Report on the Development and Validation of the Best Practice Decision Matrix

Report 2001-003-C-03

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Introduction

The Co-operative Research Centre for Construction Innovation (CRC-CI) is funding a project known as *Value Alignment Process for Project Delivery*. The project consists of a study of best practice project delivery and the development of a suite of products, resources and services to guide project teams towards the best procurement approach for a specific project or group of projects. These resources will be focused on promoting the principles that underlie best practice project delivery rather than simply identifying an off-the-shelf procurement system. This project builds on earlier work by Sidwell, Kennedy and Chan (2002), on re-engineering the construction delivery process, which developed a procurement framework in the form of a Decision Matrix (Fig 1).

Fig. 1 The Decision Matrix

Objective / Phase	Value to parties	Alignment of objectives	Holistic process	Value-driven selection process	Eliminate Duplicated effort	Process not contractual arrangement
Idea	✔	✔	✔	✔	✔	✔
Planning & design	✔	✔	✔	✔	✔	✔
Construction	✔	✔	✔	✔	✔	✔
Commissioning	✔	✔	✔	✔	✔	✔
Operation & maintenance	✔	✔	✔	✔	✔	✔

Sidwell et al 2002

The aim of this report is to develop the Decision Matrix into a more robust framework which will provide the foundation for a suite of resources that can provide project teams with information, advice and recommended actions on best practice project delivery. The report first summarises the earlier research, then looks at the Decision Matrix axis by axis, in the context of other research in the area, to confirm its veracity. In the process of validation, some modifications are suggested.

Why 'best practice'?

A Best Practice is a process or method, that when executed effectively, leads to enhanced project performance. Best practice assumes that what one organisation does, any other organisation can as well. In order to raise the performance bar in the Australian context it is useful to compare business-as-usual performance with the best performance in the industry, or better yet, with the best performance anywhere in the world. According to the report *Building for Growth* (ISR, 1999), Australian performance lags behind the norm in other countries, notably Germany, the UK and the USA. However, the report notes when non-monetary contextual factors such as quality, productivity, site location and the general performance of the built project are taken into account, the gap does not seem that insurmountable.

The indications are that efficiency improvements can most significantly be made through the re-organisation of the construction industry in Australia, and changes to the procurement process of construction. The Department of Industry, Science and

Resources in its report urges the construction industry to restructure the way it operates and to commit itself to building a better industry. To do this the various sectors, sub-sectors and firms must strive for new capabilities and competencies. This is reinforced by Construction Queensland (2001) which concludes that clients should seek to reduce the price they pay for new buildings and infrastructure by 30% and achieving this requires participants in the building and construction industry to do things entirely differently rather than just doing better what they do now.

Previous research – development of the Decision Matrix

Sidwell, Kennedy and Chan (2002) undertook empirical research into opportunities for re-engineering the construction project delivery process. Sidwell et al's research comprises case studies of ten projects selected to include building and civil projects, not all of which were successful, and to include a range of innovative delivery processes. The case studies identify actions taken by the project teams to achieve improvements in performance.

The research looked at fifty-six variables that influence project success identified by the case studies. Statistical analysis grouped the fifty-six variables into fifteen principal factors[1] of which four are identified as critical in explaining project performance. They are:

1. co-operative project teams
2. client's competency and commitment
3. continuity of key personnel
4. equitable risk allocation

The resulting data was analysed and discussed at a half-day workshop with twenty-six industry experts (Kennedy 2001). The aim of the half-day workshop was to express these results in practical ideas for improving the industry's performance. The industry workshop identified global issues that influence successful outcomes for the construction industry, regardless of contract type. The following list of actions required to achieve the four critical success factors resulted:

1. Value to parties
   Seek high levels of value for all the project participants and stakeholders.
2. Alignment of objectives
   Break the cycle of mistrust currently at work in the industry. Adopt relationship management techniques to eliminate manufactured, institutional or psychological causes of conflict.
3. Holistic process-lifecycle
   Adopt a whole of life approach to project outcomes, including a long-term approach to shareholder value if applicable.
4. Value driven selection

[1] Fifteen principal success factors identified through ten case studies:
co-operative project teams, client's competency and commitment, continuity of key personnel, equitable risk allocation, well-defined project brief, complexity, regular monitoring of key objectives, effective communication process, availability of suitable contractors, consultant selection criteria, mechanism for reward and penalty, clear reporting lines, client's preparedness to absorb risk, shared responsibility to project problems, selection of subcontractors.

