A SYSTEMS MODEL OF PROJECT MANAGEMENT

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INTRODUCTION

Project management as a profession is remarkably consistent in its approach.   Although there are a number of endorsed project management standards throughout the world, these exhibit a great deal of similarity with each other. Even where they differ it is arguable that the differences are more form than substance (Crawford, 2001).

Given this virtual unanimity it might seem reasonable to expect that the profession is mature in its development and effective in its delivery of successful projects. Project managers who apply the project management standards effectively should be able to expect project success to follow.

In fact this is not the case. The standards are collections of commonly agreed principles, tools and techniques for project management, but have not generally been tested properly from first principles (Crawford,2001). Although used for teaching, for regulation of the profession, and in practice, the standards are commonly understood by experienced project managers to be significantly inadequate by themselves as a basis for ensuring project success. Despite this, the standards are evolving very slowly and in detail rather than fundamentally.

From a systems thinking perspective this is an interesting situation and invites the obvious question of why inadequate standards would be both universally agreed and perpetuated. It also begs a further inspection of the mental model of project management represented by the standards.

This paper deals with the second question, first by looking briefly at existing models of project management and then proposing a systems model from first principles.

EXISTING PROJECT MANAGEMENT MODELS

The existing approach to project management is typified by that described in the Project Management Institute's (PMI) Guide to the Project Management Body of Knowledge (PMI,1996). Figure 1 below is reproduced from the Guide.   It shows that project management is considered to be a group of processes that repeat during different phases of projects. Each phase has different process emphasis, according to its needs.
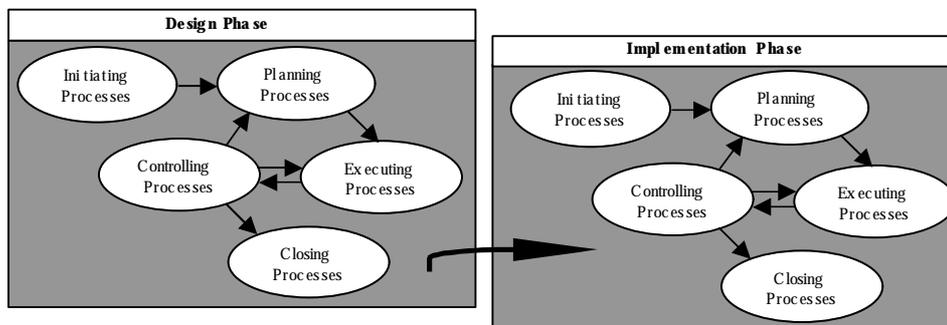

Figure 1.   The PMI Process model of project management is made up of a repeating set of process groups across project phases, for the life of the project.   Levels of activity vary between phases both as a whole, and within each process group. The phases and the processes within them tend to overlap considerably.

The thinking behind the model is revealed as much by what is not included, as it is by those elements included. The major underlying assumptions appear to be:

1. Complex tasks can be managed by breaking them down into smaller sub-tasks until they become understandable and manageable by individuals, then using processes to ensure that those tasks are carried out in a coordinated, integrated and managed manner.
2. Major task management activities can be broken down into phases and then managed using interrelated but discrete processes that repeat for each phase.

There are a range of other assumptions underlying current project management practice that may not be immediately obvious in the model shown above, but that are implied in the written guidance in the Guide to the PMBOK. These include:

1. Tasks can be successfully managed as though independent of each other, with coordination provided through process based management.
2. Complexity is additive - it is made up of simple tasks which when added together make an overall task that is progressively more complex.
3. Feedback systems are generally unimportant.
4. Uncertainty and risks to success can successfully be managed through specific processes for that purpose.

