

Integrated Performance Measurement Systems: A Development Guide

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Abstract

The Performance Management Process is seen as a closed loop control system which deploys policy and strategy, and obtains feedback from various levels in order to manage the performance of the business. The Performance Measurement System is the information system which is at the heart of the Performance Management Process and it is of critical importance to the effective and efficient functioning of the Performance Management System. Research identified two critical elements with respect to the content and structure of the Performance Measurement System, these are: Integrity and Deployment. The Viable Systems Model (VSM) provides a framework for assessing the Integrity of the performance measurement system. The Reference Model developed for Integrated Performance Measurement Systems provides a framework against which performance measurement system can be designed and audited.

Keywords: Performance Management, Performance Measurement, Integration, Audit

1.0 INTRODUCTION

Business Performance improvements arising from increased manufacturing integration continues to be one of the primary competitive issues of the 90's. Recent research in to manufacturing systems integration (Carrie and Macintosh, 1992) has identified the need for effective deployment of business objectives down through the organisation and the subsequent measurement of performance in critical areas as key elements of sustainable competitive advantage. The objective of the current research and development programme at the University of Strathclyde - Manufacturing Systems Group, is to provide industry with a comprehensive and rigorous set of tools, techniques and procedures to allow auditing of existing performance measurement systems against a reference model and consequently design more robust, flexible and integrated performance measurement systems. It is envisaged that a correctly structured and designed performance measurement system would provide the basis for a rigorous and effective performance management system which could be used as a management tool by strategic, tactical and operational levels of management.

The objective of this paper is to introduce and develop the concept of Performance Management as a key business process and focus on the criticality of the Performance Measurement System embedded within. It presents a reference model for the Performance Measurement System which is based on industry best practices. Figure 1 illustrates the concepts and objectives of the work presented in this paper.

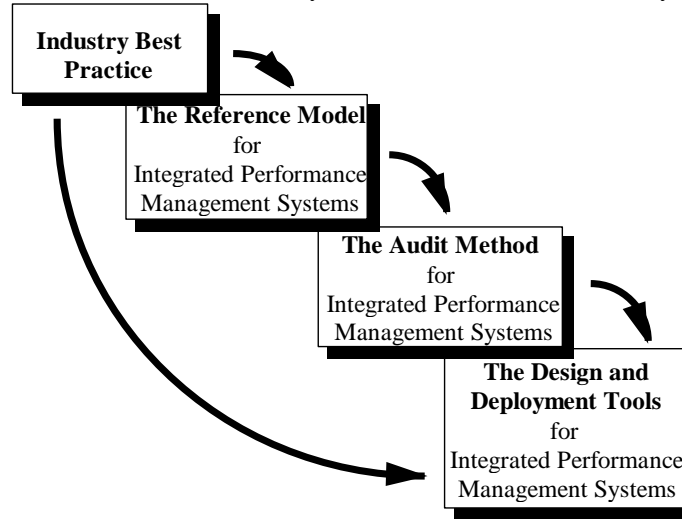


Figure 1. Concept and objectives of the R&D programme at the University of Strathclyde

2.0 BACKGROUND

The hypothesis behind the research described in this paper was borne directly from the previous research aimed at developing integrating methods based on analysis of information, material flow and organisational systems (Carrie and Macintosh, 1992). This previous programme identified the value of using performance measurement to deploy business objectives and to pinpoint and monitor performance improvements. Other researchers have also noted the links between performance measures and strategic plans and/or critical success factors of the business. The research by Grady (1991) and Eccles and Pyburn (1992) supports the same conclusions drawn in the earlier research programme. In summary, the need for an integrated set of performance measures which support rather than contradict business objectives is now clearly established (Bititci, 1994). In addition, there is already considerable work being carried out by the accounting profession on performance measurement. Indeed, most manufacturing organisations have extensive performance measurement systems based on cost and financial accounting practices. However, because these techniques are often based on old fashion overhead absorption methods they fail to support the current business objectives and do not enable continuous improvement (Bititci, 1993). More recent innovations such as Activity Based Costing improve allocation methods but still do not promote continuous improvement and strategic orientation. Notable work has been carried out by Kaplan (1990 and 1993) and Johnson and Kaplan (1987) in recognition of these weaknesses. Neely (1993) summarises the short comings of the current accounting practices with respect to performance measurement in manufacturing enterprises.

