A Classification of Quality/Cost Competitive Priorities in Japanese Manufacturing Firms: Empirical evidence based on management accounting practices

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Abstract

This study aims to examine whether there is a difference in management accounting practices among the combination of quality/cost competitive priorities. Using cluster analysis, we explore the combination of quality/cost competitive priorities. The classification suggests that 4 combinations exist, i.e. Disadvantaged, Cost-emphasis, Quality-emphasis, and Dual-emphasis. The results of ANOVA show that larger extent regarding usage of cost and performance measures in Dual-emphasis group, significant dysfunction of target cost management in Cost-emphasis firms, and no organization size difference exists between Quality-emphasis and Disadvantaged group. The classification develops operations management theory by providing possibility of quality/cost priorities' coexistence based on product development perspective. In addition, these combinations' variance proposes the contribution of management accounting information in investigating competitive priorities' relationship.

Keywords

Target cost management, quality management, competitive priority, operations performance, cluster analysis, mail survey

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Introduction

This study aims to examine whether there is a difference in management accounting practices among the combination of quality/cost competitive priorities. According to Skinner (1969, 1974) and Hayes and Wheelwright (1984), competitive priorities denote a strategy which emphasize on developing certain manufacturing capabilities that may enhance a plant's or a firm-level position in the marketplace. For more than 25 years, researchers from strategic management (e.g., Corbett and Van Wassenhove, 1993; De Meyer, Nakane, Miller, and Ferdows, 1990; Frohlich and Dixon, 2001; Miller and Roth, 1994; Noble, 1995), operations management (e. g., Boyer and Lweis, 2002; Flynn and Flynn, 2004; Kathuria, 2000) and management accounting (e. g., Chenhall and Langfield-Smith, 1998; Daniel and Reitsperger, 1991; Daniel, Reitsperger and Gregson, 1995; Daniel, Reitsperger, Morse, 2009) provide the evidence that became proof or disproof of the early pioneer works' trade-off perspective. Boyer, Swink, and Rosenzweig (2005) and Swink and Way (1995) identified the debate involves two theoretical perspectives: the trade-off and cumulative model, which between the supporters of the proposition that *trade-offs* among quality, cost, delivery, and flexibility are necessary versus supporters of a *cumulative* capabilities model specifying that these priorities can be complementary and built simultaneously over time.

Prior studies of those two models are short of meticulous explanation about the cases that is not suited to oneself, which is particularly apparent for the problem of quality and cost. Most of these problems relating achievement of high-quality and low-cost, are closely related to the management accounting perspective, an indispensable approach to the puzzle of operations management research (Hansen and Mouritsen, 2007). For example, evidence regarding trade-off priorities of quality and cost don't tell us whether the usage of management accounting information (Fry, Steele, and Saladin, 1995, 1998; Pierce and O'Dea, 2003) such as cost information (Karmarkar, Lederer, and Zimmerman, 1990) and manufacturing measurements (Kaplan, 1983, 1990; Lillis, 2002), or organization size (Kathuria, 2000; Sanjay and Golhar, 1996) leads trade-off perceived firms to dual-emphasis, and without enough attention to the coexistence of high-quality and low-cost from quality-cost researches' knowledge (Atkinson, Hamburg, Ittner, 1994; Atkinson, Hohner, Mudt, Troxel, and Winchell, 1991; Fine, 1986; Ittner, 1996; Ittner, Nagar, and Rajan, 2001). Similarly, in spite of cumulative model's proposition that quality-first competitive priority should be implemented rather than cost-first (Corbett and Van Wassenhove, 1993; Noble, 1995), little work has been done to empirically investigate that cost-first will inhibits effort to obtain sustainable competitiveness (Kato, 1993b; Shank and Govindarajan, 1993; Yoshida, 2003).

Even more important, although product and process design are the most effective levers in quality improvement and cost reduction (Anderson and Sedatole, 1998; Clark and Fujimoto, 1991), unfortunately, quality/cost competitive priorities classification that focus on product development phase remains unclear. Hence, this research classifies quality/cost competitive priorities using a product development view point of target cost management (TCM) practices.

Using survey data on the setting of TCM from Japanese manufacturing firms, we test that 4 combinations of quality/cost priorities exist, i.e. Disadvantaged, Cost-emphasis, Quality-emphasis, and Dual-emphasis. We provide evidence about features in these four groups. First, there are differences among Dual-emphasis group and the other two groups, Disadvantaged and Quality-emphasis, in terms of the importance of financial and non-financial performance measures, usage of actual costs and physical measure information. Second, the findings suggest that product engineers' exhaustion and suppliers' fatigue, a part of the dysfunction of target cost management (Kato, 1993b; Kato and Yoshida, 1998; Yoshida, 2003), is higher in the group of

Cost-emphasis than that in the others. Furtherly, the organization size of Dual-emphasis group is significantly larger than other groups', but no difference exist between Disadvantaged and Quality-emphasis.

As an exploratory analysis, the current research is one of the first step to classify the quality/cost competitive priorities by mean of product development viewpoint and management accounting practices, which offers two aspects of implications, and intends to contribute to literatures in some different ways. To start with, we develop an interpretive model exploring characteristics of quality/cost emphasis firms and find that quality-first cumulative capabilities model is supported empirically. This model enriches the literatures in strategic management and operations management research by showing that cost information and performance measures diversity may be a contribution to Disadvantaged group's possible development path to Dual-emphasis group via Quality-emphasis. On the other hand, cost-first priority forwarding to the achievement of high quality and low cost would meet a potential impediment regarding the premature capability of target cost management, which offer a new insight into the understanding of cost-first type trade-off perspective.

The reminder of this paper is structured as follows. The next section provides theoretical development, background and introduces 4 research propositions. Then it moves to indicates research method and variables measurement. The part of analyses will present the results of the standard method of cluster analysis and ANOVA (analysis of variance), and subsequent section regarding discussion. Finally, we provide the conclusions and implications for future research.

