

A methodology for knowledge based project management

(Work in progress)

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“The characteristics of our late 20th century society demand the development of new methods of management” (Metaxiotis et al., 2005)

Project management issues experienced on knowledge intensive projects led to the formulation of knowledge-based theories of projects and project management (Onions, 2007). These normative theories describe projects in terms of knowledge and suggest that project management can be treated as an optimisation and configuration problem.

Project managers accustomed to conventional methodologies may find application of these new theories difficult. This paper describes practice of knowledge based project management in terms of the project lifecycle and project management functions.

An introduction to knowledge based projects and project management

Two theories for knowledge based projects and their management (Onions, 2007a, 2007b) underpin this methodology. The Theory of Knowledge-Based Projects defines a project:

“A knowledge-based project may be defined as a finite and unique set of interrelated and interdependent knowledge and knowledge configurations that change over a finite period of time in order to achieve specific objectives within certain constraints.” (Onions, 2007a)

This theory also defines quantification and measurement of such projects:

“A knowledge-based project may be quantified through the measuring of resources and activities involved in making changes to knowledge and knowledge configurations over the finite duration of the project.” (Onions, 2007a)

That theory led to a theory of project management:

“Knowledge based project management is the systematic and optimal arrangement and coordination of knowledge and knowledge configurations to achieve specific objectives within certain constraints.” (Onions, 2007b)

Introduction to methodology

What is a project management methodology? Methodologies in literature are presented as lifecycles that appear to be based in some manner on the control cycle (*plan-act-measure-correct*) (Metaxiotis et al., 2005; PMI, 2005; Kerzner, 2001). Industry can see a methodology as a structured lifecycle based approach that defines what project management has to accomplish:

“A project management methodology is a set of inter-related phases, activities and tasks that define the project process from the start through to completion... ...The generic methodology provides a structured approach to manage any project with the amount of documentation scaled appropriately.” (Queensland Government, 2004)

There are a plethora of project management methodologies to choose from, and they represent decades of successful practice and learning that should not be discarded merely on the basis of a new theory. Adapting an existing methodology should retain essential dynamics and familiarity and hence facilitate understanding and generalisation.

A knowledge-based mindset

Adapting a methodology should begin with shifting the mindset of all involved from a task focus to knowledge-awareness. For project sponsors this means recognising and acknowledging the value of the project to the organisation in terms of experience, skills, knowledge embedded products and other forms of intellectual capital and intangible assets. For project managers this could entail an emphasis on intellectual property, knowledge work and intangibles. Team members could enjoy greater responsibility and autonomy over how tasks are done and deliverables are produced.

This mindset should be applied to all project management activities. A problem is conventionally broken down into logical activities grouped around delivery and phases (the work breakdown structure), and then scheduled so as to optimise resource utilisation, delivery and risk. Knowledge-based project management requires the project manager to manage knowledge as a resource, ensure knowledge configurations are optimal and facilitate free knowledge flows throughout the duration of the project.

The value of the project should also take knowledge into account. There will always be greater project team experience at the end of the project. Table 1 shows that experience will always be an input into a project, so the value of a project may include the value of this experience on future projects and the value of being able to do similar projects in the future.

A knowledge-based project lifecycle

A generic, non-iterative project lifecycle such as the 'waterfall' model (APM, 2006) provides a simple, well-used framework for adaptation. The knowledge based approach to the project lifecycle may be illustrated using a specific instance of the waterfall model, the conceptual 'systems development lifecycle' model used in information systems project management.

Project phase	Knowledge focus
Conceptualisation	What is the project's value in intellectual capital terms
Definition	What knowledge do we need? Where do we get it? What will knowledge acquisition cost or entail?
Design	How do we document our knowledge of the requirements? How do we translate these requirements into solutions?
Development	What technical knowledge do we need to apply? What architectural knowledge do we need to share? What functional knowledge do we transfer to users?
Implementation	How do we apply the knowledge? Who has the skills to do this? What knowledge do we embed in the deliverables?
Handover and closeout	Have we met customer expectations? Have we transferred our knowledge to the client?

Table 1: Project knowledge through the project lifecycle

This example suggests that the structure of a conventional lifecycle should still apply to knowledge-based projects, regardless of the focus of project management.

The knowledge lifecycle

Project management functions rely extensively on the work breakdown structure (WBS), the deliverable oriented decomposition of the project scope into a hierarchy of smaller, discrete activities and components.

Work packages are the smallest components of a WBS. Conventionally the project manager would be defining these in terms of contributory activities. The knowledge-based project manager on the other hand applies a knowledge focus, enabling and facilitating knowledge configurations, knowledge flows and knowledge processes. These activities would be more familiar to a knowledge manager and those acquainted with knowledge lifecycles, so some description of knowledge lifecycles, flows and processes are needed to underpin knowledge based project management methods.

