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Risk-management perspective on the project lifecycle

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Shortcomings in the project-management process can be major sources of project risk. The paper highlights these sources of risk and places them in the project lifecycle. The project lifecycle is commonly described in terms of four phases: conceptualisation, planning, execution, and termination. The paper offers a more detailed framework, involving eight stages and a number of steps within each stage. Explicit acknowledgement of this more detailed stage and step structure should facilitate more effective identification and management of process risks.

Keywords: project lifecycle, risk drivers, risk management

When considering the risks associated with a project, attention is often focused on risks specific to the physical nature of the project. However, many key project risks are associated with the project-management process itself. Such generic 'process' risks are present in all projects, regardless of their physical nature, and so they deserve special attention. More effective management of process risks would be possible if these risks were identified and considered in a more complete and systematic way than is often the case. This paper offers a framework for considering process risks that is based on a generic description of the project lifecycle (PLC), and it highlights some important areas of process risk within this framework.

Stages in the project lifecycle

The PLC is a convenient way of conceptualising the generic structure of projects over time. The PLC is often described in terms of four *phases*, with terms such as *conceptualisation*, *planning*, *execution* and *termination* being used[1]. Alternative terms may be used, such as *formation*, *buildup*, *main programme* and *phaseout*[2], but the underlying phases are essentially the same.

The PLC can be described in terms of the extent to which each phase differs in terms of the level of resources employed[1], the degree of definition, the level of conflict[2], the rate of expenditure, and so on. This can help to show how management attention to the factor plotted needs to vary over the life of the project. By way of example, *Figure 1* shows how costs typically accumulate in projects, with the majority of expenditure taking place in the execution phase, although the precise shape of the cost curve may vary greatly from one project to another.

For risk-management purposes, lifecycle diagrams such as that in *Figure 1* point to the desirability of addressing project risk earlier rather than later in the PLC, before major resource commitments are made. However, more detailed insights into the scope for risk management of PLC processes require consideration of the individual phases, and of the processes within each phase.

Table 1 is an elaboration of the four-phase characterisation of the PLC used by Adams and Barndt[1]. Breaking down the four phases of the PLC into eight stages goes some way towards highlighting sources of process risk. However, a still more detailed description of the PLC is useful in underlining where particular risks occur in the PLC. Specifically, it is useful to break the eight *stages* into a larger number of *steps*, as listed in *Table 1*. In the early stages, these steps imply a process of gradually increasing detail and focus on the provision of a product or service deliverable.

Concept stage

It is useful to think of the 'concept' stage as part of an innovation process, and to draw on ideas from Lemaitre and Stenier's description of the innovation process[3], although the scope of our 'concept' stage is somewhat different. The 'concept' stage involves identifying a deliverable to be produced and the benefits to be expected from the deliverable. It begins with a 'trigger event'[4], when a member of an initiating organisation perceives an opportunity or need. At this point, the project deliverable may be only a vague idea, and some initial development may be associated with the 'concept capture' step. 'Clarification of purpose', involving the identification of relevant performance objectives and their relative importance, is