Background and research propositions

Quality/cost competitive priorities' trade-off vs. cumulative perspective

The perspective of quality/cost competitive priorities' trade-off relationship is based on the discipline of linkage between business strategy and manufacturing competitive capabilities. This stream of research focuses the necessity to limit resources to the single manufacturing capability. Skinner (1969) and Wheelwright (1978) suggest some important trade-off decisions in manufacturing include the reliability and quality *or* low costs, Skinner (1974) also points out that low-cost plant may be a mistake if the company sacrifice in the way of quality, flexibility and delivery. Miller and Roth (1994) expand the works of Skinner (1969, 1974), they provide 3 groups regarding competitive capabilities which be named as Caretakers, Marketeers and Innovators. Competitive capabilities of the highest rank including low price and high conformance (quality), however, cannot be found in the same group via their cluster analysis. The reexaminations for Miller and Roth (1994) found mixed results regarding whether competitive capabilities of low price (low cost) and high quality can be observed in one group simultaneously. In these researches, factors such as region (Flynn and Flynn, 2004; Frohlich and Dixon, 2001; Zhao, Sum, Qi, Zhang, and Lee, 2006; Zhao, Yeung, and Zhow, 2002) and organization size (Kathuria, 2000; Sum, Kow, and Chen, 2004) have been discussed to clarify the consistency of Miller and Roth's groups, but the coexistence of low-cost and high-quality received little notice yet. Boyer and Lweis (2002) use transformation method to illustrate that relationships between competitive priorities are fairly complex. They employ survey data collected from managers and operators that have recently implemented advanced manufacturing technology (AMT) and suggest that trade-offs among competitive priorities remain in operations management decision making . In general, these papers find that most of firms are faced with manufacturing competitive capabilities' trade-offs, but this stream of researches do not provide systematic analysis to investigate why the trade-offs exists.

As an alternative approach to the trade-off perspective, researches pay close attention to the relationship regarding quality improvement and cost reduction, and investigate whether and how this trade-off is perceived by manufacturing firms' managers. This approach arises from the notion of "zero-defect" or "quality is free" (Crosby, 1979), which as an element of competitive advantage (Powell, 1995). Zero-defect is against the concept of "acceptable quality level (AQL)". Hayes and Wheelwright (1984) furthered Skinner's standpoint by investigating differences between American and Japanese manufacturing firms. They find that the American concept of an "acceptable quality level (AQL)" has not been adopted by the Japanese because the zero-defect consciousness is acceptable, in spite of no direct evidence that zero-defect with low-cost in these Japanese firms. Japanese manufacturing firms' quality management is known as a synonym of zero-defect consciousness introduced by a large number of literatures in quality management (e.g., Cole, 1998; Flynn, 1992; Garvin, 1984, 1986; Imai, 1986; Ishikawa, 1985; Juran, 1993; Schonberger, 1982; Takeuchi, 1981; Wheelwright, 1981; Xu, 1999) and management accounting (e. g., Hiromoto, 1988; Johnson and Kaplan, 1987; Kaplan, 1983) literatures since 1980s. However, Reitsperger and Daniel (1994, 1999) provide empirical evidence that substantial proportions of Japanese operating managers who either disagree with "quality is free" notions or are undecided, though their test related to the difference between Japanese and US managers' quality consciousness. This result is similar to their longitudinal study of Japanese manufacturing strategies for quality (Daniel et al., 2009), and another multinational investigation (DeMeyer, Nakane, Miller, and Ferdow, 1989). Daniel and Reitsperger (1991), Daniel et al. (1995) and Daniel, Lee and Reitsperger (2014) provide the evidence empirically, and explain that management control systems (such as quality goals and feedback) about quality performance (such as reject rate) are more frequently provided to managers adhering to a zero-defect quality strategy than to managers who are AQL proponents. In addition, Ittner and Larcker (1997) indicate that organizations placing more emphasis on quality (rather than on low-cost) in the strategic plan do tend to employ strategic control practices that are consistent with this strategic emphasis. In this way, we can presume that quality-first and cost-first manufacturing firms are distinct from each other. However, little research of this stream focus on evidence that high-quality and low-cost as a performance does exist in manufacturing firms.

In contrast to studies which investigate the relationship between trade-off and zero-defect consciousness, the other perspective of quality/cost competitive priorities holds that a cumulative capabilities model (which is also be called "sand cone model") and specifies that these priorities can be complementary and built simultaneously over time. In particular, this stream of research suggests a model which shows that to build cumulative and lasting manufacturing capability, management attention and resource should go first toward quality improvement, while all others efforts (such as flexibility) are further enlarged, direct attention can be paid to cost reduction (Corbett and Wassenhove, 1993; Ferdows and DeMeyer, 1990). As a test of Hayes and Wheelwright's foundation (Hayes and Wheelwright, 1984), Flynn, Schroeder, and Flynn (1999) demonstrate no trade-offs between dimensions competitive performance, and they find that quality management process focus practices and world-class manufacturing (Hayes and Pisano, 1994) is also simultaneously related to competitive performance. Roth and Miller (1992) find that superior financial performance firms hold more superior capabilities including quality and price than poor performance firms, but not all manufacturing capabilities are equal. Their capability profiles supports cumulative model which predicts that quality management must come first than price. Rosenzweig and Roth (2004) replicate and extend the empirically observed cumulative capabilities models through committing path analysis on high-tech manufacturing firms. Noble (1995) finds that quality is not only at the base of the cumulative model but is often the multiple capabilities in his survey data from American, European and Korean manufacturing factories, and he demonstrates that quality management is globally important. In addition, the findings of Kruger (2012) also indicate that cumulative capabilities model can be supported by South African businesses' operation strategies. However, Flynn and Flynn (2004) using data from 5 countries and 3 industries to test cumulative capabilities by regression analysis, which did not find evidence support the sequential progression of cumulative capabilities, in spite of their results support the cumulative relationship among capabilities. They suggest that it is highly unlikely that the same sequence will be optimal under all circumstance. Zatzick, Moliterno, and Fang (2012) propose that TQM is an "elaborating element" that achieves internal fit when the core elements of the activity system are orientated toward a "cost leadership" rather than "differentiation" strategic position. This finding suggests that quality priority will not be a nostrum in creating sustainable competitiveness when firm forwarding to provide differentiated products.

TCM and quality/cost competitive priorities

Although quality/cost competitive priorities' trade-off and cumulative perspectives have been widely discussed, few literature has discussed this issue from the viewpoint of product development. According to the literature review of Brown and Eisenhardt (1995) which focus on product-development, they suggest that product advantage include quality and cost should fit with core competence. In this paper, we explore the classification of quality/cost competitive priorities based on TCM.

TCM means a system of profit planning and cost management at earliest stages of product development that is price led, customer focused, design centered and cross functional (Ansari et al., 1997; 2007). TCM aims to simultaneously achieve a target cost along with planning, development and detailed design of new products (Tani et al., 1994), which may be a support for the quality/cost competitive priorities in three aspects, regarding setting lower target costs and developing more excellent quality.