Because, financial measures that are currently in place are not supporting the change process, there is a case for new styles of measurement systems that are appropriate to the needs of the modern manufacturing industry. McNair and Masconi (1987), Drucker (1990) and Russell (1992) show that there is a need for alignment of financial and non-financial measures that fit within a strategic framework. Furthermore, based on research carried out by Bititci and Swenson (1993), Blenkinsop and Burns (1991) and Gelders et al (1993) there is evidence that, even in companies where quality oriented performance measures are employed, these are still being use in a manner which does not promote integration. There has been several cases cited where the company's strategy, improvement projects and performance measures were in conflict. A paper by Bititci (1995) asserted that performance management should be viewed as a key business process which is central to the future well-being and prosperity of any manufacturing enterprise. In this paper this view is further elaborated and a clear distinction is made between performance measurement and performance management. The performance measurement system is seen as the information system which enables the performance management process to function effectively and efficiently.

Since the Seattle Conference a survey of manufacturing enterprises has been conducted to establish the senior management's view of their performance management process. The survey results shows that majority of companies have a number of systems for performance management. These range from formal systems including, management accounting, and incentive schemes to informal uses of various non-financial performance measures. The survey

indicated that when questioned, majority of the executives did not recognise performance management as a process, but identified the need to:-

- Recognise the Performance Management as a critical business process
- Define the objectives of the Performance Management Process
- Position the Performance Management Process with respect to other processes.
- Define the focus of the Performance Management Process
- Define the structure of the Performance Management Process

3.0 THE PERFORMANCE MANAGEMENT PROCESS

The Performance Management Process is the process by which the company manages its performance in line with its corporate and functional strategies and objectives. The objective of this process is to provide a proactive closed loop control system, where the corporate and functional strategies are deployed to all business processes, activities, tasks and personnel, and feedback is obtained through the performance measurement system to enable appropriate management decisions (Figure 2).



Figure 2. The closed loop deployment and feedback system for the Performance Management Process.

In essence, the Performance Management Process defines how an organisation uses various systems to manage its performance. These systems include, but are not limited to:-

- Strategy Development and Review
- Management Accounting
- Management by Objectives
- Non-financial performance measures - informal
- Non-financial performance measures - formal
- Incentive / Bonus Scheme
- Personnel Appraisal and Review

At the heart of the performance management process, there is an information system which enables the closed loop deployment and feedback system. This information system is the Performance Measurement System which should integrate all relevant information from the relevant systems (as listed above). In this context integration means that the performance measurement system should enable the correct deployment of the strategic and tactical objectives of the business as well as providing a structured framework to allow the relevant information to feedback to the appropriate points to facilitate the decision and control processes. This information system, i.e. the Performance Measurement System, to be effective in achieving its objectives as described above, should take account of the Strategic and Environmental factors relating to the business as well as considering the structure of the organisation, its processes, functions and their relationships. Similarly the effectiveness of the Performance Management Process which makes use of this information system depends on how this information is used to manage the performance of

the business. Thus, it is critical that it gives consideration to soft factors such as culture, behaviour and attitudes as well as harder factors such as reporting structures, responsibilities and the use of information technology. Figure 3 summarises this view of the Performance Management Process. In this context the structure and configuration of the Performance Measurement System becomes critical to the efficiency and effectiveness of the Performance Management Process. Therefore, the remainder of this paper focuses on the Performance Measurement System.

