

Integrated Performance Measurement Systems: A Reference Model

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Abstract

The aim of the research and development work being carried out on Integrated Performance Measurement Systems at the Centre for Strategic Manufacturing in the University of Strathclyde is to develop a Reference Model and an Audit Method for a robust and integrated performance measurement system. The Reference Model is being developed as a result of research into past and present academic work and industry best practices. This paper describes the development and structure of the Reference Model as well as discussing the principles embedded within the Model. The paper concludes with a brief description of the Audit Method.

Keywords

Performance Measurement, Models, Audits

1 INTRODUCTION

The objective of this paper is to introduce and disseminate the results of the research and development work carried out on Integrated Performance Measurement Systems at the Centre for Strategic Manufacturing in the University of Strathclyde.

Over the recent years there has been considerable emphasis on performance measurement in all industrial and commercial organisations as a means to:

- Control the strategic direction of the business and its constituent parts.
- Drive improvement programmes in line with the strategic direction of the business.
- Maximise the effect of the improvement effort.

This emphasis has led to the development of various approaches to design of performance measurement systems by academics, consultants and industrialists (Kaplan and Norton, 1992; Russell, 1992; Neely et al, 1995; Neely et al 1996) . Published case studies report various degrees of success in achieving the intended objectives (Gelders et al, 1993).

Despite the availability of various approaches to performance measurement systems design, a reference model which describes the structure and constituent parts of a robust, integrated, efficient and effective performance measurement system is not available (Bititci et al, 1996).

The aim of the research and development work presented in this paper is to produce:

- A Reference Model for a robust and integrated performance measurement system.
- An Audit Method to assess the robustness and integrity of performance measurement systems used within manufacturing industries.

2 THE REFERENCE MODEL

The prime objective of the Reference Model is to describe, in precise terms, the features of an integrated, effective and efficient performance measurement system. To achieve this objective it describes:

- the constituent components of a performance measurement system;
- provides guidelines on the appropriate performance measures.

It is intended that the reference model will be used for both the design of new systems and for auditing of existing systems. The following sections describe the development and structure of the Reference Model.

3 REFERENCE MODEL: DEVELOPMENT

The Reference Model was developed following extensive research. This research has focused on two primary areas:

- past and present academic work;
- industry best practices.

Throughout the research various concepts and practices were identified as being critical to the objectives of the Reference Model. At the early stages of the project the researchers identified the need to develop a framework to integrate all the relevant concepts and practices.

The fundamentals of the Reference Model are based on:

- systems thinking
- business processes
- policy deployment
- competitive criteria

Within its structure the Reference Model incorporates two Performance Measurement Systems. These are:

- Performance Measures for Control. A system to control the performance of the critical parts of the business with respect to its external environment.
- Performance Measures for Improvement. A system which deploys the improvement objectives down through the critical parts of the business.

A framework based on Beer's Viable Systems Model (Beer, 1985) has been used to integrate all of these key concepts with other practices identified throughout the research.

4 REFERENCE MODEL: STRUCTURE

The reference model considers an organisation in four levels. These are:

- the Business
- the Business Units
- the Business Processes
- the Activities

These levels may be physical or logical. The term 'logical' means that the organisation does not need to be physically organised to have the four levels. In most businesses these four levels do exist, management need only recognise that the four levels exist in their business.

The Business Level represents the entire business which consists of a number of logical or physical Business Units. A Business Unit is defined as the portion (phy-

sical or logical) of the organisation which serves a particular market segment with particular competitive requirements. In a Business, Business Units are distinguished from one another by the differing market requirements.

Each Business Unit in turn consists of a number of Business Processes which represent the operations of each Business Unit. Typically a Business Unit may have the following core business processes (Maull et al, 1994):

- Get Order
- Develop Product
- Fulfil Order
- Support Product

In addition there will be a number of other support processes [8] which support the core processes.

Each Business Process in turn consists of a number of Activities which may be sequential and/or parallel within the process.

4.1 Elements at Each Level

The Reference Model at each of its four levels considers four elements. These are:

- Stakeholders Requirements
- External Monitor
- Objectives
- Performance Measures

The Reference Model requires that, at each level of the business the organisation:

- Recognises and understands the requirements of it's Stakeholders.
- Monitors its external position (with respect to the stakeholders requirements) against competitors and world class performance to identify the development needs of the business.
- Sets Objectives based on implications and criticality of the development gaps together with appropriate targets and time scales.
- Expresses, reports, monitors and reviews these objectives through Performance Measures reports.

