2001

Proactive Metrics: A Framework for Managing IS Development Projects

Phil Brook
University of Western Sydney, p.brook@uws.edu.au

Proactive Metrics: A Framework for Managing IS Development Projects

Phil Brook

School of Management
University of Western Sydney, Sydney, Australia
p.brook@uws.edu.au

Abstract

Managers of information systems development projects seem to be primarily in a reactive mode of management: being concerned more with day-to-day crises than with planning for the future. This research is aimed at providing project managers with a tool that will enable them to be proactive, by putting in place a set of performance indicators that focus on those issues that will have a downstream effect on project success or failure. A rigorous cause-and-effect relationship between the measurement of current activities and future performance is derived from the Balanced Scorecard, the Generalised Scorecard Model and the Goal-Question-Metric framework. The paper reports on the results obtained to date when this approach is applied to an actual development project. The interim results suggest that the approach delivers benefits by highlighting areas of concern, and by initiating focus on project factors that might otherwise not be addressed in a timely manner.

Keywords

Project management, systems development, Balanced Scorecard, GQM, Generalised Scorecard Model, project metrics.

INTRODUCTION

The development of Information Systems has been, and still is, an undertaking strewn with difficulties - evidence abounds of projects that fail to meet their targets, especially in terms of time and cost, and even if a "product" is delivered on time, often the scope of the system has been compromised. It has been reported that up to 40% of projects fail or are abandoned, 80% are late and over budget, and 90% fail to deliver business benefits (Clegg *et al* 1996). Traditional project management methodology has concentrated on the identification of the tasks involved in producing a system, guided by a methodology. In most cases, the project plans drawn up either become outdated or require continual modification as day-to-day issues asset themselves. In either case, the project manager becomes caught in a state of reaction.

The aim of the current research is to investigate a project management tool that encourages the project manager to be proactive in managing the project. By providing focus on events that will ultimately have a large bearing on the success or failure of the project, actions can be initiated that provide some surety of eventual success, or at least highlight the need for more attention to project activities.

Based on the concepts of the Balanced Scorecard (Kaplan and Norton 1992), the Generalised Scorecard Model (Brook 2000) and the Goal-Question-Metric framework (van Latum *et al* 1998), a development project has been undertaken to determine the effectiveness of a suite of metrics as an aid to managing the project. Using these concepts, a set of metrics have been defined to be used as an aid to the project manager. At the time of writing, the project has reached the integration test stage, and preliminary results suggest that the metrics used have contributed positively to the running of the project by highlighting unsatisfactory performance and by bringing otherwise seemingly unimportant issues into the consciousness of the project manager.

THEORETICAL FOUNDATIONS

The problems associated with a managerial focus on *lag* indicators (i.e., those metrics derived from historical data) have been well documented in the case of corporate governance, especially in the corporate planning arena (Olve, Roy and Wetter 1999). Relying on performance indicators that are derived from current practice in the organisation, such as current share price, or return on investment and dividends, can lead to management practices that can be counter-productive to the organization in the longer term: for example, it is possible to manipulate financial indicators by selling assets. Relying on current practices provides little certainty that current performance will be repeated next year, or the year after, as the underlying resources, such as the customer base, financial reserves or staff skills may have been compromised.

In developing the Balanced Scorecard, Kaplan and Norton (1992, 1996), defined a set of "perspectives" that call for a focus on performance in areas in addition to the financial area – the customer, process and learning and

growth perspectives. By establishing a cause-and-effect chain between activities in the various perspectives, it is possible to develop a set of performance indicators that changes the focus of the manager away from the lag indicators described above, to *lead* indicators – performance measures that, if they are favourable, can point to success in the future. For example, by establishing a causal link between a corporate knowledge base, the processes dependent on this knowledge base, the customers who are the beneficiaries of these processes and the ultimate financial performance, then the success in establishing a corporate knowledge base is demonstrated to be positively correlated to future financial success. By identifying the key performance measures for an organization, and establishing the cause and effect chain, some degree of confidence will exist in predicting future performance based on the full set of performance measures.