Use a value driven selection process for all service providers rather than a purely price-driven process.

5. Eliminate duplicated effort
   Eliminate ambiguity or confusion about roles or responsibilities, particularly about responsibility for the coordination of documentation.
6. Process not contractual arrangement
   Achieve high standards in key performance measures by using fundamental processes rather than through existing contractual arrangements.

The findings were used to construct a matrix of best practice project delivery strategies. These six actions, called best practice guidelines, form one axis of the Decision Matrix. The other axis is provided by a model of the construction project process using the following phases which are perceived as iterative rather than discrete phases.

1. Idea and feasibility
2. Planning and design
3. Construction
4. Commissioning
5. Operation and maintenance

Significantly, the elements of successful project delivery were viewed more in terms of alignment of objectives and agreement of value rather than the need to re-sequence the process. This principles-based decision matrix may have the potential to make re-engineering the process possible by providing a tool which can identify better ways to achieve optimum value for all stakeholders. The Value Alignment Process project seeks to leverage the progress made in developing the Decision Matrix to provide a best practice guide to project delivery. Also it is envisaged that the guide will be accompanied by a tool to provide assistance to clients and project teams when making decisions regarding project delivery directions.

Validation of the Decision Matrix

In the following sections, the Decision Matrix is compared with established theory and best practice in construction project procurement, with the aim of confirming its soundness as the starting point for the *Value Alignment Process in Project Delivery* project.

The axis of the Decision Matrix that comprises a model of the construction process, that is, the phases construction projects pass through, is considered first.

Implementation Phases described in the Decision Matrix

According to Hughes (1991), the identification of the steps or stages through which a construction project passes is essential if improvement is to occur. Hughes pointed out that “every project goes through similar steps in its evolution in term of stages of work. The stages vary in their intensity or importance depending upon the project”. Construction involves a set of processes and sub-processes performed to successfully complete a project. If one generalises, then a process can be defined as a set of activities, resourced with a number of inputs such as labour, materials and money, to produce an output that is of value to the customer. Many researchers in the area of construction management have adopted the classic systems model comprising input, transformation and output. For example, Alarcon and Ashley (1996) in their study of modelling project performance for decision-making used a

model containing three levels of variables: drivers (input), construction processes (transformation), and performance outcome (output). Liu and Walker (1998) in the study on the evaluation of the outcome of construction projects adopted a similar model developed from the fundamental behaviour-to-performance-to-outcome with a feedback element incorporated in it.

As described in their research methodology, Sidwell et al (2002) adopted the classic systems model which modelled construction projects as comprising:

- *Inputs*
  This includes the processes involved in producing a client's business case and brief for a project, establishing the project's feasibility and assembling key members of the project team.
- *Transformation*
  This element of the model comprises a virtual organisation formed by the project team, its leadership and organisation, including contractual interfaces, communications, control systems, personal relationships and risk management.
- *Outputs*
  These are the satisfactions delivered to stakeholders, client, local community and construction firms, and includes the processes involved in the completion, handover and operation of the completed facility.

The five phases of the construction process adopted by Sidwell et al reflect traditional exemplars which are best illustrated by the RIBA Plan of Work (RIBA 1980), which is attractive in its clarity. However, the Plan of Work emphasises the step by step functional contribution and progressive definition of the design documentation solution in which each step is clearly delineated with the output from each stage being the input to the subsequent stage. The phases identified in the Decision Matrix are not intended to be discrete, but can actually overlap when circumstances require.

Other Australian studies, commissioned by various groups with interests in the construction industry have also classified the phases the construction delivery process similarly. Reports by the Business Council of Australia (1993), CIIA (1995), Sidwell and Francis (1996) the Australian Constructors Association (1999) and ISR (1999) all described the typical phases of implementing a project, in various iterations of the same core activities, the operations phase implicitly or explicitly including maintenance phases.

