

Dynamics of performance measurement systems

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Abstract

The paper starts with describing the background to the work and goes on to develop a model for integrated and dynamic performance measurement systems. It identifies that current knowledge and techniques are sufficiently mature enough to create dynamic performance measurement systems in practice and illustrates this through a case study. The paper ends with a series of conclusions and lessons as well as highlighting further research and development needs.

Key Words

Strategy Management, Performance Measurement, Performance Management

1 INTRODUCTION

The objective of this paper is to describe the research work conducted on Dynamic Performance Measurement Systems. The original background of the work presented in here extends back to mid 1980's where the need for better integrated performance measurement systems were identified (Johnson and Kaplan, 1987, McNair and Masconi, 1987, Kaplan, 1990, Druker, 1990 and Russell, 1992). Since then, there has been numerous publications emphasising the need for more relevant, integrated, balanced, strategic, improvement oriented and dynamic performance measurement systems. This resulted in the development of various models, tools and techniques to facilitate the development of new performance measurement systems.

1.1 Integrated performance measurement systems (IPMS)

The Integrated Performance Measurement Systems (IPMS) project researched the structure and relationships within performance measurement systems and developed a Reference Model and an Audit Method for IPMS (Bititci and Carrie, 1998 and Bititci et al, 1998a). The structure of this Reference Model is based on the Viable Business Structure (Bititci and Turner, 1998), which has emerged from the Viable Systems Theory (Beer, 1985) and the CIM-OSA Business Process Architecture (ESPRIT Consortium AMICE, 1991),

Throughout the IPMS project the researchers conducted many audits with collaborating companies and found that:

- A Performance Measurement System should be a dynamic system.
- Most organisations have only a static performance measurement system
- This, in turn, has a negative effect on the integrity of the performance measurement system as well as on the agility and responsiveness of the organisation
- The main barriers to an organisation's ability to adopt a more dynamic approach to performance measurement systems can be summarised as follows:
 - Lack of a structured framework, which allows organisations to:
 - differentiate between improvement and control measures
 - develop causal relationships between competitive and strategic objectives and processes and activities
 - Absence of a flexible platform to allow organisations effectively and efficiently manage the dynamics of their performance measurement systems.
 - Inability to quantify the relationships between measures within a system.

1.2 Active monitoring

The objective of this project was to establish the applicability of Reliability Engineering techniques to design active control systems for business processes. This research first studied literature and industrial practice with respect to Active Monitoring and developed an approach to the design of Active Monitoring Systems. This approach was tested with three different types of business processes (Operate, Support and Manage). The results of the research demonstrated that an Active Monitoring approach can be used to maintain the reliability of business processes and that it is the basis of the Internal Control System (Bititci, 1998a and Turner and Bititci, 1998).

1.3 Quantitative model for performance measurement systems

Quantitative Models for Performance Measures Project was born directly out of the IPMS project. The objective of this work was to investigate tools and techniques that can be used to model and quantify the relationships between performance

measures. The project developed and validated an approach for modelling and quantifying the relative relationships between performance measures within a system using the Analytical Hierarchy Process (Suwignjo et al, 1997 and Bititci et al, 1998b).

1.4 Emerging IT tools

Recent times have seen some newly emerging IT based management tools specifically targeted to Performance Measurement. Such tools include:

- IPM
- PerformancePlus
- Ithink Analyst
- Pb Views

A recent publication in Information Week (Coleman, 1998) critically reviewed these software packages and concluded that IPM provided the best all-round functionality.

2 DYNAMIC PERFORMANCE MEASUREMENT SYSTEMS

The fact that performance measurement systems need to achieve alignment with strategic priorities is well established within the performance measurement literature (Cross K F and Lynch R L, 1998-1989, Dixon et al, 1990, Kaplan, 1993, Neely, 1995). However, it is also commonly recognised that the external and internal environment of an organisation is not static but is constantly changing. As part of the IPMS audits conducted by the research team, it became clear that the performance measurement system needs to be dynamic by:

- Being sensitive to changes in the external and internal environment
- Reviewing and reprioritising internal objectives
- Deploying the changes to critical parts of the organisation thus ensuring alignment at all times
- Ensuring that gains achieved are maintained

Although this model is depicted in Figure 1, the reality is more complex. In practice there may be a seldom event, which may cause the whole organisation to review its corporate level objectives and priorities, which results in the need for restructuring the whole performance measurement system. It is more likely that changes within the immediate environment of a business unit or a business process may effect the way that business unit or process could best contribute to the organisations overall objectives. That is, the need for change is not always driven from the very top of the organisation but more frequently it is initiated as a result of an external or internal change within the immediate environment of a business unit or business process. This implies that the structure depicted in Figure 1 applies to the whole business as well as to each business unit or business process within the business. Figure 2 illustrates the resultant model.

