Mind the gap: Disparity between perceived importance of logistics performance measures and information reliability

Dr.Tartat Mokkhamakkul[*]

บทคัดย่อ

ปัจจุบันในการจัดการให้มีประสิทธิผลนั้น ธุรกิจมีความจำเป็นต้องพัฒนาระบบการวัดผล หนึ่งในปัจจัยที่จะประสบความสำเร็จได้คือการพิจารณาตัวชี้วัดที่เหมาะสมที่จะถูกประเมิน วัตถุประสงค์ของงานวิจัยนี้คือการเปรียบเทียบระบบการวัดผลทางโลจิสติกส์ของสองอุตสาหกรรม ได้แก่ อุตสาหกรรมไฟฟ้าและอุตสาหกรรมเหล็กโดยใช้การวิเคราะห์ความแตกต่างๆ ระหว่างความสำคัญและความน่าเชื่อถือของข้อมูล โดยตัวชี้วัดจะแบ่งตามกิจกรรมหลักของโลจิสติกส์อันประกอบไปด้วยการให้บริการลูกค้า สินค้าคงคลัง การจัดหา การขนส่งและคลังสินค้า การเก็บรวมรวบข้อมูลตามตัวแบบที่ได้มีการนำเสนอจะส่งไปยังบริษัทในอุตสาหกรรมดังกล่าว ผลของการศึกษาพบว่าอุตสาหกรรมแต่ละอุตสาหกรรมควรจะมุ่งเน้นในตัวชี้วัดที่แตกต่างกัน ระบบตัวชี้วัดควรจะมีการนำเสนอให้ตรงกับแต่ละอุตสาหกรรมเพื่อที่จะปรับปรุงการทำงานของบริษัท

[*] Lecturer, Faculty of Commerce and Accountancy, Chulalongkorn University.

Abstract

Nowadays, to achieve the effective management, it is very important for any business to develop the performance measurement system. One of the key success factors is the consideration of the appropriate performance measures to be evaluated. This purpose of the research is to compare logistics performance system on two industries which are Electronic and steel industries using gap analysis between importance and information reliability. The measures are categorized by major logistics activities including customer service, inventory, procurement, transportation, and warehousing. A survey based on the purposed model is conducted to the companies in the industries. From the survey, each industry has focuses on different performance measures. The measurement system should be proposed particularly for the industry in order to improve the company performance.

Introduction

In today's highly competitive global business environment, companies have become increasingly aware of the significance of logistics and supply chain management. Effective logistics and supply chain management can enhance business efficiency and organizational effectiveness, improve customer services, and increase profitability (Bowersox and Daugherty, 1987, pp. 46-60;Lee, 2000, pp. 30-36; Ferguson, 2000, 64-67).

Performance management has become an essential issue for companies to reach their objectives (Eccles, 1991, pp. 131-137, Perrin, 1998, pp. 367-379; Lebas, 1995, pp.23-35). Logistics and supply chain measurement is a challenge to business organizations. Harrison and New (2002, pp. 263-271) presented the international survey results that supply chain performance was very important to achieve competitive advantage. In a context of logistics and supply chain in particular, Bowersox and Daugherty (1987, pp. 46-60) argue that companies must measure their logistics performance and react to the measurement results.

Reliability of the information in logistics and supply chain measures seems to be insufficient. Harrison and New (2002, pp. 263-271) mentioned about the limitation of the formal means of measuring the supply chain performance and 19 per cent of the respondents from the international survey reported that they had virtually no means of formal assessment. Information requirement, accompanied by its accuracy, reliability, and management report, could lead to ensure the quality of information. Then, the quality of decision would be resulted by superior information (Phusavat et.al., 2009, pp. 267-285).

The results from Institute of Electricity and Electronics (2007) and Institute of Steel (2007) addressed that the companies faced up with the problems in determining the logistics performance measures. The appropriate information or the proper ways to measure were not sufficient provided in the company. With challenge in measuring logistics performance business currently limited knowledge on logistics performance measurement in the extent literature, the objective of this study is threefold. Firstly, it examines empirically the level of importance and reliability of information of performance measures in logistics and supply chain management. Secondly, it applies a gap analysis approach to analyze gap between perceived importance and reliability of information. Last, the level of important and reliability of information are compared between two industries, including electronics industry and steel industry. Results from the research can be used to prioritize the necessity of performance measures so that companies can improve their existing information organism.