First, Target costs are set at an aggressive level not only for the firm itself but also for competitors, because target price are determined in the product market and target profit are broken down from corporate targets (Cooper and Slagmulder, 1999; Kato, 1993a/b). According to the equation of TCM, "Target cost = Expected sales price – Target profit," target price is given by marketplace and target profit is determined by organizational business strategy and profit planning (Kato, 1993a/b; Monden and Hamada, 1991).

Second, TCM has multiple objectives including cost reduction, quality assurance, timely introduction of new products into the market and product development to attract customers (Tani et al., 1994). For example, as one core TCM tool and technique, quality function deployment (QFD) is used in product concept stages of TCM to combine the relationships among competitive offerings, customer requirements, and design parameters (Ansari et al., 1997), then contribute to improve design quality (Anderson and Sedatole, 1998).

Third, concurrent engineering (CE), as a key concept of TCM, which is also called rugby style product development (Takeuchi and Nonaka, 1986), overlaps phases of development (Imai, Nonaka, and Takeuchi, 1985), or simultaneous engineering (Tani et al., 1994), characterized involvement of the managers of product planning, development, design, production preparation and manufacturing as the cross-functional team in product development processes (Carter and Baker, 1992). In addition, CE made up of four parts, i.e. the company assessment questionnaire, the methods matrix, the dimensions map, and the priority roadmap. One of them, priority roadmap presented here helps engineers "determine priorities for starting to bring the dimensions into balance – the priorities for implementing the concurrent engineering vision for" (Carter and Baker, 1992: p. 72) their company. In practical terms, quality competitive priories regarding continuous improvement, CE providing direction for continuous improvement in the product and process (Carter and Baker, 1992; Imai et al., 1985), using different managers and teams' points of view at different times (Carter and Baker, 1992; Tani, 1995), revealing production problems earlier (Clark and Fujimoto, 1991). On the other hand, cost competitive priories mainly improve the new product development performance, and CE usually contributes cost reduction by innovation (Valle and Vazquez-Bustelo, 2009).

Different competitive priorities often relay on a product development that reflect firms' business strategy and realize manufacturing competitive capabilities. In this paper, we propose that quality/cost competitive priorities' difference exists in product development phase of manufacturing firms which use TCM.

Proposition 1. Based on the usage of TCM, manufacturing firms can be classified into different groups regarding their emphasis on competitive priorities: cost or quality, and both.

Cost information and performance measurement for quality management

It is suggested that traditional cost accounting do not track sources of competitiveness such as quality and flexibility timely and precisely in the global economy since 1980s (Johnson, 1990;

Johnson and Kaplan, 1987; Kaplan, 1983; 1985). Armitage and Atkinson (1990) observed usefulness of representative traditional cost accounting practices such as process costing and standard costing, and the outputs from these cost accounting practices are not found to be useful in measuring or directing productivity improvement. They suggest that effective accounting systems are not generic and must relate to the particular strategic objectives and opportunities of each firm. The effect of cost accounting or the usage of cost information on quality management has been in doubt in 1980s. According to strategic cost management research (Shank and Govindarajan, 1993), the role of cost analysis differs in important ways depending on how the firm is choosing to compete. Manufacturing cost control's importance is an example and that is higher in cost leadership strategy than in product differentiation strategy (Shank and Govindarajan, 1993). However, no direct evidence suggests that the usage of cost information from traditional cost accounting might impede product quality improvement. Some empirical evidence suggest that usage of cost information even contribute to quality management. For example, Fry, Steel, and Saladin (1995, 1998) find that users of standard cost systems manufacture products that compete in the market on quality while non-users compete on price. Even in the firms that do not focus on low price strategic priorities, evidence show that there are various usages of management accounting practices with superior organizational performance, which including traditional accounting techniques (Chenhall and Langfield-Smith, 1998). The usages of cost information are likely to be moderated by system and market factors (Tse, 2011), traditional cost information do not necessarily mean an obstacle of firms' simultaneous quality/cost competitive priorities.

Another stream of management accounting researchers began work on explore the effect of non-financial measures (Ittner and Larcker, 1998) to quality improvement. Cooper and Kaplan

(1999) present a broad array of non-financial measures to monitor and improve the quality of product when organizations' operating under the total quality management (TQM). Japanese manufacturing firms' physical measure that as opposed to a production unit measured by a monetary term is known as a feature of their excellent manufacturing from the beginning of the 1980s (Hiromoto, 1988; Okano and Suzuki, 2007). Usefulness of non-financial measures (or manufacturing performance measures) for quality management is also supported in case study (Patell, 1987) and mail survey (Chenhall, 1997). Unfortunately, controversy also exists in the prior studies which focus on usage of non-financial measures' contribution to quality management. Perera, Harrison, and Poole (1997) cannot find positive performance effects between combinations of non-financial measure and TQM. One explanation for these differing findings is in the use of the performance measures, which is the linkage of measure to reward and compensation systems (Chenhall and Langfield-Smith, 2007). However, Ittner and Larcker (1995) find no evidence that nontraditional performance measurement and reward systems improve the performance of organizations with extensive formal quality management programs. Recently, an alternative approach focuses on the effect of objective and subjective nonfinancial measures on quality strategy performance, they find that performance measurement diversity benefits performance, regardless of strategy (Van der Stede, Chow, and Lin, 2006).

The other general argument concerning the usage of cost information and performance measurement relates to quality goal or data reporting. Quality data reporting is a critical factor of quality management (Saraph, Benson, and Schroeder, 1989). Quality priority firms advocate the importance of quality-related goal, incentives or feedback (Levine and Shaw, 2000). The reporting of manufacturing performance measures to line personnel is positively related to the implementation of TQM (Banker, Potter, and Schroeder, 1993; Sim and Killough, 1998). Maiga and Jacobs (2005, 2006) provide empirical evidence about effect of quality goal, quality feedback and quality incentives on quality performance improvement. However, there was also little evidence of differences in performance reporting systems between ISO accredited and non-ISO accredited companies has been found (Carr, Mak, and Needham, 1997).

In an effort to understand the conflicting conclusions regarding the different cost information or performance measurement's contribution in disparate combination of quality/cost competitive priorities, we propose that:

Proposition 2a. The group orientation — competitive priorities emphasized — is associated with the usage of cost information.

