

# An objective-oriented and product-line-based manufacturing performance measurement

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## Abstract

Performance-measurement systems (PMSs) that are based on traditional cost-accounting systems do not capture the relevant performance issues for today's manufacturing environment. A variety of integrated systems have been proposed to overcome the limitations of the traditional PMSs, but these systems have been inadequate. This paper presents an integrated dynamic performance measurement system (IDPMS) that integrates three main areas: company management, process improvement, and the factory shop floor. To achieve an integrated system, these three areas are linked through dynamically defined performance measures and performance standards from production planning to customer. The indicators are transformed into quantitative just-in-time parameters that are utilized with management by objectives (MBO) principles to develop a manufacturing PMS that satisfies both internal and external customers. An example is given that illustrates how the IDPMS addresses current PMS requirements.

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## 1. Introduction

In today's highly competitive business environment, product manufacturers need to provide customized and innovative products. To achieve this, they require innovative methods of performance measurement. In measuring manufacturing performance, manufacturers usually compare their own plants with other manufacturing plants in the industry in terms of such parameters as customer satisfaction, product quality, speed in completing manufacturing orders, productivity, diversity of

product line, and flexibility in manufacturing new products (Cordero et al., 2005). The essential function of a performance measure is to assess how well the activities within a process, or the outputs of a process, achieve specified goals. This involves a comparison of actual results with a predetermined goal and an assessment of the extent of any deviation from that goal. A target level of performance is usually expressed as a quantitative standard, value, or rate (Ahmad et al., 2005).

The selection of a range of performance measures appropriate to a particular company should be made in the light of the company's strategic intentions, and should suit the competitive environment in which the company operates. For example,

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if technical leadership and product innovation represent the basis of a manufacturing company's competitive advantage, performance in these areas must be measured relative to the competitors. Similarly, if a service company differentiates itself in the marketplace on the basis of quality of service, it should be monitoring and controlling the desired level of quality (Ahmad and Dhafr, 2002). Whether the company is in the manufacturing sector or the service sector, it is necessary to choose an appropriate range of performance measures, and these measures must be balanced to ensure that one performance or set of performance dimensions is not stressed to the detriment of others. The mix that is chosen will differ from case to case. Incomplete metrics can lead to inappropriate action (Ahmad and Dhafr, 2002), and performance areas must therefore be operationalized (that is, made measurable) in a way that allows performance to be adequately measured against relevant performance indicators (Jose et al., 1999). To achieve this, many companies have adopted modern management strategies—such as total quality management (TQM), just-in-time (JIT), computer-integrated manufacturing (CIM), and optimized production realization (OPR).

A business can achieve success only by understanding and fulfilling the needs of its customers. A failure to recognize this can cause huge potential losses (Ernst and Young, 1992). A customer focus involves the establishment of links between customer requirements and internal processes (Sousa, 2003; Reiner, 2005), and implies a shifting of company goals from the maximization of company profits in one project to the optimization of the value of the customer's project by meeting jointly agreed objectives (Cova and Salle, 2005). However, having adopted such a customer focus, many companies use performance measures that are based on outdated management cost systems that are incompatible with their new operating philosophies. Consequently, many researchers are suggesting new comprehensive approaches to performance measurement—approaches that support day-to-day operations by providing managers, supervisors, and operators with timely and relevant information (Shah and Ward, 2003).

To provide a comprehensive overview of company performance, researchers have tried to combine more than one performance measurement through the development of integrated performance-measurement systems (PMSs). These integrated systems

address many of the shortcomings of older PMSs; however, there are still issues associated with today's manufacturing environment that must be considered. For example, these systems work primarily as monitoring-and-controlling tools, and most have not incorporated an explicit feedback loop that supports improvement in performance measurement. In addition, these systems are not dynamic, and they cannot therefore provide mechanisms for adapting to a changing manufacturing environment.

To address these shortcomings, this paper presents an integrated dynamic performance-measurement system (IDPMS), which has been developed in collaboration with an international electronics firm ('D company') in Taiwan. The proposed system focuses on improving manufacturing competitiveness by overcoming the limitations of existing PMSs and by facilitating continuous improvement (Ghalayini et al., 1997). To this end, the system incorporates interaction among three groups: (i) management (production planning); (ii) manufacturing; and (iii) customers. Having proposed the system and having discussed the indicators used in it, the present paper presents a case simulation to verify the practical suitability of the proposed system.

The remainder of this paper is arranged as follows. Following this Introduction, the next section of the paper reviews the literature pertaining to performance measurement. Section 3 then presents the proposed IDPMS. Section 4 illustrates how the system would be applied. Sections 5 and 6 provide a result comparison and summarize the benefits of IDPMS with respect to existing PMSs.

## 2. Literature review

### 2.1. Overview

An effective PMS should include the traditional financial and cost-accounting criteria used by senior management and also the tactical-performance criteria that are used in assessing a firm's current level of competitiveness. Such tactical-performance measures vary according to the needs of the various management levels and functional areas within the organization. Each functional area should develop and utilize a set of performance criteria consistent with its particular operating characteristics and strategic objectives. An effective PMS should lead

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