The Construction Industry Institute (CII 1997) in the USA, breaks down the project life-cycle for typical capital facility projects into four major divisions: business planning, pre-project planning, project execution, and facility operation. Identification of a business opportunity is the starting point of business planning and the validated project concept which results is the input to the pre-project planning process. Pre-project planning is defined as the process of developing sufficient strategic information for owners to address risk and decide to commit resources to maximise the chance for a successful project. The decision whether or not to go ahead with the project and the project definition package are the outputs. Project execution encompasses detailed design, construction and commissioning of the completed project. Facility operation includes monitoring and evaluation of operating conditions, proposing and implementation of improvements, and finally decommissioning the facility.

The four phase model is similar to those being adopted in the UK by organisations seeking to improve the performance of their own national construction industry. The Process Protocol developed at The University Salford, UK (Kagioglou et al 1998) describes the lifecycle of a project's development in terms of four main phases: Pre-Project, Pre-Construction, Construction, Post-Construction. These phases are further divided into ten phases in the life of the project, with a feedback element at the completion of each phase. This facilitates a means by which project experiences can be recorded, updated and used throughout the entire process, thereby informing later phases and future projects. The fact sheet on choice of procurement route by the Construction Best Practice Program (CBPP, 1998) also describes the process of procuring construction work as that generally falling into four main events, namely briefing, design, construction and occupation.

The model described by the Construction Industry Board (CIB, 1997) has five phases as follows:

1. getting started
2. defining the project
3. assembling the team
4. designing and constructing
5. completion and evaluation.

Like the CII model and the University of Salford model, this model gives more emphasis to the early stages of projects than Sidwell et al.'s model. It regards design and construction as one integrated stage, and does not deal with the operation of the building or other facility produced by a construction project. A significant point of difference of this model from Sidwell et al and others, is the inclusion of a "completion and evaluation" stage. CIB (1997) explains that evaluation refers to an action at the completion of a project in which the project team reviews the outcomes of in-project feedback produced at all the significant milestones throughout the project to guide and improve project performance. The evaluation action at project completion brings together all the project feedback from all the stages to identify lessons for future projects. Similarly the Process Protocol model provides feedback to other projects through the use and creation of a "legacy archive".

Figure 2 uses the classic systems model to link the phases in the Decision Matrix with the CIB model. This comparison shows that Sidwell et al.'s model may implicitly include the feedback element. Indeed the inclusion of feedback is vital to controlled systems. Without good feedback the construction industry is likely to continue to deliver its present, variable levels of performance (Bennett, 2002).

Fig 2. Comparison between Sidwell et al (2002) and CIB (1997) using the classic systems model.

Classic Model	**Sidwell et al Model (2002)**	**CIB Model (1997)**
Inputs	Idea and Feasibility	Getting Started Defining the project Assembling the team
Transformation	Planning and Design Construction	Designing and Constructing
Outputs	Operation	Completion and Evaluation

As “evaluation” is described by the CIB as an action rather than a phase, there would seem to be merit in the current CRC-CI research project including it on the action axis of the Decision Matrix, particularly as the value of feedback to the robustness of a best practice data base is recognised. Importantly, including it as an action on the cross-axis recognises that feedback needs to be ongoing throughout all phases of projects and culminates in an action at the end of projects which brings together the lessons learned in the process. This action is also essential to produce feedback from project to project (Bennett and Jayes 1998). Success and failure can offer important lessons for the future. In the development of the Decision Matrix for the *Value Alignment* Project, this action may be expressed as *“ensuring team members have feedback-driven control systems”.* (Bennett, 2002a)

Benchmarks are needed in order to make sense of feedback. Bennett (2002a) notes that benchmarks give attention to the search for better answers. Benchmarks will enable significant improvements to be made in the quality of decision-making pertaining to design and construction processes. However, the performance of many of the operations carried out by the construction industry is not currently consistently measured. The lack of comparative information and an acceptable system to measure it prevents professionals from assessing their performance, relative to their competitors (Love and Mohamed, 1995). Therefore a further action is required to be included in the Decision Matrix to ensure feedback is meaningful, that is *“agreeing how team performance is to be measured”.*

The validation of this axis of the Matrix has yielded a model of the construction process which is easily understood. In addition, it has generated two new actions to be included on the other axis of the Decision Matrix.