Proposition 2b. The group orientation — competitive priorities emphasized — is associated with the usage of performance measurement.

Organization size

Although organization size is an important contingency factor, little attention has been paid to the influence of size on coexistence of quality/cost competitive priorities. Even though there are some studies (Katuria, 2000; Sum et al., 2004) focus on the middle and small-size enterprises to test cumulative model or classify the groups of competitive priorities, little studies explore the difference of size among the clusters. We propose that the effect of organization size on quality-first competitive priority is unlike on the cost-first competitive priority.

First, size of the organization has been found to be an important factor influencing the adoption of cost and accounting system (Otely, 1980). The effect of organization size on the importance of cost information is significant (Abdel-Kader and Luther, 2008; Al-Omiri and

Drury, 2007). With the expansion of size, firms will improve efficiency, pay effort on focusing the opportunities for specialization, then larger organizations tend to have more power in controlling their operating environment (Chenhall, 2003).

Second, the relationship of organization size and quality priority may be more complex than cost priority. On the one hand, Benson, Saraph, and Schroeder (1991) find that managers' view of ideal quality management is not affected by their company size. Design management and process management on quality do not affected by firm size (Ahire and Dreyfus, 2000). More evidence demonstrate that even as small size companies, the firms can also hold zero-defect consciousness (Daniel et al., 2014; Ross and Klatt, 1986) and TQM (Ahire and Golhar, 1996) as larger size companies, and use the resource to obtain quality management certification (Sum et al., 2004). On the other hand, effect of firms' size is a factor that cannot be ignored when firms focus on quality and cost priority at the same time. Kober, Subraamanniam, and Watson (2012) cannot find evidence that TQM improved financial performance in small and medium enterprises. Their findings imply that middle and small-size firms can implement TQM actively but suffer the problem of cost reduction and profits improvement. Larger firms would be best served to apply equal efforts to internal and external failure cost reduction (Rodchua, 2008), which related to quality-based cost management (Atkinson et al., 1991; 1994; Dale and Plunkett, 1995; Institute of Management Accountants, 1993; Morse, Roth, and Poston, 1987) that link the quality performance to profits.

Less literature has investigated whether the organization size is different across various kinds of combinations of quality/cost competitive priorities. Size may have no effect on quality-emphasis firm. Thus, we propose that:

Proposition 3a. The group orientation — competitive priorities emphasized — is associated with organization size.

Proposition 3b. The group orientation — quality-emphasis and disadvantage in quality— is NOT associated with organization size.

Dysfunctional aspect of TCM and sustainable competitiveness

Because the organizational capabilities for TCM have a major influence on the sustainable competitive advantage (Yoshida, 2003), dysfunction of TCM may be a potential impediment in quality/cost competitive priorities' progress. Kato (1993a/b) and Kato, Boer, and Chow (1995) demonstrate the dysfunction of TCM including design engineers burn out, suppliers' fatigue, and mistreatment of customer requirement. It is a challenge for companies to overcome these problems while maintaining their sustainable competitiveness (Kato, 1993b). We know remarkably little about dysfunctional aspect of TCM and competitive priorities. As an important rare empirical evidence, Yoshida (2003) finds that excessive definite directional product development incurs design engineers' exhaustion (is also called burn-out), which may impede the firms to obtain sustainable competitiveness. Perhaps the extent to which TCM dysfunction exists in what competitive priorities group may be important in understanding relationships among different combination of competitive priorities. In this paper, a situation that can be summarized in our fourth proposition:

Proposition 4. The group orientation — competitive priorities emphasized — is associated with dysfunctional aspect of TCM.

Method

Sample selection, survey development

In 2014, we conduct a cross-sectional questionnaire survey (Dillman and Smyth, 2009) to executive officer or director of accounting department of 847 firms in manufacturing industries, which are listed on the first section of the Tokyo Stock Exchange. In total, 130 firms responded and an overall response rate was 15.3%, we remove the firms that don't use TCM and drop the sample with missing data. The final sample of this study is 104 firms. Table 1 shows the sample.

We use Chi-square statistics to test whether respondents and non-respondents have different characteristics such as size and industry. We find that the distribution of respondent firms and non-respondent firms across the industry is the same (p=0.69). In terms of size, respondent firms have significantly more employees than non-respondent firms and the p value is 0.05, but no significant differences exist in sales volumes (p=0.15). In sum, our sample might be subject to a non-respondent bias in terms of size and mainly reflect the actual condition of larger firms in the first section of the Tokyo Stock Exchange.

Variable measurement

Quality priority. Although the concept or definition of quality is used in a variety of approaches (Garvin, 1987, 1992; Kelemen, 2003; Reeves and Bednar, 1994), according to textbooks of operations management (Stevenson, 2015) and management accounting (Horngren, Datar, and Rajan, 2012), and academic researches (Anderson and Sedatole, 1998; Freiesleben, 2010; Ittner et al., 2001), for this study, we limit category of quality in product quality, which includes "design quality" and "conformance quality". Respondents were asked to indicate the degree of TCM effect regarding "achievement of quality and function". And we ask a sticky end of TCM regarding "deteriorate product quality" also by 1 (no problem) -7 (a serious problem) then we reverse scoring because the cluster analysis needs all item using the same direction and scale.

Cost priority. We limit "cost" here to product cost, because product design generally offers the greater potential for achieving high quality performance than process design (Anderson and Sedatole, 1998) and based on TCM view. Two items regarding types of cost target (Kato, 1993b), "market-oriented cost target (Is target cost set reflecting market prices in product development processes?)" and "aggressive cost target (Is target cost set at the challenging level that cannot be achieved easily at starting point in product development processes?)" for measuring cost priority. Because high-quality will lead to a high price rather than low cost (Phillips, Chang and Buzzel, 1983), aggressive cost target here we mean that whether such a target is too high or not based on the historical experience for similar projects in the same firm, but also based on the point of views from their counterparties or competitors. We also measure the "achievement of cost target (the cost target which has been set at starting point in product development process will be achieved frequently)". And "cost reduction" as effect of TCM be measured.

Concurrent engineering and continuous improvement. CE is measured by the question regarding "are not only design engineers but also many related cross-functional members involved in product development processes?", and our question of continuous improvement means that "daily continuous improvement as the main business unit(s)' feature". In addition, for clarify simultaneous quality/cost-emphasis, we measure "employees working towards multiple targets such as cost, quality and product performance autonomously (employees' autonomy in achieving multiple targets)".