Performance Measurement in Logistics

Performance measurement is an issue of interest among researchers for decades. The importance of performance measures is widely recognized. Performance measurement is essential to determine the scope of company's operations and operating measurement (Lebas, 1995, pp.

23-35, Simchi-Levi et al, 2000). Moreover, performance measurement system is vital to control the operations in order to achieve business goals (Perrin, 1998, pp. 367-379). The importance of performance measurement has long been recognized by academics and practitioners from a variety of functional disciplines (Neely et al, 2005, pp. 1228-1263; Forslund, 2007, pp. 901-918).

Although it has been well recognized that effective performance measurement is critical for managing organizations, performance measurement is not a simple, problem-free issue. If organizations choose inappropriate performance measures or have an ineffective measurement system, decisions could be mistaken (Ittner and Larcker, 2003, pp.88-98; Chan et. al., 2006, pp. 636-661). Globerson (1985, pp. 639-646) proposes selection guidelines to select a preferred set of performance criteria. Performance criteria must be chosen from the company's goals, and purposes of each performance criterion must be clear. Industries may prioritize the importance of performance measures in different ways (Yilmaz and Bititci, 2006, pp. 371-389; Toyli et. al., 2008, pp. 57-80).

The effective management of performance measures depends on the ability to evaluate the importance of each measure and also on the reliability of each measure's information. There are a number of performance measures but the measurement system is quite expensive and each measure must be prioritized to identify the most important ones which should be related to organization's goals (Bredrup, 1995). Moreover, the quality of management decisions is dependent upon the reliability or quality of information (Moberg et al, 2002, pp 755-770).

Similar to other areas of business management, effective logistics and supply chain performance measurement is critical. Logistics and supply chain performance has been increasingly recognized as one of the vital factors in acquiring competitive advantage in business (Simchi- Levi et al., 2000). Implementing a set of world class logistics performance indicators is argued to be a prerequisite for any companies to achieve the world class logistics, as performance indicators can have a significant influence on the way people behave (Frazelle, 2002).

The measures in logistics and supply chain have been examined in many studies, and various performance measurement frameworks for measuring logistics and supply chain performance have been proposed. For instance, Chows et. al. (1994, pp. 17-28) suggests that logistics measurement can be both qualitative and quantitative, including finance, cost, ratio of input and output, and quality. As for Shepherd and Gunter (2005, pp.242-258), they classify the logistics performance into five dimensions - cost, time, quality, flexibility, and innovativeness. Beamon (1999, pp. 275-292) identifies three types of performance measures - resources, output, and flexibility - as necessary components in the supply chain management system). Frazelle (2002) proposes four categories of logistics measures - financial, productivity, quality, and cycle time. Balance

Scorecard concept has also been used to measure the logistics and supply chain performance (Hervani et.al., 2005, pp. 330-353).

Information on logistics performance is important for companies to formulate the logistics strategy (Zelbst et. al., 2010, pp. 582-589; Green Jr., K. W., Whitten, D., and Inman, R. A., 2008, pp. 317-327). Many characteristics can be used to evaluate the reliability or quality of logistics information. Gustin et al (1995, pp. 1-21) employ accuracy, availability, accessibility, ease of use, reliability, and timeliness as the evaluative criteria of information. Zailani et al (2008, pp. 85-100) propose the measures to evaluate information quality, including timeliness, accuracy, consistency, and completeness. Closs et al. (1997, pp. 4-17) propose the important dimensions in logistics information system which include timeliness, accuracy, and availability.

Despite a number of performance measurement frameworks for logistics and supply chain proposed, relatively few studies have examined empirically which performance indicators are perceived as important in managing logistics and supply chain process. In addition, little is known about reliability or quality of the information on logistics performance. To address this gap in the literature, the current study examines the importance and information reliability of each dimension of logistics performance perceived by manufacturers in Thailand.

Research questions

In the study, companies from electronics and steel industries are examined. Results from the two industries are compared and contrasted in order to understand similarities and differences in logistics and supply chain performance measurement systems of the two industries. Electronics and steel industries are chosen because they are regarded as industries with high potential by the Office of the National Economic and Social Development Board. In addition, the two industries represent the distinctiveness in the supply chain. Electronics industry and steel industry represent upstream and downstream industry, respectively. According to previous research, there is a concern in logistics performance measures. An industry should prioritize the importance of performance measures. A set of performance measures should be specified by each industry (Mentzer and Konrad, 1991, pp. 33-61). Reliability of information is among the critical issues for businesses to reach high-quality decisions (Coyle et.al, 2003). Consequently, this research investigates the difference between the importance and the reliability of information of logistics performance measures. The gap between logistics measures presently used and the current information reliability of these measures can help the management identify the problems which the company can improve the performance management system. Two industries compared in this study are electronics and steel. The research questions are as follows.