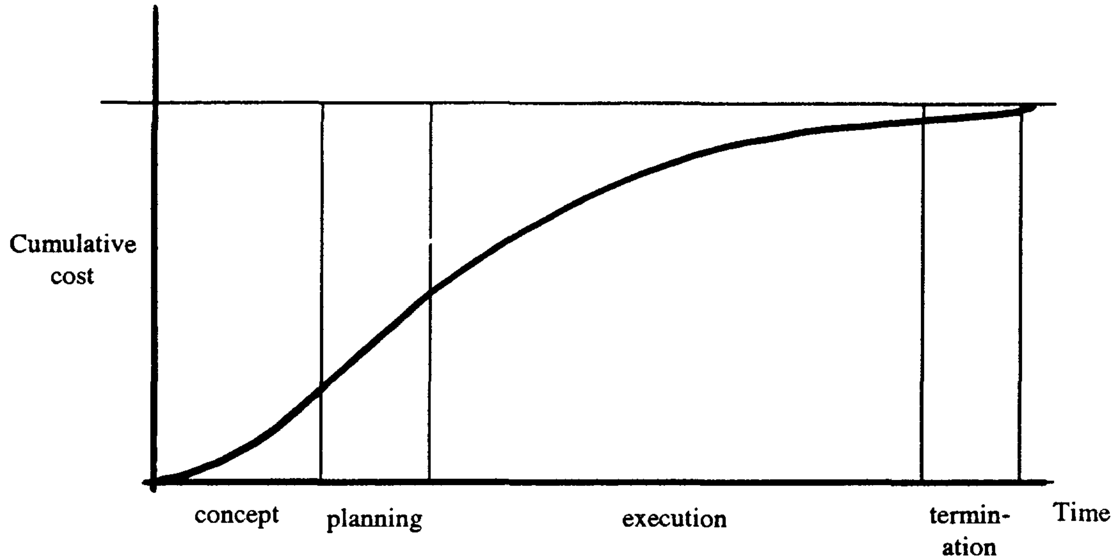

Figure 1 Cost in the project lifecycle

Table 1 Phases, stages and steps in the project lifecycle

Phases	Stages	Steps
Conceptualisation	Concept	Trigger event Concept capture Clarification of purpose Concept elaboration Concept evaluation
Planning	Design	Basic design Development of performance criteria Design development Design evaluation
	Plan	Base plan Development of targets and milestones Plan development Plan evaluation
	Allocation	Base allocation Development of allocation criteria Allocation development Allocation evaluation
Execution	Control	Modification of targets and milestones Allocation modification Control evaluation
Termination	Deliver	Basic deliverable verification Deliverable modification Modification of performance criteria Deliver evaluation
	Review	Basic review Review development Review evaluation
	Support	Basic maintenance and liability perception Development of support criteria Support perception development Support evaluation

another key step in the 'concept' stage. This step may be problematic to the extent that different views about the appropriate objectives are held by influential stakeholders who try to negotiate mutually acceptable objectives. Objectives are likely at this stage to be ill defined or developed as aspirational constraints (for example, latest completion, minimum levels of functionality, and maximum cost). Before the concept can be developed further (the 'concept elaboration' step), sufficient political support for the idea must be obtained and resources allocated to allow the idea to be refined and made more explicit. Other individuals, organisations or potential stakeholders may become involved. Support at this stage may be passive, merely allowing conceptualisation to proceed, rather than being an expression of positive approval of the project.

Eventually, an evaluation of the project concept and objectives as defined to date becomes necessary (the 'concept evaluation' stage in *Table 1*). Evaluation here (and later) is not simply a 'go/no-go' decision, but a 'go/no-go/maybe' decision. A 'go' decision takes the process into the 'design' stage. A 'no-go' decision causes it to stop. A 'maybe' decision involves iteration through one or more previous steps. The basic process risk in this stage is that of moving on to design before effective concept evaluation has taken place and the project concept and objectives have been crystallised.

Design stage

A 'go' decision at the concept stage initiates a 'basic design' step in the design stage, giving form to the deliverable of the project. This usually requires a step increase in the effort or resources involved. 'Development of performance criteria' builds on the base design and project objectives. For many projects, this involves refining the project objectives, but it may involve the identification of additional objectives and further negotiation where pluralistic views persist. This step influences the 'design development' which leads to 'design evaluation' using the developed performance criteria to assess the current design in 'go/no-go/maybe' terms. As in the concept stage, 'no-go' will end the process. A 'maybe'evaluation is most likely to lead to iteration through one or more development steps, but, if fundamental difficulties not anticipated in the concept stage are encountered, the loop may go back to the concept stage. 'Go' takes the process on to the 'plan' stage. The basic process risk at this stage is that of moving on to the plan stage before effective design evaluation has taken place. The decomposition of the planning phase into design, plan and allocation stages emphasises this risk.

Plan stage

A 'go' decision in the 'design' stage initiates the development of a base plan that indicates how the design will be executed. Yet more individuals and organisations may become involved. The 'development of targets and milestones' involves determining specific targets for producing the project deliverable, typically in terms of cost and time. 'Plan development' follows, and leads to 'plan evaluation' in 'go/no-go/maybe' terms. A 'maybe' decision may require further development of targets, milestones and/or plans, but more fundamental difficulties may take the process back to design development or even concept elaboration. The basic process risk at this stage is that of moving on to the allocation stage before effective plan evaluation has taken place.