Cost information and performance measurement. As shown in Table 2, usage of actual cost, physical measures, financial measurement, customer measurement, business process measurement, is asked to measure the usage of cost information and performance measurement. "Fitness of business strategy and performance objectives" is measured to test whether any excellent strategy planning and control practice need a precondition about fine quality performance, which can be used to discuss the cumulative model.

Dysfunctional aspect of TCM. In this study, we limit the dysfunction of TCM to "product engineers' exhaustion in TCM" and "suppliers' fatigue in TCM" (Kato, 1993a).

All of questions above are measured by 1-7 Likert scales.

Organization size. According to Kimberly (1976), we use sales, assets, and number of employees to measure the size (by evaluating natural logarithm).

Descriptive statistics of the construct are presented in Table 2. Correlation matrix is in Table 3.

Data Analysis

We employ cluster analysis to classify the combination of quality/cost competitive priorities. Cluster analysis methods provide sophisticated means for determining the way in which variables combine, and is essentially about discovering groups in data (Everitt, Landau, and Leese, 2001). In the current study, the clustering[1] provides the groups of samples that are similar in terms of a selection of target cost setting, performance of cost reduction or quality and function, and continuous improvement.

We consult the application of cluster analysis for strategic group analysis (Harrigan, 1985; Ketchen and Shook, 1996; Miller and Roth, 1994) and management accounting researches

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[1] We use standard agglomerative hierarchical clustering methods, Ward's method (minimum sum of squares). In Ward's method, cluster summed variables after fusion, which is sensitive to outliers (Everitt et al., 2001). This method contributes to the exploration of two extremes of competitive priorities or outstanding quality/cost priorities' coexistence in our survey.

(Chenhall and Langfield-Smith, 1998; Henri, 2008) to determine the most appropriate number of clusters. First, the number of clusters is limited to between *n*/30 to *n*/60, where *n* is the sample size, then two and four clusters are considered. Second, we use multivariate analysis (MANOVA) and discriminant analysis to statistically validate the robustness of these clusters (Henri, 2008). We use ANOVA, Tukey's pairwise comparison, Hedges's measure of effect size (Hedges's *g*) and measure of strength of relationship (η^2) to test differences among the clusters for our proposition 2 to 4.

Results

Our analysis procedures suggest that a four-cluster combination is the most appropriate classification for the samples which support proposition 1 (Table 4). The MANOVA shows that four clusters are significantly different on dimensions regarding quality/cost competitive priority, CE and improvement ($p< .001$). A discriminant model is developed based on these dimensions and by assuming that four clusters are classified. The three discriminant functions are statistically significant based upon Wilk's λ ($p< .001$). Group centroids for each of the four clusters differ substantially and 96.2% of the originally grouped cases are correctly classified. The four groups derived from the cluster analysis are labeled as follows: (C1) dual-emphasis, (C2) quality-emphasis, (C3) cost-emphasis, (C4) disadvantaged. Cost targets have been set rigorously and cost reduction effect is well in C1, while this group has almost highest mean scores of deteriorated product and continuous improvement. Quality-emphasis has highest scores of TCM performance regarding achievement of products quality and function, on the other hand, cost-emphasis group has higher mean scores in cost competitive priority dimension than quality-emphasis'. The remaining group (C4) has most of the lowest mean scores, this group may be disadvantaged in product development and competitive edge.

Proposition 2a and 2b predicted the usage of cost information and performance measurement is different among competitive priorities emphasized groups. Our results are shown in Table 5 and supports the proposition partly. First, the results of ANOVA show that all cost information and performance measurement but usage of business process measurement (*p*= .709) are different among four clusters significantly. Second, the results of Tukey's pairwise comparison between each cluster, and the Hedges's *g* for significant difference pairs (*g*> .6) show that the mean scores of usage of actual cost, physical measures, financial measurement, and business process measurement in dual-emphasis are higher than others' respectively. Furtherly, fitness of business strategy and performance objective's mean score in disadvantaged group (C4) is statistically lower than other three groups' (*g*> .6) significantly.

Table 6 shows the results of proposition 3a and 3b. The results of ANOVA regarding all of the organization size variables reveal statistically significant difference among the four groups (p< .01 when sales and assets as size, p< .001 when number of employees as size). The results suggest that dual-emphasis group is larger than quality-emphasis and disadvantaged group, which supports proposition 3a partly. In addition, there is no statistically significant difference regarding all three types of organization size between quality-emphasis and disadvantage group (*p*=1.00 when sale and asset as size, *p*= .99 when number of employees as size). Proposition 3b has been supported.

The mean score of product engineers' exhaustion in cost-emphasis group is higher than all three other groups (*p*< .01), and the mean score of suppliers' fatigue in cost-emphasis group is higher than quality-emphasis and disadvantage groups', all the effect size of these statistically significant difference is large (*g*> .8). Our findings suggest that proposition 4 has been supported partly (Table 7).

Discussion and conclusions

The main purpose of this research is to explore the combination of quality/cost competitive priorities based on a product development, and then examine whether the difference in management accounting practices among these combinations.

For the proposition 1, we applied a classification approach and clarified that four very different clusters exist. Prior studies which support trade-offs perspective demonstrate that high-quality cannot be achieved at a low cost level. The mixed results of trade-offs and cumulative perspective may be derived from the viewpoint which has been limited in manufacturing plants (e. g., Boyer and Lewis, 2002) or a broader business plan (e. g., Miller and Roth, 1994). When we use product development viewpoint in this study, the Japanese firms successfully achieve high-quality and low-cost or cannot be found concurrently. In the current study, cluster 1 (dual-emphasis group) has all the highest scores in dimension of cost competitive priority and improvement activities. Meanwhile, this group has a higher performance level of quality, and overcome the deteriorated product quality successfully. We also found that firms of cluster 2 and 3, which are skilled quality improvement or cost reduction. Our findings are in line with those obtained by other researchers who have examined empirically the relationships between quality management and firm performance growth. For instance, evidence has been provided to support that quality management rewarded firms not only have more excellent performance than competitors, but also have better results after receiving awards (Zhang and Xia, 2013). TCM as an important profit planning system that contributes to realizing different possibly conflicting goals, such as low cost, high quality, customer needs, and effective production (Cooper and Slagmulder, 1999; Kato, 1993a, b; Tani et al., 1994), which is neglected for a long time at the stream of competitive priority research.