- Does importance of each performance measure differ between these two industries?

- Does reliability of information for each performance measure differ between these two industries?

- How does each industry improve the performance management by analyzing the gap?

Gap analysis

Gap analysis is an approach which is used to identify the difference between what the current operations perform and what the company expects the operations to be. Parasuraman et. al. (1985, pp. 41-50) has been one of the most influential literature in gap analysis approach. The paper focuses on analyzing gaps of perception between the service that respondents expect to receive and the actual service. Balm (1996, pp. 28-33) proposes the analysis of gap between the current practice (baseline) and the best practice (benchmark) to keep the company competitive in the market. Rho et.al. (2001, pp. 89-97) address that the gap variable indicating inconsistency between manufacturing strategy and implementation practices plays a more important role that the strategy or implementation variation in discriminating the superior from the inferior performance groups by using data from the companies in the US and Korea. The gap variables are cost, quality, flexibility, delivery, and customer service.

Apart from the manufacturing, gap analysis was widely used in other areas such as quality of customer service in fast food restaurant and banking (Davis and Heineke, 1998, pp. 64-73; Mukherjee and Nath, 2005, pp. 174-184). Tourism business also applies the gap studies to compare importance and satisfaction in tourism attributes(Tonge and Moore, 2007, pp. 768-776), and to evaluate satisfaction and perception of the visitors toward national park (Arabatzis and Grigoroudis, 2010, pp. 163-172). Min and Min (1996, pp. 58-72) develop the standards to compare service performance with that of the service leader in Korean hotel business.

There are several approaches in gap analysis suggested by researchers. Important Performance Analysis (IPA) was introduced by Martilla and James (1977, pp. 77-79). This analysis is formed basically by two axes: importance and performance. IPA is a technique widely used to develop marketing strategy and improve service quality. Lee et. al. (2008, pp. 488-501) developed the modified IPA by introducing Tagushi's signal-to-noise ratio approach.

The SERVQUAL scale is based on gap theory (Parasuraman et. al., 1985, pp. 41-50). The theory consists of several gaps as follows.

- Consumer expectation-management perception
- Management perception-service quality specification
- Service quality specification-service delivery
- Service delivery-external communication
- Expected service- perceived service

Cronin and Taylor (1992, pp. 55-68) propose SERVPERF as the performance-expectation gap model. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) is used to compare the service quality gap with SERVQUAL and loss function (Mukherjee and Nath, 2005, pp. 174-184). Reed et. al. (1991, pp. 231-240) and Ennew et. al. (1993, pp. 59-70) propose the simple indices, based on IPA, that can be applied to ordinal or cardinal data and provided a convenient summary of the extent to which a product meets consumer expectations.

This paper will concentrate on gap analysis comparing between the importance and the perception of reliability of information on each performance measure using simple indices reconized in Reed et. al. (1991, pp. 231-240) and Ennew et. al. (1993, pp. 59-70). Adapting the concept proposed by Stock and Lambert (2001) and Coyle et al (2003), these logistics and supply chain performance measures are categorized into five major logistics areas, including procurement, customer service, transportation, inventory, and warehousing. And each area is further classified into four subcategories; financial performance, quality performance, flexibility performance, and cycle time performance (Frazelle, 2002).

Weighting Matrices

Reed et. al. (1991, pp. 231-240) and Ennew et. al. (1993, pp. 59-70) suggest the approach that applies a simple set of ordinal weights to the cross-tabulation of survey results on the ranking given by respondents to the importance of each measure and to the perceived quality of the each measure which, in this paper, is adapted to reliability of information. The responses from the questionnaire are simple adjectival scale that the respondents will rank the degree of importance for each dimension of performance and their assessment of the reliability of information that they perceive. A simple cross-tabulation of responses generates a matrix of responses as shown in Table 1.