Decision Matrix guidelines considered in the context of best practice research
We now consider the axis of the Decision Matrix that identifies actions, or best practice guidelines. These are investigated in the context of recent developments related to project delivery strategies which are based on collaborative approaches. These are generally known as relationship contracting, and reference is made particularly to project alliancing, and strategic partnering. These approaches seek a closer alignment of client and project team goals and a better understanding of risk sharing for win/win outcomes. In a significant departure from traditional project procurement practice, these approaches advocate a ‘no blame’ approach. Success or failure is a joint responsibility of the parties involved. The Australian Constructors Association (1999) assert that the key benefits of relationship contracting include enhanced business relationships and improved behaviour of parties to contracts.

The Decision Matrix is considered with reference to previous research on the subject in the Australian context which has been conducted by clients, end-users, and constructors, as well as with reference to international studies.

- The report by the Business Council of Australia (BCA, 1993) *Fundamentals of Project Implementation for the Building and Construction Industry* was a precursor to both the Latham (1995) and Egan (1997) reports from the UK.
- The Commonwealth Government through the National Building and Construction Committee (NatBACC) commissioned *Building for Growth* (1999) to identify those areas in which the industry needs to strengthen its capabilities.
- The Australian Constructors Association publication *Relationship Contracting - Optimising Project Outcomes* (ACA 1999) endorsed a flexible approach to

procurement as the way forward and outlined proven practices and techniques to optimise project outcomes.
- The Queensland Government through the Construction Queensland Equitable Delivery Strategy Taskforce prepared *Wealth Creation through Equitable Asset Delivery* (CQ, 2001).

Reference is also made to the unpublished Outputs Document prepared by the Queensland Department of Main Roads following *Achieving Outstanding Performance,* an industry workshop on relationship based contracting held in August 2000 (SRD Consulting).

According to the UK Construction Best Practice Programme (CBPP 1998) partnering is a structured management approach to facilitate team working across contractual boundaries. Partnering in the form most often encountered in Australia is less well-received than in the highly evolved forms used in the USA and UK. This is generally due to the project-based nature of most partnering agreements rather than the use of partnering on a long-term basis, and the cultural attitude that ensures the contract dominates rather than the non-legally binding Partnering Agreement. For the purposes of validating, and developing, the decision matrix against world's best practice, the international theory is used for comparison here.

Validating the guidelines

1. Value to Parties, and 2. Alignment of Objectives

These two guidelines are combined because they are integral to each other's achievement. "Value to parties" refers to ensuring that outcomes achieve positive project objectives for all stakeholders. Furthermore, the correct identification and prioritisation of the Stakeholders and their needs is essential to enable effective decision-making throughout the project lifecycle (Kagioglou et. al. 1998). The "value" guideline equates with Construction Queensland's concept of wealth creation which values the benefit that the constructed facility provides over its entire lifetime. Construction Queensland (2001) notes that in the construction context, indicators of wealth creation can include return on investment, extra value achieved from capital outlay, extra services incorporated for end-users, supplier margins that are met or exceeded, improved quality of life for the community and stakeholders and improved morale of all those involved in a project. Clearly, achieving this "value" depends on a shared understanding of each party's goals and values (SRD, 2000) which is described by the alignment of objectives guideline.

Sidwell et al. emphasise "alignment of objectives" by first considering the value provided by the project for all the participants. Bennett and Jayes' (1998) identify an early action in partnering that refers to alignment, called "agreeing mutual objectives". In strategic partnering the combination of considering value to stakeholders and agreeing mutual objectives is called "strategy" thus assigning importance to the long-term view. It is however, like the project-based concepts, concerned with teams agreeing what they jointly aim to achieve. In project alliancing these actions are achieved by the "alliance agreement" which shapes the relationships participants have with each other, to the project, and to its risks.

The critical issue of alignment of objectives has been addressed by a number of recent studies conducted in the area of procurement[2]. The Business Council of Australia noted "early involvement of key participants and clear communication of purpose, objectives and needs", in the initiating stage of a project is essential to its success. Relationship contracting as described by the Australian Constructors' Association requires that all parties to the contract agree to align their individual goals, thereby establishing common or aligned goals for the project.