While the results in term of proposition 2a and 2b were partly significant, the overall direction of results showed features that could be helpful to know about whether management accounting information is contribute to quality/cost competitive priorities' achievement. This paper, then, highlights the importance of cost information and performance measurement. First, the contribution of usage of actual cost, physical measures, financial measurement to quality/cost competitive priority has been documented by researchers who exploring the importance of management accounting information (Hansen and Mouristen, 2007). Dual and quality-emphasis pay more attention to the usage of actual cost, which means that they use a simple cost accounting system such as actual costing or normal costing (Horngren et al., 2012). Japanese's management accounting practices focus a lot on the usage of physical measures (Hiromoto, 1998; Okano and Suzuki, 2007), which compares with our test that suggest dual-emphasis' attention to these measures. Low level regarding usage of financial measurement exists in disadvantaged group may be an explanation about conflict conclusions in prior studies, because both quality and cost-emphasis groups will realize the importance of financial measurement. However, the reasons for these two groups' usage of financial measurement may be different. Quality-emphasis group can use financial measurement for a "return on quality" (Kroll, Wright, and Heiens, 1999; Rust, Zahorik, and Keiningham, 1995; Rust, Moorman, and Dickson, 2002), while cost-emphasis use financial measurement for variation analysis (Chenhall and Langfield-Smith, 1998; Kaplan, 1983). Second, as an exception, we cannot find that mean scores of usage of customer measurement is higher in dual or quality-emphasis group. This finding is conflict to the demonstration of Kaplan and Norton (1996), but similar to the findings of Ittner and Larcker (1995). In particular, in more advanced quality practices, strategic information is communicated more broadly throughout the organization, and quality program reflects organization's overall business strategy (Ittner and Larcker, 1995). In addition, there are also two aspect of customer satisfaction's contribution in TQM, one is monitoring and assessing known customer needs, and another one is scanning for new customers (Sitkin, Sutcliffe, and Schroeder, 1994). Hence, we propose that quality/cost target will not be achieved if firms focus on customer satisfaction partially. Third, according to the difference of fitness of business strategy and performance objectives among clusters, we suggest that the fitness should have to been paid attention, in order to a more explicit competitive priorities combination. We can also explain this result based on a cumulative perspective, and demonstrate that quality-priority may be a foundation in any excellent business strategy management system (where the fitness will be realized). The latter explanation is still a potential topic of future research. In sum, the diversity of usage of cost information and performance measurement may be a factor for the disadvantaged group to develop into dual-emphasis.

Our test also provides an understanding relating the effect of organization size on quality/cost competitive priority. As our mentioned, studies suggest that small-size firms can implement quality management preeminently (Ahire and Dreyfus, 2000; Ross and Klatt, 1986), but researchers cannot find the relationship between quality management practices and performance growth (Kober et al., 2012). The findings of our proposition 3a and 3b, provide the evidence that no statistically significant difference between cluster 2 (quality-emphasis) and 3 (disadvantaged), but cluster 1 (dual-emphasis) is larger than these two group. When smaller size firms look forward to a path from quality-first to dual-emphasis firms, their problem may be cost management system, organizational capability, or organizational culture, rather than the quality management technical matter.

Finally, our empirical design also provides a test of proposition 4 relating dysfunctional aspect of TCM in different combinations of quality/cost competitive priorities. Whereas much of the research on quality/cost competitive priorities focus on the superiority (Daniel et al., 1995) or negligence (Fine, 1986) of cost-priority, we have measured major factor relating the sustainable competitiveness, such as product engineers' exhaustion or suppliers' fatigue. These more important variables provide indirect insight but fine-grained measures of one of the sources of sustainable competitiveness (Yoshida, 2003). In the cost-emphasis group, product engineers' exhaustion in TCM is highest among other three groups, even statistically higher than other three groups' mean score. The cost-emphasis group has a successful cost reduction performance, however, which may sacrifice long term growth then lose sustainable competitiveness. This result is the evidence of the theoretical review of Kato (1993a, b) and empirical work of Yoshida (2003), and is the proof of cumulative perspective in which quality-first has been suggested rather than cost-first. In addition, cost-emphasis associated with suppliers' fatigue in TCM, the mean score in this group is higher than quality-emphasis and disadvantaged groups. Although supplier-buyer relationship in Japanese manufacturing supports the excellent performance regarding high-quality and low-cost (Cusumano and Takeshi, 1991), cost-priority sight may disrupt this relationship. On the other hand, there is no statistically significant difference between dual and cost-emphasis groups. It may be a tocsin about the Japanese supply chain relations which has been called as practices of "beyond the contract" (Dekker, Sakaguchi, and Kawai, 2013). Target setting and operational reviews as some parts of outstanding Japanese supply chain management (Dekker et al., 2013), which will make a success relating high-quality and low-cost, however, potential risk of suppliers' fatigue may exist in dual-emphasis group firms or their suppliers (Kato, 1993b).

This research contributes to understanding the quality/cost competitive priorities based on a product development viewpoint, and the differences which among combinations of these two competitive priorities. Evidence from our Japanese manufacturing firms' practices indicates that quality/cost competitive priorities can be emphasized simultaneously in product development phase. And multiple management accounting information or fitness of business strategy and performance objectives, and organization size can contribute firms' dual-emphasis. Finally, our analysis highlights a serious dysfunction of TCM in cost-first competitive priority that may face with impediment or no way for their sustainable competitiveness building. We show this relationship by an interpretive model in Figure 1. Subsequent work might explore the difference of quality management practices, cost management system, process management activities, and organization performance among these competitive priority combinations based on this hypothetical model. We also suggest that case study may be an alternative method to analysis how and why the different competitive priority combinations emerge.