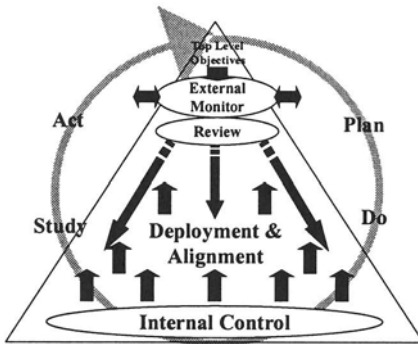


Figure 1. The dynamic performance measurement systems model.

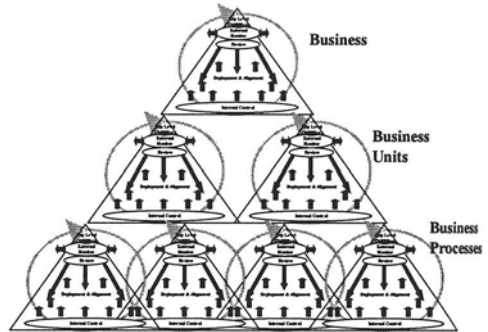


Figure 2. The integrated model

Based on the discussion so far, the following capabilities are required to create a truly dynamic and self-auditing performance measurement system.

- A framework for a dynamic performance measurement system including:
 - External control system
 - Review mechanism
 - Deployment system
 - Alarm system
 - Causal relationships modelling
 - Quantification of criticality
 - Internal control system
 - Gains maintenance
- An IT platform to facilitate use of the dynamic performance measurement systems

The researchers conducted a critical comparison of the presently available frameworks, tools and techniques against this set of requirements (Bititci et al 1999). This review included the following frameworks: Integrated Performance Measurement Systems (Bititci et al, 1998a), Active Monitoring (Turner and Bititci, 1998), Quantitative Model for Performance Measurement Systems (Suwignjo et al, 1997), Balanced Score Card (Kaplan and Norton, 1996), SMART - (Cross K F and Lynch R L, 1998-1989), Cambridge Performance Measurement Systems Design Process (Neely et al, 1996), Performance Measurement Questionnaire (Dixon et al, 1990), Integrated Dynamic Performance Measurement Systems (Ghalayini, 1997). The study concluded that present models, tools and techniques collectively provide sufficient understanding and know-how for practical implementation of dynamic performance measurement systems. More specifically this study illustrates that the IPMS Reference Model, Active Monitoring and QMPMS together with the IPM software would be capable of fulfilling the functionality required to create a dynamic performance measurement system.

3 CASE STUDY

The case study is based on DSL, which is a major apparel manufacturing subsidiary of a Japanese group. Its main operations consist of design, manufacture, sale and distribution of gents and ladies garments, such as jackets, trousers and skirts. An IPMS audit against Reference Model v.2.4 was conducted during January 1998, the results of which was reported in a previous publication (Bititci et al, 1998c).

Following the IPMS audit, DSL re-engineered its performance measurement system in line with the requirements of the IPMS Reference Model. Table 2 illustrates the resultant performance measures adopted. Due to space restrictions this Table does not show the performance measures adopted for the support processes and the active monitors corresponding to each process.