A typical project team is comprised of individuals representing a wide variety of functional groups with diverse priorities and requirements. As each team member enters the project process, they may have different priorities and expectations. Essentially, they all are working to juggle the elements of price, quality and time, within what is becoming an increasingly complex regulatory framework to meet environmental, social and economic objectives. Typically disparate objectives of various project team members may be: the owner wants the best product for the least price in the least time; the design team wants a functional design that reflects their philosophies; the construction team wants a buildable product within reasonable risk limitations. Clearly, if not properly coordinated, divergent internal team goals and objectives are likely to emerge. This will adversely affect the effectiveness of teamwork. When a project team is 'out of alignment' none of the outcomes of the project is entirely satisfactory, and the participants are in a constant struggle to maintain their viewpoints (Griffith and Gibson 2001). Alignment is the process of incorporating all of these distinct priorities and requirements into a uniform set of project objectives that meet the business needs for the proposed facility. The final stage of a successful alignment process is the acceptance and commitment of the entire team to those overall project objectives. The CII (1997) developed the following definition of alignment:

> "The condition where project participants are working within acceptable tolerances to develop and meet a uniformly defined and understood set of project objectives."

Research conducted by the CII (1997) identified factors which significantly contribute to alignment of participants in the earliest project phases, and demonstrated that the level of alignment during pre-project planning positively contributes to the ultimate success of the project. These factors are:

- Stakeholders are appropriately represented on the project team.
- Project leadership is defined, effective, and accountable.
- The priority amongst cost, schedule, and required project features is clear.
- Communication within the team and with stake-holders is open and effective.
- Team meetings are timely and productive.
- The team culture fosters trust, honesty, and shared values.
- The pre-project planning process includes sufficient funding, schedule, and scope to meet objectives.
- The reward and recognition system promotes meeting project objectives.
- Teamwork and team building programs are effective.
- Planning tools are used effectively.

[2] (e.g. CIIA 1994, CII 1997, APP 1998, ACA 1999, Griffith and Gibson 2001, Budiawan 2002)

These are very similar to the key points which relate to 'value to parties' and 'alignment of objectives' identified by Sidwell et al. (2002):

- Seek high degree of stakeholder involvement,
- Enhance working relationships between parties through team building concepts,
- Resolve customer needs and business objectives.
- Consider and record risk and risk allocation and share of rewards to stakeholders,
- Use team-building concepts which avoid conflict and assist convergence of interests,
- Adopt genuine alignment of incentives where all participants share savings.

The foregoing discussion suggests a modification to the initial action of the Decision Matrix, to become:

- *agreeing project objectives taking account of the project stakeholders' values and the need to improve over industry norms.*

3. Holistic Process - Lifecycle

The key elements of this objective in the Decision Matrix are:

- Front-end participation by a wide spectrum of expertise to predict and inform whole of life issues,
- Value engineer the entire process including operations,
- Consider impact on other parts of the virtual organisation when making decisions,
- Identify non-conformities. These can be rectified at the conceptual stage for a fraction of cost further downstream in the project's life; and
- Simplify construction.

Obviously, the objective is to take an holistic approach from recognition of a need, to the design, production and operation and maintenance of a constructed facility, with regard for ecological sustainability. This also suggests that a multi-disciplinary approach is brought together at the outset of the project to determine how downstream environmental, societal or economic issues may be affected by early decisions. Sidwell et al identified two factors which hinder the adoption of holistic approaches to project delivery. (a) Artificial time frames imposed on project teams have a negative impact when they leave little time to plan prior to commencement of construction. (b) The separation of capital budgets and operational costs is also a hindrance - the emphasis on meeting tight project budgets means that a less than optimum product is constructed with higher operational and maintenance costs.

