011-0288

Using Maturity Models to Improve Project Management Practice

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POMS 20th Annual Conference, Orlando, Florida U.S.A.,May 1 to May 4, 009

Abstract

This paper presents the findings of an investigation to evaluate the role of Project Management Maturity Models (PMMM) in improving practice. PMMM are widely used constructs. Implicit within their use is an idea that they improve project performance. However, limited empirical evidence exists to understand the comparative effectiveness of these approaches. Furthermore, there are a number of key omissions in some existing maturity models

The paper critically evaluates existing PMMMs and delineates a number of differences between them. (These include differences in scope and definitions of maturity.) The evaluation shows that PMMM are typically used reactively and not proactively and that they do not have sufficiently rigorous protocols in the evaluation of project management maturity. The paper concludes by highlighting the limited empirical evidence that has linked project maturity and project performance and makes suggestions for further investigations to fill this gap.

1) Introduction

In an environment where projects are increasingly becoming the fundamental components of business operation, project management has recently been the subject of much scrutiny. Against this background, Grant and Pennypacker (2006) report that in the last 10 years more businesses are employing project management as a way to develop a competitive advantage, but projects do not always progress as planned. They highlight the role of PMMMs in understanding project performance.

The consideration of maturity models provides an approach to continuous improvement in many areas of business. Duffy (2001) specifically identifies the application to strategy development and formulating responses to change, suggesting “the value of a maturity model lies in its use as an analysis and positioning tool”.

The PMMM has its origin in the Capability Maturity Model developed at Carnegie Mellon University in the USA between 1986 and 1993 (Paulk et al, 1993). Since then around 30 different models have been developed each addressing a specific business model or industry context (PMForum, 2008). This proliferation of model variants and inclusion in both the APM and PMI Bodies of Knowledge (APM, 2006 and PMI, 2004) demonstrate that PMMMs have now become an established part of documented practice.

Maturity models have their origin in the field of total quality management (Cooke-Davies, 2002). They drive strategically linked continuous improvement and so require a thorough understanding of an organisation's current position and where it aims to be in the future. Commitment to this change is essential and requires the support and involvement of senior management (Hayes, 2007). Identifying the maturity model in the change domain suggests that many of the ideas developed to address broader business change are applicable to the project management environment. Conversely, McKenna (2002) suggests that the project management framework is a good choice for guiding the implementation of a change initiative in a business.

Despite the acceptance of maturity models into the accepted bodies of project management knowledge, evidence as to the extent of use and impact of the models is very limited. Grant and Pennypacker (2006) identify only three studies prior to their own that explore the subjects of use and impact. They make the point that in many cases where studies have taken place, the data is not available in the public domain.

2) PMMMs: Disparities in Operationalisation

Reviewing the current experience of the use of project maturity management models highlights a number of disparities in the ways in which they are currently conceptualized. These disparities include:

- their delineation of the 'maturity' construct
- the project management knowledge areas they cover
- their scope

Andersen and Jessen (2003) start their investigation of project maturity in organisations with a review of the definition of what it is to be mature. Webster's Dictionary defines it as "being ripe or having reached the state of full natural or maximum development". In many respects, this is the only feature common across the range of models that have developed since the original Capability Maturity Model. In reviewing the literature it is apparent that the definition and scope of each model is different in some way to the other models that have been developed.

Stage of Maturity	**Description**

1) Performed	Unpredictable process that is poorly controlled and reactive
2) Managed	Project process is characterised but is often reactive
3) Defined	Characterised process for the organisation that is proactive
4) Quantitatively Managed	Process measured and controlled
5) Optimising	Process improvement focus

Table 1 Stages of Maturity (Paulk et al, 1993)

Most models identify a group of knowledge areas and a series of maturity levels. In its simplest form, the responses to questions asked in each of the identified knowledge areas are then assessed as to the level of project management maturity they represent. Many models use the original Carnegie Mellon maturity level definitions (Table 1).

It is common in project management texts to see a modified description of the Carnegie Mellon maturity levels that is more intuitive. From Level 1 to Level 5 they are described as Ad hoc, Repeatable, Well defined, Managed, Optimising (Gray and Larson, 2007). Although the definitions may vary, the 5 level approach is the one that has seen general acceptance.

The knowledge areas are less consistent. The approach described by Crawford (2006) is to use the 9 knowledge areas identified in the PMI Body of Knowledge. Cooke-Davies and Arzymanow (2003) discuss a model in which 10 domains are used as the basis for the model. A very different approach is described by Andersen and Jessen (2003) in which 12 areas are suggested with 4 each identified within 3 top level dimensions – attitude, knowledge and action. These three examples are presented in Table 2 as a comparative description.

