Proceedings of the Institution of Civil Engineers
Municipal Engineer 156
December 2003 Issue ME4
Pages 263–271

Paper 13429
Received 10/07/2003
Accepted 05/09/2003

Keywords:
management/planning & scheduling/statistical analysis

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Project start-up phase: the weakest link

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A project is normally undertaken to produce a product or facility that has been deemed necessary to satisfy a need. Within the total life cycle of a project, from start to finish, the period that often receives less than the attention and effort it deserves is the initial start-up phase. The start-up or concept phase is defined as that period prior to identifying that a project exists, and before the allocation of substantial funds, and when all options including the no-go option have been investigated. Yet it is during this phase when decisions are taken that can have maximum impact on the outcomes during the later phases of a project. Should appropriate problem solving and decision making be neglected in the early stages (a stage being part of a phase) of a project then the very reasons for creating the final product for which the project was initiated would be highly questionable. In this paper the normal decision-making process is examined for completeness and in particular with regard to how obtaining value should be integrated within the start-up process. Value here is defined as the maximisation of project functionality while concurrently minimising the total life-cycle cost. The paper concludes with the author's recent experiential view of a practical guide that all clients, sponsors, project managers, and other project stakeholders should consider as the process and the associated deliverables for the start-up phase for capital works projects.

1. MEASURING SUCCESSFUL OUTCOMES

If a project satisfies the mission for which it was initiated and there is a high level of achievement from the key stakeholders (performing organisation, customer organisation, project team, users, etc.) concerning the project's outcomes then the project is considered an overall success. But what are the variables that are perceived as contributing to success and, for that matter, failure? Seven factors[1] contributing to perceived project success are now listed, along with, in parentheses, a comment on meaning

(*a*) coordination and relations (between all stakeholders)
(*b*) adequacy of project structure and control (manager's and team's satisfaction with)
(*c*) project uniqueness, importance and public exposure (project different in scale and familiarity)
(*d*) success criteria salience and consensus (importance of performance requirements to all stakeholders)
(*e*) competitive and budgetary pressure (emphasis on staying within budget)
(*f*) initial overoptimism, conceptual difficulty (difficulty in meeting predetermined requirements)
(*g*) internal capabilities build-up (within the performing organisation).

Based on an analysis of 650 projects, what this 1970s decade research[1] indicated was that many of the project success factors are directly related to the actions and control of the project manager and the project team. What was also clear was that the technical performance variable is more closely associated with perceived success than either cost or schedule performance. In essence, what really seemed to matter was the performing organisation's (but not excluding other stakeholder) satisfaction with the product produced by the project; this aspect of project performance meaning much more than good schedule and cost performance.

Work undertaken in the subsequent decade[2] was based on information obtained from 50 project managers from whom the categorisation of ten critical factors that formed the basis for diagnostic measurement of project success was proposed. The factors, along with a brief explanation in parentheses, are

(*a*) project mission (clearly defined goals and general directions)
(*b*) top management support (willingness to provide necessary resources and empower authority to project team)
(*c*) project schedule/plan (a detailed specification of the activities to be undertaken for conceiving, designing, and implementing the project)
(*d*) client consultation (close network with all parties to the project)
(*e*) personnel (identifying/assigning/training the project team personnel)
(*f*) technical tasks (the availability/expertise to accomplish the project's technical tasks)
(*g*) client acceptance (being able to sell the final deliverable(s) to the intended users)
(*h*) monitoring and feedback (the provision of comprehensive project status information during all life-cycle stages)
(*i*) communication (providing the project stakeholders with the required information, when needed, and in accordance with a communications management plan)
(*j*) troubleshooting (the ability to handle variations and unexpected deviations from the plan).

In general, the factors appear to conform to a sequence where the first three are referred to as strategic and the remaining seven are referred to as tactical. In other words *project mission*, *top management support* and *project schedule/plan* are factors that are related to the early stages of a project. It was also found that many of the factors could be related in a sequence of steps with *project mission* being the first step.

When a database of over 400 projects was used to assess these success factors it was found that the ten factors represented over 61% of the causes that bring about project implementation success.

Subsequent research has been carried out on testing and ranking the success factors identified in the previous decades. An assessment[3] of success factors in the IS (information system) industry showed the following ranking for project success factors

(*a*) clearly defined goals
(*b*) top management support
(*c*) competent project manager
(*d*) competent team members
(*e*) sufficient resources
(*f*) client consultation
(*g*) adequate communication
(*h*) responsiveness to clients
(*i*) feedback capabilities
(*j*) technical tasks
(*k*) client acceptance
(*l*) control mechanisms
(*m*) troubleshooting.

About 50 firms involved either as professionals or users of IS participated and the total sample size was 78 individual participants.

