The Effects of Benchmarking and ABCM Organisational Support and Coherence on Organisational Performance: A Test of Two-Way Interaction

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Abstract

Using a hierarchical regression model, this study examines the complementarity of benchmarking and activity-based cost management (ABCM) on performance. Survey data were collected from 97 U.S. manufacturing business units. Overall, the results indicate support for the theoretical framework linking benchmarking/ABCM interaction to the performance of business units. The implications, limitations, and directions for future research are discussed.

Keywords

Activity-Based Cost Management
Benchmarking
Manufacturing Performance
Organisational Support

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Introduction

Management has turned aggressively to implementing innovative techniques such as activity-based costing (Young and Selto, 1991) and benchmarking (Elnathan et al., 1996). Advocates of activity-based cost management (ABCM) cite many benefits of these systems (Anderson et al. 2002; Anderson, 1995; Banker and Johnson, 1993; Kaplan, 1992) and identify factors associated with ABCM success (Krumwiede, 1998; Foster and Swenson, 1997; McGowan and Klammer, 1997; Anderson and Young, 1997; Shields, 1995).

Shields (1995) is the first empirical study to propose certain ABCM organisational and technical factors and found only organisational factors such as organisational support and coherence[1] to be related to ABCM success. Thus, organisational support and coherence can help facilitate the implementation and outcomes of an innovation, such as ABCM. These findings suggest that information provided by an internal ABCM analysis alone is not sufficient, as the benchmarks derived from such a process may be suboptimal and non-competitive.

The neoclassical definition of complementarity factors of production focuses on direct inputs such as labour and capital. In this study, we define complementarity as the interaction between management accounting systems and production systems to produce higher performance. Research on complementarity within accounting is beginning to appear (Drake et al., 1999). For example, in recent work, researchers have investigated complementarities among investment bundling decisions (Miller and O'Leary, 1997), between organisational structure choices (Ghosh, 2000), between Total Quality Management (TQM), Just-in-Time (JIT) and performance measures (Sim and Killough 1998), and between cost system and incentive structure (Drake et al.

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(1999).

The purpose of this paper is to investigate the main and complementarity effects of benchmarking and ABCM organisational support and coherence on manufacturing unit performance, controlling for size and past performance. The unit of focus for this paper is the strategic business unit (SBU) because competitive advantage is ultimately won or lost primarily at the SBU level rather than at the corporate level (Porter, 1980). This study uses questionnaire responses from 97 electronics plants located in the United States.

The paper is organised as follows. First, the literature review is discussed and hypotheses are developed. Next is a discussion of the research methods. Then, empirical results are reported, followed by a concluding discussion with suggestions for future research presented.

Literature Review and Hypotheses Development

This section provides a summary of prior literature and develops relevant hypotheses. The discussion provides arguments for the main and interaction effects of benchmarking and ABCM organisational support and coherence on the performance of strategic business units (SBU).

ABCM Organisational Support and Coherence

ABCM system is widely suggested as a key tool for improving the behavioural, business, and accounting practices in organisations (Anderson and Young, 1997; Foster and Swenson, 1997; McGowan and Klammer, 1997; Anderson, 1995; Shields, 1995; Cooper and Zmud, 1990). Thus, many organisations have found that the pursuit of performance can best be achieved by implementing activity-based cost management systems (Compton, 1996). However, if organisational support and coherence is a desirable quality of ABCM implementation, then it would be advantageous to have those variables have the highest degree of presence during implementation (Shields, 1995).

Shields and Young (1994), Shields (1995), and McGowan and Klammer (1997) have asserted that successful implementation of ABCM is predicated on organisational support and coherence. The effectiveness or success of any implementation project, such as ABCM, can be measured by the impact of innovative techniques on organisational performance. It is noted, however, that attitudinal dimensions related to the perceived impact of an innovation on decision performance, interpersonal relations, communication within the organisation, and goal commitment by workers account for much of the variance in implementation success (Bhimani and Pigott, 1992).

Because of the importance of attitudes, we have used a questionnaire instrument to elicit "perceptions" of the management of SBU's. As with other administrative innovations, top management support for ABCM is crucial and is the manifestation of organisational support. Executives can focus resources (e.g. money, time, talent), goals, and strategies on initiatives they deem worthwhile, deny resources for innovation they do not support, and provide the political help needed to motivate employees or to mitigate the influence of individuals and coalitions that resist the innovation (Shields, 1995). The theory of organisational change also recognises the role of top management support in helping to create a suitable environment for change (Manley, 1975) and in increasing the appreciation of others for the potential contribution of the system to meeting the needs of the organisational unit (Doll, 1985).

Schultz and Slevin (1975) point out that for a model to be implemented successfully in a social organisation, it must not only be accepted by the individuals in the organisation, but it must also be compatible with the existing organisation. Thus, linkage to competitive strategy, performance evaluation, and compensation are important to motivate employees to appropriately focus on and use ABCM to improve their firm's competitive position and profits and reward those who are successful in doing so (Shields, 1995).

When the rewards of individuals are tied to performance according to certain criteria, their behaviour is guided by the desire to optimise performance with respect to those criteria (Govindarajan and Gupta, 1985). Related consensus about and clarity of the objectives of ABCM systems designers and users are necessary to ensure that ABCM systems and information are produced efficiently and are effectively used (Shields, 1995). As goals become clearer, performing tasks increases either in direct anticipation of achieving goals or because of expected rewards (Robey, 1979). Also, because non-accountants may be more likely to take ownership of ABCM if it is linked to their personal welfare, the linkage of ABCM to performance evaluation is included in the definition of organisational support and coherence (Shields, 1995).

