Optimising virtual team leadership in Global Software Development

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Abstract: The globalisation of the software development industry has solved one set of problems and created a new set. Skills shortages in the host organisation can be solved by Global Software Development, yet the effective management of virtual teams is a new challenge. This study proposes a process reference model (PRM) and assessment model for the leadership of project teams, including complex virtual teams. Using modelling techniques from Software Engineering, the Leadership PRM describes the attributes that a project manager should possess, and the activities they should perform if they are to be perceived by those around them as leaders. The developed model contains the essential leadership characteristics. Leadership is difficult to define since it is situationally expressed. The context determines the outward form that leadership takes in a given situation. A manager who innately embodies these essential leadership qualities will be perceived as a leader by those around them. Leadership is a skill that can be learned and developed over time to a higher level of competence. Managers coordinate the activities of team members in the pursuit of goals, while leaders extend this management capability by knowing how to motivate team members to want to do what it is the leader wants them to do.

1 Introduction

The general topic of leadership has been studied and discussed for a very long time, at least since the classical period of ancient Greece, as evidenced in the writings of Plato and others [1]. In truth although, leadership studies almost certainly go back further than that to the even more ancient civilisations of the Nile Valley and Mesopotamia. These pre-date by several thousand years the classical period of Greece. Little written materials survive from these earlier civilisations, although their highly organised societies and engineering accomplishments point towards having possessed well-developed organisational skills, which must have included leadership.

Despite the longevity and diversity of the literature on leadership, it is interesting that little consensus exists as to what constitutes true leadership. In recent times in the academic and practitioner literature, this question has been the subject of intense on-going controversy among psychologists, sociologists, historians, political scientists and management researchers [2]. Despite this, no consensus has been reached on how leadership is defined. Operational definitions of leadership have much to do with the purpose and perspective of the researcher [2]. This view is confirmed by Stodgill [3] in his comprehensive review of leadership studies, which points out that there are almost as many definitions of leadership as there are persons who have attempted to define the concept.

It appears the combined efforts of researchers from sociology, psychology, political science, management etc, have tended to cancel each other out. What follows is a sample of the opinions of some highly regarded scholars since the 1940s. Bernard [4] considers that leadership studies has resulted in a great deal of dogmatically stated nonsense.

Burns [5] believes that leadership is one of the most observed but least understood phenomena on earth. Bennis and Nanus [6] observe that despite the thousands of empirical studies performed on leadership over the previous 75 years, no clear and unequivocal understanding has emerged as to how we can distinguish leaders from non-leaders. Yukl [2] notes that leadership research has typically focused on narrow issues with little effort made to integrate findings from different approaches and disciplines. No consensus exists as to what constitutes true leadership.

The lack of consensus on how to define leadership would seem to indicate that there are certain underlying character traits and activities (e.g. vision, integrity and resilience) that must be present if the quality of leadership is to be manifested in a given situation. But the ‘way’ that these underlying traits are expressed will differ according to the needs of a given set of circumstances, hence the lack of consensus. The leadership model outlined in this chapter is derived from the set of essential underlying traits and activities from the broad literature, and distils them into a set of processes that can be applied in a broad range of situations.

2 Distinguishing managers from leaders

The differences between managers and leaders appear to be deeply embedded in the human psyche [7]. In his seminal
paper on leadership, Zaleznik suggests that it is attitudes towards chaos and order that are the basis of the difference. A manager is more risk-averse, aiming for stability and control. Managers seek to solve problems as quickly as is practical, sometimes at the cost of understanding the nature of the problem fully. Leaders, by contrast, accept or at least tolerate chaos and lack of structure so that they might perceive and come to understand the underlying causes of situations. Uncertainty is the price that must be paid for the acquisition of a deep understanding. Zaleznik argues that leaders have more in common with creative thinkers such as artists and scientists than they do with managers. Leaders use their vision of future possibilities to proactively promote new directions while managers execute existing ways. Managers are more likely to adhere to orthodox approaches and resist new ways of doing things.

The ability to envisage a desirable future state and communicate it in a way that creates enthusiasm emerges from the literature as the pre-eminent leadership quality. This is nicely summed up in 19th Century French writer Victor Hugo’s most famous quote that ‘one resists the invasion of armies; one does not resist the invasion of ideas’. Such ideas fire the imagination of people and motivate them to realise the idea.