A 1997 study[4] used a similar approach to earlier research but assessed project success along four distinct dimensions of

(*a*) project efficiency (management of the project process—time, cost, etc.)
(*b*) impact on the customer organisation (meeting customer requirements—performance measures, functional requirements and technical specifications)
(*c*) direct and business success (measure/assessment of impact the project will have on the organisation)
(*d*) preparing for the future (long-term organisational and infrastructure change).

This offered a basis for determining success at different times during a project life cycle and from the perspective of different stakeholders. The research was based on the analysis of responses from 127 project managers working on projects in a broad range of Israeli industries, including aerospace, chemical, computers, construction, electronics and mechanical.

The research that has been carried out over the last 30 years has generally concentrated on the project success factors of the final deliverables but, as alluded to by some in this field, there is little that has been undertaken that deals with the success variables that change with time. Variations in the success variables, their relative importance and the associated metrics are different at every stage of the project. For example, the success factors that would be appropriate at the end of the production phase will be different and more extensive than those at the end of the design phase, which in turn will be more extensive and different to what applies at the end of the concept phase.

Slevin and Pinto[2] discuss what they refer to as strategic success factors and tactical success factors and state that the strategic factors would apply more to the earlier stages of a project than to the later stages. The success variables of *project mission*, *top management support* and *project planning*, as defined by Slevin and Pinto, are strategic and therefore would be variables that would measure the first stage of the project. The broad range of human, technical and financial resources that are the basis of implementing all projects would not be success variables that would be measured at a project's earliest phase. It is at this earliest phase when the resources utilised will be a small percentage of the total project expended effort or project cost expenditure, and therefore many, if not most, of the tactical success factors would not be relevant.

It also could be argued that most, if not all, measurable success factors from the subsequent phases of the project can be related back to the initial success variable *project mission*—that is, clearly defined goals and direction. It is this variable, closely linked with the deliverable from the initial phase, which is referred to here as *the best go-option*, that is the basis for demonstrating that the concept phase is most often found to be the weakest link in successfully delivering the final product of the project. As shown in Fig. 1 the first phase of what is presented here as a generic five-phase development of the project life cycle is the time when project resource commitments are at a minimum. But it is also at a time when the potential for influencing the project outcomes is at a maximum. The 'generic project' is assumed to require services and goods, therefore procurement as a phase is separately identified. The generic life-cycle phases are shown as

(*a*) concept (start-up)
(*b*) design
(*c*) procurement
(*d*) production
(*e*) termination.

The deliverable at the end of each phase is termed *best go-option*, *definitive control plan (DCP)*, *detailed firm plan (DFP)*, *substantial completion* and *project hand-over*, respectively. The second and third deliverables, DCP and DFP, are composed[5] of a number of elements, most of which can be related to process outputs explained in a project management framework publication.[6]

The window of opportunity is therefore when the project's stakeholders can adequately define the *project mission* and develop the *best go-option*.

2. THE CONCEPT PHASE PROCESSES

One, or more, of the following typically creates the need for a project[7]