Table 1 Response matrix

		Importance of measures					Row total
		Very important 1	2	3	4	Not important 5	
Perception of reliability of information	Very good	a_{11}	a_{12}	a_{13}	a_{14}	a_{15}	r_1
	2	a_{21}	a_{22}	a_{23}	a_{24}	a_{25}	r_2
	3	a_{31}	a_{32}	a_{33}	a_{34}	a_{35}	r_3
	4	a_{41}	a_{42}	a_{43}	a_{44}	a_{45}	r_4
	Poor	a_{51}	a_{52}	a_{53}	a_{54}	a_{55}	r_5
Column total		c_1	c_2	c_3	c_4	c_5	N

According to Table 1, the individual cells in the matrix represent the number of the respondents who indicated that the service was characterized by a particular combination of importance and reliability of information. For example, a_{11} represents the number of respondents who rated a measure as very important and considered that the reliability of information was very good. Row totals represent the aggregate assessments of the respondents on the reliability of information. Column totals express the aggregate preferences of the respondents. A weighting matrix as shown in Table 2 indicates the weight of each element. An m x n weighting matrix can be defined by the multiplication of supply weight and demand weight.

$$W_{jk} = s_j d_k \qquad j = 1, 2, 3, ..., m, k = 1, 2, 3, ..., n \qquad (1)$$

The d_k weights are increased as the importance attached to the performance measures increases, and all weights should be positive, since although a measure may be considered as unimportant, this does not imply that it is viewed in a negative light. The s_j weights are increased as the reliability of information increases. However, different from d_k, below average reliability can be given a negative weight. There are three indices used in the analysis.

Table 2 The weighting matrix

		Importance of measures					Supply weights
		Very important 1	2	3	4	Not important 5	
Perception of reliability of information	Very good	w_{11}	w_{12}	w_{13}	w_{14}	w_{15}	s_1
	2	w_{21}	w_{22}	w_{23}	w_{24}	w_{25}	s_2
	3	w_{31}	w_{32}	w_{33}	w_{34}	w_{35}	s_3
	4	w_{41}	w_{42}	w_{43}	w_{44}	w_{45}	s_4
	Poor	w_{51}	w_{52}	w_{53}	w_{54}	w_{55}	s_5
Demand weights		d_1	d_2	d_3	d_4	d_5	

- The Attainment Index (W) is designed to reflect on the gap between the importance and the reliability of information of the measures. The maximum is 1, and the minimum is below 0. The highest level will happen when all respondents indicate that the measure is important and its information is reliable. The index is calculated as follows.

$$W = \frac{1}{w_{11}\,N}\sum_{j=1}^{m}\sum_{k=1}^{n} w_{jk}a_{jk} \qquad (2)$$

- The Supply index (S) is the reliability of information index. The maximum value is 1, and the minimum value is below 0. The index is calculated as follows.

$$S = \frac{1}{s_1\,N}\sum_{j=1}^{m} s_j r_j \qquad (3)$$

- The Demand index is the importance index. The standardized index can range between 0 and 1. The index is calculated as follows.

$$D = \frac{1}{d_1\,N}\sum_{k=1}^{n} d_k c_k \qquad (4)$$

Methodology

This study utilizes database from Mokkhamakkul (2009, pp. 149-164). In addition, questionnaires were distributed to companies in electronic and steel industries. The sample sizes of these industries are calculated by the following equation. The number of sample sizes for electronics and steel industries are 49 and 35 respectively.

$$n = \frac{NZ^2\sigma^2}{NE^2 + Z^2\sigma^2} \quad (5)$$

Questions cover the importance and reliability of information which were measured using a Likert 5-scale. The scale of importance ranges from not at all important (1) to extremely important (5). For the reliability of information, as addressed in Reed et. al. (1991, pp. 231-240) and Ennew et. al. (1993, pp. 59-70), the respondents can give negative scale if they do not please with the information system in the company. Consequently, the scale ranges from most negatively satisfied (-3) to very highly satisfied (5). For both importance and reliability of information, the companies were given the same list of performance measures, covering procurement, customer service, transportation, inventory, and warehousing.

In addition to gap analysis based on Reed et. al. (1991, pp. 231-240) and Ennew et. al. (1993, pp. 59-70), two-sample t-test was employed to compare the statistically significant difference of importance and reliability of information between the two industries to examine whether their population means differed.

H1: The level of importance for each performance measure between electronics industry and steel industry is significantly different.