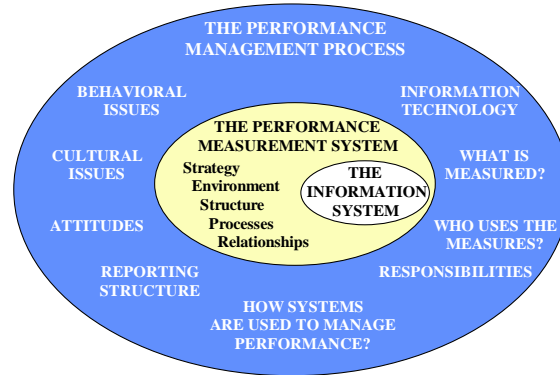


Figure 3. The Performance Management Process and the position of the Performance Measurement System

3.1 The Structure and Configuration of the Performance Measurement System

The research work undertaken at the University of Strathclyde revealed two critical considerations with respect to the structure and configuration of Performance Measurement Systems. These are:-

- Integrity of the System
- Deployment

3.1.0 Integrity of the System

Integrity refers to the ability of the performance measurement system to promote integration between various areas of the business. Previous research on manufacturing systems integration undertaken by the same consortium identified the value of the Viable Systems Model (Beer, 1979 and Blenkinsop, 1993) as a framework for assessing a systems integrity. The theory behind the Viable Systems Model (VSM) is that for any system to be viable it must have five sub-systems. The VSM identifies these five sub-systems as System 1, System 2, System 3, System 4, System 5 and the Meta System which is a combination of the Systems 3, 4 and 5. These systems are discussed in the following paragraphs.

System 1 are the operational units which produces the goods or services. In other words it represents the productive function of the organisation. It could be interpreted that system 1 consists of Business Processes such as Order Fulfilment, Product Development, Get Order, and so on. From a performance measurement systems perspective system 1 will consists of performance measures which objectively measure the performance of an individual Business Process.

System 2 is the supervisory system which co-ordinates the activities of operational units. This system represents the Business Process which co-ordinates the activities of system one.

System 3 represents the tactical management system which manages the operations of the systems 1 and 2 by setting targets and priorities. Also, in terms of the Meta system it would be the system for the implementation of change. This is the management system which is responsible for the performance of business processes and activities in line with the requirements of the higher level systems. From a performance measurement systems perspective this is the system which deploys the strategic policies and priorities. It is therefore responsible for deploying targets and priorities to the measures under systems 1 and 2

System 4 is the developmental system which concerns itself with the external environment and therefore the future. Its focus is on improvement. In terms of the Meta system this is the system which identifies the changes necessary to the lower level systems, i.e. systems 1, 2 and 3. This effectively is the benchmarking system which by focusing externally identifies the improvement gaps. The performance measures used in this system tends to be externally focused and comparative, e.g. delivery performance with respect to the competitors or market requirements. In addition to measuring the performance gaps with respect to the external environment, one other key function of this

system is the prioritisation of the these gaps in line with the corporate and strategic objectives set by the higher level system 5. It would be appropriate to combine the external focus of this system with the Results category of the EFQM model for TQM where the focus is on Customer Satisfaction, People satisfaction, Business results and Society satisfaction. From a reference model point of view it may be appropriate to expect externally oriented measures corresponding to each one of the four areas.

System 5 is the boss, this system sets the direction, the policy and strategy the organisation would be adopting in the future. With respect to performance measurement system, this systems sets the high level priorities and targets by relating the performance gaps, from system 4, to business objectives and priorities.

The Meta System is the combination of systems 5, 4 and 3 which is responsible for identifying and managing change. System 5 sets policy and direction, system 4 identifies the necessary changes and system 3 implements these changes. According to VSM these five systems represents the core of any viable system. However, within VSM there are other concepts which are of critical importance to performance management. These concepts are further explained in the following paragraphs.

Amplification is the concept which refers to the deployment of objectives from higher level systems to lower level systems. For example, the meta system will set the strategic objectives and deploy these down to the operational systems (i.e. system 1's).

Trnsduction is the concept used to describe the translation process required during Amplification. That is, as higher level objectives are deployed down to lower levels, the objectives are translated in to locally meaningful terms.