ABCM takes a proactive role in reducing costs by encouraging managers to pay more attention to managing activities and processes, rather than merely the costs. This is important because it is the activities themselves that consume resources which, in turn, cause the costs. For example, ABCM can identify activities involved in a poor quality situation and link those activities with operational performance measures and costs (Kaynak 2003). The process of ABCM provides work teams with a mechanism to prioritise, justify, and define (in terms of cost, time, and quality metrics) the initiatives that should be undertaken. Through ABCM the effects of poor quality become readily apparent and various improvement projects can then be identified and evaluated (Carolfi, 1996; Armitage, 1993). In creating an economics-of-quality reporting system, for instance, the organisation also takes a key step toward activity-based management. Concentrating on activities will enable the organisation to align its performance resources with the processes it needs to achieve its goals, i.e., to lower the costs of executing processes (eliminating waste and reducing costs) and to be responsive to change (Armitage, 1993; Cooper, R. and Slagmulder, 2000; Kaynak 2003).

ABCM focuses on costs associated with activities, but it also evaluates whether those activities add value, thus providing a means of understanding how to reduce costs most effectively. In addition to cost reduction benefits, applying ABCM gives managers a sound means of monitoring ongoing performance (Player, 1998). The central theme of ABCM systems is that their use leads to improved product costing, cost management, decision making, and competitive advantage (Raffish and Turney, 1991; Brimson, 1991; Swenson, 2000). Therefore, through all of these mechanisms, performance of the firm improves.

Taken together, the literature suggests that the implementation of ABCM organisational support and coherence should lead to higher performance. Specifically, we posit:

H_1: *There is a significant positive relationship, ceteris paribus, between the extent of ABCM organisational support and coherence implementation and:*

H_{1a}: *product quality improvement,*

H_{1b}: *product cost improvement, and*

H_{1c}: *return on investment (ROI)*

Benchmarking

Recent developments in diffusion research and institutional theory provide additional insight by emphasising that one of the most important properties of today's organisations is their relatedness. That is, they exist within an interconnected organisational field. Firms are also connected to other firms in myriad ways, and these connections can act as diffusion/transference mechanisms for new ideas and techniques (Chua and Petty, 1999).

Institutionalists such as DiMaggio and Powell (1991) argue that organisations learn from or model themselves on other significant or similar organisations or industry leaders which are large corporations with strong reputations, etc. Through such copying, practices are diffused throughout an organisation. They also propose that imitation may be effected through a variety of conduits or change

agents, i.e., employees who change firms, consultants, trade/professional associations, and common/interlocking directors. We wish, in particular, to investigate the role of benchmarking as a diffusion mechanism for the improvement of firm performance.

Adopting "best practices" that focus on firm production processes (Hart, 1995; Stead, 1995) can result in the reduction of input and waste-disposal costs and in the reduction or even complete elimination of non-value added activities (Camp, 1989). Indeed, the very act of selecting benchmarks from industry leaders implies that the firm is establishing goals to achieve those benchmarks which are, by definition, a superior level of performance than is currently being attained by that firm. The quality literature also argues that benchmarking allows organisations to determine what level of performance is achievable, to set challenging but attainable goals, and to identify superior methods for designing products and processes (Ittner and Larcker, 1995).

Based on the discussion above, the following hypotheses are developed and tested:
H_2: *There is a positive relationship, ceteris paribus, between the extent of benchmarking implementation and:*
H_{2a}: *product quality improvement*,

H_{2b}: *product cost improvement, and*

H_{2c}: *return on investment (ROI)*

Complementarities

Milgrom and Roberts (1990, 1995) provide a theoretical framework that attempts to address the issue of how relationships among parts of a manufacturing system affect performance. They suggest that organisations often experience a simultaneous shift in competitive strategy along with changes in various elements of organisational design. In addition, synergies, or complementarities, often arise within clusters of these elements that improve overall performance. In essence, Milgrom and Roberts' (1995) framework suggests that successful implementation of new manufacturing techniques requires complementarity management accounting systems. Also, the notion of complementarities implies that management accounting systems can interact with production systems to produce higher performance than would be achieved by production systems alone (Wruck and Jensen 1994). This is in line with resource-based theory that claims that complementarity resources may enjoy synergistic performance impact (Eisenhardt and Martin 2000; Teece et al. 1997).

Although the literature suggests that the benchmarking and ABCM can independently improve the performance of firms that implement the processes well, Coburn et al. (1995) and Kline (2003**)** suggest that benchmarking works better in conjunction with ABCM. Within this framework, ABCM can be viewed as an "enabler" to support the development of cost-effective product designs and manufacturing processes. For example, with accountants providing important inputs into product design and development decisions, ABCM attempts to mirror the manufacturing process, so that engineers and production managers easily can see how design changes will affect costs (Swenson, 1998). Furthermore, by extending the concepts of ABCM and benchmarking, accountants can provide data on the relative costs of continued production problems and product design changes so that product managers can evaluate alternatives when poor design quality arises (Kaplan and Norton, 2001). As a result, it is expected that product quality, product cost, and ROI will be enhanced when there is an appropriate match between benchmarking and ABCM. It is the synergy in their joint implementation that has even greater impact on product quality, product cost, and ROI. For example, if an organisation desires to achieve high product quality while pursuing benchmarking, then its product quality improvement will be higher to the extent that benchmarking initiatives are used in concert with ABCM. Specifically, although the use of benchmarking may be effective independently of ABCM, the synergy between these two systems will lead to

higher product quality, cost improvement, and ROI. As a result, as depicted in Exhibit 1, we propose that the implementation of benchmarking when combined with ABCM is likely to have a significant positive impact on product quality, cost improvement, and ROI.