Figure 1 illustrates the final structure of the Reference Model. Additionally, a number of references and concepts are provided which may be used for guidance at each stage.

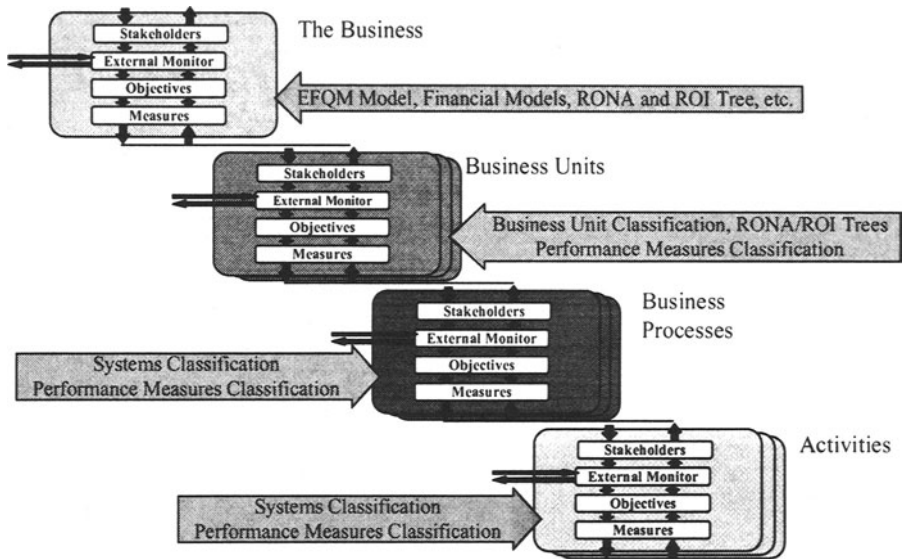


Figure 1 Reference Model for Integrated Performance Measurement Systems.

5 REFERENCE MODEL: PRINCIPLES

There are a number of fundamental principles integrated within the Reference Model, which the reader should be aware of in order to understand the logic of the Model. These are described in the following sections.

5.1 Management Control

A convention based on the Viable Systems Model (Beer, 1981), which is used throughout the entire Reference Model, is to view each level of the organisational structure as consisting of two elements:

- a management element, and
- an operational element.

This convention enables the separation of the “management element” from the “operational element”. This feature repeats itself through the four levels of the Reference Model. The following statements will help to clarify this principle.

- The Business represents the management element and the Business Units represent the operational elements of this business.

- Each Business Unit has its own management element and its own operational elements. The business processes inherent within a business unit represent the operational elements of that business unit.
- Similarly, each business process has its own management element and its own operational elements. The activities inherent within each business process represent the operational element of that business process.

5.2 Deployment

As the Reference Model progresses downward through the four levels the higher level becomes a stakeholder of the lower level. In addition, other stakeholders may be added, as appropriate at each level. Therefore, the management element at each level deploys its objectives to its operational levels. That is:

- The Business deploys its objectives and targets at the Business Unit level.
- Each Business Unit deploys its local objectives at the Business Process Level.
- Similarly, each Business Process deploys its local objectives at the Activity level.

5.3 Transduction

This is a key feature of deployment. As the objectives are deployed from one level to the next they are expressed in locally meaningful and unambiguous terminology.

5.4 Resource Bargaining

This is the term applied to the action of negotiation between two levels of the model. This is also a key feature of deployment. It relates to the need to ensure that deployed local objectives are realistic and achievable

5.5 Normative Planning

The principle of Normative Planning by Beer (Beer, 1979) relates to target setting and performance improvement planning rather than performance measurement. In setting the objectives at each level due consideration should be given to setting of the following targets:

- Capability Target – the performance achievable under current constraints.
- Potentiality Target – the performance achievable providing all constraints are removed.

5.6 Active Monitoring

Most performance measures relating to objectives tend to be reactive, i.e. they measure performance after the event. To promote an agile and proactive management style it is important that the reactive performance measures associated with the objectives are supported / accompanied by a number of active performance measures.

For example, “% customer satisfaction” is a reactive measure. A factor which influences customer satisfaction may be partnership agreements, thus “number of partnership agreements in place” may be a good active measure to adopt.