Attenuation is the concept which describes the upward communication process where lower level systems provide feedback to the higher level systems by filtering the large variety of information to critical few.

Recursion is the concept which describes the repetitive nature of systems thinking. In VSM each operational system must exist as a viable system in its own right. Therefore, each viable system should have its own five sub-systems. Figure 4 illustrates the levels of recursion in the VSM architecture developed by the research group. This architecture identifies three levels of recursion. At the first level of recursion the business is considered as a whole with its own management and with its own system 1's as the Business Units. Each Business Unit consists of its own local management (i.e. systems 2, 3, 4 and 5) and own system 1's as the key Business Processes. Similarly each Business Process consists of its own management processes (i.e. systems 2, 3, 4 and 5) and own system 1's as the key Activities. The readers should note that the concepts of Amplification, Transductions and Attenuation apply within each level of recursion as well as between these levels of recursion.

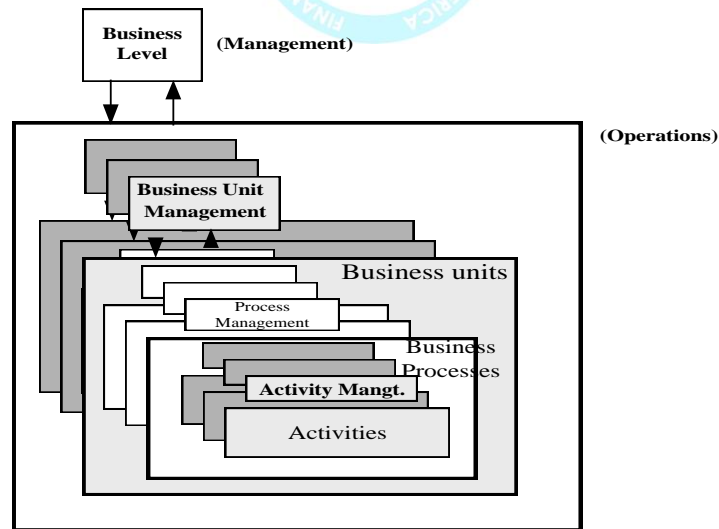


Figure 4. Levels of recursion and the VSM architecture of an enterprise.

Deployment: Deployment refers to the deployment of business objectives and policies throughout the hierarchical structure of the organisation as illustrated earlier in figure 2. Objective of deployment, in this context, is to ensure that:

- Performance measures used at various levels of the organisation reflect the business objectives and policies.
- Deployment is consistent through the hierarchy of the organisation.

- Deployment is relevant and correct with respect to the impact and influence of individual business areas (i.e. processes, functions and activities).

3.2 Reference Model

The reference model developed by the research team at University of Strathclyde is based upon the two facets of the performance measurement systems as identified above. These are: Integrity and Deployment. Although in the above section Integrity and Deployment has been discussed as if they are mutually exclusive, in practice deployment is a function of integrity. However, VSM itself does not clearly establish the exact requirements for correct deployment. But, when it is combined with the three basic objectives specified with respect to deployment a complete reference model is developed. A pictorial view of this reference model is provided in Figure 5. A reference model has been developed following a study of best practices. The Viable Systems Model (Beer) has been adopted to provide the basic structure of the Reference Model which consists of the following four levels:- **Corporate, Business Units, Business Processes and Activities**. At each level of the structure four key factors are considered, these are:- **Stakeholders, Control criteria, External measures, Improvement objectives and Internal measures**. The reference model places emphasis on the **amplification, transduction and attenuation** of performance objectives between these levels.