Takala [1] suggests that what managers and leaders have in common is the ability to get things done. Takala distinguishes them by seeing managers as a kind of instructor who puts pieces together, and then manages the ‘things’. A manager is primarily concerned with making an organisation function by evolving routines that serve the ongoing and sometimes changing purposes of the organisation. Takala [1] observes that management is an activity typical in larger corporations. But there is leadership in every organisation, and not only in business organisations. A leader is a person who takes care of people and emphasises in his/her activities the social psychology of the organisation. Takala [1] notes that this is the somewhat artificial but commonplace distinction made in the management literature between the two activities. He acknowledges, however, that a person who runs a business or leads an organisation acts situationally in both roles – sometimes a manager, sometimes a leader.

3 Leadership process reference model (PRM)

The leadership PRM was developed progressively using a re-iterative design research approach [11] in which an initial prototype was developed based on the broad literature and reviewed in a series of design iterations over an 18 month period (a total of six reviews). The general method is shown below (see Fig. 1).

The reviews included the standard PRM-developer’s method of practitioner and expert reviewers, plus a [12] conformance review to ensure the model met the requirements of that standard. The PRM was also validated with Behaviour Engineering [13], a formal method for checking content and syntax for errors and ambiguities that was developed initially for validating software requirements for complex systems, but which has proven a highly effective method for validating PRMs [14].

Having passed through these six reviews, the V1.0 PRM was released and reviewed again by a focus group over a full day. The group comprised two practitioner project managers and two experts on process models in software engineering.

Data collection for the final iteration was by a focus group review whose terms of reference of this post-release review was to evaluate the efficacy of the leadership PRM, particularly in relation to (a) fitness for purpose, (b) organisation of and content of elements, and (c) what would make it more usable from a practitioner’s point of view?

The focus group review was performed by a rigorous examination of the model over a 6 h period. The group comprised four project managers, each of whom were actively coordinating the activities of a virtual team. Two of the project managers were from the IT projects segment of the higher education sector; the other two were from the systems development segment of the Australian Defense contractor sector. The group evaluated each process and associated outcomes for accuracy, understandability and comprehensiveness.

The focus group data were recorded into a pro-forma, as shown in the table below (Table 1). The data included objective evidence that an outcome is actually being performed, and suggested improvements to the wording and content of the model. The information thus collected and consolidated was later incorporated into Version 1.1 of the PRM.
model. Copies of draft V1.1 were later distributed to the participants for comment to validate that their input had been correctly interpreted.

Importantly for the purposes of this section, the clear consensus of the focus group was that the leadership PRM would be a useful model for them to use. They each wanted a copy of the finalised V1.1 PRM for use in their own projects, which they were duly given. This feedback lends support to the argument that a PRM can be a useful and usable artefact for practicing project managers.

Also emerging from this first post-release review was a ‘process assessment model’ (PAM) based on the leadership PRM. This PAM was developed in accordance with [15]:2004 parts 1 and 2:

It is important to note that the PRM can be used in three possible ways, (a) by project managers to evaluate their own practice, and engage in self-improvement by benchmarking against best-practice, (b) by organisations wishing to improve their internal management capability, and (c) by external agencies wishing to evaluate a potential supplier’s management capability (the capability dimension is currently being developed) (see Table 2).

Also emerging from this first post-release review was a ‘process assessment model’ (PAM) based on the leadership PRM. This PAM was developed in accordance with [15]:2004 parts 1 and 2:

Table 2 Structure and content of PRM

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<tr>
<th>Leadership PRM</th>
<th>Individual process group (IND)</th>
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<td>Team process group (TEM)</td>
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<td>Organisation process group (ORG)</td>
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<td>ORG.3</td>
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3.1 Comparison with other work in engineering management leadership

In benchmarking the PRM against recent work done in engineering management, Polito and Martinich [16] summarise leadership in engineering management as below. It will be seen that it is consistent with the PRM.

A. Initial intensive immersion week contents

1. Communication skills for engineering leaders
2. Building collaborative relationships
3. Conflict management
4. Practical negotiation skills
The shared vision is a clear and unambiguous expression of an envisioned future. It is the basis for a common understanding among stakeholders of the aspirations and governing ideas of the team in the context of that desired outcome. Conditional on being effectively communicated by the leader to the team, the shared vision grounds the team’s governing ideas and principles and allows for appropriate objectives to be derived

Highly effective groups are often convinced they are engaged in important work, sometimes nothing short of being on a ‘mission from God’. The work becomes an abiding obsession, a quest that goes well beyond mere employment. This intensely shared vision and sense of purpose endows cohesion and persistence

Creating and communicating a compelling vision of the future is an aspect of charisma; inspirational motivation, optimism, individualised consideration and contingent reward all appear to optimise team performance by creative a positive affective climate

In summary when promulgating a shared vision, the following factors should be considered:

1. the project’s objectives
2. the conditions and outcomes the project will create
3. interfaces the project needs to maintain
4. the visions created by interfacing groups
5. the constraints imposed by outside authorities (e.g., environmental regulations)
6. project operation while working to achieve its objectives (both principles and behaviours)

Virtual and/or integrated teams

In virtual environments the means by which the leader communicates the vision is of critical importance. Ideally, the virtual team should be brought to a single location for a team launch and team building exercise. Next best is high definition video-conferencing in conjunction with other channels of communication such as group-ware and email

In integrated team environments, the complexity of the overall project team is likely to present practical difficulties in the means by which the leader’s vision can be effectively communicated. As with virtual teams, the most effective method until fully immersive virtual environments are available is to bring everyone together at a project launch. Team bonding activities can and should be organised at the launch. If such an event is not practical, then effective use of the available communications technology must be made

Process ID IND.1 Vision
Process name Vision
Process purpose The purpose of the vision process is to create and communicate a shared vision in ways that inspires people to realise that vision
Process outcomes As a result of successful implementation of the vision process:
1. A vision of the goal(s) is created.
2. The vision of the goal(s) is communicated to the team
3. Commitment by team to the shared vision is gained

Informative notes

Outcome 1 – the vision of the goal is seen by the leader as achievable. The goals will still be abstract at this point. The goal(s) become concrete when translated into objective(s)
Outcome 2 – the shared vision should be communicated in a way that creates positive expectation and motivation among the team
Outcome 3 – the way in which the shared vision of the abstract goal(s) is communicated should generate strong commitment to the achievement of the goal(s)

General

In virtual and/or integrated teams the consultation process may be more difficult but is nonetheless important. The leader needs to get team member buy- in, or commitment, to the objectives, and this requires canvassing widely the views and attitudes of the team. The objectives must then be framed in a way that is consistent with those attitudes. The objectives are then fed back to the team. The team should recognise something of their input in what they receive

Unquestioning obedience to orders coming down the chain of command is a necessity in the military, but is unlikely to work in a non-military environment, particularly where knowledge workers are concerned. Knowledge workers usually value themselves highly, often knowing more than the leader about their particular job. They require careful handling with an attitude of respect

Continued
In virtual environments where the leader’s presence is diminished, a good strategy is to lead by subtle influence – allowing team members to exercise their sense of self-government, gaining influence by allowing them to feel influential. Appearing to lack a compelling vision of the future will quickly undermine the confidence of the team for your leadership.

### Process ID

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<thead>
<tr>
<th>Process ID</th>
<th>IND.3 Integrity</th>
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<tr>
<td>Process name</td>
<td>Integrity</td>
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<tr>
<td>Process purpose</td>
<td>The purpose of the integrity process is to consistently act with integrity and competence over time in pursuit of the vision</td>
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<tr>
<td>Process outcomes</td>
<td>As a result of successful implementation of the integrity process:</td>
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<td>1. Integrity is consistently practiced</td>
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<td>2. Competence is consistently exhibited</td>
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### Informative notes

**Outcome 1** – the leader consistently displays integrity, characterised by openness to truth, trustworthiness, and adherence to principle. **Outcome 2** – the leader manifests competence, characterised by technical and interpersonal skills, and advanced conceptual and reasoning skills. Competence in this context can be seen as an aspect of integrity in that it would be dishonest of an incompetent leader to act in a capacity that requires competence.

**General**

Principle-centred leadership creates a climate in which team members can rely on a leader to act according to guiding principle rather than exigent circumstances. Involves doing the ‘right thing’ all of the time, even when it is easier not to under the circumstances. Such a leader leads by example, leads by having an open, enlightened mind, leads by remaining true to him/herself. Such a person is a natural leader, one who is respected and whose example is followed. The antithesis is the tyrant who is closed-minded and who uses force to make people cooperate. Such a leader acts from a sense of oneness with those being led. This sense of oneness is cultivated in a general sense by learning to recognise the interdependence and connectedness of the group members.

Such a leader avoids using unnecessary force to achieve ends, understanding that to do so create a new set of problems. Self-worth is encouraged when the leader minimises the perceived distance between their sense of their own position and the position of those they lead. By identifying with the group members the leader can better understand the psychological needs of the members, and so their decisions are more aligned with those needs. By extension, an effective leader might go so far as to practice humility as a way of engendering the trust and respect of the group members. The interests of the members are naturally promoted because they are the interests of the leader as well. Therefore, effective leaders win the confidence of group members because the members sense the leader’s identification with them.