H2: The level of information reliability for each performance measure between electronics industry and steel industry is significantly different.

In-depth interviews with four respondents in these industries were also conducted to discuss the implications of the study. Two respondents interviewed were from each industry, and one worked in government sector, while the other worked in private sector.

Results

Descriptive results

A total of 69 companies consisting of 37 companies from electronics industry and 32 from steel industry completed this questionnaires. This resulted in response rate of 76 percent and 91 percent for electronics and steel industry, respectively. Non-response bias test was conducted in this research to avoid the situation that the answer from non-respondent would be different from the answer from respondent. The paired t-test is used to compare two groups of respondents which are classified by the period that the questionnaires are returned. The result shows that there is no statistically significant difference between the mean responses of these two groups. The means of importance and information reliability are shown in the table 3. Moreover the gap matrixes of both industries are illustrated in figure 1 and figure 2. The numbers in the figure represent each performance measure following table 3.

Table 3 Means of Importance and Information Reliability

			Electronics		Steel	
			Importance	Reliability	Importance	Reliability
1	Customer Service	Financial	2.81	-0.57	2.25	-1.00
2		Productivity	3.18	-0.81	3.03	-1.28
3		Quality	3.84	0.51	3.80	-0.22
4		Cycle time	3.46	-0.08	2.91	-0.75
5	Inventory	Financial	3.11	-0.15	3.33	0.02
6		Productivity	3.28	-0.19	3.20	-0.75
7		Quality	3.66	0.12	3.56	-0.20
8		Cycle time	3.41	0.41	3.31	-1.00
9	Procurement	Financial	3.30	-0.27	2.84	-0.81
10		Productivity	3.02	-0.94	2.71	-1.00
11		Quality	3.88	0.63	3.41	-0.25
12		Cycle time	3.61	0.43	2.95	-1.09
13	Transportation	Financial	3.59	0.78	3.83	1.00
14		Productivity	3.44	-0.59	3.36	-0.50
15		Quality	3.19	-0.31	3.19	-0.91
16		Cycle time	3.47	0.41	3.36	-0.72
17	Warehousing	Financial	3.31	0.68	2.83	-0.13
18		Productivity	3.21	-0.42	3.15	-0.79
19		Quality	3.62	0.15	3.36	-0.23
20		Cycle time	3.23	-1.38	2.92	-1.38