There is no obvious equivalent in the literature on relationship contracting generally for this best practice guideline, though taking a whole project view is recommended by the Process Protocol (Kagioglou et al. 1998). However, it implies that a whole project view is to be adopted on individual projects. There is growing acceptance of the need for a long-term approach regarding not only operational and maintenance costs of development and construction, but also environmental, and societal impacts that should be applied in taking actions concerned with both individual projects and the organisation of a series of projects. However, taking a long-term view is not an action. Sidwell et al.'s intention is that a long-term view is taken in making project planning and design decisions. So the action should be:

- *agreeing the design strategy to take account of (environmental, societal and economic) life cycle costs.*

Furthermore an action of

- *agreeing the construction strategy taking account of life cycle costs* should also be included to ensure that whole of life decisions made in the design phase are not overshadowed by short-term issues which may arise during the implementation phase.

These actions are able to be explicitly featured in an alliance agreement where participants are collectively responsible and accountable for all project outcomes.

4. Value-driven selection process

The elements of this objective of the Decision Matrix address several key points, which include:

- Selection based on non-price criteria.
- Matching the capability of the project teams with the project objectives.
- Appointing whole teams on the basis of previous performance in meeting benchmarks.

A value-driven selection process essentially suggests a move away from traditional price-focused decision-making in the project delivery process, from engaging consultants to awarding contracts, including sub-contracts and supply contracts. Further, in valuing the relative merits of one proposal against another, clients will increasingly measure whole-of-life costs rather than capital costs to arrive at a decision as to who should be awarded a contract (Australian Procurement and Construction Council, 1997).

The APCC believe there are indications that government clients of the Australian construction industry are moving away from price-focused decision making in awarding contracts and instead the trend is toward selection on the basis of prequalification and performance in the execution of work. However, this view is not universally supported by the industry.

The ACA (1999) notes that the selection of parties to form an integrated project team in a relationship contracting situation, is crucial to project success. The selection criteria for contractors and consultants must be based on the type, size and other specific requirements of the project. The selection of parties also needs to be based on criteria which include commercial and technical competence. A criterion recommended by the BCA (1993) is the need for tenderers to demonstrate that their management systems, and staff with the skills to implement them, meet the client's predetermined standards for the management and control of project objectives.

Clearly, this objective is explicitly included in strategic partnering as "Membership" which deals with the choice of firms to be involved in a partnering arrangement. In alliancing, this action is called "participant selection". The selection of firms must be conducted thoroughly so that only those capable of putting the overall strategy into effect are selected.

This objective is also concerned with the selection of people who can carry out their individual roles effectively. The BCA report *Fundamentals of Project Implementation* (1993) stated that having the right people for the job, and using and developing

quality people in all aspects of project procurement is critical to project success, and advised that considerable attention be paid to selection processes to ensure this. The BCA found that the greater the experience or capability of the respective project staff of the client, contractor or consultants, the greater the likelihood of continuity of key personnel on projects, and achievement of project objectives. Project Alliance teams take this approach by selecting individuals from across the alliance on a "best for project" basis. (Hampson et. al. 2001).

An element which Sidwell et al (2002) identified as being important to the implementation of this guideline is that the selection panel must include competent people in the evaluation process. Construction Queensland (2001) notes that non-price selection criteria must also be measurable. Generally there is strong support for the application of non-price criteria in selection processes, however there is a major concern within the contracting side of the industry that selection processes are becoming so costly as to be crippling at certain levels. A major hurdle for the industry to cross in coming years will be to keep value-driven competitions at sustainable cost levels.

This guideline from the Decision Matrix can now be expressed as:

- *Selecting team members on the basis of the value they add to the team.*

5. Eliminate duplicated effort

The elements of the 'eliminate duplicated effort' guideline in the Decision Matrix address several key points which include:

- Assemble the integrated design and construction team by matching expertise to objectives.
- Eliminate ambiguity and confusion about roles and responsibilities.
- Early selection of team and inclusion in decision-making process.
- Establish effective open communication between the parties.
- Encourage a co-operative multi-skilled approach.

This 'eliminate duplicated effort' objective essentially suggests a move from the conventional systems (e.g. traditional, design and build) in which project participants tend to spend considerable human resources and time in non-value-added activities such as contract administration, duplicated inspection procedures and so on, because all of the conventional systems legally bind participants through contractual terms. Participants work separately and this encourages bureaucratic, non-value-added activities and prevents participants from concentrating on processes.