The preceding discussion leads to the following hypotheses that are tested in this study:

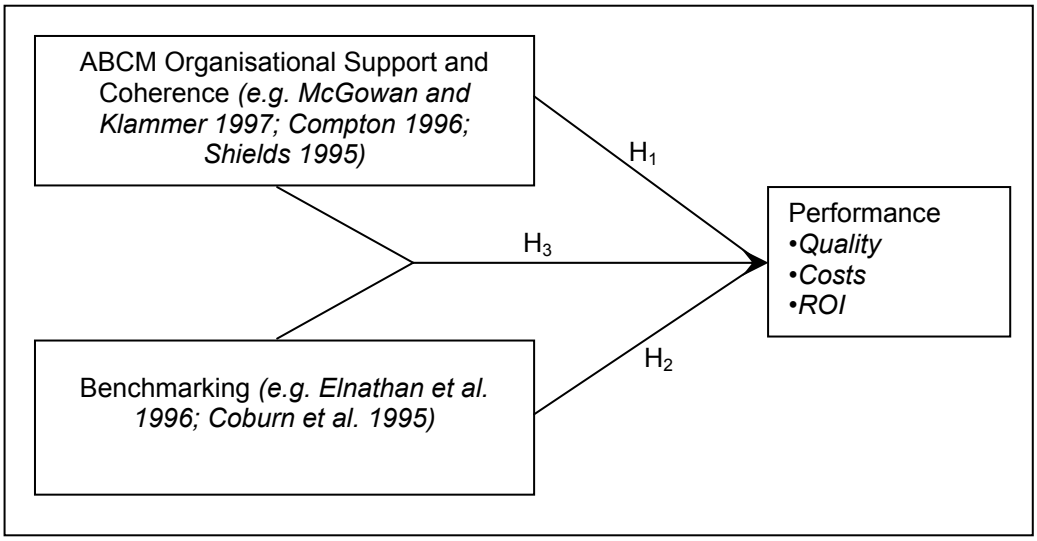
H_3: *The ordinal complementarity between the extent of ABCM organisational support and coherence implementation and the extent of benchmarking implementation will be positive and significantly related to:*

H_{3a}: *Product quality improvement*

H_{3b}: *Product cost improvement*

H_{3c}: *Return on investment (ROI)*

Exhibit 1: Theoretical Relationships between Independent and Dependent Variables



Research Methods

Sample

The sample selection process for this study involved searching a variety of sources to identify adopters of ABCM and benchmarking. The primary source was the National Automated Accounting Research System (NAARS) database that was searched to identify any firms that mentioned benchmarking and ABCM adoption in their annual report or form 10-K. Additional sources included The Wall Street Journal, Industry Week's series on manufacturing excellence, various industrial engineering journals, and periodical indices for articles in any journal that might produce a case report or other information to determine if benchmarking is related to production systems. The names and addresses of the managers and directors were obtained from the Industry Week series and journal articles cited above and randomly selected. A total of 345 questionnaires were mailed to managers in the electronics industry.[2] Within five weeks, 69 of the managers had responded. Eight weeks later after the initial mailing, a reminder to complete the questionnaire was sent to all 345 managers. A cautionary note stated that if the individual had previously completed the survey, this mailing should be discarded. This second mailing resulted in 54 new responses. In total, 123 questionnaires were returned, however, 9 returned questionnaires from the first wave and 17 from the second wave were unusable. This elimination resulted in 97 usable responses or a 28.11 % response rate.[3] Table 1 contains sample distributions by early and late respondents and Table 2 presents information on the respondents' job titles. This information indicated that almost all respondents were plant managers, manufacturing managers, operations managers, and directors of manufacturing.

Table 1: Frequencies by Wave of Responses

Response Wave	Returned Responses	Useable Sample Size	Percent of Sample	Cumulative Response
Responded within 5 weeks	69	60	17.39	17.39
Responded after 5 weeks	54	37	10.72	28.11
Total	123	97	28.11	

Table 2: Job Title of Respondents

Job Title Used by Respondents	Number of Respondents	Percentage
Accounting Manager	5	5.2
Plant Manager	37	38.1
Manufacturing Manager	21	21.7
Operations Manager	16	16.5
Director of Operations	3	3.1
Director of Manufacturing	12	12.4
Sourcing and Fabrication Manager	2	2.0
Product Integrity Manager	1	1.0
Total	97	100%

Independent Variables

To test the main and complementarity effects of benchmarking and ABCM organisational support and coherence on SBU performance, one construct was used to measure ABCM organisational support and coherence (Shields 1995) and one construct was used to measure degree of benchmarking (Ahire et al., 1996). These constructs (independent variables) are expressed in operational terms below.

ABCM Organisational Support and Coherence: The ABCM variables and behaviours used in the current study are based on the framework of Shields (1995) and are identified as organisational support and coherence. They are actions taken by management to ensure the success of ABCM. Six composite organisational support and coherence variables were used in the questionnaire: (1) management support, (2) consensus on objectives, (3) competitive strategy link, (4) the degree of linkage to quality initiatives, (5) degree of non-accounting ownership, and (6) the degree of linkage to performance evaluation/compensation. The measures were provided by respondents using a seven-point Likert scale (1 = extremely low 7 = extremely high). To examine the extent to which these measures are interrelated, we used principal component analysis that produced one factor with a total variance of 61.65 percent and an eigenvalue of 3.69. A reliability check for the ABCM measures produced a Cronbach's alpha of .859, indicating that the measures were reliable (Nunnally, 1967). The loadings of the measures are consistent with Shields (1995). Next, a mean score of the six items was computed as the measure of organisational support and coherence for use in the analyses.