Knowledge flows between people and between activities, and can be described in terms of one of the most fundamental systems models; input-process-output (Figure 1 below):

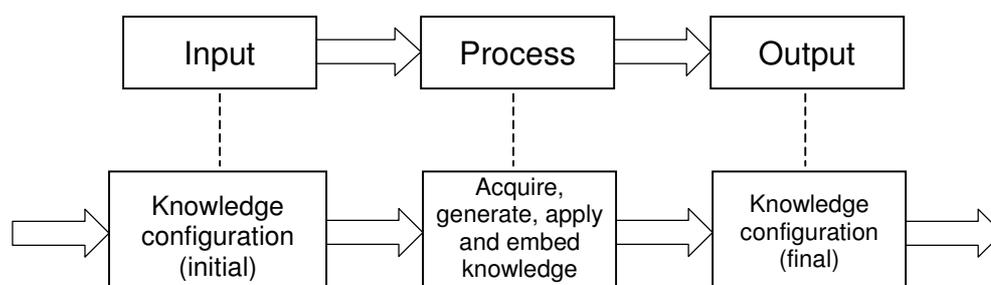


Figure 1: The knowledge system model

The knowledge system may be interpreted as follows:

- Each knowledge activity begins with what we know. This initial knowledge configuration¹ consists of knowledge that has been transferred from any predecessor activity, skills and experience of team members, and knowledge that is outside the organisation.
- Knowledge is then acquired (purchased, hired, borrowed etc) or transferred (from predecessor configurations, other team members etc.). This acquisition should be goal oriented. Once acquired, and often during acquisition, 'work' can begin. This interim state represents a different knowledge configuration to the initial knowledge configuration previously mentioned.
- Work commences. In so doing knowledge in the form of skills, experience and education is used to create new knowledge. This represents yet another interim knowledge configuration. Knowledge may also be embedded into products or services, such as automating a process previously performed manually.

¹ From the knowledge-based theory of projects, a knowledge configuration is the structural arrangement and content of knowledge in a particular context at a point in time.

- Once knowledge is applied and/or embedded and the deliverable produced or process completed, the state of knowledge may be referred to as the final knowledge configuration.
- At any stage knowledge may become a knowledge input for any subsequent knowledge process.

The work breakdown structure specifies in detail how something will be done. In its place the knowledge breakdown structure should describe these knowledge configurations in sufficient detail so as to allow planning, scheduling, control and other project management functions. This will involve questions such as:

- What do we need to do?
- What knowledge do we require to do this?
- What knowledge do we have, and don't have?
- Where do we acquire this knowledge?
- Who will convert this knowledge into the final knowledge configuration?

Again a fundamental shift in mindset is required. The role of the project manager must now take on duties akin to those of a knowledge manager. Team members will have to be consulted about what they know, how long it will take to acquire and assimilate knowledge, and the steps required to apply that knowledge. Rather than building 'fat' or contingency into the estimates of tasks, risk can be directly managed by adding activities to acquire 'unknown' knowledge. In addition to conventional budgetary and quality constraints, the knowledge-based project manager will be responsible for facilitating and optimising knowledge acquisition, knowledge transfers, knowledge flows, knowledge retention and dissemination.

Teams would also be affected. The members will be responsible for acquiring and internalising knowledge, making such usable, possessing the necessary skills, applying them, and transferring the knowledge to others in a format most suited to them. They will also have to articulate their requirements to the project manager, and utilise the project manager's new role to improve their own knowledge processes.

Project management functions

Project management bodies of knowledge describe project management roles in terms of functions. Respected online project management author Max Wideman (2008) identifies the eight functions to involve scope, quality, time, cost, communications, procurement, human resources and risk.

Knowledge based project management theory allows knowledge equivalents to be developed. The primary project management functions of estimating, resourcing, scheduling, controlling and risk management (Kerzner, 2001) will be used to illustrate the adaptations required.

Estimating

Depending on the accuracy of the estimate required, the general process described in figure 1 above should support estimating. Estimating would be based on the knowledge breakdown structure that specifies the knowledge requirements and configurations, and ask questions such as:

- How much will it cost to acquire this knowledge, and how long will it take?
- How long will it take to acquire?
- How long will it take to apply this knowledge?
- How long will it take to transfer the knowledge to subsequent 'activities'?

Knowledge consists of what we know as well as what we don't know. This is allowed for to some extent in the above list of questions, but is a factor that should consciously be considered when estimating. For example, there may be an externally imposed and unpredictable delay in waiting to find something out, or the team may not have sufficient experience with a subject to support planning.