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Table 1

Sample

Industry classification	
Food and beverages	10
Textile mill	4
Pulp, paper	2
Chemical	14
Drugs, medicines	4
Rubber	1
Glass, clay	3
Steel	3
Non-ferrous, fabricated metal	2
Fabricated metal	4
Machinery	10
Electrical, electronics	25
Transportation equipment	15
Precision equipment	2
Other manufacturing	5
Total sample	104

Size of organizations	
No. of employees	
200-1000	15
1001-5000	33
5001-10000	20
10001-15000	5
15001-20000	9
20001-25000	6
25001-30000	0
30001-35000	3
35001-40000	3
40001-45000	2
45001-50000	0
50001+	8
Total sample	104

Table 2

Descriptive statistics on variables

					95% CI	
	Mean (SD)	Median	Min	Max	LL	UL
(1)Market-oriented cost target	5.07(1.30)	5	2	7	4.81	5.32
(2)Aggressive cost target	3.67(1.38)	3	1	7	3.41	3.94
(3)Cost target achievement	3.46(1.06)	3	1	6	3.26	3.67
(4)Cost reduction	5.21(1.17)	5	2	7	4.98	5.44
(5)Quality and function	4.40(1.14)	4	2	7	4.18	4.62
(6)Deteriorated product quality (reverse scoring)	2.69(1.12)	2	1	6	2.47	2.91
(7)Concurrent engineering	5.18(1.33)	2	7	5	4.92	5.44
(8)Employees' autonomy in achieving multiple targets	4.69(1.08)	5	2	7	4.48	4.90
(9)Continuous improvement	5.15(1.34)	2	7	5	4.93	5.38
(10)Usage of actual cost	5.24(1.50)	5	1	7	4.95	5.53
(11)Usage of physical measures	4.78(1.62)	5	1	7	4.47	5.10
(12)Usage of financial measurement	6.05(1.16)	6	2	7	5.82	6.27
(13)Usage of customer measurement	4.07(1.50)	4	1	7	3.78	4.36
(14)Usage of business process measurement	3.75(1.45)	4	1	7	3.47	4.03
(15)Fitness of business strategy and performance objectives	5.16(1.38)	5	2	7	4.90	5.43
(16)Product engineers' exhaustion in TCM	3.20(1.06)	3	1	6	3.00	3.41
(17)Suppliers' fatigue in TCM	3.16(0.95)	3	1	6	2.98	3.35
(18)Sales (natural logarithm of sales volume)	5.24(0.63)	5.24	3.93	6.99	5.12	5.36
(19)Assets (natural logarithm of assets value)	5.29(0.60)	5.30	4.05	7.13	5.17	5.40
(20)Employees (natural logarithm of number of employees)	8.62(1.56)	8.63	5.53	12.59	8.32	8.93

Note. n=104, but "usage of physical measures" sample size=102. CI = confidence interval.

Table 3

Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1)	1	.300**	.153	.468***	.237*	.032	.302**	.181	.085	.155	.295**	.146	.037	.204*	.336***	.047	.030	.165	.163	.170
(2)		1	-.022	.308**	.178	-.154	.235*	.252**	.144	.137	.313**	.150	-.055	.221*	.224*	.307**	.303**	.254**	.228*	.297**
(3)			1	.265**	.263**	.222*	.319***	.303**	.214*	.173	.163	.179	.120	.315**	.281**	-.049	-.066	.104	.080	.069
(4)				1	.387***	.053	.293**	.359***	.281**	.313**	.275**	.307*	-.041	.151	.515***	.075	.144	.188	.186	.188
(5)					1	.107	.176	.347***	.177	.153	.221*	.162	.075	.220*	.318***	-.028	.001	.082	.064	.091
(6)						1	.235*	.175	.137	.065	.068	.011	.103	.083	.250*	-.552***	-.495***	.086	.084	.049
(7)							1	.243*	.225*	.206*	.335**	.234*	-.011	.104	.244*	-.068	-.039	.261**	.304**	.246*
(8)								1	.505***	.327***	.210*	.058	-.029	.130	.375***	-.047	.050	.263**	.233*	.245*
(9)									1	.080	.231*	-.013	.102	.311**	.307**	-.034	.094	.244*	.195*	.281**
(10)										1	.506**	.244*	-.076	.130	.319***	.036	.020	.011	.026	-.045
(11)											1	.289*	-.069	.157	.260**	.041	.034	.072	.085	.137
(12)												1	.076	.117	.354**	-.056	-.016	.151	.167	.112
(13)													1	.404***	.155	.046	.033	.104	.072	.127
(14)														1	.352***	.027	-.055	.017	.012	.074
(15)															1	-.123	-.043	.128	.129	.101
(16)																1	.832***	-.023	.000	.024
(17)																	1	.150	.135	.185
(18)																		1	.969***	.928***
(19)																			1	.892***
(20)																				1

Note. Using Pearson correlation coefficient. Sequence number of variable is the same as Table 2. ***p< .001, **p< .01, *p< .05.

Table 4

Mean scores of variables within clusters

	(C1) Dual-emphasis (quality/cost) n=21	(C2) Quality-emphasis n=32	(C3) Cost-emphasis n=17	(4)Dis-advantaged n=34	F
Cost competitive priority					
Market-oriented cost target	**6.05** (1.024)	5.22 (1.184)	5.59 (1.176)	4.06 (0.919)	17.511***
Aggressive cost target	**5.00** (1.000)	3.09 (1.228)	4.41 (1.460)	3.03 (0.834)	19.137***
Cost target achievement	**4.24** (1.044)	3.75 (1.047)	3.29 (1.047)	2.79 (0.592)	12.151***
Cost reduction	**6.05** (0.805)	5.50 (0.916)	5.53 (1.068)	4.26 (1.024)	17.988***
Quality competitive priority					
Quality and function	4.62 (0.973)	**5.09** (1.254)	4.06 (0.966)	3.79 (0.770)	10.070***
Deteriorated product quality (reverse scoring)	**5.95** (0.129)	5.88 (0.125)	3.65 (0.270)	5.21 (0.139)	34.568***
Concurrent engineering and improvement					
Concurrent engineering	**6.19** (0.680)	5.53 (1.367)	5.24 (1.091)	4.21 (1.067)	15.534***
Employees' autonomy in achieving multiple targets	**5.67** (0.966)	4.84 (0.954)	4.47 (1.007)	4.06 (0.814)	13.784***
Continuous improvement	**6.29** (0.784)	4.88 (1.129)	4.82 (0.883)	4.88 (1.038)	11.275***

Note. Standard agglomerative hierarchical clustering methods, Ward's method (minimum sum of squares). Mean numbers represented as bold means the top rank among four clusters. The higher the "Deteriorated product quality" score, the less product quality problem. ***$p < .001$