Degree of Benchmarking: Three items in the questionnaire used to measure benchmarking were developed and then validated by Ahire et al. (1996). The items were (1) emphasis on benchmarking competitors' products and processes, (2) effectiveness of benchmarking on product quality improvement, and (3) effectiveness of benchmarking on product cost reduction. The measures were obtained using a seven-point Likert scale (1 = extremely low improvement; 7 = extremely high improvement). A principal component analysis produced one factor with a total variance of 61.38 percent and an eigenvalue of 1.84. A reliability check produced a Cronbach's alpha of .676, indicating that the measures were reliable (Nunnally, 1967). Next, a mean score across the three items was computed as the measure of the degree of benchmarking to be used in the

analyses.

Table 3: Variables Used in the Study

Variables	Measurement
Independent Variables	
ORGSUP =ABCM Organisational Support and Coherence	
	1. The degree to which the ABCM initiative has the support of top management
	2. Extent of consensus about the ABCM objective
	3. The degree to which ABCM is linked to competitive strategy
	4. The degree of linkage of the ABCM initiatives to quality initiatives
	5. The degree of non-accounting ownership
	6. The degree of linkage of ABCM to performance evaluation and compensation
BENCH = degree of benchmarking implementation	
	1. Emphasis on benchmarking competitors' products and processes
	2. Effectiveness of benchmarking on product quality improvement
	3. Effectiveness of benchmarking on product cost reduction
Dependent Variables	
PQ_{1999} = product quality improvement in 1999	
	1. Units of defects as a percentage of units inspected (at final inspection)
	2. Cost of scrap as a percentage of total manufacturing cost
	3. Units reworked as a percentage of units inspected (at final inspection)
	4. Units returned as a percentage of units sold
	5. Warranty cost as a percentage of sales dollars
PC_{1999} = product cost improvement in 1999	
	Extent to which product costs have improved for the year 1999
ROI = return on investment	
	Extent to which ROI has improved for the year 1999 (ROI is operating income before interest, corporate expense allocation, and tax over total assets.)
Control Variables	
PQ_{1997} = product cost improvement in 1997	
	Extent to which product costs have improved for the year 1997
ROI_{1997} = Extent to which ROI has improved for the year 1997.	
PC_{1997} = product quality improvement in 1997	
	1. Units of defects as a percentage of units inspected (at final inspection)
	2. Cost of scrap as a percentage of total manufacturing cost
	3. Units reworked as a percentage of units inspected (at final inspection)
	4. Units returned as a percentage of units sold
	5. Warranty cost as a percentage of sales dollars
SIZE = plant size	
	Number of employees working at the plant

Dependent Variables

To test the hypotheses, we constructed two indices of performance: operational performance and business performance. Operational performance measures improvement in product quality and is represented by a mean score over five questions in the questionnaires. Business performance measures improvement in product cost and return on investment, each of which was derived by a single question in the questionnaire.

***Product Quality Improvement*:** Borrowing from Lynch and Cross (1991), product quality improvement was used as the first performance measure. Five items from the questionnaire, validated by Lynch and Cross (1991), were used to measure product quality improvement for 1999: (1) units of defects as a percentage of units inspected (at final inspection), (2) cost of scrap as a percentage of total manufacturing cost, (3) units reworked as a percentage of units inspected (at final inspection), (4) units returned as a percentage of units sold, and (5) warranty costs as a percentage of sales dollars. Respondents were asked to assess product quality improvement using a seven-point Likert scale (1 = extremely low improvement; 7 = extremely high improvement). A principal component analysis produced one factor with a total variance of 58.691 percent and an eigenvalue of 2.935. The Cronbach's alpha was .794 for 1999. Product quality improvement was thus measured as an average over the five questions in the questionnaire.

Product Cost Improvement: According to Cooper and Kaplan (1992), an improved costing system is a means to an end. By focusing on cost, management is in a much better position to identify and eliminate costs that do not add value, thereby improving product cost and firm performance. Product cost improvement for 1999 was a single item measure in the questionnaire. Respondents were asked to use a seven-point Likert scale (1 = extremely low improvement; 7 = extremely high improvement) in their reply.

ROI: At the business unit level, ROI (operating income before interest, corporate expense allocation and tax divided by total assets) is the dominant financial performance measure in both research and practice (Simmons 1987). Horngren and Foster (1991) suggest that ROI is appealing conceptually because it blends all the major ingredients of profitability (revenue, costs, and investment) into a single number. Respondents were asked to assess the extent to which ROI has improved. The item measuring ROI improvement was derived using a seven-point Likert scale (1 = extremely low improvement; 7 = extremely high improvement).

Control Variables

***Past Performance*:** Following Sim and Killough (1998), we controlled for past performance because of these assumptions: (1) organisational performance can be described as a first-order autoregressive process, (2) the autoregressive parameter is identical for each organisation, and (3) past performance is not correlated with product cost improvement, quality improvement, and ROI. If organisations choose their current ABCM organisational support and coherence and benchmarking practices as a function of past performance, the inclusion of past performance will reduce the explanatory power associated with both variables. However, the organisations typically remained in the same ABCM organisational support and coherence and benchmarking categories in both 1999 and 1997.