Resourcing

A fundamental difference between conventional and knowledge based project management is in the treatment of resources as part of knowledge configurations. An example describing a hypothetical knowledge configuration may illustrate:

The initial knowledge configuration for designing the database will consist of:

- John Brown; Client X's representative, with knowledge of the business requirements.
- Jane Wright; business analyst experience to acquire specifications from the client.
- Peter Jones; database design experience to translate the business requirements into a normalised database.
- ABC Methodology; our firm's database design methodology to assure quality.
- DataPackPro Support; a support contract that provides technical support on the database engine if needed by Peter.

Note in this example the mention of specific people. This has several implications:

- Specific people, possessing specific combinations of skills, are important on projects and should be planned for accordingly. This will prevent resource conflicts and any tendency to throw more resources at a project to complete it sooner.
- The ultimate solution will be in the hands of the knowledge workers and not planned up front by or with the project manager. This will allow team members flexibility and creativity.
- People will have to be trusted since knowledge and people are inseparable. In managing people, maturity of team members must be assumed (Y theory as per McGregor's (1960) X and Y theory) and trust given.
- The careers of valued resources can be managed better by affording them the opportunity to study and develop in support of future projects.

Scheduling

The importance of people has been noted as a resource constraint. Some other factors should be considered in the application of this theory to scheduling:

- Completion and commencement of knowledge activities are based on knowledge transfer, and it is the responsibility of the person completing a task to pass that knowledge on to the next activity.
- Confirmation of transfer must be made by the recipient. Therefore a previous activity is not 'signed off' until the next successor activity is completed or the recipient acknowledges the knowledge has been transferred.
- Projects would have decision points, where options are selected and future uncertainty or unknown direction is eliminated. This will be more important on those projects that are not designed up front – where the solution is not apparent at conceptualisation.
- Activity completion can be based on deliverables. These deliverables may be tangible and they may be intangible. Knowing how to do something of what the customer may want may be written down in a report, or they may be just as validly transferred verbally (and hence intangible). Knowledge based project management will therefore not emphasise tangible deliverables.
- All projects are subject to external constraints and delays. Lag and delays may be built into the activity estimates or as unknowns.
- Planning will entail asking what a person needs to know; and then working backwards from that to find out where to get the knowledge, how long it will take to get it/create it, and how much it will cost.

Controlling

Project managers use a concept called earned-value to plot an S curve showing the 'earned value' of the project as it evolves over time. The knowledge-time curve similarly describes various profiles of a project.

If knowledge is quantified in terms of time or cost to acquire or apply knowledge then this curve should closely approximate the conventional earned value curve.

It is theoretically possible to manage projects using the knowledge-time curve. Changes to the gradient or curve during the course of the project would indicate a change in risk profile, scope change, changes in team knowledge, or undetected uncertainty that has become realised.

Risk management

Regardless of the project management approach, all projects are affected by the same risks. Knowledge based project management should emphasise the knowledge risks on a project, but not exclusively. Conventional risk management would be appropriate, and the following should be highlighted:

- Projects have decision points where future uncertainty is eliminated.
- Knowledge specific risks can be evaluated, such as those to specific personnel, sources of knowledge and those created by information politics.

Conclusion

This paper offers some practical guidance for the implementation of a novel knowledge based theory of project management. The change to a knowledge mindset is introduced, and the adaptation of some common project management functions is described.

This conceptual research is limited. The range of activities and functions involved in managing projects is wide, and would require more than a conference paper to describe comprehensively. These knowledge-based theories are novel and normative, and there is no empirical evidence to indicate their validity. Project management is also a pragmatic field, so this paper is not intended to be applied rigidly. Project managers should remain free to adopt those aspects that work, and integrate with other techniques and methodologies where appropriate.

It is anticipated that this approach may alleviate certain problems common to Knowledge Economy projects:

- Projects that commence development without adequate/comprehensive planning or technical input. This approach forces the team to evaluate start and end configurations in the planning phases of the project.
- Technically proficient project managers who stipulate to the team how to execute the project. Project managers are forced to engage with the team and the maturity and autonomy of team members is reinforced with the knowledge-based approach,
- Isolated and parallel efforts. The knowledge process resembles a Value Chain (Porter, 1985) where knowledge has to be transferred to subsequent processes. The project manager has to be aware of and plan for these transfers, and ensure the team is responsible for packaging and communicating that knowledge in a way that is most suited to the recipient.

Naturally there will be limitations. Corporate governance would require projects to produce an acceptable business case and demonstrate realistic control. Project managers will probably continue to include tangible elements such as deliverables in their plans, and scope and budget accordingly.

Future research will concentrate on empirical testing of the theories and improving the methodology.

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