



An empirical study of performance measurement systems in manufacturing companies

J.E. Carr, M. Hasan *

School of Mechanical & Manufacturing Engineering,
The University of New South Wales, Sydney 2052, Australia

* Corresponding author: E-mail address: m.hasan@unsw.edu.au

Received 10.09.2008; published in revised form 01.12.2008

Manufacturing and processing

ABSTRACT

Purpose: The aims of this study were to, determine the current state of performance measurement systems in New Zealand manufacturing companies and determine what approaches to performance measurement are used by New Zealand manufacturer.

Design/methodology/approach: A questionnaire, sent out to a sample of New Zealand manufacturing companies, was used to determine the current state of performance measurement systems in New Zealand. More specifically, manufacturers New Zealand wide were asked to what extent they used various performance measures, whether they had a performance measurement system in place and if so, what type and whether or not they had an enterprise planning system or any information system to support their PMS. The study also ascertained the manufacturers view on the topics of linking performance measures to staff compensation, and whether there had been cost savings and/or improvements in revenue generation as a result of PMS.

Findings: New Zealand manufacturer's are not only aware of, but are also implementing modern performance measurement system. Furthermore, the respondents indicated that the non financial measures are being used more frequently than the financial. However, it is important and somewhat disappointing to note that irrespective of the type of PM approach adopted, the majority of the respondents' information systems are not giving good support to their performance measurement endeavours. It appears that the respondents information systems are still very much attuned to the historical dominance of the financials. This is perhaps not all that surprising even when the system is an ERP. ERP systems are typically modularised and if expense or time is an issue with the information system implementation, it is the financial module that organisations typically implement before anything else.

Practical implications: World class performance measurement techniques are being used, and there are indications that financial as well as non-financial measures are being used. Whether the organizations have got the balance right is something they may only have a better feel for over time. It also appears that the PMS are not being reviewed or modified as often as might have been anticipated from the literature. Certainly the literature is adamant that a PMS should not be static and must change to reflect the organizational strategy and business environment in which it operates.

Originality/value: There have been indications that some organizations have implemented an ERP system in order to keep it up with their competitors. It is hoped that this is not what has happened with the new PMS approaches.

Keywords: Manufacturing; Performance; Measurement; Organisation

1. Introduction

The environment in which organizations operate has undergone considerable change over recent years. Globalisation, deregulation, information technology, competitive pressures, consumerism, changing work attitudes, and the emergence of a knowledge-based economy, have all contributed to some dramatic changes in the business environment [7]. Changes in the manufacturing industry, in particular have been considerable and management accounting practices have simply not kept pace. Over the years management accounting has seemingly been reduced to a cost accounting exercise that focuses on measuring cost of goods sold and inventory on hand; financial figures that contribute little to the internal information needs of management particularly at the operational level. Further, it has become increasingly obvious that the performance measures generated by the old stove piped, functional accounting systems have serious flaws and can lead to numerous problems.

Traditional, financially focused systems can be damaging to a manufacturing company because the current business environment demand more accurate and different measures of performance not just an historical perspective of cost driven performance measures [6]. Eccles [3] points out, that even senior executives have recognized that “new strategies and competitive realities demand new measurement systems” what matters is how a company is doing compared with its current competitors, not with its own past” (p.134, [3]) the new systems emerging treat financial figures as just one of a more expansive set of measures rather than the predominant measure. Furthermore, organizations are recognizing the importance of having both qualitative and quantitative information in the current competitive, deregulated global market.

1.1. Developments in performance measurement

Grady [5] suggests “performance measures should be implemented as a means of articulating strategy and monitoring business results”. Ideally the measures will evolve from the organisations’s strategy, be developed to support business objectives, be collected and reported at various levels in the organization and be linked cross functionally. Beischel and Smith [1] also provide a framework for measuring manufacturing performance and it stems from two principal ideas. Firstly, that manufacturing performance can and should, be linked to company financial performance”. Secondly, “all manufacturing measures, at all organizational levels, should be linked to ensure constancy of purpose among organizational levels and to point to cause-and-effect relationships”. The rationale is that if these things are done effectively, employees at all levels will be aware of what the problems are and know how to fix them in order to improve performance. It is important to recognize that when deciding on performance measures, all levels of management need feedback on whether organizational strategies and objectives are being met. However, in a dynamic business environment strategies cannot be static, they must be continually changing, responding to the business environment. Thus it follows that performance measures