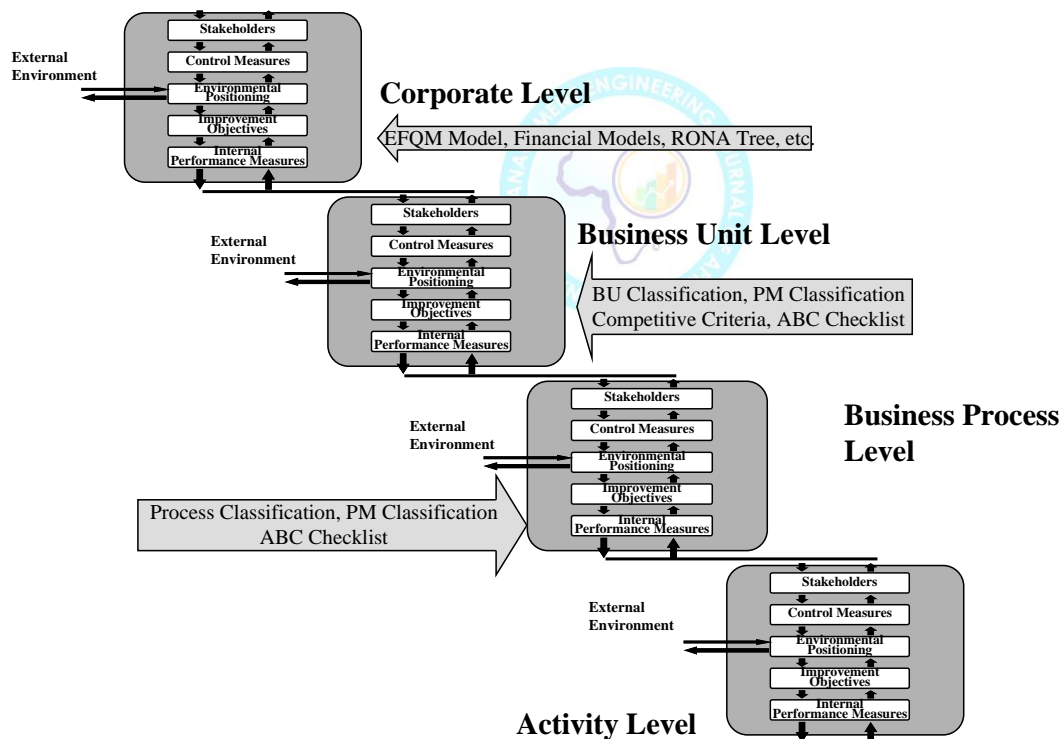


Figure 5. A Reference Model for Integrated Performance Measurement Systems

The reference model uses this basic structure to integrate a following concepts into a single framework:

- **Policy Deployment.** The deployment of corporate and stakeholder’s objectives throughout the organisation.
- **Competitive Criteria and Benchmarking.** The definition of key competitive factors and position of the Business and the Business Units within its competitive environment.
- **Process Orientation.** Focusing on key business processes to manage business performance.

- **Normative Planning.** The measurement methodology which differentiates between Actuality, Capability and Potentiality.
- **Active Monitoring.** The use of proactive performance measures rather than reactive measures.

Within the framework created, the Reference Model uses the following models to ensure completeness and integrity of the performance measurement system.

- The European Model for Business Excellence (EFQM,1995)
- Business Classification Model (Puttick, ??? and Hill, 1993)
- Systems Classification Model (Ginzberg)
- Performance Measures Classification Model (Dixon, Nanni and Vollmann, 1990).

4.0 The Audit Method

Having identified and defined the key characteristics of an integrated performance measurement system (i.e. Integrity and Deployment), the researchers at the University of Strathclyde have developed and tested a method for auditing the Integrity and Deployment of the performance measurement system as defined in the reference model. The audit process consists of three phases. These are:-

- Data Collection
- Integrity Audit
- Deployment Audit

4.1 Data Collection Phase

The Data Collection Phase, using a workbook developed by the research team, collects all information relevant to the Performance Management Process of the business. The information collected includes:-

- Identification of Business Units (BU) within the business.
- The market requirements in terms of qualifiers and differentiators for each BU.
- The development plans or objectives for the business or each of its BU's.
- The performance measures used and reviewed by the executive management team within the business, i.e. the Strategic Performance Measures
- The performance measures used and reviewed within each function of the business, i.e. the Functional or Operational Performance Measures.
- Personal objectives and any associated incentive scheme for the executives, managers, supervisors and operational personnel
- Review, reporting and performance responsibilities associated with measures used at all levels.