Allocation stage

A 'go' decision at the 'plan' stage takes the process on to the 'allocation' stage, and to a base allocation of resources and contracts to achieve the plan. The 'what' (design) and the 'how' (plan) is followed by the 'who' of 'base allocation'. The 'allocation' stage is a significant task involving decisions about project organisation, the identification of appropriate participants, and the allocation of tasks between them. Either implicitly or explicitly, the allocation process involves the allocation of execution risks between participants. This activity is an important source of process risk, in that this allocation can significantly influence the behaviour of participants and hence impact on project performance. In particular, the allocation of execution and termination-phase risks influences the extent to and manner in which such risks are managed. This warrants careful consideration of the basis for allocating tasks and risks in the 'development of allocation criteria' step.

'Allocation development' may involve detailed planning of production in order to allocate tasks. Contracts and subcontractual structures may require development. Again, the nature of the issues changes with the stage change, and the level of effort may escalate. As in the earlier stages, development of the basic step is followed by 'allocation evaluation'. A 'maybe' decision which goes back to the plan, design or even concept stage is extremely unwelcome, and a 'no-go' decision will be seen as a serious disaster in many cases.

Design, plan and allocation stages

A possible argument against the decomposition of the planning phase into design, plan and allocation stages relates to their interdependent nature, and the need to iterate within this phase. However, we argue that the importance of this dependence and the process risks that it generates is highlighted by their separation. Quite different tasks are involved, with different end products and process risks, despite their very important interdependencies.

Control stage

A 'go' decision at the allocation stage initiates the main body of the project, the 'control' stage. The start of this stage signals the start of order-of-magnitude increases in effort and expenditure. The talking is over, and the action begins. During execution, the essential process risk is that coordination and control procedures may prove inadequate. A common perceived source of risk in the execution phase is the introduction of design changes, but these may be earlier risks 'coming home to roost'. Consequent adjustments to production plans, costs and payments to affected contractors should be based on an assessment of how project risks are affected by the changes, and the extent to which revised risk-management plans are needed.

For most projects, repeated iteration is necessary through the three steps of 'modification of targets and milestones', 'allocation modification' and 'control evaluation'. Exceptionally, loops back to earlier stages may be necessary. Very nasty surprises could take some aspects of the project right back to the concept stage, or lead to a 'no-go' decision, including project abortion. Nasty surprises are realised risks from earlier stages which have not been identified, indicating a failure of the risk-management process at earlier stages.

Deliver, review and support stages

The project termination phase has three distinct aspects, captured in the 'deliver', 'review' and 'support' stages, each encompassing different risk-management concerns.

Deliver stage

The 'deliver' stage involves commissioning and handover. Again the issues are different from those in previous stages. The 'basic deliverable verification' step involves verifying what the product of the project will do in practice: its actual performance, as opposed to its designed performance. An important risk is that the deliverable may fail to meet the expected performance criteria. The modification of product performance may be achievable, but the modification of performance criteria or the influencing of stakeholder expectations and perceptions may be necessary. However, unless they were explicitly anticipated, these are not process risks in this stage: they are a realisation of earlier unmanaged risks. 'Delivery evaluation' focuses on the need for quality assessment and modification loops, including compensating for unanticipated weaknesses by developing unanticipated strengths. Loops back to the concept stage or a 'no-go' abort decision are still possible.

Review stage

The 'review' stage involves a documented audit after delivery of the product. Some lessons are obvious: the 'basic review' starting point. However, allocating resources to systematic study to draw out lessons which are not obvious ('review development') is important. Missing important lessons means that mistakes will be made again, the key process risk at this stage. Not having such a stage explicitly identified almost guarantees the realisation of this risk. Hindsight may suggest that some actions were successful or not, for unanticipated reasons. Such occurrences should be noted for further reference. An important aspect of the review should be documentation of the manner in which performance and other criteria relevant to each stage were developed, and in particular the rationale for changes. 'Review evaluation' involves evaluating the likely relevance and usefulness of review data for informing future project-management practice.

