of the customer, recognition to keep him satisfied would mean the continued existence and improvement of the industry.

Attitude towards customer complaints

Complaints received from customers are usually indicative of the Construction Industry's lack of responsiveness, ignorance and failure to deliver to their satisfaction. These are usually irritating and can mean deterrence and / or withdrawal of customers. Complaints are unavoidable. Their occurrences must, however, be seen as positive means by which failures, unsatisfactory performance can be improved.

Loosemore¹ explains that one of the first tasks for Project Managers should be concerned with is to establish very clearly what the needs of the client are.

The challenge, in the Construction Industry, therefore is to endeavour to take its services to the client with the view of:

- ❑ Understanding that every project and client is unique and their needs are different each other
- ❑ Knowing Who the client really is, as in the hospital example
- ❑ Verify deliverable and ambiguities
- ❑ Fully define requirements in close consultation with the client
- ❑ Establish close Client-Project Manager-Project Team relationships
- ❑ Educate the client including clearly spelling out client's extent of responsibilities, authority and role particularly in decision-making
- ❑ Make client realise and appreciate the difficulties of the project
- ❑ Corporate/organisation/individual values of the client assessed and understood well.
- ❑ Create a sense of identity of the Client in the project process as this enables a greater sense of ownership and participation

An interesting approach is the Ove Arup method. Where practical, the project team establish themselves within the premises of the client. This enables them to interact with the client which consequently gives them a far greater understanding, appreciation, needs, feel of operations, organisational set up and a whole host of the client's character. As such this "comprehensive" knowledge that the project team gains enables them to develop and establish the project documentation and delivery system with ease and great confidence, but most importantly, one which best suits the client. Other aspects that Project Managers need to improve regarding to this issues are, such as making provisions for client feedback, identifying emerging Client trends, creating long term relationships with customers and undertaking client surveys

PEOPLE INVOLVEMENT

Crow (1993) points out that the development, creativeness, innovation, involvement, etc of people is essential to the industry's entrepreneurial culture, and if we may add, competitiveness and success in efficiency and prompt delivery. It is, therefore, necessary that factors relating to and affecting human desire, attitude, response to work, etc in the industry's delivery system is well analysed accordingly.

Training and Development

Loosemore⁴⁵ in his example of the UK Construction Industry, indicates that there is enormous lack of attention accorded to training. He attributes this in part to the growth in Sub-contractors who mostly lack funds to undertake training for its personnel. As a result of these sorts of problems, the Construction Industry is faced with the shortage of appropriate skills necessary for efficient project delivery.

¹ Loosemore, M., "Managing The Design Process"

⁴⁵ Loosemore, M., "The Challenge of Managing Construction Projects"

This consequently has a chain-reaction effect, in that the lack of appropriate training would lead to lesser quality products, excessive costs, ineffective labour force, time and cost overruns, etc. It is, therefore, considered a challenge, particularly for the larger organisations to take the leading role in providing adequate and appropriate training.

Perhaps with the support of government agencies, sub-contractors, professional associations and learning institutions, a Construction Industry Training Forum could be established. Particular attention can be focussed in the area of training costs, which could be subsidised and all instructors drawn from participating agencies at reasonable fees.

Sexual Discrimination

It is a global fact that the Construction Industry has had a long history of dominance by males. It is also a fact in today's global society that females are now as highly trained and experienced in almost all areas of specialisation in the Construction Industry. As a result of the increasing "equalising scenario" it is necessary to move away from the traditional "male dominated" culture into accepting females as equals. This has become so because they are active participants in these activities. And recognition is necessary. The challenge in this situation is to merely accept females as equally capable, intelligent, willing and motivated to tackle a previously male dominated industry. The involvement of these capable females can undoubtedly contribute to success of projects.

Motivation and Empowerment

People have the tendency to perform and increase productivity when accorded acceptable and attractive motivation, which can be attributed to a variety of things. Assuming that money, the single biggest motivator, was already awarded at an acceptable level, the Project Manager must recognise or investigate other means of motivation with the view of implementing them. The following could perhaps be considered:-

- ❑ Accord recognition and reward such as holiday trips, paid time-off, gifts,
- ❑ Recognise employee status and importance of their role in organisation/project,
- ❑ Liaise with Client to provide genuine appreciation to personnel involved, perhaps in the form of formal letters or similar,
- ❑ Acknowledge the good quality of product as a result of their input,
- ❑ Delegate some degree of authority or power in undertaking their activities,
- ❑ Ensure a greater sense of responsibility and ownership, etc...