Taking this as a whole, the current project management model becomes as shown in Figure 2. To be effective it requires that processes are in themselves fully capable in the real world. For example, it requires that risk management processes identify and effectively deal with all risks. This is inherently a reductionist view of the world, since it requires that a bounded linear process deal successfully with complexity and uncertainty within the whole project management system. Despite the fact that there is some feedback between processes within phases, taken as a whole the phased model implies continuing linear progress towards the ultimate goal of project completion. Many of the complexities of project management, especially those involving human behaviour and other causes of uncertainty, are at best only alluded to.
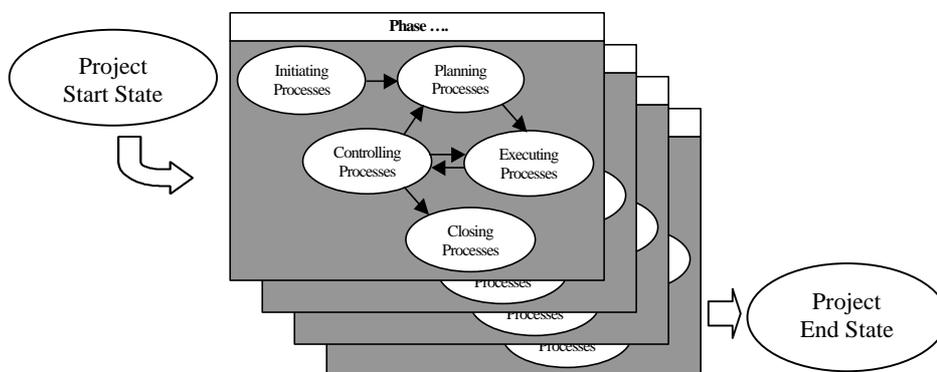

Figure 2. The overall process based model.

Project management researchers such as Morris have challenged the effectiveness of the standards and the usefulness of current models (Morris,1994). Although some of those models look very different to Figure 2, they reflect the same underlying reductionist approach to project management thinking. Morris recognises and discusses the complexity of project management in terms of external forces, internal behavioural issues, politics, project organisational structures and more. Despite this, he does not take the next step of dealing with that complexity using a whole of systems approach. He appears to remain in the underlying reductionist thinking paradigm embodied in the project management standards and visible in the model in Figure 2.

A SYSTEMS THINKING ALTERNATIVE

The alternative model is based upon the assumption that the world is uncertain, changing and very complex. Interrelationships are common between tasks, events, risks and issues. To manage successfully, we must consider all project related events and issues as part of a single complex system. We should also accept that uncertainty arising from systemic complexity always involves some degree of unknowability (unpredictability).

Given this, it is appropriate to consider project management not from a task or planning perspective, but rather as a continuing series of events or changes that when added together over time lead to the final project result. We deal with the uncertain and unpredictable nature of the world by continually re-assessing the current state of the project and taking actions, then reassessing its new state, taking actions, and so on. In a mathematical sense, this is represented in Equation [1] where $f(m)$ is the impact upon the project state of ongoing management action and $f(ew)$ is the impact upon the project state of the external world.

$$\text{Project End State} = \text{Project Start State} + \int (f(m) + f(ew)) \, dt \qquad [1]$$

The focus of the new model lies in understanding the management process $f(m)$ and its relationship with the external world $f(ew)$. $f(m)$ can be described as a process of transformation - taking an understanding of the world and transforming that understanding into actions with impacts upon the project. Looked at more closely, the process involves a series of transformations - of information into knowledge, knowledge into understanding, understanding into decisions and decisions into action. Finally, the actions taken have an impact upon the project state.

At the same time, the external world continually changes the rules by not remaining constant or even predictable. The overall impact upon the project state is therefore the combination of management actions and the changes in the external world. These functions are not independent - that is, $f(m) + f(ew)$ are related. As we will see from the model, this occurs largely through a feedback mechanism.

Following these ideas, the development of the new model commences by considering the nature of the work undertaken whenever a project is managed. Rather than viewing this in the traditional way and describing the nature of the task, this can be done in terms of the role of managers. Whether dealing with short or long term issues, managers gather data about their tasks and the world around them, apply rules, tools and experience, make judgements (decisions) and then implement the actions necessary.