Crawford (2006)	**Cooke-Davies and Arzymanow (2003)**	**Andersen and Jessen (2003)**
Integration	Project culture	Attitude – risk and insecurity
Scope	Organisational leadership	Attitude – power and responsibility sharing

Time	Business culture	Attitude – hard and soft values
Cost	Multi-project management	Attitude – co-operation
Quality	PM structure, methods and systems	Knowledge – suppositions
Communication	Degree of authorisation	Knowledge – ways of working
Human resources	Location of information	Knowledge – desirable results
Risk	Matching team to project	Knowledge – totality
Procurement	Capability of PM staff	Action – at strategic level
	Strength of project vs functional management	Action – at tactical level
		Action – at administrative level
		Action – at operational level

Table 2 Knowledge Areas

Another level of complexity is introduced by Kwak and Ibbs (2002) when they consider the 9 knowledge areas used by Crawford, but applied to each of the 5 parts of the project process – initiating, planning, executing, controlling and closing. It should also be noted that within each of the areas identified in Table 2, there is often a degree of decomposition to identify more specific characteristics. Table 2 identifies clearly the different conceptual approaches to maturity model development. This makes comparisons between the work of different authors problematical.

The scope of the different models is also variable. Some are much more focused on the project management process, whereas others are much broader, taking in the entire organisation. Wheatley (2007), reporting on a 2004 Pricewaterhouse Coopers survey, identifies that it is organisational factors that are more likely to drive project failure, thus suggesting that the broader organisational models are more appropriate. This argument is supported by Thiry and Deguire (2007) who suggest that in project-based organisations, project management practice influences organisational practice and vice versa. This influence requires “the development of a

collaborative relationship between the fields of project and general management and a common language that fosters dialogue" if projects are to be performed successfully.

In the area of IT project management, Lee and Anderson (2006) have used a Delphi study to investigate factors not covered by maturity models that influence project management capability. The study involved 33 participants and identified 13 additional factors impacting performance. These factors are identified in Table 3 and clearly demonstrate the importance of organisational considerations in any maturity model.

Organisational Level	**Team Level**	**Individual Level**
Senior management support	Clear definition of success for the project team	Understanding of organisational politics and the power structure
Clearly defined organisational strategy	Clear understanding of each member's role in a project	Good project manager / functional manager relationships maintained
Project portfolio management and governance processes	Project team member loyalty to the project	
Role of Project Manager clearly delineated from functional managers		
Project teams aligned with organisational strategy		

Table 3 Additional factors impacting performance (Lee and Anderson, 2006)

The Current Use of Project Maturity Models to Improve Practice

The literature that explores the impact of the maturity model approach on project management practice is limited. Few large scale empirical bench-marking investigations have been undertaken and even fewer have related their results to the performance of project management. The 'benchmarking' activity undertaken in these empirical investigations is not structured around delivering recommendations on how to improve project management practice rather on identifying the areas in which project management practice should be improved.

Grant and Pennypacker (2006) performed a benchmarking study of 126 organisations across 17 different industries. Their findings, determined from a web-based survey that studied 42 components of maturity, indicated a median level of project management maturity at level 2 with

no significant difference across the industries studied. Previous studies referred to by the Grant and Pennypacker in their paper had determined the findings summarised in Table 4.

Study	Key findings
Levene et al, 1995	13 organisations across 3 business sectors Focus on competence Interviews at three organisational levels Information Technology (IT) project practices found to be similar across all business sectors
Mullaly, 1998	65 organisations Focus on process Survey gaining over 280 responses 1 organisation achieved Level 3 maturity, over 70% Level 2 and 25% Level 1 Engineering, transportation, oil and gas, and business services generally achieved a higher level than financial services, health and insurance
Ibbs and Kwak, 2000	38 companies from 4 industries – engineering and construction, telecommunications, information systems and hi-tech manufacturing Focus on financial and organisational impacts Survey Overall maturity level was 3.26 Engineering and construction achieved the highest level (3.36) and information systems the lowest (3.06)

Table 4 Key findings of impact studies

The Grant and Pennypacker study, provides a foundation on which future research can be identified. Their approach uses the 9 PMI knowledge areas with 5 levels of maturity. Intuitively, Grant and Pennypacker suggest that the difference between the maturity levels is not uniform. This develops the idea of a continuous spectrum of change rather than a series of discrete steps. Gareis and Hueman (2000) support this view when proposing the spider web presentation of project management competency data. Moving companies from level 2 to level 3 is identified by Grant and Pennypacker as the major recommendation of their study. To enable this, two key suggestions are made. Firstly, the creation of an organisational project management standard for each organisation that captures practice, ensures alignment with strategy and consistency across the organisation. Standardisation is identified by Milosevic and Patanakul (2005) as having an influence on project success. Project management tools, leadership and process have been found to have most influence, although flexibility is also seen as important. Secondly, the expansion of involvement in the project management process to include stakeholders both internal and

external to the organisation is identified as having a positive impact on moving a company from level 2 to level 3.