5.7 Classification and Performance Measures

Business Units, Business Processes and Activities can be classified according to the complexity and uncertainty of their operating environment. This classification provides guidelines on the most appropriate type of performance measure.

Figure 2 illustrates this classification for Business Units. This is a classification system used by the DTI’s Factory of the Future Project, which was conducted as part of a European Programme (DTI, 1996; Kehoe & Little, 1997).

As illustrated in Figure 2 this classification model allocates Business Units into four sectors and for each sector specifies the performance criteria associated with that sector (e.g. Fitness for purpose, Timeliness, Value for money and Price) as well as the key competencies required.

Similarly, based on the same variables of Complexity and Uncertainty a model for systems classification is available (Kehoe and Little, 1997; Ginzberg, 1980). This classification system, as illustrated in Figure 3, is equally applicable to the classification of Business Processes and Activities.

Figure 3 illustrates the Process classification model where low uncertainty equates to the process being procedural (i.e. repetitive) and high uncertainty equating to the process being decisional. Similarly, the complexity of the process reflects the amount of internal co-ordination required within the process.

	HIGH	COMPLEXITY	LOW
H I G H U N C E R T A I N T Y	<ul style="list-style-type: none"> • Aerospace • Shipbuilding • Major Construction • Etc. 		<ul style="list-style-type: none"> • Cosmetics • Textiles • Food and Drink • Etc.
	FITNESS FOR PURPOSE		TIMELINESS
	KEY Competence: Product Design and Development		KEY Competence: Time to Market
	<ul style="list-style-type: none"> • Automotive • White Goods • Conventional Machine Tools • Etc. 		<ul style="list-style-type: none"> • Simple Components • Paper • Commodity Tools • Glass • Etc.
	VALUE FOR MONEY		PRICE
LOW	KEY Competence: Supply Flexibility		KEY Competence: Manufacturing Productivity and Logistics

	HIGH (DECISIONAL)	HIGH (INTEGRATED)	COMPLEXITY	LOW (STAND ALONE)
U N C E R T A I N T Y		Complex Decisional and Integrated Processes		Simple Decisional and Stand Alone Processes
		Complex Procedural and Integrated Processes		Simple Procedural and Stand Alone Processes
LOW (PROCEDURAL)				

Figure 2 Business classification model.

Figure 3 Process classification model

A Performance Measurement classification model is available (Dixon et al, 1990) which classifies performance measures as follows:

- Internal Measures
- External Measures
- Capability / Learning Measure
- Financial Measures
- Non-Financial Measures

Research by Kehoe and Little (1997) demonstrates that the emphasis on the type of measure does change depending on the classification of the Business Unit, Process or Activity. For example:

- The more uncertain the operating environment the more decisional a Business Unit or Process would need to be. To support this, emphasis should be on capability / learning type measures.
- Where a process consists of a complex array of activities the co-ordination of these activities becomes critical. Therefore, emphasis should be placed on internal measures, which monitor and promote integrity between the activities.

6 THE AUDIT METHOD

An Audit Method has been developed, which allows assessment of the integrity of an organisation's performance measurement system against the Reference Model. Figure 4 contains the executive summary of an actual audit report. The audit method examines:

- the level of conformity with the structure of the reference model;
- appropriateness of the performance measures used;
- appropriateness of the targets and objectives set .

7 CONCLUSIONS

The Reference Model for Integrated Performance Measurement Systems presented in this paper is based on a collection of academic works and industrial best practices. The Viable Systems Model has been used to provide a framework, which facilitates the integration of various models, concepts and practices in to a single Reference Model.

The Reference Model has been documented in a form to make the academic theories and concepts transparent to the user. The Document presents the Refe-

rence Model as a simple series of requirements, which are easily understood without any specialist knowledge.

Executive Summary

An audit of the Performance Measurement Systems used within XYZ Company Distribution (UK) Ltd. was constructed against the IPMS Reference Model v2.3. This audit was conducted through a series of meetings with the key management personnel from XYZ Company Distribution (UK) Ltd.