Business Measures			
<ul style="list-style-type: none">• Sales• Cost of Sales• Current Assets		<ul style="list-style-type: none">• Brand Image• Fixed Assets	
Brand Business Unit Measures		Contract Business Unit Measures	
<ul style="list-style-type: none">• Value for money• Delivery reliability• Quality (RTM)• Responsiveness/flexibility• Brand Image		<ul style="list-style-type: none">• Price• Delivery reliability• Quality (RTM)• Responsiveness/flexibility• Innovation	
Operate Process Measures			
Generate Demand	Develop Product	Store and Distribute	Manufacture and Purchase
<ul style="list-style-type: none">• Sales• Forecast accuracy• Selling Expenses• New cust. aq.• Customer retention• Av. customer age• C-C-C Ratio	<ul style="list-style-type: none">• Ease of production (Standard Minutes)• Margin (Price-Materials)• Innovation• Post Range New Products• Post Release Changes• Time to market	<ul style="list-style-type: none">• Delivery speed• On-time Delivery Performance• Delivery Accuracy• Product Deterioration• Distribution Costs• Storage Costs• FGS record accuracy• Average age of Stock	<ul style="list-style-type: none">• <i>MPS Hit Rate / Average Lateness</i>• Line Velocity• Materials Costs• Labour costs• Quality• F/Goods Stock-turns• F/Goods Shortages• Obsolescence
Active Monitors			
<ul style="list-style-type: none">•	<ul style="list-style-type: none">•	<ul style="list-style-type: none">•	<ul style="list-style-type: none">•

Table 2 Structure of performance measures adopted by DSL
(Table does not include measures for Support Processes and Active Monitors)

The logic behind this structure is that:

- The business exists to generate value for the shareholders - Business Measures
- The business generates value for the shareholder by servicing demand from two distinct market segments. That is, the Business operates two Business Units to fulfil this demand - Business Unit Measures.
- Each Business Unit operates a number of business processes to service these markets - Process Measures

- The success of each business process is dependant on the successful operation of its critical inputs and activities - Active Monitors.

The management team within the company has arrived at the measures illustrated in Table 2 as a result of application of the above logic, which is an inherent part of the IPMS Reference Model. Throughout the process the team used QMPMS tools to model the relationships between the individual performance measures (Suwignjo et al, 1997).

In order to illustrate the dynamic use of the performance measurement developed within DSL we have taken an extract of the top-level performance measurement report used by the management team within the Company, which is illustrated in Table 3. In its full form this report would normally include all Business and Business Unit measures.

	Measure	Ext. Monitor	Target	Comp Status	Jan	Feb	Mar	Apr	May	Jun
rand us. nit	Delivery Reliability %	Well Ahead	90	D	55	60	65	70	75	73
	Customer Satisfaction Index	Below Average	50	Q	60	55	53	49	54	48
	Quality (RTM) %	Well Ahead	2	D	5	6	5	4	3	3

Table 3 Extract from the Company's top-level performance report

To demonstrate the dynamic use of the above table lets assume that June is the current period and look back at the first of the three scenarios presented at the beginning of the paper. The system will tell you that, although quality is a differentiator (D) and that you have not achieved your target of 2%, you are still well ahead of the competitors in this area. However, customer satisfaction, which is classified as a qualifier (Q) for this particular market, (although near target) is below average. Therefore, it is in urgent need of improvement and revision of the target. As a result, the system is responsive to the changes in its internal and external environment.

4 CONCLUSIONS AND LESSONS

The researchers, having used a combination of these methods, tools and techniques in a number of organisations to create dynamic performance measurement systems, have come to the following conclusions.

- Concepts and techniques emerging from previous research programmes, such as IPMS, Active Monitoring and QMPMS together with the capabilities offered by the newly emerging software tools, goes some way towards satisfying the requirements of a dynamic performance measurement systems.
- Although the logic behind the review mechanism has been demonstrated in a simplistic scenario, there is a significant gap in knowledge with respect to the review mechanism to deal with more complex scenarios.

- Artificial intelligence techniques may provide a way forward to understand and create review mechanisms, which can advise in more complex scenarios.
- The use of dynamic performance measurement systems allows changes in priorities to propagate throughout the business, through its critical business units and business processes to its suppliers.
- Provided that the suppliers are operating a similar dynamic performance measurement system, they could receive the changed priorities and take proactive action to fulfil the customers needs.
- It is the hypothesis of this research that dynamic performance measurement systems would allow more responsive management of the performance of the company's network of suppliers and subcontractors
- Current IT platforms are somewhat limited in nature and do not provide a seamless links with other business systems, such as ERP, Product Data Management and Design systems.
- In order to provide true dynamism and full integration with other business systems the performance measurement system should be an integral part of the companies ERP system.

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