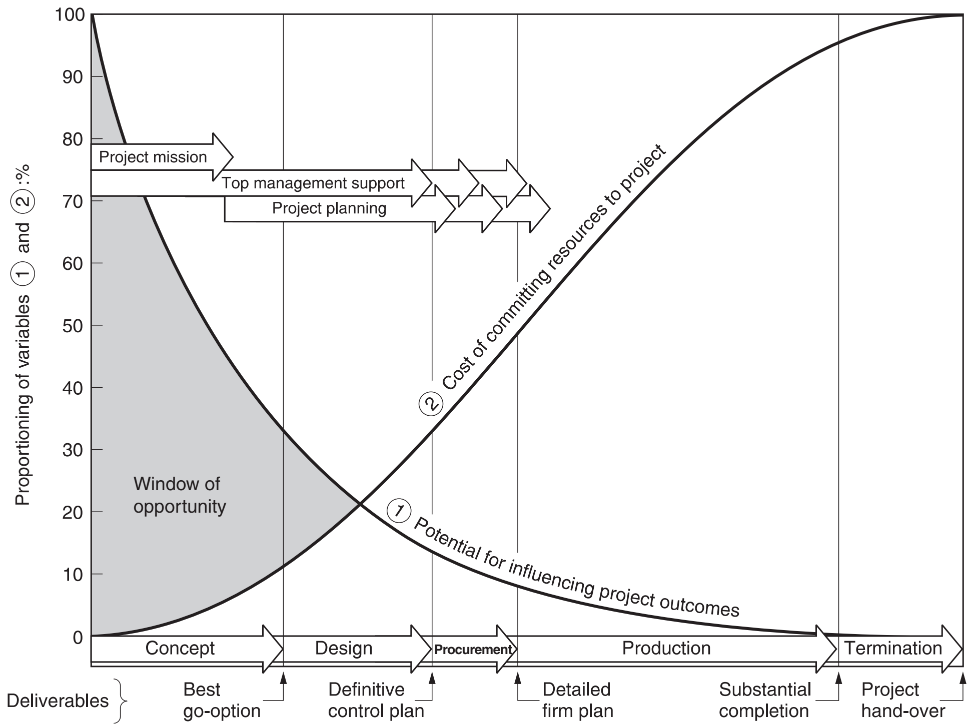


Fig. 1. Window of opportunity

(*a*) national requirement
(*b*) market idea/need
(*c*) social or domestic demand
(*d*) business need
(*e*) customer request
(*f*) technological advance
(*g*) legal requirement.

These needs are mostly self-explanatory. An example of national requirement can be explained by considering the energy sector and, say, the generation of electricity of some nation. Forecasting the electricity demand for the next five to ten years based on historical trends and predictions of domestic growth and industrial requirements will indicate the size, and possibly type, of the next generating station. For a different sector, say textiles, and the forecasting by a textile manufacturing company could be for the utilisation of nylon over the next decade. Such future predictions of *market need* created by fashion, the identification of new markets, the company's competition, etc. will determine the output capacity, and possibly location, of a new nylon production line or complete facility. These are but two examples in explaining what it is that can create the need for projects.

The project management industry generally recognises that the project management process starts from the realisation of a need—a new power station, a new production line or facility. But at this time, although a need has been identified, a project response has not yet been proven. Therefore the purist can argue that a project does not yet exist until such time as the project has been specified or more clearly defined. At this point all that can be assumed is that there are a number of options that may satisfy *the need*, one of which, it may transpire, will be the project. The purist may therefore feel that project management and its many processes do not start until such time as the best option (the project) has been identified. However, most theoreticians and practitioners (which includes the author) would believe the project management process commences on identification of need, and this is coincident with the start of the first phase of any project, namely the concept phase.

During the concept phase of the project there are various stages of information gathering and decision making that need to be taken between the identification of a need and the identification of the project that will answer that need.[8] These stages are termed

(*a*) opportunity (or screening)
(*b*) pre-feasibility (or evaluating)
(*c*) feasibility (or ranking)
(*d*) bankable (or funding).

Although these stages are sequential as listed, in reality they are somewhat artificial but they do provide a basis for the processes of information gathering and decision making taking place during the period of conception. Broadly speaking, what is important about this process is that it should begin with the identification of a number of options (or alternatives) using existing information and gathering new data in such a way as to limit the options under consideration to those few which are most promising. In short, the concept phase is essentially one of elimination.

The stages that normally describe the concept phase are shown in Fig. 2. The screening stage's deliverable can often be referred to as the opportunity report. The deliverable from the evaluating stage will normally be referred to as the pre-feasibility report, and the deliverable from the ranking stage is traditionally referred to as the feasibility report. Assuming funding is to

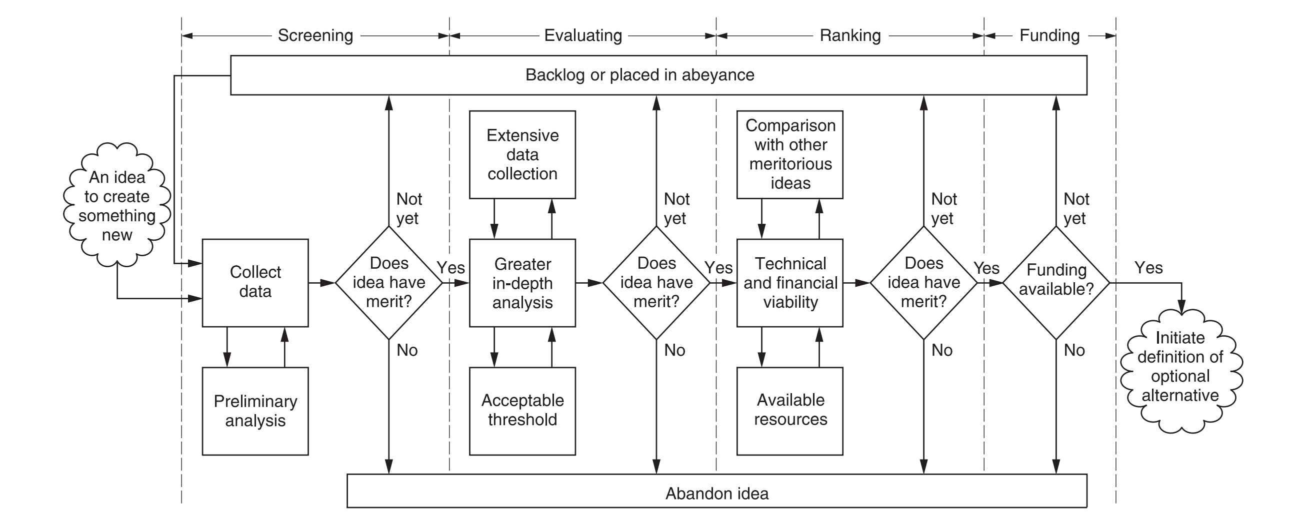


Fig. 2. Concept phase stages

be sought for the project then the deliverable at the end of the funding stage will be what can usually be referred to as a bankable document or report.