Whereas the Balanced Scorecard has as its main focus corporate planning and strategies, the Generalised Scorecard Model (Brook 2000) extends the concept to essentially any task. This is achieved by defining a set of "meta-perspectives" that can be used as the basis for performance perspectives applicable to particular cases. Thus, the Balanced Scorecard is a special case of the Generalised Scorecard Model. Of particular interest is using the Generalised Scorecard Model as a basis for developing a set of performance metrics for Information Systems development projects. Using this model, the required perspectives and performance indicators can be derived to provide the project manager with a set of performance indicators that encourages a focus on lead indicators, that is, encourages a proactive approach to managing the project.

One of the questions that arises when using the Generalised Scorecard Model is how to move from the perspectives to definitive metrics. One approach that provides the necessary transformation is the Goal-Question-Metric framework (van Latum *et al* 1998). This framework takes as its starting point a set of goals that the ultimate metrics are required to satisfy, and poses a series of questions related to that goal in order to better define the required metrics. For example, if the goal is to assess the skills base of the project, then the questions may relate to the currency of the project skills audit and to recruitment activities, leading to metrics for each of these.

The first step is to take the Generalised Scorecard Model (GSM) and define the descriptors for the application under consideration (see Figure 1). These descriptors are then combined into perspectives that recognize the dynamics of the application (in this case, the focus on building a system). For each perspective, a set of indicators is defined, based on the descriptors. These indicators are then analysed using the Goal-Question-Metric framework to define the metrics required for the particular application (see Figure 2). The end result is a set of performance measures (metrics) that are causally linked through the indicators, and which provide a set that permit and encourage a proactive approach to the management of the development project.

Although the metrics defined and used include both objective and subjective measures, there is the danger of the project being "managed by numbers", in the sense that the measurement becomes the focus and objective of the exercise. This approach could be counter-productive, as the project manager has to look behind the metrics to find solutions to problems highlighted by measurements. Therefore, care has been taken to use the metrics as a way of bringing focus to the important issues, and not as an end in themselves.

RESEARCH METHODOLOGY

This research is being undertaken using participatory or action research (Benbasat and Zmud 1999, Borda 2001). In order to determine whether or not the use of proactive metrics has an effect on the conduct and outcome of a development project, it is desirable to use the approach on an actual project in order to discover the realities of using the approach in practice (Heron and Reason 2001), involving as many of the stakeholders as possible (Remenyi, White and Sherwood-Smith 1997).

To this end, a relatively small (less than six months) project was available, with the author being able to act in the role of assistant project manager. The project is being managed using the metrics determined using the approach described above. During the project, records are being kept by the author on the day-to-day conduct of the project, in addition to the technical artifacts required to produce the system. Some of these are germane to the project itself, especially the periodic calculation of the metrics. These metrics, prepared in the form of graphs, are used in the day-to-day running of the project. In addition, the author is maintaining a comprehensive diary of events as they occur, and in particular, notes on the interaction of the team members, their contributions to the effort, and related observations. At the end of the project, interviews will be held with the team members to elicit their views on the conduct of the project.

The prime evidence used for this research project will be the experience of the project manager in bringing the project to conclusion. If there is an identified difference in focus of the project manager towards managing using the lead indicators, and if there is an identified contribution of these metrics to the overall project success, then there is some evidence of the validity of the approach, as determined by an analysis of the research project

records. As with many projects that rely on indirect evidence for their success, the management approach will need to be reused many times in different types of project to build up a portfolio of cases. Only then can more general conclusions be drawn.