Product quality improvement for 1997, product costs improvement for 1997, and ROI for 1997 were used as past performance measures. Five items were used to measure product quality improvement for 1997: (1) units of defects as a percentage of units inspected (at final inspection), (2) cost of scrap as a percentage of total manufacturing cost, (3) units reworked as a percentage of units inspected (at final inspection), (4) units returned as a percentage of units sold, and (5) warranty costs as a percentage of sales dollars. The items were anchored by a seven-point Likert scale (1 = extremely low improvement; 7 = extremely high improvement). A principal component analysis produced one factor with total variance of 64.403 percent and eigenvalue of 3.220. The Cronbach's alpha was .847 for 1997. An average for these five variables was calculated as the measure for past performance related to quality.

Product cost improvement for 1997 was a single item measure in the questionnaire. Also, ROI for 1997 was a single item measured as the extent to which ROI has improved. Responses for both product cost

improvement and ROI improvement were provided using a seven-point Likert scale (1 = extremely low improvement; 7 = extremely high improvement).

***Plant Size*:** We also controlled for plant size, measured by the number of production employees, because it (size) has been asserted to be an important factor (Lawrence and Hottenstein 1995). The literature shows varying opinions on whether smaller or larger companies are more likely to successfully implement ABCM and benchmarking. For example, Innes and Mitchell (1995) find larger firms are more likely to adopt ABCM, although the reasons for the size impact are not clear. Hicks (1997) suggests that smaller companies often avoid implementing ABCM not for a real lack of resources but for a perceived lack of resources. Smaller plants have flatter organisational structures and more informal communication channels; thus, benchmarking and ABCM organisational support and coherence may be more effectively applied in smaller plants because they are more manageable. Researchers have also asserted that smaller organisations have more ability to encourage and implement innovation (Sironopolis, 1994). On the other hand, larger firms have more capital resources and professional managerial expertise (Finch, 1986).

Research Model and Testing Procedures

Hierarchical regression models were used to analyse the data. This approach was selected to facilitate the partitioning of the proportion of total variance accounted for by the additive model and the two-way interactive model (Cohen and Cohen, 1983). The hierarchical approach also permits the main effects of the independent variables to be analysed separately. The following regression models were employed to test the hypotheses[4]:

$$(1)\ P_{i1999} = \alpha_0 + \alpha_1 Pi_{1997} + \alpha_2 SIZE + \varepsilon$$

$$(2)\ P_{i1999} = \alpha_0 + \alpha_1 Pi_{1997} + \alpha_2 SIZE + \beta_1 ORGSUP + \beta_2 BENCH + \varepsilon$$

$$(3)\ P_{i1999} = \alpha_0 + \alpha_1 Pi_{1997} + \alpha_2 SIZE + \beta_1 ORGSUP + \beta_2 BENCH + \beta_3 ORGSUP*BENCH + \varepsilon$$

where:
P_{i1999} = product quality improvement in 1999 (PQ_{1999}), Product cost improvement in 1999 (PC_{1999}) and ROI improvement in 1999 (ROI_{1999})

P_{i1997} = product quality improvement in 1997 (PQ_{1997}), Product cost improvement in 1997 (PC_{1997}) and ROI improvement in 1997 (ROI_{1997})

SIZE = plant size

ORGSUP = ABCM organisational support and coherence

BENCH = degree of benchmarking

α_0 is the intercept; $\alpha_0, \alpha_1, \alpha_2, \beta_1, \beta_2,$ and β_3 are regression coefficients, and ε is the error term.

Equations (1) and (2) are used to analyse the effects of the control variables and independent variables, respectively. Equation (3) is used to analyse the two-way interaction.

Results

This section includes both the descriptive statistics and results related hypotheses testing.

Descriptive Statistics

Table 4 lists the degree to which benchmarking variables (upper part of Table) and ABCM organisational support and coherence variables (lower part of Table) are present and shows a wide variation in the degree to which these variables are present. Table 5 presents the scale means, standard deviations, and internal consistency reliabilities of the variables used in the study. Mean responses for benchmarking (BENCH) and ABCM organisational support and coherence (ORGSUP) are 3.40 and 4.78, respectively, indicating moderate implementation. Table 5 also indicates that

the reliabilities of the variables, as measured by the Cronbach's alpha, are high. Table 6 reports the intercorrelations among the variables. It can be observed from the table that the correlation between benchmarking (BENCH) and ABCM organisational support and coherence (ORGSUP) is significant, thereby indicating that these variables are dependent on each other. One interpretation of this result is that the adoption of a new manufacturing technique like benchmarking could be accompanied by the modernisation or improvement of existing management accounting systems such as ABCM (Elnathan et al., 1996).

Table 4: Degrees of Benchmarking and ABCM Implementation

Degree Factors are Present in Benchmarking Implementation							
	Extremely Low						***Extremely High***
	1	2	3	4	5	6	7
Emphasis on benchmarking competitors' products and processes	14.4	3.1	20.6	61.9	-	-	-
Effectiveness of benchmarking on product quality improvement	11.3	5.2	10.3	17.5	54.6	1.0	-
Effectiveness of benchmarking on product cost reduction	7.2	24.7	59.8	4.1	4.1	-	-
Degrees Factors are Present in ABCM Implementation							
	Extremely Low						***Extremely High***
	1	2	3	4	5	6	7
The degree to which the ABCM initiative has the support of top management	1.0	4.1	15.5	21.6	29.9	16.5	11.3
Extent of consensus about the ABCM factor	-	7.2	17.5	29.9	8.2	29.9	7.2
The degree to which ABCM is linked to competitive strategy	5.2	8.2	-	28.9	8.2	18.6	30.9
The degree of linkage of the ABCM initiatives to quality initiatives	-	2.1	24.7	21.6	11.3	40.2	-
The degree of non-accounting Ownership	6.2	8.2	13.4	12.4	20.6	15.5	23.7
The degree of linkage of ABCM to performance evaluation and compensation	1.0	7.2	8.2	14.4	24.7	33.0	11.3