If people are to be motivated to become productive and responsive to organisational and Client satisfaction, it is necessary and perhaps a challenge that recognition/awards by way of means other than the usual financial means be considered and duly awarded.

Given the positive sense of motivation and empowerment, people are likely to continually find ways and means to better themselves to be creative, innovative, productive and eager, which will culminate in the continued improvement and performance of the Construction Industry.

Teamwork, Co-ordination and Co-operation

It cannot be emphasised more that the entire system of project delivery of the Construction Industry is inherently fragmented. As such greater consideration and efforts are required from all participants of the industry, including clients to focus on reasonable efforts to achieve Teamwork, Co-ordination and Co-operation.

With the assumption that clients know little about the Construction Industry project delivery systems (although we acknowledge that some clients are very knowledgeable), it is entirely up to the Construction Industry to “reach out and educate” clients with the view of establishing greater understanding of how the Construction Industry works, and to foster closer relationships. The Project Manager must create and embed into the mind of the client that they can be trusted, are reliable and can promptly deliver to their expectations. How nice it would be to exceed client expectations.

PLANNING

Planning is basically about anticipating future events. In improving construction industry, particularly the planning process, there are several paradigm shift in the enterprise planning process to be made.

Alignment to Strategic Objectives

Alignment to strategic objectives means that all the participants have to have a clear picture of the strategic direction of the industry, where our major systems are organised around a clear business purpose. In other words they have to agree to a common goal to enable to support each other to create an effective overall system (CIDA, 1993) as illustrated in Figure 4.

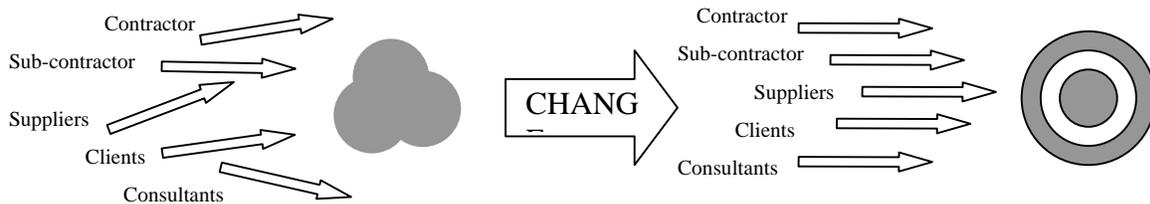


Figure 4. Aligning the Strategic Objectives
(Source: CIDA, 1993)

The question is how to bring all of these participants’ different view together? Government involvement is critical in bringing an industry-wide “wake up call”. Australian government had taken this measurement, by launching Industry Reform Strategy in 1990 that cited about “the world best practice” for meeting the international competition. Despite the effort made by CIDA to promote the reform strategies, for construction enterprises, it is important to note that the willingness to change would only become significant if they come from the top level management.

Responsiveness to External Change

It had been cited many times before that the construction industry is lagging behind the other major industries. One of the main reason for this is the failure to closely monitor trends in external factors that could influence the performance of our industry (CIDA, 1993). The present condition is construction industry tends to *react* to external changes only when it has been clearly demonstrated by others that the changes are absolutely necessary. More pro-active is needed, so that construction industry could *anticipate* the coming changes.

The only way construction industry could improve in this area is by allocation resources to research and development, where only by this would enable the industry to probe into the future, learn from the past and to analyse the current practice. Gale et al (1990, pp. 431) cited that *“it is necessary to go beyond superficial and self-congratulatory discussion and challenge the very basis of the construction industry as we have come to know it”*. Concern need to be raised about the present condition of the industry’s research and development, where it only invest 0.01% of the turn over compare to other industries where 20%-30% of the turn over is dedicated for research.

PROCESS IMPROVEMENT

In order to achieve the world best practice improvement in the process how we carried out our business need to change. CIDA, pointed out several problem that need to be addressed particularly the use of quality assurance, how we assign problem causes and the process structure. These issues are approached more detail in the following discussion.

Use of Quality Assurance

If asked why the construction industry could not perform like the manufacturing industry, one of the favourite-cited defense is that the construction industry is unique thus face unique problems in every site. Notwithstanding the general truth of this statement, most of the problems faced, to some extent, have similarities. There is lack of special effort in ensuring that solved-problems are recorded and share between the participants. Cheetham (1996, pp. 375) highlight the practical application difficulties of Quality Assurance, where on site there is constant pressure for production and coordination of design information from many source.