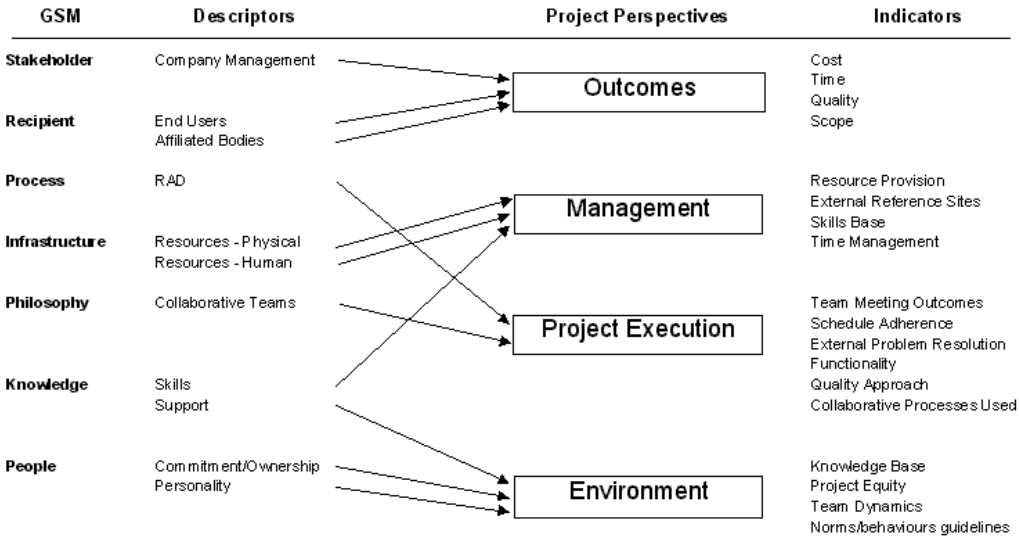

Figure 1: Deriving indicators from the GSM for a development project

CURRENT STATUS

At the time of writing, the project is approximately three-quarters completed, in terms of elapsed time. The metrics identified as being relevant to this project have been measured at the appropriate intervals, and interpreted for action as necessary. At this point in time, there are several interesting issues that have arisen.

Trends are important. Measurements obtained each period may be considered in isolation. The completed functionality metric (Module Completion) is a measure of the degree of completeness of each of the modules of the system at that point in time. At any point in time, a conclusion can be drawn about the status of the project, but of more interest is the trend evident from this graph. Whilst the project has been performing unsatisfactorily since its inception (according to the upper and lower bounds), the continued upward slope points to an underlying activity to bring the project back to the required time.

Metrics in combination reveal a more complete picture. A different view of the project is provided by the metric that assesses team collaboration. This graph shows a measure of the (subjectively) assessed extent to which each member of the team is working in a style that can be termed 'collaborative' (e.g., exhibits knowledge sharing behaviour). Since the start of the project, the degree of collaboration has been steadily rising. When this metric is compared to the completed functionality metric, the similarity of trends suggests the possibility of an underlying relationship between these measures, and such a correlation can be hypothesized from a consideration of the mechanisms associated with project development. A preliminary analysis supports the view that a more comprehensive assessment of a project's status can be gained from considering metrics in combination. It was observed by the author that the availability of a measure relating to how the team was interacting, provided the project manager with important additional information on which to base action.

Focus leads to action. The list of metrics defined for the project provide the project manager with a significant amount of information. It has been observed by the author that this information is providing the project manager with a comprehensive picture of the state of the project. Firstly, in the assessment of the actual measurements (such as the functionality completed metric discussed above), and secondly, in bringing to attention issues that require management, yet would not normally be treated as important issues until they become critical. In this second case, it may not be the measurement that is the important factor, but the existence of these issues. However, further research needs to be performed to assess whether treating this class of metrics as a 'checklist' will retain their usefulness, as it may be the case that the act of measurement ensures that they remain in focus.