The logical structure of the business was discussed with the management team prior to the audit and the following three individual business units were identified:

- The OEM Business Unit
 - The Distributor/Retail Business Unit
 - The Service and Repair Business Unit
- The general findings of the report may be summarised as follows:
 - In general terms all stakeholders requirements are understood at all levels.
 - There is a general absence of an external monitor with the exception of the areas which are monitored through the key customers Quarterly Business Reviews. This lack of visibility could compromise XYZ Company's competitive position in the long term.
 - The objectives set each level reflect most of the stakeholders requirements, however there are some critical gaps with respect to competitive requirements of some of the business units.
 - The company does not seem to differentiate between control and improvement measures. This could lead to certain amount of confusion within the business.
 - The Business and Business Unit objectives are relatively well deployed to the core business processes (i.e. the Order Fulfilment Processes). The stakeholder requirements are not at all deployed to the support processes such as Order Entry, Engineering Support and People Capability Management.
 - There is no evidence of a practical Resource Bargaining Process relating to the support processes and theirs stakeholders requirements.
 - The performance reports do not include targets (except in some cases) and time scales which suggest that these measures are for control purposes rather than improvement.
 - There are no evidence of active measures being used against each one of the performance measures relating to objectives at this level – however, there is an improvement planning system in place in the form of action plans which are loosely relate to the business objectives.

Figure 4 Executive summary of an actual audit report.

The Reference Model and the corresponding Audit Methodology has now been used in anger in a number of organisations including:

- Pharmaceutical manufacturing
- Explosives manufacturing
- Bottling and packaging
- Textiles manufacturing
- Electronics manufacturing
- Construction
- Engineering consultancy
- Public sector organisation

In all cases the application of the Reference model and the IPMS Audit identified gaps in the organisation's existing performance measurement systems. In all cases the senior management in the organisation decided to take action to rectify the identified gaps.

In using the Reference Model and the Audit Method to assess the completeness and integrity of an organisations performance measurement system the research team came to the following conclusions:

- Primary beneficiary of the Audit is the organisation itself. That is, the Reference Model together with the Audit provides a mechanism for rationalisation and simplification of the company's existing performance measurement system, resulting in an efficient and effective performance measurement system. In this context the benefits are internal.
- In some cases, the PMS Audit was initiated by the local Economic Development Agency on behalf of a Company. The researchers were asked to conduct a PMS Audit in the Company and report the results of the Audit to the Economic Development Agency. In this case, the Economic Development Agency wanted to be confident that the Company they were about to fund for development had an effective and efficient performance measurement system in place. In this context the motivation and benefits may be considered to be external.
- More recently, the case for the use of the Reference Model and the Audit method as an external control tool was strengthened when the potential for these tools to be used by a franchiser to control its franchisees were identified on two separate occasions. Once by a bank specialising in franchising and once by a specialist franchising consultancy.
- The opportunity for using these tools as control tools across an extended enterprise or industrial network has been identified, mainly as a result of the previous point. The researchers believe that the customer/supplier relationship which exist in an extended enterprise, is well reflected in the structure of the reference model as the reference model is driven through stakeholders requirements. However, at this stage this is a theoretical hypothesis. The researchers intend to develop a new research line to explore this opportunity.
- The measures used by the companies could be classified as quantitative and qualitative. The quantitative measures could be measured in numerical terms where the qualitative measures could only measured qualitatively, e.g. achievement of ISO900 or IIP standards. The Reference Model reflects and accommodates both types of measures as long as the achievement of an objective or progress towards it is objectively measured.

- The use of secondary models, such as the business unit classification model described earlier in the paper, proved to be very valuable where companies were not aware of their own core competencies in terms of order winning and qualifying criterion. However, the researchers believe that the Audit method alone does not explore this area in sufficient depth and it remains the most facilitator dependent aspect of the audit process.
- A large portion of the companies audited listed flexibility and agility as key stakeholder requirements and objectives. However, almost in all cases, there were no measures of flexibility or agility at business, business unit or process levels. Although there were some measures which compliment flexibility and agility objectives, these were applied at activity level, such as change-over times, and its relationship with the higher level objectives were not clearly understood.
- In all cases, although all companies had performance measures of various degrees of complexity and detail, they did not have a performance measurement system, which structured and organised these measures in a structured manner. Consequently the cause and effect relationships between various objectives and performance measures were not clearly understood and communicated. The audit process, through its initial stages, structures and classifies the company's performance measures according to the logical structure of the business (i.e. Business, Business Unit, Business Processes and Activities). This classification itself aids in the clarification of the structure of the company's existing, but informal, performance measurement system.

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9 BIOGRAPHIES

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