linked to those strategies, will also have to change. In the past this was not common practice however with new ideology of performance measurement systems, the importance of having dynamic performance measurement systems, the importance of having dynamic performance measurement systems is acknowledged [6]. Modern performance measurement theorists [1] also support manufacturing measures being linked to financial ones somewhere in the measurement system. Their reasoning is that manufacturing decisions ultimately impact on the business’s profitability (primarily through sales) which in turn impacts on future investment in manufacturing resources and the survival of the business. Certainly recent research by Gosselin [4] highlight the continuing importance of financial measures in Canadian manufacturing companies despite the increasing emphasis put on non-financial measures in the literature. A combination of cost and non-cost measures arguably supports the notion of cross functional strategies and performance measures. The key activities in a performance measurement system, should be based on an analysis of the business, and should drive the business’s critical strategy. Maskell [7] argues that another important component of a performance measurement system is competitive benchmarking. Certainly an external benchmark provides a means of evaluating the feedback from your PMS against some independent’ best practice’ source. Competitive benchmarking has also been used by a number of industry organizations (including Xerox) when setting goals for their business. These organizations have found that not only is their competitors’ data available but with some analysis they have been able to determine their competitors strengths and weaknesses.

It appears that a good PMS will have an appropriate balance of internal measures with external benchmarks, cost and non-cost measures, results measures and process measures. An organization with an effective PMS that incorporates all these things will be able to promote continuous improvement through corrective actions when results and processes are seen to be drifting away from the organisation’s strategic plans and objectives. Performance measures should be used to enhance a continuous improvement environment in an organization and stimulate employee involvement.

Certainly the literature suggests modern performance measurement systems are placing less significance on financial measures, as discussed earlier, nonetheless it is still important to link the performance measures with the financial measures. Through this linkage the performance measures may have predictive value; they may be early indicators of profit levels. In addition, quality has become one of the major strategic tools for manufacturers to stay competitive and as a consequence more resources are being diverted to monitor things like; defect rates, response time and delivery commitments to improve their overall performance.

However, as Gosselin [4] discovered, little research has been done on the actual application of the new PMS’s to business in the real world. Chenhall [2] also points out in his research, that numerous different combinations of systems exist, and very little is known about them. It appears there is a need for studies that investigate the extent to which companies have implemented modern performance measurement systems and what type of system they have in place. The drivers for using particular performance measures also need to be examined in more depth.

Two recent empirical studies relevant to this work are those conducted by Gosselin [4] and Chenhall [2] who was interested in the

role of strategic performance measurement systems (SPMS) in organizations competitive strategy development. On the other hand Gosselin [4] investigated how well the literature aligned with what Canadian manufacturers actually implemented in terms of a PMS. Both studies placed importance on the role of non financial measures in manufacturing PMS.

However, of particular interest is Gosselin's [4] study and indeed his questionnaire was adopted, with some modifications for this research. Gosselin found that manufacturers in Canada are still using financial performance measures, and that few had implemented modern approaches such as Balanced Scorecard and Integrated Performance Measurement Systems. It is also evident in his findings that non financial measures were not extensively used by Canadian manufacturers and their use did not increase as a result of adopting one of the new PM approaches. This researcher indicated there was scope for further research in this area and that a theory was needed to explain how firms used their performance measures to enhance their activities and competitiveness.

The aims of this study were to:

- determine the current state of performance measurement systems in New Zealand manufacturing companies
- determine what approaches to performance measurement are used by New Zealand manufacturer.

2. Research design

A questionnaire, sent out to a sample of New Zealand manufacturing companies, was used to determine the current state of performance measurement systems in New Zealand. More specifically, manufacturers New Zealand wide were asked to what extent they used various performance measures, whether they had a performance measurement system in place and if so, what type and whether or not they had an enterprise planning system or any information system to support their PMS. The study also ascertained the manufacturers view on the topics of linking performance measures to staff compensation, and whether there had been cost savings and/or improvements in revenue generation as a result of PMS.

2.1. Sample selection

The organizations surveyed were selected on the basis that they were manufacturing oriented. The 219 organisations meeting this criterion were selected from a commercially held New Zealand database. Copies of the questionnaire and a covering letter were sent to the director of Manufacturing for each of the identified manufacturing companies. The survey instrument contained no means by which individual respondents could be identified.

2.2. Research instrument

The survey instrument was adopted from one used to examine organizations prescription to current performance measurement literature [4]. The instrument was divided into four sections.