Once the data is collected it is then analysed to conduct the Integrity and Deployment audits respectively.

4.2 Integrity Audit

In order to conduct the Integrity Audit in a comprehensive, rigorous and repeatable manner, the research team has compiled a checklist to search for objective evidence supporting the existence of all five systems within the VSM. Following the analysis of this data against this checklist various gaps are identified with respect to the completeness and integrity of the performance measurement system. An extract from the results of the Integrity Audit carried out on a collaborating organisation illustrates the nature of the conclusions obtained from such an audit (Table 1).

System 5

- A policy making system is in place where the business objectives and strategy is stated in the form of a business plan.
- There is no evidence of the business plan and objectives being based on external competitive position and actual performance of the business.

System 4

- There is no evidence of a formal or informal mechanism for identifying the company's current performance with respect to the external environment.
- The strategic objectives are not expressed in measurable terms with associated targets - with the exception of the objective relating to *reduction of material costs*.

System 3

- There is no evidence of a system which prioritises and deploys the business objectives to systems two and one any deployment seems to be random (see deployment audit results).

System 2

- There is no evidence of system 2/co-ordination type measures.
- There is no evidence of the recognition of the key business processes.

System 1

- There are numerous measures at this level, however non of these are linked in any way to the business objectives.
- Measures at this level do not have targets associated with them
- Measures at this level are not prioritised.

Table 1. Extracts from an Integrity Audit

4.3 The Deployment Audit

During early stages of the research programme it became apparent that most businesses, small or large, consists of discrete business units which in turn may be treated as standalone businesses. The common terminology applied to these business units are Strategic Business Units (SBU). The configuration of SBU's within an organisation could vary dramatically. In one organisation it could be very much product driven in others it could be market driven and in some it may be a hybrid of market and product characteristics.

In the first instance the deployment audit requires the identification of the individual SBU's and their strategic requirements in terms of *the qualifiers* and *the differentiators*. The performance measurement system should ensure that the priorities between the above two criteria are balanced and appropriately managed in a dynamic environment.

In order to audit the deployment of the performance measurement system a there stage audit method has been developed:

- **Stage one** focuses on to the requirements of each SBU environment and through a series of matrices assesses the deployment of environmental requirements through business objectives to strategic and functional performance measures.
- **Stage two** focuses on to the business objectives and through a series of similar set of matrices assesses their deployment through the strategic performance measures to functional levels.
- **Stage three** focuses on the deployment of strategic performance measures to the functional levels, again through the use of similar matrices.

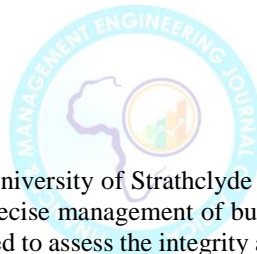
The audit process is designed to be rigorous in order to ensure repeatability. A scoring system has been devised to measure the strength of deployment which results in a rigorous approach and repeatable conclusions. An extract from the results of the Deployment Audit carried out on a collaborating organisation illustrates the nature of the conclusions obtained from such an audit (Table 2).

STAGE 1: BU 1 - Market Requirements

- Differentiator *Production Flexibility* is:-
 - not deployed as an business objective
 - not deployed as a strategic performance measure
 - marginally deployed within the manufacturing function with no direct measure of performance and associated target.
- Qualifier *Product Functional Performance* is:-
 - partially deployed as an business objective
 - not deployed as a strategic performance measure