As early in the screening stage as possible the concept (or study) team and resources assembled to undertake the conception work will be required to establish the *project mission*. The establishment of the project mission becomes, as stated earlier, the starting point against which all other subsequent project matters will be linked. Get the project mission wrong and there is little hope of ever expecting the project's final outcome to be anything other than some degree of unsuccessfulness. Get the project mission anything other than right and the project may never be able to recover to be anything like a success.

The screening stage should normally not involve any substantial costs in its undertaking as it is intended primarily to highlight the principal investment, or social return, aspects of a particular option that would satisfy the project mission. The purpose of the screening stage is to arrive at a quick and relatively inexpensive determination of the salient facts of an investment possibility or possibilities. Screening studies are usually rather sketchy in nature and rely more on aggregate estimates than on detailed analysis. Cost data are usually taken from comparable existing projects and not from quotations from vendors and the like. As Fig. 2 indicates, the screening study should identify investment opportunities or project ideas, which when subject to further scrutiny, will be proved viable or parked (for possible future consideration) or rejected. Ideas or options that are shown to be viable would be recommended for further consideration in a more detailed study; this is the evaluating stage and includes the work required to undertake a pre-feasibility study. Pre-feasibility and feasibility studies differ primarily with respect to the amount of work required in order to determine whether an option looks viable.[9] To arrive at the outcome of the feasibility study can be costly and time-consuming and so it is normal to undertake a preliminary technical assessment of all options in a pre-feasibility study. Those ideas that survived the screening stage, plus any others that are conceived during the evaluating stage, become subject to technical and economic analysis to a depth that is commensurate with the level of data and information available and is consistent across all options. The principal objectives of the evaluating stage are to find if

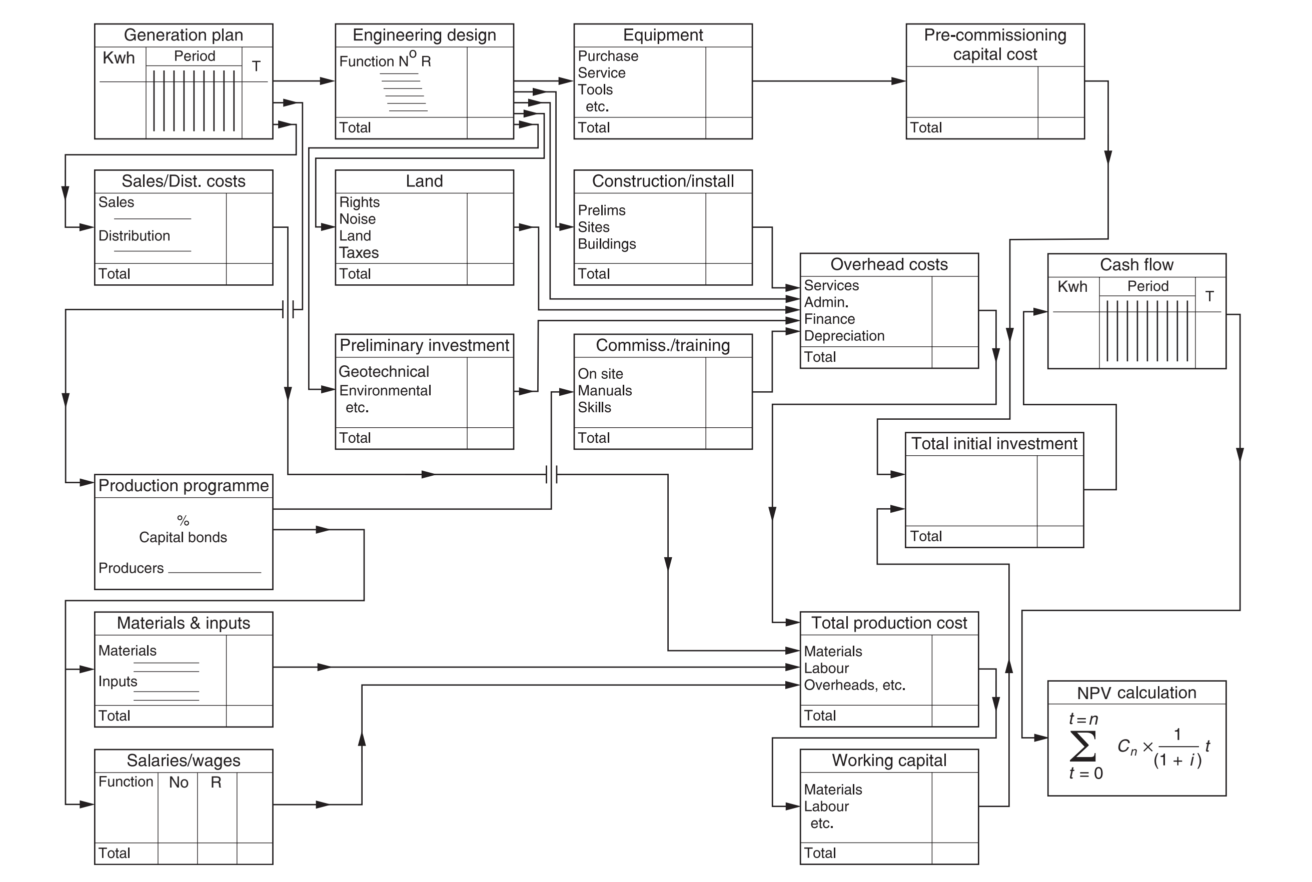
(*a*) an option is so promising that an investment decision would appear likely
(*b*) an option justifies a detailed analysis in the next stage (ranking)
(*c*) an option requires further special investigation before it can be considered for advancing to the next stage
(*d*) the findings relative to an option are overwhelmingly unattractive hence the option is not viable.