Table 5: Mean, Standard Deviation, and Reliability

	Mean	**Standard Deviation**	**Reliability**
BENCH	3.4021	.8619	.676
ORGSUP	4.7835	1.1922	.859
PQ_{1997}	2.3093	1.1398	.847
PC_{1997}	3.5155	1.0115	Na*
ROI_{1997}	3.9175	.9538	Na
SIZE	162.6838	79.4297	Na
PQ_{1999}	4.5670	1.3221	.794
PC_{1999}	4.4948	2.0368	Na
ROI_{1999}	4.9588	1.0985	Na
*Single item measure			

Table 6: Correlation Matrix

	BENCH	ORGSUP	PQ_{1997}	PC_{1997}	ROI_{1997}	SIZE	PQ_{1999}	PC_{1999}
BENCH 1								
ORGSUP	.420** .000							
PQ_{1997}	.211 .038	.050 .628						
PC_{1997}	.256** .000	.137 .182	-.049 .631					
ROI_{1997}	-.073 .476	.222* .029	-.321** .001	-.042 .684				
SIZE	.012 .910	-.061 .552	-.201* .048	.136 .184	.182 .075			
PQ_{1999}	.310** .002	.429** .000	-.152 .137	.161 .116	.128 .210	.165 .106		
PC_{1999}	.396** .000	.495** .000	-.116 .258	.204* .046	.139 .174	-.086 .402	.889** .000	
ROI_{1999}	.458 .000	.439** .000	-.098 .340	.216* .033	.186 .069	-.023 .819	.511** .000	.791** .000

* Correlation is significant at .01
** Correlation is significant at .05

Hypotheses Tests

Three hierarchical regression analyses are conducted with each of the dependent variables (product quality improvement, product cost improvement, and ROI). The control variables are entered first in the regression model (equation 1), the independent variables are entered next (equation 2), and finally, the interaction term is entered (equation 3). In addition, because interaction regression models are used in this study, the approach of standardising the independent and control variables is adopted to reduce the correlations between the product terms and the component parts of the independent variables (Cohen and Cohen, 1983; Cronbach, 1987; Jaccard et al., 1990). Tolerance of greater than .10 was achieved. Variance inflation factor values from the regression analyses conducted for all the variables were less than 2, which is lower than the guideline of 10 (Hair et al., 1995). Hence, multicolinearity does not appear to be a problem. Tables 7, 8 and 9 present the regression results, including the beta weights, F-values, R^2, R^2-change between steps of the regression, and significance levels. All of the hypotheses are supported.

Table 7 reports the results for the first dependent variable, product quality improvement. Equation (1) includes the control variables: size and past performance. The results show that neither control variable has a significant effect on product quality improvement ($p > 0.10$). In support of hypotheses H_{1a} and H_{2a}, equation (2) indicates that both independent variables, benchmarking and organisational support and coherence are positive and significantly associated with product quality improvement with $t = 2.009$ ($p < .05$) and $t = 3.510$ ($p < .01$) respectively with an explained variance $R^2 = .257$. The R^2 change is .253. The interaction of organisational support and coherence with benchmarking (equation 3) is significant ($t = 2.087$, $p < .05$) and results in an explained variance of .291 and an R^2 change of .034. Therefore, our analysis supports H_{3a}, i.e., there is a positive and significant relationship between product quality improvement and the interaction between benchmarking and ABCM organisational support and coherence.

Table 7: Regression Results with Product Quality (PQ-1999) as the Dependent Variable

	Equation (1)				Equation (2)				Equation (3)			
	B	Std. Error	t	Sig.	B	Std. Error	t	Sig.	B	Std. Error	t	Sig.
Constant	4.546	0.452	10.066	0.000	4.811	0.407	11.817	0.000	4.635	0.409	11.344	0.000
PQ-1997	-0.143	0.120	-1.191	0.237	-0.221	0.109	-2.020	0.046	-0.225	0.108	-2.089	0.040
SIZE	0.002	0.002	1.274	0.206	0.002	0.002	1.087	0.280	0.002	0.002	1.393	0.167
BENCH					0.269	0.134	2.009	0.047	0.342	0.136	2.511	0.014
ORGSUP					0.460	0.131	3.510	0.001	0.509	0.131	3.890	0.000
BENCH*ORGSUP									0.267	0.128	2.087	0.040
F		1.945					7.969				7.479	
p-value		0.149					0.000				0.000	
R*2		0.040					0.257				0.291	
R*2-change							0.253				0.034	

Table 8 presents the results of the second dependent variable, product cost improvement. The control variables in equation (1) show that only past performance is significant ($t = 2.131$, $p < .05$). In equation (2), both independent variables, benchmarking and organisational support and coherence are positive and significantly related to product cost improvement ($t = 1.701$, $p < .10$; $t = 4.027$, $p < .01$ respectively), supporting H_{1b} and H_{2b}, with an explained variance of .290. The R^2 change is .239. The interaction in equation (3) is also found to be significant ($t = 2.862$, $p < .01$) with an explained variance of .349 and R^2 change of .059. Therefore H_{3b} is supported, i.e., there is a positive and significant relationship between product cost improvement and the interaction between benchmarking and ABCM organisational support and coherence.