Section A solicited information regarding the importance placed on different performance measures by New Zealand manufacturing companies by asking them to indicate to what extent they used 73 common performance measures. Section B was pertaining to the performance measurement approach adopted by the organization and whether they were planning to implement a new approach in the foreseeable future. They were then asked to comment on the effectiveness of their system, staff compensation, whether they reviewed performance measures regularly, who was responsible for decision making regarding the implementation of new PM's and ISO accreditation. Participants were asked questions about their organisations's information system in section C. In particular, they were asked if they had an ERP system and/or any specialised software or systems to support their PMS. Respondents were then asked to evaluate on a five point scale the level to which their information system supported eleven specific PMS reporting factors. The last section, section D, solicited information on the background and size of the respondent's organization.

A copy of the survey instrument, covering letter and a pre-addressed envelope was mailed to each of the 219 companies who appeared to be of a manufacturing nature and were contactable. No follow-up was conducted due to expense and time constraint..

2.3. Limitations

The study has several limitations. First, one question asked if the organization reviews its performance measures regularly; regularly is a highly subjective work. Thus the participants' answers to this question were based on their perception of what constituted 'regularly' for an organization. This gives rise to a potential inconsistency in the response to this question.

A major limitation is the low response rate, which is probably due in part to the lack of a follow up mail out. There was a lack of funds to send out a second round and time to record and analyse the data was limited. This has resulted in low response rate and could produce a non response bias.

3. Results

3.1. Response rate

Two questionnaires mailed to the director of manufacturing were returned as a result of having incorrect addresses. A total of 38 responses were received, 30 of which were usable, giving a response rate of 15%. The sample population was fairly evenly distributed between those who were international firms (53.3%) and those who were local firms (46.7%). The respondents' status as an international or a local firm provided an opportunity to examine whether world class performance measurement systems is only prevalent in organizations who have offices globally.

Non response bias can result from a low response rate and/or missing responses affecting the conclusions about the variables being examined in the study. The anonymity of the survey responses combined with the limited data received about the sample population made testing for non response error difficult.

However, it has been reported that mail surveys are not the most effective response generators [8]. Thus taking this point into consideration as well as the fact that no second mail out was conducted, 15% is possibly as high as could be expected in the circumstances. It is too low however, to make any statistical testing meaningful.

3.2. Results and analysis

Respondent Organization Profiles

The respondents were spread over a range of industry groupings with the majority being, food and beverage at 16.7% and industrial, also at 16.7%. The next largest industry was building materials and construction with 3.3%, closely followed by electronic and computers (10%) and equipment and services (10%). In the tail end were; agriculture (6.7%), textile and apparel (6.7%), intermediate and durables (3.3%), oil and gas (3.3%), steel manufacturer (3.3%). Over half (53.3%) of the organizations who responded were international firms and of these, 43.75% had head office in New Zealand, 25% in Australia, 18.75% in France and 6.25% in both UK and Austria.

When asked what the nature of their organization was 53.3% of the respondents said a private company. Of the remaining responses, 30% said they were a partnership and 16.7% were 'other'. The 'other's were unspecified as "subsidiary company" and "co-operative company". Balanced scorecard users were for the greater part publicly listed companies and the users of integrated performance measurement systems (IPMS) were predominantly private companies. The size of the companies varied greatly, from 22 to 100,000 employees, with annual revenue varying just as much, between 10,000 and 255 billion New Zealand dollars

Performance Measures

When listing the performance measures to be rated on frequency of use they were divided into four factors; financial, production, sales and customer satisfaction, and human resources. Participants were asked to state the frequency of use of each measure using a scale from one to seven, one being daily and seven being never. The mean results from this section were then tabulated. Table 1 takes a preliminary look at the extent to which organizations used the top ten most used performance measures. They are dominated by production measures (7), followed by human resource measures (2) and lastly financial measures (1).

Performance Measurement Approach

Another aim of this research was to determine what approaches to performance measurement are used by New Zealand manufacturers. Table 2 shows that almost a third of the respondents use Kaplan and Norton's Balanced Scorecard method of measuring performance, with 10% of these also employing an integrated performance measurement approach. 23.3% of the respondents use an integrated PM approach on its own, while 10% used other PM approaches. These other approaches were specified as being "scourcom PLC automation", "theory of constant throughput measure", and lastly one had "details included with monthly financial accounts". The other 36.7% did not state what approach they used. Interestingly, none of the respondents planned to adopt a new performance measurement approach in the near future and 80% indicated that they consider

their current PM system to be effective. Some positive comments from the respondents' using the balanced scorecard included; "Global measurement system linked to strategic plan", "reasonable but constantly evolving" and also "results are produced in a timely and accurate manner allowing them to be used for decision making purposes"

Table 1.