The ranking stage provides the basis for a rigorous technical, economic, social and political assessment of each surviving option. A satisfactory feasibility study is one that analyses all basic components and implications of an option, any shortfall in this regard limiting the utility of the study. The critical elements that relate to producing the deliverables within each option are defined and analysed on the same basis as all other options.

In undertaking the analysis an iterative process is used that will cycle feedback and inter-linkages on possible alternative solutions for performance outputs, technology, locations, contract strategies, operational organisation, and all other factors that have to be harmonised to meet the requirements. Sensitivity testing, optimising, assumption justification, scope of work, etc. are carried out where needed for all options.

The deliverable from the ranking stage is a feasibility report that provides a ranking of options from the most attractive to the least attractive, possibly based on some benefit/cost ratio. This is not an end in itself but only a means to arrive at an investment decision. Often a project's performing organisation will not fully conform to the conclusions of a study and will decide, or influence a decision, on some hybrid or combination of options.

A typical information flow chart for undertaking a planned power station feasibility study is shown in Fig. 3.



$$\sum_{t=0}^{t=n} C_n \times \frac{1}{(1+i)}t$$

Fig. 3. Flow chart of information (feasibility study)

Once the ranking stage has been completed the proposed or selected option (best go-option) will either require or have the funds needed to start and complete what can now be termed the project.

The accuracy of estimates for each of the stages outlined will vary as the conception of options progresses from one stage to the next. On average the approximate ranges of input data accuracy used in calculations of option performance and investment are shown in Table 1.

These averages are empirical values that may differ from project to project and according to the applied methods of estimating performance and costs. However, it is essential that all options within a given stage are analysed and examined on the same accuracy basis.

3. DECISION-MAKING PROCESS

As stated earlier, the concept phase is primarily concerned with the elimination of options. This is achieved through the processes of decision making and problem solving, which take place over the period of project conception (and of course beyond). Decision making is part of the larger process of problem solving;[11] it focuses around the central problem of choice between alternative options. Decision making, or decision analysis, is stated[12] to be a process of three steps, namely

(*a*) *decomposing and structuring* the problem
(*b*) assessing the *uncertainties and values* of the options
(*c*) determining the *optimal strategy.*

In other words decision making is about taking decisions that will provide value options in an environment of uncertainty. There are numerous techniques that are used in making the right decision and arriving at the right outcome. A distinction needs to be drawn between a good decision and a good outcome. Following the three-step process and using a set of techniques[13] is more likely to provide good decisions; such a framework is the best insurance we have against a bad outcome. The process is shown in Fig. 4.