### Virtual and/or integrated teams

In virtual environments a leader’s perceived integrity serves as a guiding and unifying influence to team members. Integrity engenders trust. Consistent integrity becomes something akin to a trusted presence in the mind of the team member, giving them a degree of certainty and helping to overcome the self-doubt that is sometimes inherent in an isolated work context.

In complex teams where members do not regularly encounter the leader, a similar benefit is observed. Integrity is defined in general as being whole and complete, with nothing missing. A leader who displays integrity is the embodiment of principled behaviour; someone who can be relied upon to act in a principled way regardless of circumstance. Integrity therefore calls for a high degree of moral courage, since from social psychology we know that people generally act according to who they are with rather than on principle, particularly if doing so will make them unpopular.

### Process ID

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<tr>
<th>Process ID</th>
<th>IND.5 Intelligence</th>
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<tbody>
<tr>
<td>Process name</td>
<td>Intelligence</td>
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<tr>
<td>Process purpose</td>
<td>The purpose of the intelligence process is to apply appropriate cognitive resources in the achievement of goals</td>
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<tr>
<td>Process outcomes</td>
<td>As a result of successful implementation of the intelligence process:</td>
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<tr>
<td></td>
<td>1. Original thinking in team-members is facilitated</td>
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<td>2. Situations are realistically understood</td>
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<td>3. Cause(s) of objective-achieving outcomes are generated</td>
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### Process ID

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<tr>
<th>Process ID</th>
<th>IND.6 Individualised consideration</th>
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<tr>
<td>Process name</td>
<td>Individualised consideration</td>
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<tr>
<td>Process purpose</td>
<td>The purpose of the individualised consideration process is to convey to team-members their value as individuals</td>
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<tr>
<td>Process outcomes</td>
<td>As a result of successful implementation of the individualised consideration process:</td>
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<tr>
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<td>1. Individual team-members are valued</td>
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<td>2. Individual team-members are unified into team</td>
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<td>3. Empathy towards individual team-members is practiced</td>
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<td>4. Objective-achieving team behaviour is rewarded</td>
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<tr>
<th>Process ID</th>
<th>TEM.1 Team structure</th>
<th>TEM.2 Team requirements</th>
<th>TEM.3 Team recruitment</th>
<th>TEM.4 Team environment</th>
<th>TEM.5 Team formation</th>
<th>TEM.6 Team roles</th>
<th>TEM.7 Team rules</th>
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<tr>
<td>Process name</td>
<td>Team structure</td>
<td>Team requirements</td>
<td>Team recruitment</td>
<td>Team environment</td>
<td>Team formation</td>
<td>Team roles</td>
<td>Team rules</td>
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<tr>
<td>Process purpose</td>
<td>The purpose of the team structure process is to create a flexible, goal-oriented team structure</td>
<td>The purpose of the team requirements process is to allocate project requirements to teams</td>
<td>The purpose of the team recruitment process is to recruit persons with skills appropriate to the achievement of project goals</td>
<td>The purpose of the team environment process is to establish the project’s work environment</td>
<td>The purpose of the team formation process is to constitute the team structure</td>
<td>The purpose of the team roles process is to define member roles</td>
<td>The purpose of the team rules process is to establish rules for optimal teams conduct in support of objectives</td>
</tr>
<tr>
<td>Process outcomes</td>
<td>As a result of successful implementation of the team structure process: 1. Objective-aligned team structure is established 2. Adaptable team structure is established</td>
<td>As a result of successful implementation of the team requirements process: 1. Team structure is verified. 2. Team sponsor(s) are appointed (integrated)</td>
<td>As a result of successful implementation of the team recruitment process: 1. Team members with appropriate skills are recruited 2. Virtual team members with appropriate skills are recruited (virtual) 3. Team leaders consistent with requirements are appointed (integrated)</td>
<td>As a result of successful implementation of the team environment process: 1. Appropriate infrastructure is provided 2. On-demand, synchronous, hi-resolution communications media is provided (virtual and/or integrated) 3. On-demand, synchronous, hi-resolution communications media is used (virtual and/or integrated)</td>
<td>As a result of successful implementation of the team formation process: 1. Team structure consistent with project requirements is established 2. Team charter consistent with requirements is established 3. Resources consistent with project requirements are allocated.</td>
<td>As a result of successful implementation of the team roles process: 1. Team member roles are understood 2. Contingency plans for team member absences are developed 3. Singular roles per member in synchronous virtual environments are defined (virtual teams only) 4. Singular and/or multiple roles per member in asynchronous virtual environments are defined (virtual and integrated teams)</td>
<td>As a result of successful implementation of the team rules process: 1. Criteria for optimal team performance in support of objectives are established 2. Empowered operating conduct for optimal team performance in support of objectives is established</td>
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### Table 3  Continued