Quite the contrary from the site staff’s belief, Quality Assurance plays a critical role in continuous improvement effort because it helps the industry to continually extend its performance. Therefore, it is in the interests of the management to make all the operatives aware of their roles in the implementation of the Quality Plan. The site difficulties faced by the operatives have to be addressed to make this happen. A lot of researcher share Mars (1996, pp. 408) opinion that in practice, the quality system does not have to be a fixed methodology, instead it should be custom made to the operatives’ business.

Assigning Problem Causes

The common reaction whenever a problem arises, is to find out who to blame based on the view that most problems lies those who is directly involved in the process of the activity. This cause the employees tends to hide problems from us until they become absolutely critical, at time which it have become difficult and very expensive to rectify. This habit have to change to best practice management where time have to be spared to help people to understand and improve the processes where they work. Management have to ensure that the worker have enough training, resources and support to make the processes work effectively.

The major factor to bring about this shift is the level of understanding in Human Resources Development of the industry. A survey done by Hancock et al (1996, pp. 317-320) to large construction company in Australia reveal that they understood the concept of Human Resource Development, but only 53.6% apply that practice within their company. Education to the management level of construction is needed in order to adopt

management style that is more people-oriented that could enhance the internal and external communication thus helps to facilitate decision making.

LEADERSHIP

Leadership in the construction industry has been widely recognised as a major essential element. Today's complex project environment, especially for project managers, requires greater skills at leadership than even before. With the managerial practises of outsourcing, downsizing, Total Quality Management and continuous improvement becoming even more prevalent in our organisational environment, it can be expected that project managers are experiencing increased performance pressure. However, the commitment to the continuous improvement and Total Quality Management should be demonstrated by senior management, not just project managers.

The study of Thomas W, Zimmerer and Yasin M, 1998 in USA projects has indicated that the impact of the leadership on success project was 75.6%, whereas the impact of leadership on project failure was 67%.

Consistency of Words and Actions

In current situation, it is often found that much time consumed to telling people what things have to be done and giving them extra attention. "Close" atmosphere has caused all employees are not free to give us feedback about the consistency of our words and action. As senior management, they prefer having a gap that can protect them from any possibility corrective actions. Authority and position are also often viewed as barriers that separate the senior management and employees.

The challenge here is, related to this issue, how we delete a "credibility gap" that it will erode the integration of a team, especially between senior managers and subordinates. Confidence of our team must be built to create a better and integrated enterprise. The willingness to change, particularly for senior management should be established, therefore feedback about the work done can exist in order to improve our team's performance. In addition, the need for a shared vision and communicate this vision to our people and also clients should be encouraged in the beginning of project.

Role of Management

Empowerment as a element in leadership seems to be rarely found in today construction activities. The major problem is that the senior managers always think that their managerial roles is to control what happens and make sure everything are done at the right time by issuing appropriate instructions. The successful of work is sometimes measured by what they have done based on the instructions without questioning.

Making sure and trust to what the employees doing is not easy. However, to improve and increase the performance of our enterprise and also reduce wasted effort, trust as a base of empowerment should exist in the team. The senior managers should see their role as one of supporting employee actually doing the work. The success of the project should depend to a large extent on how much senior managers can stimulate and support the initiative and energy of their employee who actually doing the work. There is the opposite direction in order to get people doing their jobs successfully, in other words, instruction or order should not be given without any attention to support all resources and

information. As our employees are also our internal customers, the words of “ *pleasing the boss* “ should be replaced by “ *serving customer* “.

Characteristic or Behaviours of A Leader

Based on the results of a survey of senior project managers in U.S (Thomas W.Z 1998), the certain characteristics of a leader have been identified as successful factors. The need to change the role of leader has been initiated in this survey, for instance, in the last 5 years technical expertise is not considered as crucial factor that a project manager must have. Team builder, communicator and high self-esteem are more desired to run the project. The table below shows the lists of both 12 highest rated characteristics and behaviours of project managers.

Rank	Characteristic or Behaviour
1	Team Builder
2	Communicator
3	High Self-esteem
4	Focuses on Result
5	Demonstrations of Trust
6	Goal Setter
7	Demonstrations of Respect
8	Flexibility in Response to Change
9	Team Player
10	Employee Developer
11	High Level of Technical Expertise
12	Empowers Subordinates

Table 1. The 12 Highest Rated Characteristics and Behaviours of Managers
(Adapted from Thomas W Z and Yasin M, 1998)

SUPPLIER RELATIONSHIPS

Suppliers are all the enterprises who supply materials and services (CIDA, 1993), which involve: architects, engineers, project managers, contractors, subcontractors and material suppliers..