Based on the author's observations of European-derived/based projects, the step of *uncertainty and value* is not clearly understood and seldom, if ever, fully undertaken during the project start-up phase. A general comparison of his experiences of North American projects versus European projects shows that this is a substantial area of difference and may be part of the reason for different levels of successful outcome. A form of technical, economic, and perhaps social evaluation is carried out to determine the attractiveness of one option versus another but it is rare to see a fully inclusive approach taken that

Stage	Accuracy: %
Screening stage (opportunity study)	±40
Evaluating stage (pre-feasibility study)	±20
Ranking stage (feasibility study)	±15

Table 1. Input data accuracy[10]

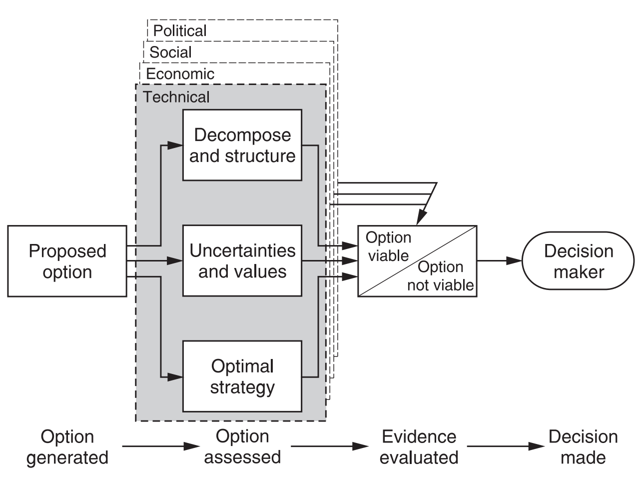


Fig. 4. Decision-making process

balances the effort to be applied within each decision-making step. Nor does one often see an equitable approach on the technical, economic, social and political issues with regard to project uncertainty and value.

There are numerous fairly recent professional publications dealing with the subject of risk; these would include References 14–17 plus a significant number of published papers too extensive to list here. These books and papers provide guidance on how to handle project risk and such approaches would be very much applicable to the concept phase. But relatively little guidance is conveniently available to the practising project manager that would help in describing how to deal with the matter of project value.[18]

To develop the project requirements, to identify the measurable criteria that will deliver these requirements, to measure each option against other options, and, in general, to create a framework for developing project value, will require a knowledge of the value process and the associated tools and techniques.

The starting point in determining the project mission (screening stage) is to define the overriding purpose. The overriding purpose needs to be developed as an agreed statement from the performing organisation and/or customer organisation. The statement will be action-oriented, short, simple, straightforward, and unambiguous. The statement will define the final deliverable, should be the continuing point of project reference throughout its life cycle, and be the focus for all objectives and work activities to relate to. In all cases the project mission statement should have the input of the end-user and be developed using the experience of the performing organisation and, if in place, the concept (study) team.

Using a value tree, see Fig. 5, the project objectives can be created, usually through stakeholder participation within a facilitated workshop. These objectives are sub-goals and not actual work that has to be achieved. The objectives should be specific, measurable, assignable, realistic and time-related and be fully realisable if the overriding purpose of the project is to be achieved.[19] The next level in the value tree identifies what is often referred to as value function attributes; these attributes