Figure 1 Gap Matrix of Electronics Industry

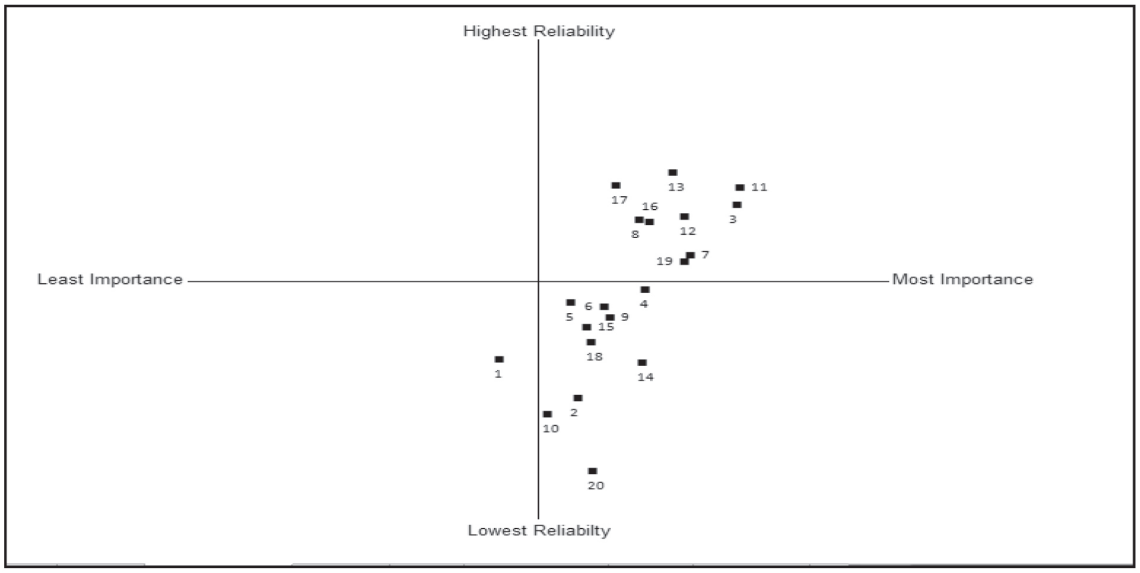
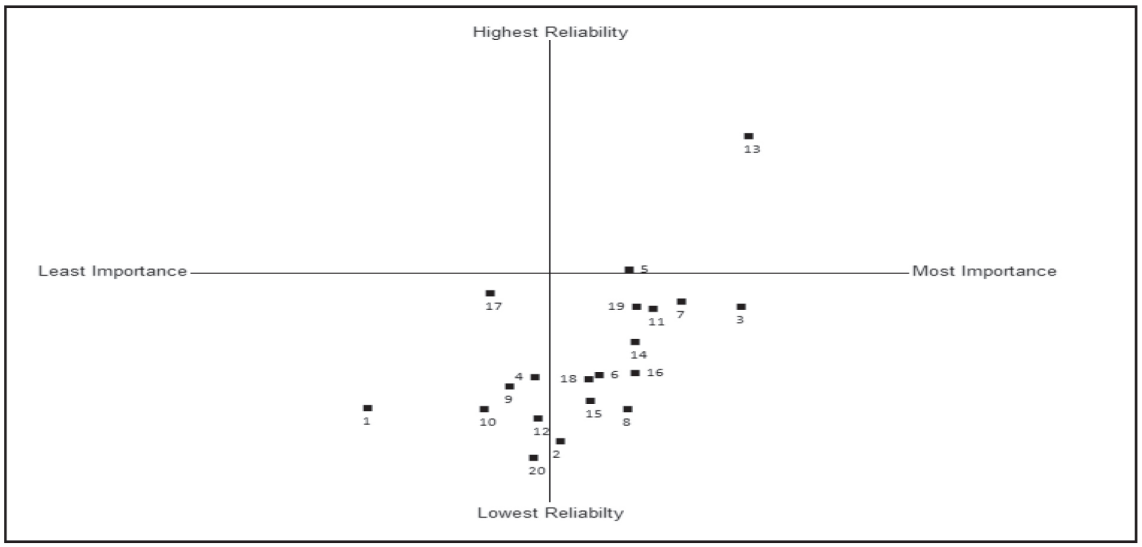


Figure 2 Gap Matrix of Steel Industry



According to table 3, respondents from electronics industry indicate quality in procurement (mean = 3.88), quality in customer service (mean = 3.84), quality in inventory (mean = 3.66), quality in warehouse (mean = 3.62), and cycle time in procurement (mean = 3.61) as having the highest levels of importance. Those given the lowest levels are financial in customer service (mean = 2.81), productivity in procurement (mean = 3.02), financial in inventory (mean = 3.11), productivity in customer service (mean = 3.18), and quality in transportation (mean = 3.19). For respondents from steel industry, not quite similar to electronics industry, those with the highest importance levels are financial in transportation (mean = 3.83), quality in customer service (mean = 3.80), quality in inventory (mean = 3.56), quality in procurement (mean = 3.41), quality in warehouse (mean = 3.36). Respondents from companies in steel industry shows that financial in customer service (mean = 2.25), productivity in procurement (mean = 2.71), financial in warehouse (mean = 2.83), financial in procurement (mean =2.84), and cycle time in customer service (mean = 2.91) are considered as the lowest important performance.

For the information reliability, the highest-scale performances in electronics industry include financial in transportation (mean = 0.78), financial in warehouse (mean = 0.68), quality in procurement (mean = 0.63), quality in customer service (mean = 0.51), and cycle time in procurement (mean = 0.43), while cycle time in warehouse (mean = -1.38), productivity in procurement (mean = -0.94), productivity in customer service (mean = -0.81), productivity in transportation (mean = -0.59) and financial in customer service (mean = -0.57) are given the lowest scores. Results from steel industry indicates financial in transportation (mean = 1), financial in inventory (mean = 0.02), financial in warehouse (mean = -0.13), quality in inventory (mean = -0.20), and quality in customer service (mean = -0.22) as the highest perceived levels of information reliability. The measures that receive the lowest levels of information reliability are cycle time in warehouse (mean = -1.38), productivity in customer service (mean = -1.28), cycle time in procurement (mean = -1.09), financial in customer service (mean = -1), cycle time in inventory (mean = -1), and productivity in procurement (mean = -1).