Table 8: Regression Results with Product Cost Improvement (PC-1999) as the Dependent Variable

	Equation (1)				Equation (2)				Equation (3)			
	B	Std. Error	t	Sig.	B	Std. Error	t	Sig.	B	Std. Error	t	Sign
Constant	2.569	0.897	2.864	0.005	4.212	0.998	4.222	0.000	3.983	0.964	4.131	0.000
PC-1997	0.435	0.204	2.131	0.036	0.021	0.243	0.085	0.932	-0.018	0.234	-0.078	0.938
SIZE	0.002	0.003	0.956	0.342	0.001	0.002	0.574	0.567	0.002	0.002	0.987	0.326
BENCH					0.451	0.265	1.701	0.092	0.626	0.263	2.381	0.019
ORGSUP					0.811	0.201	4.027	0.000	0.904	0.197	4.599	0.000
BENCH*ORGSUP									0.541	0.189	2.862	0.005
F			2.508				9.413				9.757	
p-value			0.087				0.000				0.000	
R*2			0.051				0.290				0.349	
R*2-change							0.239				0.059	

Table 9 shows the results for the third dependent variable, ROI improvement. In equation (1), past performance exhibits significant impact on ROI improvement ($t = 1.864$, $p < .10$) while size shows little effect on ROI improvement. Results of equation (2) show that both H_{1c} and H_{2c} are supported, i.e., benchmarking and ABCM organisational support and coherence exhibit significant and positive influence on

ROI improvement ($t = 3.744$, $p < .001$ and $t = 2.520$, $p < .05$, respectively) with an explained variance of .307 and R^2 change of .271. Also, the interaction benchmarking by ABCM organisational support and coherence is found to be significant ($t = 2.426$, $p < .05$) with and explained variance of .349 and R^2-change of .042, supporting H_{3c}, i.e., there is a positive and significant relationship between ROI improvement and the interaction between benchmarking and ABCM organisational support and coherence.

The above findings provide evidence that SBU (Strategic Business Unit) performance is a function of benchmarking, ABCM organisational support and coherence, and their interaction. The strength of the interaction is reflected in the difference in R^2 of models with and without interaction (Jaccard and Wan 1996). Our results are therefore consistent with both Milgrom and Roberts' (1995) framework and resource-based theory that claim that complementary resources may enjoy synergistic performance impact. For managers, the implication is clear: deployment of both benchmarking and ABCM organisational support and coherence is essential for maximum performance.

Table 9: Regression Results with Return on Investment (ROI-1999) as the Dependent Variable

Equation (1)					Equation (2)				Equation (3)			
	B	Std. Error	t	Sig.	B	Std. Error	t	Sig.	B	Std. Error	t	Sig.
Constant	4.171	0.492	8.478	0.000	4.313	0.437	9.858	0.000	4.086	0.436	9.361	0.000
ROI-1997	0.221	0.119	1.864	0.065	0.189	0.106	1.785	0.078	0.204	0.103	1.977	0.051
SIZE	0.000	0.001	-0.341	0.734	-0.001	0.001	-0.487	0.627	0.000	0.001	-0.162	0.872
BENCH					0.400	0.107	3.744	0.000	0.470	0.108	4.347	0.000
ORGSUP					0.276	0.109	2.520	0.013	0.317	0.108	2.936	0.004
BENCH*ORGSUP									0.247	0.102	2.426	0.017
F			1.737				10.209				9.778	
p-value			0.182				0.000				0.000	
R*2			0.036				0.307				0.349	
R*2-change							0.271				0.042	

Discussion and Conclusion

This study seeks to provide empirical evidence about the main and interaction effects of ABCM organisational support and coherence and benchmarking on manufacturing unit performance, controlling for past performance and size. It was necessary to capture the perceptions of SBU managers because of the importance of the attitudinal dimensions related to the perceived impact of these innovations on business performance. Thus, data from a mail questionnaire sent to a sample of manufacturing units within the electronic industry is used for the analyses. The results of the study indicate that manufacturing unit performance is positively influenced by ABCM organisational support and coherence as well as by the degree of benchmarking. These finding support previous suggestions of the benefits of performance improvement derived from ABCM organisational support and coherence (Krumwiede, 1998; Anderson, 1995; Banker and Johnson, 1993; Shields, 1995) and from benchmarking implementation (Camp, 1989). Even though the results of this research support the notion that performance gains can result from ABCM organisational support and coherence and benchmarking implementation as suggested in extant literature (Shields, 1995), it adds to that literature by showing the significantly positive interaction effects on performance. These results support suggestions provided by Elnathan et al. (1996) and Coburn et al. (1995). Overall, we interpret the theoretical

and empirical evidence presented as supporting the view that benchmarking and ABCM can have synergistic effects to provide higher performance.