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<th>Process ID</th>
<th>Process name</th>
<th>Process purpose</th>
<th>Process outcomes</th>
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</table>
| TEM.8      | Team authority     | The purpose of the team authority process is to create efficiently functioning teams by establishing mechanisms that allows team leaders and members to recognise clear channels of responsibility | As a result of successful implementation of the team authority process:  
1. Clear channels of responsibility are established  
2. Responsibilities are understood  
3. Team authority and decision-making mechanisms are understood |
| TEM.9      | Team performance management | The purpose of the team performance management process is to manage team performance through the development of empowered performance-management functions that allow team members to manage themselves | As a result of successful implementation of the vision process:  
1. Self-managing performance functions are developed  
2. High-capability self-managing performance functions for complex asynchronous tasks are developed  
3. Anticipatory self-management functions for proactive adaptation to change are developed.  
4. Higher-capability self-managing performance functions across complex team boundaries are developed (virtual and integrated teams) |
| TEM.10     | Team development   | The purpose of the team development process is to establish team development functions to promote productivity and coherence | As a result of successful implementation of the team development process:  
1. Development practices for team coherence are established  
2. Stable team membership is maintained |

**Organisational process group (ORG)**

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<th>Process ID</th>
<th>Process name</th>
<th>Process purpose</th>
<th>Process outcomes</th>
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| ORG.1      | Team boundaries                      | The purpose of the team boundaries process is to manage team boundaries          | As a result of successful implementation of the team boundaries process:  
1. Team boundaries are managed  
2. Blended team culture is facilitated |
| ORG.2      | Team collaboration                 | The purpose of the team collaboration process is to ensure effective collaboration among interfacing team elements | As a result of successful implementation of the team collaboration process:  
1. Environment for collaboration is established  
2. Environment for integrated and/or virtual team collaboration is established (virtual and integrated teams) |
| ORG.3      | Team and home organisation balance | The purpose of the team and home organisation process is to balance team and home organisation responsibilities | As a result of successful implementation of the team and home organisation process:  
1. Guidelines for balancing team and home organisation responsibilities are established  
2. Guidelines for balancing team and home organisation responsibilities are maintained |

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5. Managing innovation: processes, infrastructure, competencies  
6. Risk management  
7. Developing a culture that fosters success  
8. Engineering project management  
9. Building trust  
10. Gaining support for your projects  
11. Strategic planning  
12. Working with others: introduction to the Myers–Briggs-type indicator  

**B. Follow on ‘Hot Topics’ topics**

1. Managing up  
2. Letting go of engineering tasks: maintaining  
3. Competency while shifting focus  
4. Hiring and retaining the right people  
5. Diversity  
6. Managing your time  
7. Building trust within your team
improvement, small and very small enterprises. This would significantly extend the breadth of application of the standardised approach to process assessment.

5 Conclusion

Project managers around the world have multiple challenges facing them as they move forwards into an uncertain future, not the least of which that of managing/leading complex virtual teams. It is increasingly likely that in a globalised future, projects will be done by virtual teams. Given the rising complexity of the world in general, such projects are also likely to be complex in nature, requiring a diverse talent multi-disciplinary team to perform it.

Arguably, one effective way to meet this challenge is with process models. The Engineering domain across its various disciplines has long made good use of process models to achieve consistent, high-quality outcomes; but such models have until recently been focused on prescriptively describing how to do things. A new generation of process model is evolving in which ‘organisational behaviour’ is being described. Leadership, as difficult as the concept is to define, fits within this new category. The PRM discussed in this chapter is broadly applicable across sectors; it contains no engineering-specific processes. There is no reason why it could not be effectively applied to marketing and PR projects, or other non-engineering projects, since the content of the model is generic.

The difficulties of defining leadership notwithstanding, a leadership PRM developed by a rigorous design research process, tested in trials and found to be useful by practitioners and experts is arguably a viable model that can be recommended for use by Project managers. The feedback from the four post-release trials supports this view.

The possibility of developing other PRMs and associated PAMs that cover other organisational behaviours across a wide range of disciplines include but is not limited to financial institutions and banks, automotive systems and software, aerospace systems and software, medical device systems and software, IT service management, test process improvement, small and very small enterprises.

Note: readers wishing to obtain the latest version of the Leadership Process Reference Model and associated Assessment Model may email the author (d.tuffley@griffith.edu.au) to request.

6 References