Figure 1 and figure 2 illustrate the relatively high importance of most performance measures ranked by both industries. However, information reliability of measures is mostly performed under expectation of the respondents. The result shows clearly that both industries need an attention of the reliability of information. Especially, respondents from steel industry satisfy with information of only one measure, financial in transportation.

Importance-information reliability gap

From the previous discussion, all indices will be calculated. Table 4 and Table 5 display the calculated importance index, reliability index, and attainment index for electronics and steel industry, respectively. Most importance indices illustrate

Table 4 Attainment, Reliability, and Importance Indices of Electronics Industry

		Attainment	Reliability	Importance
Customer Service	Financial	-17.57	-39.19	-9.46
	Productivity	-24.32	-41.90	8.11
	Quality	1.23	-12.16	45.95
	Cycle time	-6.16	-27.03	22.97
Inventory	Financial	-27.48	-39.19	6.76
	Productivity	-16.07	-36.49	-6.76
	Quality	-12.46	-21.62	44.59
	Cycle time	-9.01	-13.51	24.32
Procurement	Financial	-10.06	-27.03	22.97
	Productivity	-25.23	-48.65	-2.70
	Quality	1.47	-13.51	51.35
	Cycle time	0.00	-13.51	32.43
Transportation	Financial	5.53	-5.41	33.78
	Productivity	-26.13	-41.90	24.32
	Quality	-22.97	-35.14	20.27
	Cycle time	-8.26	-18.92	22.97
Warehousing	Financial	-1.65	-9.46	22.97
	Productivity	-14.11	-35.14	13.51
	Quality	-9.01	-22.97	37.84
	Cycle time	-37.24	-58.11	10.81

Table 5 Attainment, Reliability, and Importance Indices of Steel Industry

		Attainment	Reliability	Importance
Customer Service	Financial	-22.22	-50	-37.5
	Productivity	-35.42	-57.81	6.25
	Quality	-16.15	-32.81	42.19
	Cycle time	-24.83	-43.75	-4.69
Inventory	Financial	-18.75	-34.38	18.75
	Productivity	-25.35	-45.31	15.63
	Quality	-23.09	-37.5	32.87
	Cycle time	-28.82	-50	15.63
Procurement	Financial	-23.09	-50	-7.81
	Productivity	-25.69	-50	-18.75
	Quality	-15.45	-34.38	20.31
	Cycle time	-24.65	-51.56	-3.13
Transportation	Financial	10.37	0.00	57.81
	Productivity	-21.36	-37.5	17.19
	Quality	-34.72	-53.13	6.25
	Cycle time	-25.69	-42.19	28.13
Warehousing	Financial	-18.92	-34.38	-10.94
	Productivity	-29.34	-45.34	10.94
	Quality	-6.08	-29.69	23.44
	Cycle time	-31.94	-59.38	0.00

positive number for both industries. For electronics industry, financial in customer service index, productivity in inventory index, and productivity in procurement index show small negative scores, while quality performance for most logistics activities attracts the highest value among the four dimenstions of performance except in transportation which financial performance receives the highest value. For steel industry, financial and cycle time in customer service performance, financial, productivity, and cycle time in procurement performance, and financial in warehouse performance show egative scores. Similar to electronics industry, in steel industry, the highest importance score is given to quality performance in most activities except in transportation that the highest value is given to financial performance.

For reliability index, considering procurement indices, both industries responses no positive numbers. Financial in transportation index is the highest number for both industries. Obviously, most attainment indices show the negative values. The highest number of each industry is financial in transportation.

Importance and information reliability hypotheses test

According to two hypotheses previously discussed, the importance and information reliability illustrated in table 3 are statistically tested to compare between the two industries. The performance measures which are significantly different are presented in table 6.

Table 6 Statistical Test of Importance and Information Reliability between the Two Industries

	H1	H2
Financial measure in customer service	t = -2.104, p value = 0.039	Not significantly different
Financial measure in procurement	t = -2.259, p value = 0.027	Not significantly different
Financial measure in transportation	t = 2.253, p value = 0.028	Not significantly different
Financial measure in warehousing	t = -2.596, p value = 0.012	Not significantly different
Quality measure in procurement	t = -2.343, p value = 0.022	Not significantly different
Cycle time measure in procurement	t = -2.725, p value = 0.008	t = -2.123, p value = 0.037

For example, importance of financial measure in customer service is significantly different between electronics industry (mean = 2.81) and steel industry (mean = 2.25), while its information reliability is not significantly different. The other measures which are not presented in table 6 are not significantly different as well.