Managers follow such processes at all levels in any organisation, for varying complexity and timeframes. Most do so for many tasks simultaneously – for example they manage short term work as it arrives on their desk at the same time as dealing with long term issues they have been managing for some time. All of the time they are assessing information and its context, making decisions, and carrying them out. A knowledge management and decision view of project management is shown in Figure 3.
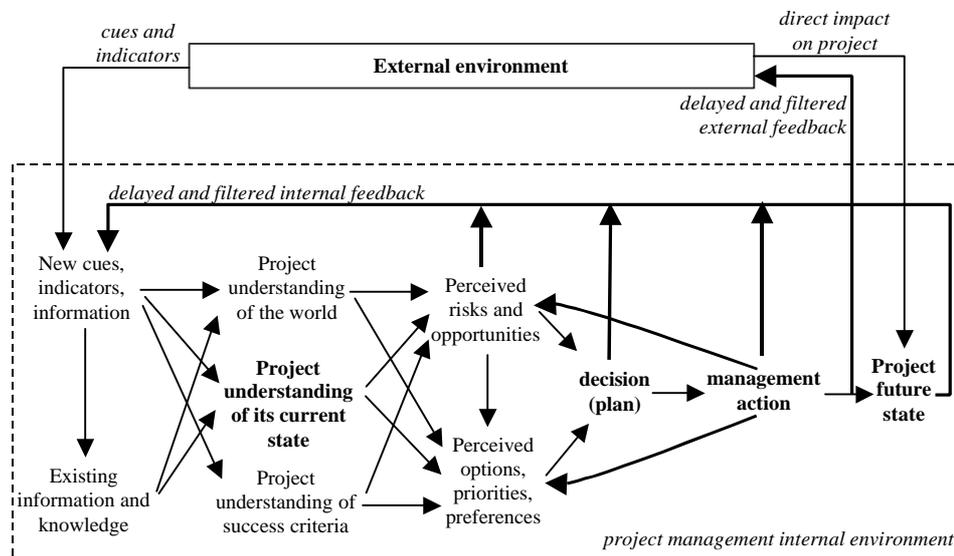

Figure 3. By nature, project management involves a series of transformations.

New cues and indicators are combined with existing knowledge to provide a current understanding of the world, of the project, and of the criteria for success. This translates in an inter-related and complex manner into an understanding of what the risks and opportunities are, together with the options, priorities and preferences that apply. Further transformations occur first into a decision on how to act, and then into implementing action leading to a new future state for the project.

As knowledge is processed it provides new feedback. There is direct feedback from the management action into the perceived risks and opportunities, since there is an expectation that actions taken will have the intended impact (whether they do or not). Finally, the real new state of the project provides feedback, although this new reality may or may not reflect the intended outcome.

The project does not exist in isolation, and the overall impact of the real external world is included at the top of Figure 3. It provides cues and indicators, and directly affects what is happening to the project. The project also has an impact back into the external world, adding a second feedback loop to the overall process. This is intuitively correct, since the external world will react to what the project is doing and will modify its cues and indicators accordingly – i.e. feedback is occurring.