Rank	Performance measure	Mean	Standard deviation
1	No of units produced	1.90	0.96
2	Backlog in the delivery schedule	2.47	1.94
3	Total sales revenue	2.57	1.01
4	Amount of finished good inventory	2.63	0.67
5	Rate of incidence of production defects	2.73	1.68
6	Amount of raw material inventory	2.77	0.73
7	No of worker injuries	2.87	1.36
8	Gross profit margin	2.90	0.48
9	Cost of goods sold	2.93	0.37
10	No of customer orders completed	2.93	2.03

Table 2.

Performance Measurement Approach

Approach of measuring performance	Count	Average no. Employees	Average Turnover NZ\$
Balanced scorecard and integrated performance measurement	3	33623	8,152,333,333
Balanced scorecard	6	16930	42,637,583,333
Integrated performance measurement	7	197	49,000,000
other	3	112	57,000,000
Not specified	11	159	54,333,333

* Two missing responses

Even though 36.7% didn't state what system they were using, eight out of these eleven were happy with their PMS and believed it was effective while the remaining three thought that their system was ineffective, stating reasons such as, "lack of timely information systems not sophisticated (yet)"and also "needs further tuning to meet requirements". These comments suggest that some organizations are having trouble fine tuning their measures to get results in a timely fashion and to measure what is actually required. However, the majority (80%) are confident their performance measurement system is doing the job it was set in place to do. The questionnaire also required participants to state any annual cost savings and/or improvements in revenue as a result of their PMS. A total of 22 (73%) responded positively, six

(20%) said it had not and two (6.7%) did not respond to the question. On the negative side of things, two respondents who used the balanced scorecard saw no increase in revenues or reduction in costs, while one using an integrated PMS and the one including details with their monthly financial accounts chose not to answer this question.

Performance measures are regularly reviewed by 83.3% of the respondents, 3.3% review them once a year and the remaining 13.3% did not review them on a regular basis. Half of those that did not review regularly were organizations using other PMS's, specifically, the scourcom PLC automation and the respondent that included details with the financial reports. Another notable point is that the respondent who reviews measures once a year, use the Balanced Scorecard and also remarked that they didn't consider their PMS effective due to the fact that they needed more measures.

Lastly, this section of the survey solicited information on the organisation's ISO accreditation, whether they were accredited and what ISO number if they were. The responses came back with 70% ISO accredited and 30% not, one was in the process of being endorsed. The ISO numbers for the 70% accredited were predominantly, 9001 for quality management and 14001 for environmental management systems.

Organisation's Information System

This section of the survey was designed to solicit information pertaining to the companies information system. In particular, whether they use an ERP system and/or specialized software or systems, it was also to determine how well their information system support different performance measurement system factors. It was determined that 70% of the respondents' do in fact have an ERP system and some of the systems used by more than one organization were Mapics, Syteline and SAP. Balanced scorecard users all had an ERP system whereas none of the 'other' PMS users did and neither did two out of the seven users of an integrated PMS. Respondents' answers were split fairly evenly in regard to whether or not their PMS was supported by specialized software or systems. 50% were supported, 46.7% were not and 3.3% was a non response. The supporting software/systems were, for the most part, of an in-house nature.

Table 3.
Supportiveness of Information Systems to PMS factors

Performance Measurement Systems Factors	Mean	Standard Deviation
Employee performance data collection	2.60	0.87
Quality measurement data collection	2.73	0.81
Non-financial data collection	3.13	0.97
Accessible performance information	3.43	1.04
Relevant performance reporting	3.47	1.13
Operational data collection	3.50	0.63
Supply chain management data collection	3.53	1.18
Sales performance data collection	3.90	1.02
Timely reporting	4.13	1.01
Financial data collection	4.27	1.31

The last question in this section required respondents to state how well their current information system supported certain PMS factors using a five-point scale ranging from no support (1) to

excellent support (5). The factors and their mean values are shown in Table 3. The mean value was lowest for the factor 'employee performance data collection'(2.73). At the other end of the spectrum, the highest mean value was for the factor 'financial data collection' (4.27). These findings suggest a tendency for information systems to support financial factors better than non financial ones.

4. Discussion

As little is known about the state of performance measurement in New Zealand, the intention of this research was to conduct an empirical study solely of manufacturing organizations. All recent literature on performance measurement systems stresses the need to move away from traditional management accounting techniques that focus on financial measures and measure non-financial assets as well.