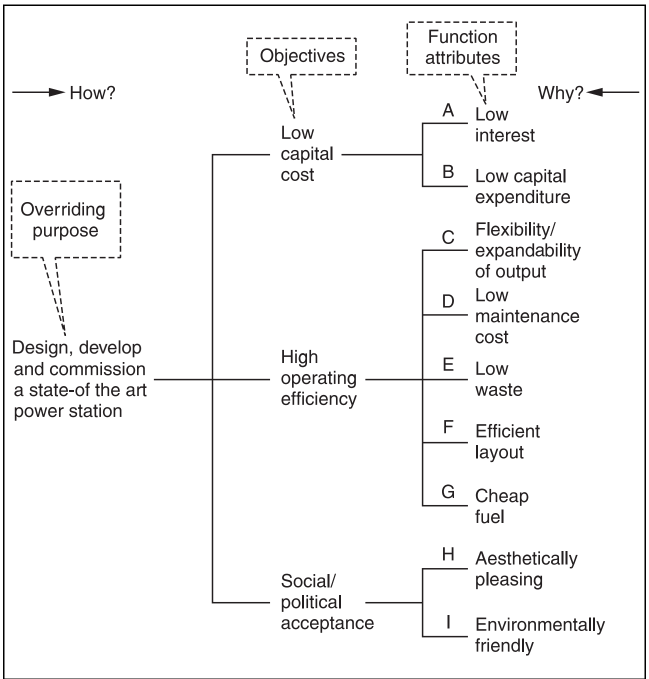


Fig. 5. A project's value hierarchy

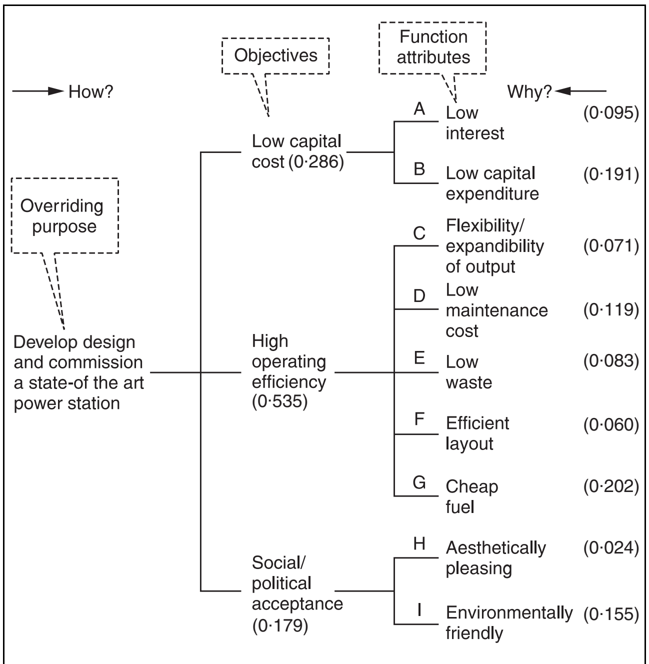


Fig. 6. Weighted value tree

will be fully supportive of the objectives to which they relate, and in turn will deliver the goal of the project.

These attributes will be assigned a weight, see Fig. 6, which represents their preference as established usually by all stakeholders. By aggregating the product of each function's value and their weight a means can be derived that will compare the value of each option against all other options. But how are these weights derived?

The weights of each attribute are normally achieved through group brainstorming sessions. Each attribute's importance relative to each other attribute has to be discussed and

(a)

1st attribute	B	C	D	E	F	G	H	I	Raw score
A	A–B	C–2	A–D	A–2	A–2	G–3	A–2	I–2	8
B		B–2	B–D	B–3	B–3	B–G	B–4	B–I	16
C			C–2	E–2	C–F	G–2	C–H	I–2	6
D				D–2	D–2	G–2	D–3	D–I	10
E					E–2	E–G	E–H	E–I	7
F						G–3	F–4	I–2	5
G							G–4	G–I	17
H								I–3	2
I									13

2nd attribute →

Preferences
None 1
Low 2
Medium 3
High 4

(b)

① Attribute	② Description	③ Raw score	④ Weight col. ③ ÷ 84	⑤ Ranked order
A	Low interest	8	0·095	5
B	Low capital expenditure	16	0·191	2
C	Flex./exp. of output	6	0·071	7
D	Low maintenance cost	10	0·119	4
E	Low waste	7	0·083	6
F	Efficient layout	5	0·060	8
G	Cheap fuel	17	0·202	1
H	Aesthetically pleasing	2	0·024	9
I	Environmentally friendly	13	0·155	3
	Total	84	1·000	

Fig. 7. Attribute rating and weighting

determined in relation to satisfying the project objectives and in turn the project's mission. As part of the decision-making process, the technique that will determine these weights is referred to as SMART (simple multi-attribute rating technique).[20]

Each attribute (A, B, C, . . ., etc.) is compared with each other attribute in turn to determine its importance in satisfying the project's overriding purpose. In order to compare attributes we need to assume that *mutual preference independence* exists between the attributes—in other words determine what is important and what is less important. To apply preference independence a scoring system that has 1 = no preference, 2 = low preference, 3 = medium preference, and 4 = high preference is often assumed.

Figure 7(a) half-matrix, shows the assumed result of group activity outcomes in having compared and preferred the comparison of attributes A to I inclusive. For example, in the first row of the matrix, A v. B indicates that the stakeholder view is that there is no preference when attribute *low interest* is compared with attribute *low capital expenditure*, so the result is A–B—that is, both A and B have a point each. In the next cell A v. C shows that the collective view is that C has a low preference over A in satisfying the overriding purpose; therefore the result is C-2. The raw score of each attribute is obtained by simply adding the scores for each attribute in turn. For instance the total of A's scores $(1 + 1 + 2 + 2 + 2 = 8)$ represents A's raw score and this appears in the first row of the extreme right-hand column of the half-matrix.

Below the matrix is a table (Fig. 7(b)) that shows all attributes, their description, and their transposed raw score. The raw score for each attribute is then converted into a weight as shown in column 4 which can then be ranked (column 5) from the highest to the lowest (in this case G, *cheap fuel* (0·202) to H, *aesthetically pleasing* (0·024), respectively). These weights can then be superimposed on the value tree and in this case the weights are shown in parentheses against each attribute to which they refer (see Fig. 6).

The next step is to use these weighted function attributes to compare the options that have been identified as satisfying the project's mission. Assume that there are three viable options called X1, X2 and X3, which are the final outcome of having undertaken opportunity or pre-feasibility or, possibly, feasibility studies, and all three options will satisfy the performing organisation's requirements. Fig. 8 shows the evaluation of each option against the value functions.