According to Mendelsohn (1998), the single human factor that affects productivity most in any enterprise, particularly in the labour-intensive construction industry, is cooperative effort of a group of individuals toward meeting a collective goal. This is achieved by defining roles and responsibilities of the members of the team and then providing a climate that promotes the efficient operation of those roles and responsibilities. By cooperation, coordination and cordiality, the team can produce more than the individual efforts taken alone. Team members are motivated to go beyond the letter of the contract and work in a spirit of cooperation. This is also an immediate benefit of one integrated team under alliancing's "team and leadership structure" in which team members are selected on a best person for the job basis (Peters et al, 2001).

The importance of correctly defining roles should not be neglected. Role ambiguity is found to be caused by discrepancies in information available to an individual and that required for the expected performance of their role. On construction projects this occurs when integration fails between organisations; work is duplicated and omissions are made (Gray and Suchocki 1996). Defining clear roles and responsibilities of the members of the team is essential to achieve cooperative effort of the team toward meeting a collective goal (Mendelsohn 1998). Boudjabeur (1996) found that the consequences of role ambiguity on the contractor's performance are very damaging and far reaching, leading to poor job performance and eventually resulting in considerable loss of time, inflated cost and poor quality work. Construction Queensland's (2001) review of various reports on the performance of the construction industry found that up to 40% of the cost of management of projects adds no value to the end-user and therefore is wasted effort that reduces the investment value of the built asset to the government/taxpayers and companies/shareholders.

The Business Council of Australia (BCA) emphasises the importance of proper allocation of responsibility and accountability to project success. The broad conclusion from case studies (BCA 1993) was that the more successful projects tended to have a single guiding authority and the shortest practical lines of responsibility. The BCA notes that an organisational strategy to secure and retain the commitment of those involved in the project is essential and should create a climate where as far as possible, those working on a project should relate strongly to it and feel responsible for its success. This requires a cooperative and transparent approach to management of projects. Efficient and clear allocation of tasks avoids confusion, duplication and conflict.

Bennett and Jaye's (1998) action of continuous improvement through "project processes" essentially describes the same action as "eliminate duplicated effort". The main aim of strategic partnering is to improve performance. When people continue to work in the traditional way there are very real limits to the savings that can be achieved. Improved performance requires that processes are examined and then made more efficient. That means each activity in the process is questioned to identify any that do not add value for the client. Non-value adding activity is regarded as waste.

Thus there is considerable support for Sidwell et al.'s 'eliminate duplicated effort' guideline.

In developing the Decision Matrix this action can now be expressed as:

- *aligning team members' interests, using project processes.*

6. Process not contractual arrangement

The elements of this objective address several key points, which include:

- Front end participation by a wide spectrum of expertise to predict, inform, and design out problems which might be encountered at the later stages of the project process.
- Ensuring coordination role lies with appropriate parties.
- Integrated supply chain.
- Investigating new approaches to improve construction output "learning" project teams.

- Team participation and empowerment.
- Accurate, open data communication ensuring decisions are based on up-to-date information.

Collectively, these points are in essence about integrated processes which are structured around effective coordination, teamwork, improved communication, degree of empowerment given to team members and aimed directly at meeting the client's overall requirements. They should involve key parties very early in the project's life

Research by Mitropoulos and Tatum (2000) has indicated similar findings to Sidwell et al.'s 'process not contractual arrangement' in that integration is needed during all project phases. For example, at the planning stage, integration with designers, contractor, and suppliers is needed to ensure that the owner's expectations are realistic and can be achieved with the available means. Lack of certainty during project planning may result in scope uncertainty, ambiguity, unclear priorities, and unidentified needs and constraints, which in turn cause changes, rework, and delays. During the construction phase, integration increases responsiveness of the project organisation. The uncertainty surrounding construction projects, namely uncertainty of the physical and the business environments, requires a responsive organisation able to make fast and effective midcourse corrections.

Essentially, Sidwell's et al. 'process not contractual arrangement' emphasises the importance of integration that goes beyond contractual integration through efforts similar to partnering. Furthermore, it also implicitly highlights the need for technological integration as indicated by the element 'Accurate open data communication to ensure decisions are based on up-to-date information'. This objective reinforces previous research studies by Puddicombe (1997) and Mitropoulos and Tatum (2000), which addressed the need for a combination of organisational and technological integration to overcome a major stumbling block to increased performance, that is, the required change in the roles and expectations of the project participants.