Overall Supplier Relationship

Currently the enterprises are being relatively distant from their customers and partners. It’s still chronically conflicts and claims between each party. The suppliers do not make much of an effort to communicate them clearly, although they have firm views of what would be expected from their clients, customers, and partners. The suppliers have no considerations about the possibility of long term partnerships and alliances with their clients, customers, and partners.

The challenge is that, the relationship between suppliers should be very close formally and informally, and knit harmonious relationships to their clients. The enterprises should have formed good working relationship, closely aligned of intentions with several partners to extend of their business plant, and long-term alliances. In order to achieve those processes, the enterprises have to develop common system (e.g.: Project

Management) with their key partners. Open communication with their partners before, during, and after projects should be encouraged.

Supplier's Selection

Today, enterprises focus mainly on the initial cost of their services, they do not keep any data that tell the final long-term cost of using any given project partners. There is not possible yet in the construction industry, that have to develop a high degree of trust and more openness with project partners. Communication open lines, and efficiency worked with a few number of key project partners developed, and in turn will help them to jointly solve problems, develop joint project opportunities of efficient systems for sharing information, undertake project management efficient and effectively. The suppliers maintain data that help them evaluate the full cost of using the various project partners, identify who are they should focus on, and which opportunities identified for improvement in their relationships with potential project partners.

Overall, partnership must be seen as an evolving relationship and continuously reassessed by its suppliers for its relevance and each benefit to each other. Its objective should be specifically defined and if necessary redefined when they change with the time.

INFORMATION USE

Since information technologies are changing so rapidly, many organisation find it difficult to keep face with new developments. The facts is that there is not anyone responsible for overall accuracy and availability of information to all projects team members. They do seem to have up-to-date drawings and information at any stage throughout the project. This means that they make many errors by working to inappropriate drawings and specifications.

In order to improve the performance, the critical challenge here is then one of using this knowledge to set service quality standards for the organisation. It is all very well having a reasonable if slightly underestimate, understanding of what users want but it is more important to deliver what user expect. This intelligent must be converted into meaningful service quality standard for the Information system department.

When the enterprises want to use of trend data for decision-making, the current situation should be seen from record data from of their performance trends, which can help them understand more clearly and prevents from over reaching or under reaching to a single piece of information.

As there is no the best way to implementation information system in construction company, monitoring and review the progress of the implementation activities can be seen as a way. However, experience has shown that there are a number of information use success factors. The senior management must commit and re-examine the integration of this information technology into their business process as it might require powerful software to be harnessed. In order to achieve this aim, the enterprises must invest in Information Technology infrastructure of the kind that will allow for open communications based on industry standard protocols. Training of implementing and using information technology is recommended to educate the employees in understanding the use of information technology in its many forms.

CONCLUSIONS

It is concluded that in order to meet the needs and demands of the future, which includes globalisation of the Construction Industry, it is necessary to have guidelines of future challenges that should serve as the stimulus for improving the industry's performance.

It was found that the Australian Construction Industry is falling well behind the performance of other industries such as the manufacturing industry. Based on the CIDA Survey in 1993, some significant factors which the Australian Construction Industry has not attempted to improve on but have been made by other industries and many leading overseas companies in order to achieve world best practice were identified.

Based on those facts above, industry's environment factors have also been indicated as environment challenges that also influence the performance of a enterprise. Therefore, the discussion mainly is divided into 2 types of future challenges, firstly – Environment challenge namely Sustainable construction, Education, Technology, Industrial Relation and Research and Development Roles, and secondly - Enterprise Challenge – as initiated by CIDA, it consists of customer satisfaction, people involvement, planning, process, supplier relationship, information use and leadership.

The fragmented and one-off nature of the construction industry needs to be considered as the major factor with which to distinguish the way we meet these challenges with other industry might have. Continuous Improvement is not a dramatic way of change or quick-fix solution as other industries have in order to improve their performance, but it is the continuous change that maintains improvements in every stage of the industry's performance particularly enterprises' performance.

In globalisation era, as the need to achieve higher performance has strongly been identified as a crucial requirement to survive of doing business, the efforts to maintain and develop each element of the current Enterprise challenges of the construction industry is thus paramount.

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