The first step in completing the evaluation matrix is to rank each value function against each of the options using a scoring system of 1 = poor, 2 = fair to reasonable, 3 = good, and 4 = excellent. The ranking is best carried out during a group session of the stakeholders. These scores are placed in the lower right sector of each cell within the matrix. The second step consists of multiplying the rank and the weight for that value function; the product is placed in the upper left sector of each cell. The third step is to total all figures in the upper left sectors across a row to obtain the weighted score of each option. Based upon the analysis presented in Fig. 8, option X3 has the highest score and would, all other things being equal, be selected as the *best go-option* and hence would become the *project* to proceed with into the design and subsequent phases.

4. TEMPLATE PROCEDURE FOR PROJECT START-UP

Almost irrespective of the size of an envisaged project a structured framework for conceptualising the project should be developed by the performing organisation and this framework used by the concept team for the benefit of the project's customer organisation. Evidence from projects that have not produced successful outcomes or have been deficient in some significant way can inevitably track the reasons for this lack of achievement back to inadequate processes and/or misapplication of certain tools and techniques during the start-up phase. The following seven-point outline plan is suggested as a way of creating a framework that will tackle the concept phase processes.

Point 1. Divide the concept phase into a number of stages, with each stage having an identifiable document deliverable as its output. Use the deliverable from any stage to be the kick-off for the next stage. Concentrate team effort and work actions only on the stage that is current.

Point 2. Place the strategic, brainstorming, identification of options, identification of measurable criteria to be met, and big picture vision effort that is the conception work as early in the concept phase as possible.

Point 3. Use brainstorming as one of many group techniques that can be used by the project stakeholders to agree on a defined statement that becomes the *project's mission*.

Point 4. Through group sessions use the value tree technique to derive the objectives and the value function

Value function	A Low interest	B Low capital expenditure	C Flexibility/ expandability of output	D Low maintenance cost	E Low waste	F Efficient layout	G Cheap fuel	H Aesthetically pleasing	I Environmentally friendly	
Weight	0·095	0·191	0·071	0·119	0·083	0·060	0·202	0·024	0·155	Score
Option X1	0·285 / 3	0·573 / 3	0·213 / 3	0·238 / 2	0·083 / 1	0·240 / 4	0·606 / 3	0·048 / 2	0·620 / 4	2·906
Option X2	0·285 / 3	0·764 / 4	0·142 / 2	0·357 / 3	0·166 / 2	0·180 / 3	0·606 / 3	0·048 / 2	0·465 / 3	3·013
Option X3	0·285 / 3	0·764 / 4	0·142 / 2	0·476 / 4	0·332 / 4	0·120 / 2	0·606 / 3	0·072 / 3	0·620 / 4	3·417

Satisfaction scores 1 = Poor
2 = Fair to reasonable
3 = Good
4 = Excellent

Cell key: (SS × attribute weight) / Satisfaction score (SS)

Fig. 8. Option evaluation matrix

attributes (measurable criteria) that will satisfy the performing organisation's requirements as reflected by the *project mission*.

Point 5. Identify and analyse as many alternative ways of technically, economically, socially and politically satisfying the project's mission. Screen off all those options (alternative solutions) that are not viable after carrying out an opportunity-level study.

Point 6. In evaluating opportunities assess the technical, economic, social and political aspects of each option by following a process map of steps (similar to that shown in Fig. 3) and the three-step decision making (as per Fig. 4) which includes, interalia, an assessment of uncertainty (risk). Other project knowledge areas that will be part of evaluating options will be the assessment of the project's scope, time plan and schedule, estimated budget cost, contract strategy, quality plan, communication system, and human resource needs. The latest time when such assessments should be undertaken will be during ranking when the options will be subject to a more rigorous feasibility-level study.

Point 7. Evaluate each solution option against the measurable criteria (Point 4) and use the result of the weighted score to assist in deciding which option is the *best go-option* and most likely to satisfy the project's mission.

Such an outline plan, if followed, will not guarantee successful project outcomes but it will most certainly provide a basis for reducing the many disastrous outcomes that all too often are commonplace in the modern project environment. The plan is applicable to conceptualising any type of project of almost any complexity and from the small to the extra large.

The author has recently introduced this template to a large local authority within the British Isles. This template, sometimes with slight variants, is being used on an extensive portfolio of engineering projects and the improvement is already apparent to the practitioners involved. Monitoring of each project's performance is ongoing and the change in successful outcomes of this authority's projects, although too early to call, will be documented and reported on. The general past performance of this authority's projects has traditionally been unsatisfactory and considerable improvement is anticipated.

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