Support stage

The 'support' stage involves living with the ongoing legacy of apparent project 'completion', possibly in a passive 'endure' mode. 'Basic maintenance and liability perception' is the starting point when the project is complete in the handover sense (but note that handover may be an internal matter in organisational terms). The 'development of support criteria' and associated 'support perception development' leads to 'support evaluation', which may be repeated periodically. The focus of this evaluation may be a within stage loop back to the development of perceptions, or a limited loop back to the deliver stage. Exceptionally, the outcome is a 'no-go' decision involving product withdrawal or other explicit withdrawal of support for the project's product. Again, surprises are not risks inherent in this stage, but process risks in earlier stages realised in this stage.

Elaborations

Despite the number of steps in *Table 1*, and the possibility of iteration at each evaluation step, our description of the PLC is still a simple one in comparison with the complexities of real projects. Nevertheless, to the extent that we are concerned with highlighting sources of process risk, it is a useful basic framework. In any event, this framework is easily elaborated to describe particular project situations and areas of interest. Some examples of complications which might be addressed follow.

Project dimensions

In practice, projects are planned and executed in several dimensions, which include physical scope, functionality, technology, location, timing, economics, financing, and the environment. Thus each step in *Table 1* could be viewed as multidimensional, with the dimensions in each step being considered in parallel or in an iterative sequence. In the latter case, the PLC can be visualised as a spiral of activities moving forward through time, in which each completed circle of the spiral represents one completed step in *Table 1*, and each spiral represents sequential consideration of the various project dimensions.

Component projects

For many projects, especially large ones, it is common practice to treat the project as a number of component projects. The steps in *Table 1* can still be used to describe the progress of each component project, although there is no necessity for the component lifecycles to remain in phase at all times. 'Fast tracking' is a simple example of this, where completion of the parent project can be expedited by overlapping the project planning and execution phases. Thus, some components of the parent project can be planned, and execution can be commenced for these components, before planning is complete for other components. As is widely recognised, such staggered execution is only low-risk to the extent that the design of components first executed is not dependent on the design of subsequent components. Clearly, plans which involve an element of 'fast tracking' should be supported by an appropriate risk analysis, with feedback from more advanced components into the lifecycle steps of following components.

Incomplete definition of methods

In some projects, such as product-development projects, it may not be practicable to completely define the nature or sequence of activities required prior to commencing the execution phase[5]. In such cases, management expects design, planning and execution to take place in turn on a rolling basis, with the achievement of one milestone triggering detailed planning or design, and the planning of the next part of the project deliverable. In this scenario, previous 'go' decisions in the design, plan and allocation stages are made on the understanding that subsequent control evaluation steps will take the process through further design and plan stages as necessary when the appropriate milestone has been achieved.

Prototyping is a special case of this scenario, and it is a natural approach where the intention is to mass produce a product, and the product involves novel designs or new technology. Prototyping, particularly for expensive or high-technology items, can be regarded as a project with just two main components: the prototype, and (mass) production. For the production component, the PLC 'concept' and 'design' stages are replaced with the prototype PLC. The production PLC then proceeds from the 'plan' through to the 'support' stages in *Table 1*.

Objectives that are not easily definable

For many projects, objectives and related performance criteria can be refined progressively through the conceptualisation and planning phases of the PLC. However, in some projects, for example management-information systems and software-development projects, it may not be practicable to ensure that all the project objectives are well defined or crystallised prior to the control stage. This becomes apparent in previous stages, where 'go' decisions acknowledge the situation. In this scenario, 'control evaluation', undertaken each time a milestone is achieved, should include a 'configuration review'[5,6] of project objectives that are currently achievable. If these are unsatisfactory, further design and plan stages may be necessary.

Contracting

In the 'allocation' stage, the allocation of tasks involves the employment of contractors, and the tendering and subsequent production work of the contractor can be regarded as a project (or component project) in its own right. For the contractor, all the steps in *Table 1* are passed through when it becomes involved in the parent project. What the client regards as the 'allocation' stage is regarded by the contractor as the 'concept', 'design', 'plan' and 'allocation' stages. In the case in which the contractor has a major responsibility for design (as in turnkey and design-and-build contracts), the client moves quickly through the 'concept', 'design', and 'plan' stages, perhaps considering these stages only in general outline terms. Then, the contractor carries out more detailed work corresponding to these stages. For the contractor, the 'trigger' involves both a need and an opportunity to tender for work, which is usually managed at a high level in the contracting organisation. The 'concept' stage corresponds to a preliminary assessment of the bidding opportunity and a decision on whether to tender[7]. This is followed by the costing of design specifications and plans provided in more or less detail by the client, perhaps some additional design and plan development, evaluation of the tendering opportunity, price setting, and the submission of a bid. For a contractor, the 'allocation' stage involves further allocation of tasks, perhaps via subcontracting, detailed design work and production scheduling, as indicated above.