Although the low response rate does not support statistical analysis nor any generalization of the findings, certain observations can be made. The findings of this study with regard to performance measures used on a regular basis by the New Zealand manufacturing respondents contrast quite markedly in some aspects to those found by Gosselin [4]. This researcher found that the ten most frequently used measures were dominated by financial measures, whereas this study suggests that production measures are most regularly used by New Zealand manufacturers. This suggests that New Zealand manufacturers may be beginning to prescribe to current theories on how best to measure performance. It also suggests there is scope for further research in this area. However, many of the measures that appeared in Gosselin's 15 least regularly used measures appeared in this study's list of least regularly used, and they were predominantly sales and customer satisfaction measures. The literature suggests that much more emphasis should be placed on customer satisfaction in order to effectively measure an organisation's performance. But both Gosselin [4] and this survey results imply it is not a suggestion that is being readily picked up by organizations.

The study also sought to find out what performance measurement approaches were commonly adopted by New Zealand manufacturers. Over half (16) use contemporary systems, that is, the balanced Scorecard and IPMS. Eleven of these 16 were international firms, over half of which had their head office in New Zealand. No clear trends were evident in the results though, as to whether these modern PM approaches used non-financial measures to a greater extent than financial. The Balanced Scorecard literature implies, that if this system is implemented correctly, non-financial measures should be foremost. Results from this study showed little or no difference between approaches. Interestingly, no organization that completed the survey was planning on adopting a new performance approach in the foreseeable future and a clear majority (80%) considered their current PMS effective. This appears contradictory to comments in the literature, where it is maintained that more emphasis on non-financial measures is required before a PMS will become entirely effective. Non-the-less, 73.3% of the respondents in this survey claim they realized annual cost savings and/or revenue increases varying between 2% and 25%. Nineteen survey participants linked their performance measures to staff compensation and a

further two companies were reviewing their position on the subject. ISO accreditation was most frequently attained by publicly listed companies (89%), private companies also had a higher tendency to be accredited (62.5%). International firms had 75% accredited compared with 64% of national firms.

In accordance with the recommendations of current literature, 83.3% of New Zealand manufacturers who responded review their performance measures regularly. However, the term regularly was not defined, so any further elaboration on this finding is problematic. One particular respondent found the Balanced Scorecard ineffective. Niven (2005) firmly believes that the Balanced Scorecard system is not flawed if implemented correctly, so it may be appropriate for the company to re-examine the design and measures implemented in its PMS. Another justification for reviewing it more regularly is that a PMS, according to the literature, should be responding to strategic changes and striving for continual improvement.

For 73.3% of the respondents local management was responsible for decisions about modifying existing performance measures and implementing new ones. Corresponding literature believes the involvement of senior executives is important in this process, while Niven (2005) agrees this would be ideal, it is not always possible. As a compromise it is considered useful to have a person who has influence with upper management on the design team.

Section C gathered data on the organisation's information system. The literature on ERP systems suggest that larger companies with bigger revenues are more likely to have implemented an ERP system as they are expensive to purchase and set up. The average number of employees for companies with an ERP system was 6782, average revenue \$19,168,611,111 in comparison to 116 employees was the average for companies without an ERP system with an average revenue of \$35,333,333. Although it is only a small sample of the population these findings clearly support the literature.

The PMS factors best supported by the survey samples information system were predictably the financial ones. Financial data collection was well supported while employee performance data collection was poorly supported. These results indicate a deficiency in current information systems, they appear to favor traditional performance measures.

5. Conclusions

It appears that New Zealand manufacturer's are not only aware of, but are also implementing modern performance measurement system. Furthermore, the respondents indicated that the non financial measures are being used more frequently than the financial. However, it is important and somewhat disappointing to note that irrespective of the type of PM approach

adopted, the majority of the respondents' information systems are not giving good support to their performance measurement endeavours. It appears that the respondents information systems are still very much attuned to the historical dominance of the financials. This is perhaps not all that surprising even when the system is an ERP. ERP systems are typically modularised and if expense or time is an issue with the information system implementation, it is the financial module that organisations typically implement before anything else. World class performance measurement techniques are being used, and there are indications that financial as well as non-financial measures are being used. Whether the organizations have got the balance right is something they may only have a better feel for over time. It also appears that the PMS are not being reviewed or modified as often as might have been anticipated from the literature. Certainly the literature is adamant that a PMS should not be static and must change to reflect the organizational strategy and business environment in which it operates. There have been indications that some organizations have implemented an ERP system in order to keep it up with their competitors. It is hoped that this is not what has happened with the new PMS approaches.

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