<ul style="list-style-type: none"> • is marginally deployed at the Manufacturing function and is not deployed in any other function. Expected deployment path for this measure would have included Manufacturing and Technical functions. <p>Stage 2: BU 1 - Business Objectives</p> <ul style="list-style-type: none"> • Business objective <i>Reduce Production and Inventory Costs by Range Rationalisation</i> is:- <ul style="list-style-type: none"> • is not deployed as a strategic measure • is partially deployed in the Manufacturing function. Expected deployment path for this measure would have been the Technical function. <p>Stage 3: BU 1 - Strategic Measures</p> <ul style="list-style-type: none"> • Strategic measure <i>Cost</i> is strongly deployed across all functions. Expected deployment path for this measure would have included all functions. <p>Terminology:- Strongly deployed - deployment is measurable with an associated target Partially deployed - deployment is measurable with no target or priority. Marginally deployed - deployment is indirect Expected deployment path - identifies the functions where the reference model would expect to see a strong deployment</p>

Table 2. Extracts from an Deployment Audit



4.0 CONCLUSIONS

The research and development effort at the University of Strathclyde is aimed at development of practical tools and techniques to facilitate more scientific and precise management of business performance. To this end, the first stage of the work produced an audit method designed to assess the integrity and relevance of the performance measurement system used in an organisation. Figure 6, below, summarises the output from the first stage of the research.

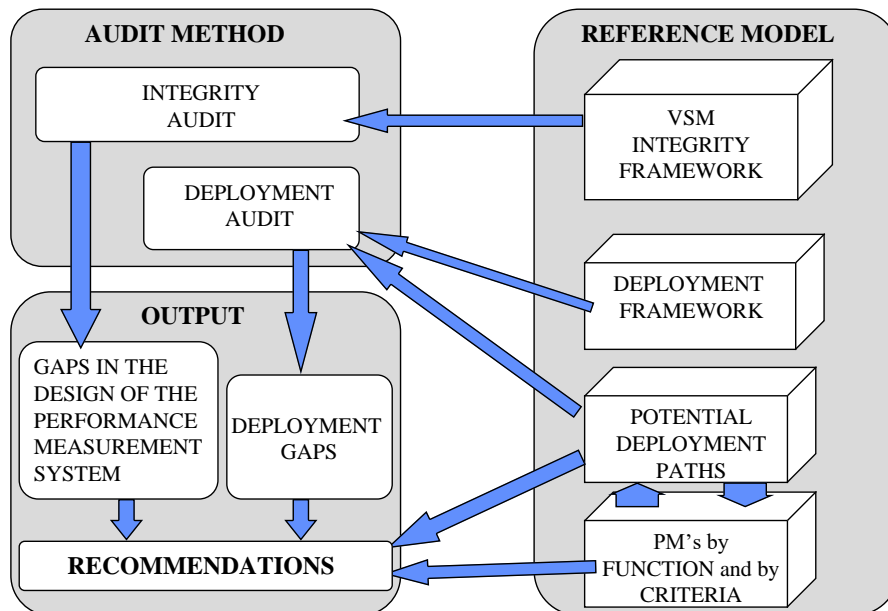


Figure 6. Stage 1 research output from the University of Strathclyde.

More specifically the research and development work presented in this paper may be summarised as follows:-

- The research project carried out at the University of Strathclyde as part of a larger project focusing on performance measurement systems identified the need to study Performance Management as a process.
- The Performance Management Process is seen as a closed loop control system which deploys policy and strategy, and obtains feedback from various levels in order to manage the performance of the business.
- The Performance Measurement System is the information system which is at the heart of the Performance Management Process and it is of critical importance to the effective and efficient functioning of the Performance Management System.
- Research Identified two critical elements with respect to the content and structure of the Performance Measurement System, these are:- Integrity and Deployment.
- The Viable Systems Model (VSM) provides a framework for assessing the Integrity of the performance measurement system.
- Within the VSM framework, Deployment is an integral element which largely corresponds to system 3.
- The Reference Model developed for Integrated Performance Measurement Systems provides a framework against which performance measurement system can be designed and audited.
- The Audit Methods developed to assess the Integrity and Deployment of the performance measurement system provide simple but rigorous and repeatable tools which may be used to improve the effectiveness and efficiency of the Performance Management Process.

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