In project alliancing, this guideline is similar to "alliance principles" which are applied to evaluate and validate each decision taken by the participants in delivering a project (Hutchinson & Gallagher, 2003). It is also similar to strategic partnering's "integration" pillar which deals with agreeing how decisions are made. The integration pillar deals with systematically developing over time more effective ways for teams to work together (Bennett and Jayes 1998). This approach, which attempts to integrate project members through partnering, is classified as organisational integration (Puddicombe 1997, Mitropoulos and Tatum 2000). Unlike the partnering approach however, the alliance principles, along with the project objectives, are a contractual requirement and prominent part of the alliance agreement. The integrated project team approach is also strongly advocated by the ACA.

The action described by this guideline can be expressed as:

- *agreeing the processes to be used, including how decisions will be made and how the team will be integrated.*

Equity or commercial framework in project delivery.

The foregoing discussion shows that there are direct similarities between the Decision Matrix and recent developments in improving project delivery processes. The six original guidelines have been validated and expressed as actions rather than as principles. Two actions regarding feedback, and benchmarks have been added.

However, there is one major omission that must be rectified before the Decision Matrix can be said to provide a sound basis for the CRC-CI project, *Value Alignment Process in Project Delivery.* That is, the issue of equitable risk and reward for project participants.

This issue is widely accepted in the literature[3]. The ACA notes that the parties to an agreement should be aligned not only through common goals, but also through shared business interests in the project's success, linking profitability to performance throughout the supply chain.

Bennett and Jayes (1998) note that a key to giving everyone the confidence to concentrate on joint interests and mutual objectives is to make sure that they are rewarded fairly for work well done. The "equity" pillar of strategic partnering uses the client's business case as the basis for a firm budget, guaranteeing all the firms involved fair, predetermined profits and paying all their costs using open book methods. This requires rigourous cost control backed by rigourous audit. Moving to a full open book approach takes time in building up confidence in the financial systems and trust in the people involved.

Establishment of a commercial framework is a key feature in the project alliance. A gainshare/painshare mechanism is structured so that the parties will either win or lose together. The notion of equity in project delivery describes actions aimed at ensuring that the financial arrangements agreed amongst client and project team members do not impede team-working.

Therefore a further guideline should be added:

- *ensuring the financial arrangements support team-working.*

Conclusion - summary of modified Decision Matrix

The foregoing validation process suggests a modified Decision Matrix for individual projects. It comprises an axis formed of a fundamental construction process expressed in terms familiar to construction practitioners:

- *Ideas and feasibility*
- *Planning and design*
- *Construction*
- *Commissioning*
- *Operation (including maintenance,)*

An the axis which describes generic actions which need to be taken to achieve project success is modified and expanded to include the following:

[3] (eg. CIIA, 1994, Ireland 1994, ACA 1999, Bennett and Jayes 1998, CQ 2001, Hutchinson and Gallagher 2003)

- *Agreeing the project objectives taking account of the project stakeholders' values and the need to improve over industry norms.*
- *Selecting team members on the basis of the value they add to the team.*
- *Aligning team member's interests.*
- *Ensuring the financial arrangements support teamworking.*
- *Agreeing the processes to be used including how decisions will be made and how the team will be integrated.*
- *Agreeing how team performance is to be measured.*
- *Ensuring team members have feedback driven control systems.*
- *Agreeing the design strategy to take account of life cycle costs.*
- *Agreeing the construction strategy to take account of life cycle costs.*

This provides a robust foundation for the development of a best practice guide to project delivery, and a decision support tool to assist the decision-making process for project delivery. Sidwell, Kennedy and Chan's case studies provide many detailed actions that can populate a data base which expands the generic actions into project-specific examples to which decision-makers can relate. Construction Queensland (2001) and Crow and Barda (2001) provide more actions. There are many other published case studies of best practice which can be used to build up a large database of actions to support a practical and effective project delivery decision support system.

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