Indicators	Goal	Question	Metric 1	Metric 2	Metric 3
Cost	To achieve required functionality within established cost parameters	What is the position of budget vs actual?	Expenditure to date		
Time	To meet production release deadline.	Are we on time?	Completed functionality		
Quality	To ensure that the release system exhibits quality to end users.	Is the system exhiting any errors?	Oustanding errors by type		
Scope	To provide functionality that ensures a competitive advantage at release.	Is user modelling complete? Is design uptodate?	Modelling done vs estimate	Design complete vs modelling	
Resource Provision	To ensure that the necessary resources are made available to the project team.	Are plan lead times being adhered to? Are team requirements uptodate?	Outstanding action items	Resource needs current	
External Reference Sites	To ensure that timely responses are received from external parties.	Are external parties responding in a timely fashion?	Response times by category		
Skills Base	To ensure that the required skills are available when needed.	Is the skills audit uptodate? Are recruitment activities on time?	Skills audit current	Outstanding recruitment	
Time Management	To ensure tasks allocated recognise the time constraints of the team.	Is the time resource list current? Does the plan reflect time resources?	Time resources current	Currency of plan	
Team Meeting Outcomes	To ensure that team meetings achieve positive outcomes.	Are all contributing? Are action lists followed? Does the meeting stay focused?	SD of contribution	Issue Finalisation Rate	Efficiency
Schedule Adherence	To confirm that current schedules are consistent with resources.	Is there sufficient time to finish on schedule?	Skills audit current	Time resources current	Currency of plan
Problem Resolution	To ensue that problems raised are resolved so as not to impact delivery	Are problems prioritised? Are problems being resolved on schedule?	Response times by category		
Functionality	To ensure that the system will deliver the minimum business functionality.	Is requirements documentation current? Is the design current?	Modelling done vs estimate	Design complete vs modelling	
Quality Approach	To ensure that appropriate quality plans are in place and followed.	Is there a quality plan? Does the schedule incorporate quality assurance activities?	Status of quality plan	Completeness of schedule	
Collaborative Processes	To ensure that appropriate processes are in place and understood	Has the team been trained in collaboration? Are the team actively collaborating?	Briefing plan	Interaction Quality Ratio	
Knowledge Base	To provide a resource for developers relevent to their development needs.	Is a comprehensive knowledge base being built in advance of need?	Knowledge plan status	Completeness of schedule	
Project Equity	To monitor the implementation of equity of the developers in the product.	Is a plan in place to ensure that appropriate ownership is given to team members?	Status of legal structure plan		
Team Dynamics	To assess and develop positive team dynamics.	Are the developers working as a team?	Interaction Quality Ratio	Estimated morale	
Norms and Behaviours	To ensure that appropriate norms and behaviours occur in the team	Are the team members acting as expected?	Interaction Quality Ratio		

Figure 2: Using the GQM approach to define project metrics

COMMUNICATION OF RESULTS

The project is scheduled for completion towards the end of 2001, following which a more complete analysis of the project outcomes will be possible, and the interim observations made above either supported or requiring further investigation. No definitive conclusions about the approach adopted, or its general applicability to other development projects will be possible, but this study will form the basis for other projects.

REFERENCES

Benbasat,I. and Zmud,R.W. (1999) Empirical Research in Information Systems: The Practice of Relevance *MIS Quarterly*, Vol.23, No.1, pp3-16.

Borda,O.F. (2001) "Participatory (Action) Research in Social Theory: Origins and Challenges", in Reason,P. and Bradbury,H. (Eds) 2001 *Handbook of Action Research*, SAGE, London.

Brook, P.W.J. (2000) Managing IS Development Projects Using a Generalised Set of Scorecard Perspectives, *Proceedings 11th Australasian Conference on Information Systems*, Brisbane

Clegg,C.W., Axtell,C., Damodaran,L., Farbey,B., Hull,R., Lloyd-Jones,R., Nicolls,J., Sells,R., Tomlinson,C. and Ainger,A. (1996) *The performance of information technology and the role of human and organizational factors*, Report to the Economic and Social Research Council, UK.

Heron,J. and Reason,P. (2001) "The Practice of Co-operative Inquiry: research 'with' rather then 'on' people", in Reason,P. and Bradbury,H. (Eds) 2001 *Handbook of Action Research*, SAGE, London.

Kaplan, R.S. and Norton, D.P. (1992) The Balanced Scorecard – Measures that Drive Business Performance, *Harvard Business Review*, 70, January-February, 71-79.

Kaplan, R.S. and Norton, D.P. (1996) *The Balanced Scorecard.* Harvard Business School Press, Boston.

van Latum,F., van Solingen,R., Oivo,M., Hoisl,B., Rombach,D. and Ruhe,G. (1998) Adapting GQM-Based Measurement in an Industrial Environment *IEEE Software*, Vol.15, No.1, January/February.

Olve, N.G., Roy, J. and Wetter, M. (1999) *Performance Drivers: A Practical Guide to Using the Balanced Scorecard.* Wiley, Chichester.

Remenyi,D., White,T. and Sherwood-Smith,M. (1997) Information Systems Management: The Need for a Post-Modern Approach, *International Journal of Information Management*, Vol.17, No.6, pp421-435.

COPYRIGHT