Table 5

Cost information, performance measurement and clusters

		(C1) Dual-emphasis (quality/cost) n=21	(C2) Quality-emphasis n=32	(C3) Cost-emphasis n=17	(4)Dis-advantaged n=34	F	η^2
Usage of actual cost	C2	0.33					
	C3	0.62	0.30				
	C4	1.27* (*g*=0.89)	0.94* (*g*=0.62)	-0.65			
	Mean	5.86	5.53	5.24	4.59	4.035**	0.11
Usage of physical measures	C2	1.22* (*g*=0.78)					
	C3	1.19† (*g*=1.10)	-0.03				
	C4	2.00* (*g*=1.54)	0.78	0.81			
	Mean	6.00	4.78	4.81	4.00	7.842***	0.20
Usage of financial measurement	C2	0.05					
	C3	-0.14	-0.19				
	C4	0.89* (*g*=0.71)	0.84* (*g*=0.70)	1.03* (*g*=0.85)			
	Mean	6.33	6.28	6.47	5.44	5.290**	0.14
Usage of customer measurement	C2	-0.31					
	C3	-0.06	0.25				
	C4	0.12	0.43	0.18			
	Mean	4.00	4.31	4.06	3.88	0.463	0.01
Usage of business process measurement	C2	0.79					
	C3	0.54	-0.25				
	C4	1.21* (*g*=0.90)	0.42	0.68			
	Mean	4.48	3.69	3.94	3.26	3.344*	0.09
Fitness of business strategy and performance objectives	C2	0.17					
	C3	0.74	0.57				
	C4	1.59*** (*g*=1.44)	1.42*** (*g*=1.20)	0.85† (*g*=0.73)			
	Mean	5.86	5.69	5.12	4.26	10.461***	0.24

Note. One-way Independent ANOVA. Tukey's post-hoc tests. ***p< .001, **p< .01, *p< .05, † < .10

Table 6

Organization size and clusters

		(C1) Dual-emphasis (quality/cost) n=21	(C2) Quality-emphasis n=32	(C3) Cost-emphasis n=17	(4)Dis-advantaged n=34	F	η^2
Sales	C2	0.59** (*g*=1.03)					
	C3	0.31	-0.28				
	C4	0.60** (*g*=1.07)	0.00	0.29			
	Mean	5.67	5.07	5.36	5.07	5.700**	0.15
Assets	C2	0.54** (*g*=0.95)					
	C3	0.29	-0.25				
	C4	0.54* (*g*=0.97)	0.00	0.25			
	Mean	5.68	5.14	5.38	5.14	4.984**	0.13
employees	C2	1.59***(*g*=1.06)					
	C3	0.62	-0.97				
	C4	1.47**(*g*=1.00)	-0.13	0.85			
	Mean	9.69	8.10	9.07	8.23	6.60***	0.17

Note. One-way Independent ANOVA. Tukey's post-hoc tests. All variables have been evaluated by natural logarithm.

***p< .001, **p< .01, *p< .05, †< .10

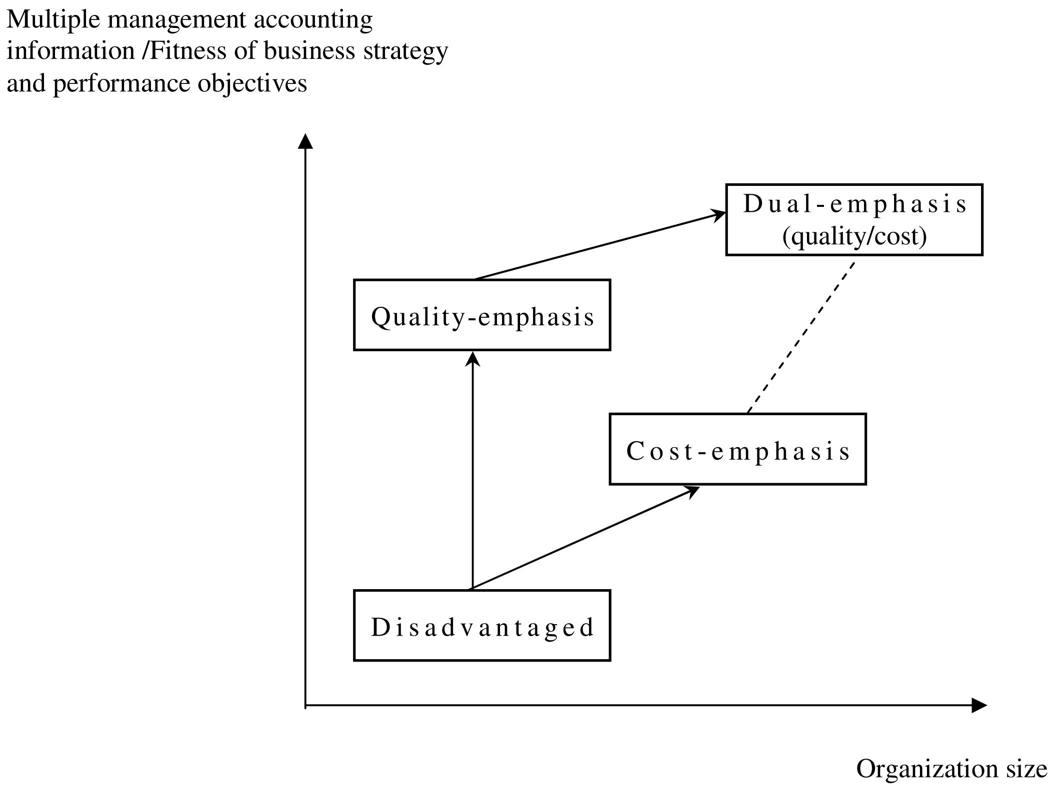
Table 7

Dysfunctional aspect of TCM and clusters

		(C1) Dual-emphasis (quality/cost) n=21	(C2) Quality-emphasis n=32	(C3) Cost-emphasis n=17	(4)Dis-advantaged n=34	F	η^2
Product engineers' exhaustion in TCM	C2	0.35					
	C3	-0.93** (*g*=0.89)	-1.27** (*g*=1.13)				
	C4	0.10	-2.44	1.03** (*g*=1.19)			
	Mean	3.19	2.84	4.12	3.09	6.532***	0.16
Suppliers' fatigue in TCM	C2	0.39					
	C3	-0.59	-0.98** (*g*=1.01)				
	C4	0.15	-0.24	0.74* (*g*=0.86)			
	Mean	3.24	2.84	3.82	3.09	4.508 †	0.12

Note. One-way Independent ANOVA. Tukey's post-hoc tests. ***p< .001, **p< .01, *p< .05, † < .10

Figure 1. An interpretive model exploring characteristics of quality/cost emphasis firms



Note. Dotted line presents that cost emphasis group will face with problems because of their immature capability of TCM, when this group develops to dual-emphasis.