In 2003, Cooke-Davies and Arzymanow performed a benchmarking study that explored variations in project management practice in 21 organisations across six industries. The empirical research was based on in-depth interviews with "knowledgeable project management practitioners". The authors identify their results to be qualitative rather than statistically reliable indicators of project management maturity in the organisations studied. Rather than determine a single number to represent an organisations maturity level, the data are represented as maturity profiles plotted on a spider web presentation. This is valuable as it identifies the differences across the 10 domains used by Cooke-Davies and Arzymanow. A good example of this is demonstrated by the construction industry data. From the profile data, an overall maturity level of 3.56 can be calculated. This does not show that in the authorisation domain the companies score at 4.5, yet for team types they score at 1. These individual domain results are important as they will direct where effort is needed to improve practice. For ease of comparing across the industries studied, overall maturity level scores have been calculated from the data presented by Cooke-Davies and Arzymanow (Table 5).

Industry (number of companies)	**Maturity Level Score**
Large pharmaceutical R+D (9)	2.97
Medium pharmaceutical R+D (6)	3.04
Telecommunications (5)	3.46
Defence (4)	3.90
Financial services (3)	3.66
Construction (2)	3.56
Petrochemical (2)	4.69

Table 5 Maturity Level Scores
(calculated from Cooke-Davies and Arzymanow)

Despite the small sample size, it is demonstrated that there is variability between industries, a conclusion that is different to that of Grant and Pennypacker. The more established users of project management such as the engineering-based industries demonstrate a higher level of maturity. Again, in contrast to Grant and Pennypacker, the identified maturity level is one greater i.e. level 3 rather than level 2. The subjective nature of the determination, along with the characteristics of the dataset are likely to be key influences on this observation.

The Mullaly study, the base line of which was discussed by Grant and Pennypacker, is the one longitudinal study that has been reported in the literature (Mullaly, 2006). The study considered 550 international organisations over a period of 6 years. The maturity model is a proprietary model that has not been published and it uses 5 maturity levels and 12 capability areas. The 12 capability areas are decomposed into a number of capabilities and these are in turn broken down into identified practices. Data was collected using a multiple-choice survey with some limited verification using interviews and reviews of practice. The context for the survey in this study is the most recent project the respondent was involved in rather the more global organisational context of the previous studies discussed.

Over the 6 year period the number of organisations at level 1 increased (30% to 72%), at level 2 decreased (64% to 28%) and at level 3 decreased (6% to 0%). No organisations were assessed to be at levels 4 or 5. The reasons for this decline in maturity are not clear. Mullaly offers several suggestions, the main one being that the organisations participating in the study varied from year to year. This self-selection may have seen companies achieving increased levels of maturity self-selecting themselves out of the study, with less mature organisations joining. Changing attitudes to project management (strategic enabler, core competency or fad), the loss of project management 'champions' and external factors (economic, regulatory and market driven) are also identified as potential influences on the data presented.

Mullaly does not break down the data to clearly identify the differences across industries. For the three industries discussed, taking the results for 2002, the maturity levels were as follows:

Communications – 2.29
Municipal government – 2.22
Transportation engineering – 2.47

These results are consistent with Cooke-Davies and Arzymanow, the engineering industry showing the highest maturity level.

The results of the Mullaly study are consistent with the work of Jugdev and Thomas (2002) who found little evidence to support the argument that the use of maturity models led to process capability improvement and then project success.

PMMMs: Future Developments

Reviewing the current experience of using PMMMs leads to the identification of a series of linked investigations that are needed to support the use of PMMMs in improving project management performance. These include:

- **establishing empirical evidence that increasing project management maturity increases project management performance.**

The beginning of an empirical evidence for the efficacy of maturity models in software engineering has begun using a meta-analysis approach (Galin and Avrahami, 2005). A similar

approach needs to be adopted for PMMMs to take the evidence for their efficacy beyond the anecdotal.

- **identifying which PMMMs are best at stimulating effective change in project management**

An important consideration when using any tool is that it must have a purpose. In the case of the PMMM, this is defined as being 'to provide a focus on an organisation and its ability to implement strategy through projects'. From this it should become possible to identify the necessary steps that are needed to improve practice. Understanding the current maturity of project management implementations is of little practical use to organisations unless they can use this assessment to identify what action they need to take to increase their level of maturity. Investigations need to identify what constructs need to be included within the PMMMs to insure that the models are assessing the determinant of project management efficacy. (These in essence are considerations of model 'scope.') Investigations also need to develop the work of Cooke-Davies and Arzymanow (op. cit.) in identifying

- **the development of rigorous PMMM protocols**

This review of current practice in PMMMs has shown a wide range of project knowledge constructs used in the evaluation of maturity and confusion over the number and definition of maturity performance levels. This, when combined with the unresolved issues of who should be consulted in PMMM assessments (Grant and Pennypacker, 2006) underlines the need for the development of rigorous protocols for the application of PMMMs. only by such rigor in application can consistency and hence the real ability to benchmark be achieved.

If these streams are investigation are followed then PMMMs can join the portfolio of existing maturity models and provide efficacious guidance on understanding where project management is within an organisation, where it needs to be and how the organisation is going to get there.

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