In the case in which the client and contractor work closely together from the beginning (for example when contracts are negotiated), the client is more likely to identify with the contractor's view of the prevailing PLC stages. The client will then cycle back from the 'allocation' stage to work with the contractor on all stages, commencing with the 'concept' stage.

Discussion

A basic premise of this paper is that a characterisation of the PLC beyond the well known four-phase model is useful in highlighting important sources of process risk in the PLC.

The characterisation presented here offers a two-tier elaboration of the four-phase model, with the 'steps' offering more detailed insight than 'stages'. This framework is sufficiently detailed to highlight important areas of process risk. It should help to ensure that risk management addresses process risks over the *complete* PLC, and that the interdependencies and significance of risks are more readily recognised. For example, risk management in the concept stage needs to be very wide in scope, and very foreseeing, being concerned with issues such as product or design-fault liability, but it would be unreasonable to expect all the risks of relevance in all eight stages to be fully assessed during 'concept evaluation'. Getting the balance right is a major issue.

The value of breaking down the PLC into such a large number of stages and steps might be questioned, since these steps and/or stages may be difficult to distinguish cleanly in practice. For example, the later evaluation steps may be regarded as being nonexistent in practice, because the decision to proceed is not usually an issue beyond a certain point. However, we would argue that it is worthwhile identifying such steps beforehand, given their potential significance in terms of managing process risks. Many of the really serious risks experienced in projects are late realisations of unmanaged risks from earlier stages, and the detailed stage and step structure helps to make this clear. In many projects, there is a failure to give sufficient attention to 'go'/'no go'/'maybe' decisions. Such decisions should involve careful evaluation of risk, to appreciate both the risks inherent in a 'go' decision, and the rewards foregone in a 'no go' decision. Equally important is the need to recognise when a 'go'/'no go' or 'maybe' choice should be on the agenda. Many projects appear to involve just one 'go'/'no go' decision, at the end of the 'concept' stage. However, the large number of projects that run into major problems of cost escalation, time overruns and quality compromises suggest that explicit 'go'/'no go'/'maybe' decision points in later stages would often have been worthwhile.

A further reason for the detailed step structure is to highlight the process of objectives formation and its significance for project risk management. Definition of project objectives and performance criteria has a fundamental influence on the level of project risk, since risk is measured in terms of uncertainty about the attainment of project objectives. Setting tight cost or time targets makes a project more cost or time risky by definition. Conversely, setting slack time or quality requirements implies low time or quality risk. Failure to acknowledge the need for a minimum performance against certain criteria (for example noise levels or seating capacity) automatically generates risk on those dimensions. Morris and Hough[8] argue for the importance of setting clear objectives and performance criteria which reflect the requirements of various stakeholders (for example regulatory authorities). The various project objectives of interested parties and any interdependencies between the various objectives need to be appreciated. In the PLC, the objectives and performance criteria are initially vague, but they are likely to be progressively clarified and refined during the conceptualisation and planning phases. This process needs to be recognised and the implications understood. A situation in which the objectives of a project change imprecisely during the project without proper recognition of the new situation implied is particularly risky. From a risk-management viewpoint, any changes in objectives and performance criteria at any stage of the PLC need to be carefully evaluated for risk implications. Strategies for managing risk cannot be divorced from strategies for managing project objectives.

Much of 'good project-management practice' could be thought of as the management of pervasive and fundamental process risks in the PLC. Thus good practice in planning, coordination, the setting of milestones, the institution of change control procedures and so on amounts to a general response to process risks such as human error, omissions, communication failures etc. which are not necessarily explicitly identified or confined to particular stages of the PLC. The framework presented here focuses on more specific process risks, with different PLC stages involving rather different risk-management considerations. Further elaboration of this framework might be worthwhile to develop a deeper appreciation of process risks in particular project contexts. There is obvious value in being clear about which risks are specific to particular stages in the PLC and which are not.

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