This model demonstrates some of the real-world complexity involved in decision making and it also illustrates some of the major feedback affects involved. Despite this, it is a very much simplified view of project management, leaving out some of the most important factors determining the success or failure of projects. The first of these is the complex structure of the project's external world, included in Figure 4.
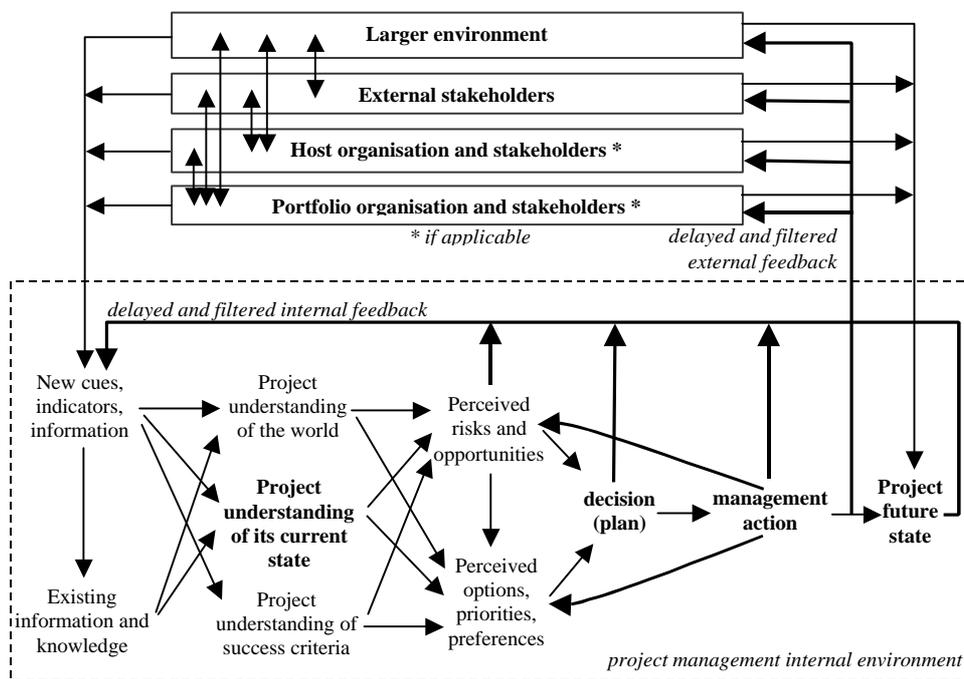

Figure 4. The complexity of the external world of a project.

Figure 4 shows the added complexity many projects experience when dealing with the external world, especially when part of a portfolio of projects and of a larger host organisation. The project and its portfolio organisation (if one exists) are both part of the host organisation. In the external environment, stakeholders are shown separately from the rest of the world because they are of special interest to project managers and because they behave differently than the larger generally disinterested world.

Each of these is also interrelated, as shown by the vertical flows. This makes sense, since we know that there will be exchanges of information and activity between portfolio management and the host organisation, and between the larger environment and the portfolio level, for example. These exchanges will indirectly influence the cues and indicators received by the project, and the project's future state.

Figure 4 still does not represent the full complexity of the project management world, since it does not show some powerful forces that determine how information is processed and understood. These are shown in the complete model (Figure 5).
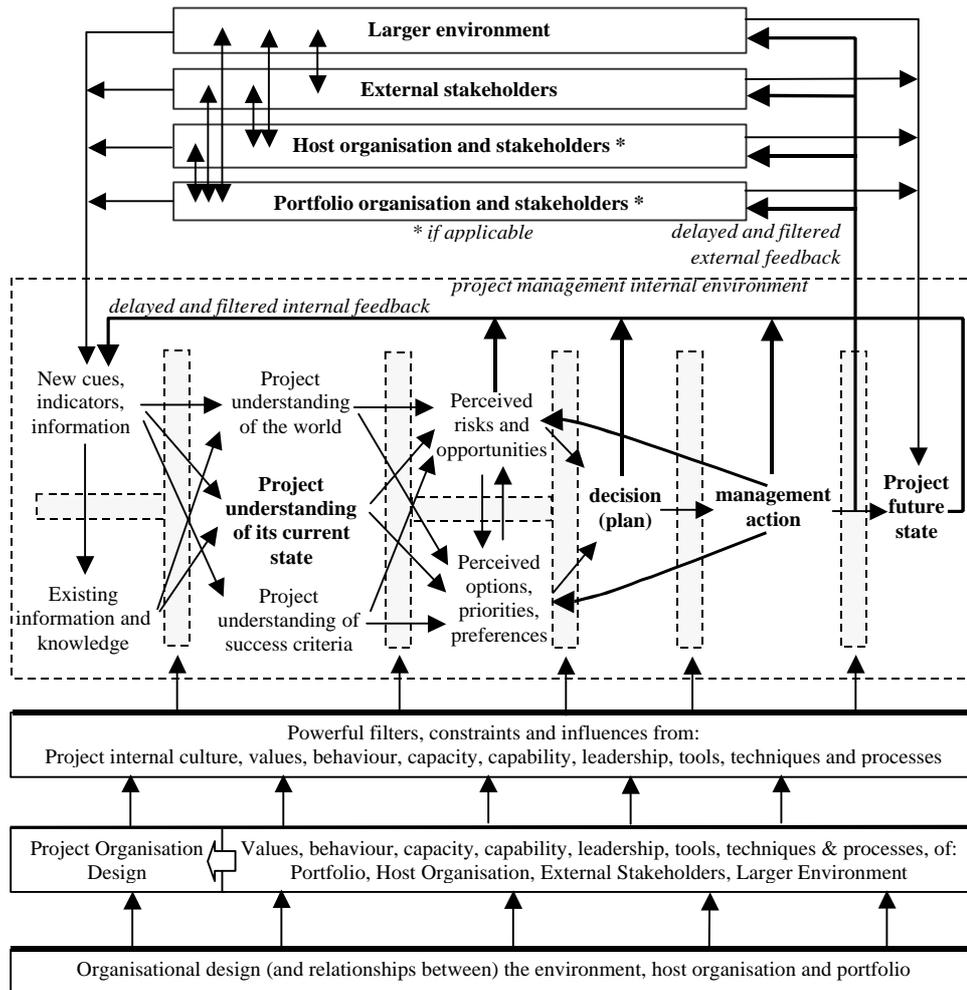
Figure 5. The complete systems model of project management.