In empirical research of this type, results of this study should be assessed in light of several limitations. First, the use of the questionnaire survey method has some inherent limitations, such as hidden biases and random errors that can potentially inflate associations (Bagozzi et al., 1991). However, it is the only way to capture the perceptions of a large number of SBU managers which is essential to this study as an important contribution. Second, the cross-sectional design of this study examined the interactive impact of benchmarking and ABCM organisational support and coherence on business performance at the same point in time and does not consider the difference between short-term and long-term effects. Due in part to the large sample size, there is no reason to believe that the sample was biased in terms of those temporal effects. The dynamic effects of implementing benchmarking and ABCM could be studied with longitudinal data. Third, this study considered only ABCM organisational support and coherence as a measure of ABCM. Future research could incorporate other features of ABCM and benchmarking to identify additional types of interaction effects on manufacturing and non-manufacturing performance. Fourth, this study focuses on one industry to eliminate the noise associated with industry effects, and this necessarily affects the ability to generalise of the findings outside the electronics industry. Though there is little a priori reasoning to suggest that the perception of managers might be different across industries, further research can examine whether the relationships found here hold in other industries. Fifth, while considerable care was taken in selecting the sample, participation of the subjects in the study was voluntary, leading to the potential effects of self-selection bias. Also, we do not have an explicit estimate of organisational performance in the absence of the ABCM and/or benchmarking programs, so we cannot directly determine whether performance would have been lower (or higher) than the observed value if ABCM and benchmarking systems had not been adopted. Finally, since the date of our data cover the periods 1997-1999, we suggest more recent data for further analyses.

Despite the limitations, this research makes the important point that ABCM organisational support and coherence and benchmarking interact to improve firm performance. Inferences from this research are that: (1) Researchers need to be aware of the important role ABCM organisational support and coherence can play in determining the effectiveness of any "intervention" in contemporary manufacturing environments, and (2) companies seeking to make substantial improvements by learning from the "best-of-the-best" should make sure to modify the social environment to complement the new performance standards.

Endnotes

1. Organisational support and coherence are factors (management support, consensus on objectives, competitive strategy link, linkage to quality initiative, non-accounting ownership, and performance evaluation/compensation) found to be associated with ABCM success. However, Shields did not provide a specific definition of success (Shields 1995).

2. The electronics industry (SIC code 36) was chosen as the primary industry for the study. Restricting the sample to a single industry reduces noise, thereby increasing statistical power, and consequently providing a higher likelihood of identifying valid relationships, even though generalisability may be diminished. A survey questionnaire, with a cover letter explaining the purpose of the study, assuring respondents of the confidentiality of the information provided, was utilised. A self-addressed, postage-paid envelope was attached for returning the questionnaire to the researcher. Respondents were business unit managers and directors of several levels of management hierarchy. These managers and directors were approached to participate in the study as they are the most appropriate personnel, with experience, and are in charge with the responsibility for the performance of their units.

3. We used discriminant analysis to compare respondents to the first mailing, the early respondents, to those responding to the second mailing, the late respondents (Fowler, 1993). Results revealed that the two groups did not differ significantly in either the level of the variables or in the relationship between the variables at the .05 level. This suggests that non-response bias may not be a problem.

4. Three assumptions are made when interpreting the estimation results of the models. First, we assume that some organisations have not chosen their ABCM and benchmarking practices optimally, so that organisational performance will vary cross-sectionally with the observed ABCM and benchmarking choices. Second, we assume that the variables have low measurement error and the functional form of the models is appropriate. Finally, we assume ABCM and benchmarking constructs are exogenous, making the coefficient estimates for our model consistent.

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Appendix: Survey Questionnaire

Part I

A. Please indicate the degree to which each of the following activity-based cost management organisational support and coherence initiatives are present:

	1 = extremely low						7 = extremely high
1. The degree to which the ABCM initiative has the support of top management	1	2	3	4	5	6	7
2. When the ABCM initiative began, the extent of consensus about the ABCM objective	1	2	3	4	5	6	7
3. The degree to which the ABCM is linked to competitive strategy	1	2	3	4	5	6	7
4. The degree of linkage of the ABCM initiative to quality initiatives	1	2	3	4	5	6	7
5. The degree of non-accounting Ownership	1	2	3	4	5	6	7
6. The degree of linkage of ABCM to performance evaluation and compensation	1	2	3	4	5	6	7

B. Please indicate the degree to which each of the following is present in your benchmarking initiatives

	1 = extremely low						7 = extremely high
1. Emphasis on benchmarking competitors' products and processes	1	2	3	4	5	6	7
2. Effectiveness of benchmarking on product quality improvement	1	2	3	4	5	6	7
3. Effectiveness of benchmarking on product quality reduction	1	2	3	4	5	6	7

Part II

A. Please indicate the extent to which product costs have improved for the years 1997 and 1999 as a result of benchmarking initiatives and activity-based cost management organisational support and coherence (please circle one):

	1 = extremely low improvement **1999**						7 = extremely high improvement **1997**
	1	2	3	4	5	6	7

B. Please indicate the extent to which waste (or non-value added activities) has improved for the years 1997 and 1999 as a result to of benchmarking initiatives and activity-based cost management organisational support and coherence (please circle one):

	1 = extremely low improvement **1999**						7 = extremely high improvement **1997**
1. Units of defects as a percentage of units inspected (at final inspection	1	2	3	4	5	6	7
2. Cost of scrap as a percentage of total manufacturing cost	1	2	3	4	5	6	7
3. Units reworked as a percentage of units inspected (at final inspection)	1	2	3	4	5	6	7
4. Units returned as a percentage of units sold	1	2	3	4	5	6	7
5. Warranty cost as a percentage of sales dollars	1	2	3	4	5	6	7

Appendix - Continued

C. Please indicate the extent to which return on investment has improved for the years 1997 and 1999 as a result to of benchmarking initiatives and activity-based cost management organisational support and coherence (please circle one). Note: For purposes of this study, ROI is defined as operating income before interest, corporate expense allocation, and tax over total assets.

	1 = extremely low improvement **1999**								7 = extremely high improvement **1997**						
	1	2	3	4	5	6	7		1	2	3	4	5	6	7

Part III.

1. How many employees work at your plant? _____

2. Please indicate your position _____