The shaded areas indicate the powerful and complex influences of a combination of factors upon how knowledge is transferred, processed, perceived, understood and interpreted. Such influences occur whenever a transformation takes place that involves human interpretation. For example, in Figure 5 they determine which new cues and information become part of (future) existing information and knowledge, and in what form. The same complex factors also influence decisions and actions, and how actions are carried out. They have a potentially powerful impact on everything the project does.

As implied in the current project management standards, these influences include the tools and techniques applied and the skills and competence of the people involved. However this model also emphasises a multitude of other factors, including the affects of morale, culture, values and leadership. For example, two individuals with the same background and skill sets but with different cultures or values may form very different views of the facts, the risks, the options and the preferred actions. Such influences may be subtle in that they are difficult to see, understand or measure, but they are powerful since they tend to drive the perceptions, decisions and behaviour of individuals.

Figure 5 also infers interrelationships between organisational design and these influences. The values, culture, behaviour and leadership within a project will over time be substantially controlled by the project organisation design. This can be illustrated by considering questions such as – What kind of people tend to be selected to work in (and lead) the project? Are roles and accountabilities clear? Is individual performance monitored and managed effectively? Answering these questions requires an understanding of the project organisation (structures, systems and processes) and of the links that exist between organisational design and individual behaviour.

As also shown in Figure 5, it is likely (over time) that the leadership behaviour, values and culture at portfolio level will affect those at the project level, and also impact upon the project organisational design. This repeats itself at the next

level, where the host organisation and the external world impact upon the portfolio level design and upon its behaviour, values and culture.

CONCLUSIONS

The emphasis of this model is not on individual processes or phases, nor is it on skills, tools and techniques. Unlike existing models, this model does not seek to represent the project task. Instead the model seeks to represent "what project management is about". By taking this approach it is able to consider project management from a systems perspective and without being in any way constrained by any specific type or form of project task.

An immediate difference from previous models is that the tools, techniques and skills applied in the project will influence the project organisation's capacity and capability (and hence the outcomes) but they will not necessarily predominate. There are other potentially much more powerful forces at work, such as the direct influence of the world on the project's future state and the impacts of culture, values and leadership.

In its detail, the model contains many assumptions and permits many hypotheses. Major assumptions at the macro level are:

1. A project's future state is determined by its current state, by the activity of project managers and by direct external intervention.
2. Project management activity is made up of a number of interrelated transformations including information into knowledge and understanding, understanding into decisions and decisions into actions.
3. Those transformations are not simple, nor necessarily predictable. They are powerfully affected in complex ways by many factors, including human factors such as culture, values, and leadership.
4. External influences may have many inter-related components and may affect the project's future directly, through cues and indicators, or through their influence on the transformations involved in the project.
5. Project organisation design is a factor in determining the nature of many of the influences on project management transformations and hence is important to project performance.

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