Analysis and Discussion

In-depth interviews with a couple of executives who have been working in each industry for more than 20 years provide more understanding of the finding. Participating executives from each industry agree with the findings and propose the improvement of performance measurement system

Overview of the industries

Gap analysis provides the macro picture of the industries. The result suggests that the steel industry which is upstream in supply chain holds different view on the importance of performance measures, compared to the electronics industry which is downstream. It is important to recognize that quality in procurement and customer service are the two highest priorities in electronics industry. This may be caused by the fact that electronics industry is considered a high technology industry. The quality of parts and components affects quality of finished products, therefore the companies must minimize the problems that would have been a result of low grade materials. This finiding is consistent with previous research. Lau (2002, pp. 125-135) ranks the competitive factors of the US computer and electronics companies, and quality is the most important competitive factor. Similar to the study of Caplice and Sheffi (1995, pp. 61-74), customer and quality metrics are measured in digital companies. As for automotive industry which also requires high techonology equipment, Olugu et al (2010) find that the crucial measures focus on customer, quality, and supplier perspective. In aerospace industry, the quality measures are the most established (Hon, 2005, pp.139-154). Vickery et al (1997, pp. 317-330) rate quality measures as the highest in furniture industry which shares the same character as electronics industry in term of downsteam industry.

On the other hand, the steel industry considers financial in transportation as the highest importance. This can be explained by the high transportation cost, compared to the product cost. The decrease of transportation cost can offer competitive advantage in the market. The study of Caplice and Sheffi (1995, pp. 61-74) states that transportation expense measure of tire manufacturing companies which produces bulky items similar to companies in steel industry. Warehousing activity is not of great concern by steel industry because steel does not require special or complex storing process. Procurement of electronics business is notably considered to be more significant than steel business. This may be a result of the fact that there are a lot of vendors with different levels of quality. Therefore, the right vendor must be properly selected in order to perform the superior production. On the other hand, steel business does not have many upstream

suppliers. Moreover, the quality of raw materials from each supplier does not differ significantly.

Both industries do not rely on the information they collect and believe that the information system can not provide information which sufficiently satisfy executives when making decisions. Particularly, quality and financial measures in logistics activities are considered as having the lowest level of reliability. Executives from both industries suggest about the investment in technology such as Global Positioning System in order to assure the service quality of delivery and control the transportation cost.

Comparative performance

From statistical analysis, companies from electronics industry give higher level of importance on financial in customer service, compared to companies from steel industry. Electronics industry has ,more variety of products with some international customers. Customer ordering process may be complex, using the electronics system which can lead to high cost. Similarly, importance level of financial in procurement is higher in electronics industry than in steel industry because an electronics company has several international suppliers. Therefore, the procurement system must require large investment in order to receive accurate information.

Quality and cycle time of procurement are perceived as having higher level of importance for electronics industry than steel industry. Electronics companies have adopted several operations concepts such as lean production and total quality management, which concern about waste elimination by applying the smooth flow of materials. Consequently, the loss occurred by waiting time and low quality materials must be removed.

The finding from the statistical analysis also suggests that steel industry pays more attention to financial in transportation than electronics industry. Executives in steel industry argue that the high proportion of the total logistics expenses comes from transportation activities. On the other hand, financial in warehouse is perceived as a lower level of importance in steel industry than electronics industry because of the fact that electronics products need special and expensive equipment in the warehouse.

Comparing to steel industry, electronics industry has significant higher level of cycle time in procurement. From discussion with executives in electronics business, procurement duration is very essential element to smooth the production since lean manufacturing concept has been applied to the production. Therefore, many electronics companies develop the system that can measure the time performance related to the suppliers.

Conclusions

In this dynamic environment, developing a performance measurement system in a logistics sector is very challenging and evolving vital activity in the company. This research proposes two main recommendations. First, the study mainly focuses on the priority of importance and information

reliability for logistics measures. Two industries including electronics and steel suggest the different levels of importance and information reliability. Each industry must identify its own objectives, characteristics, and environment in order to select the right important performance measures which can best address their concerns. Secondly, the paper has found that problems associated with logistics performance lie in the gap between importance and information reliability. This finding illustrates that performance measurement system should be improved. Executives must understand and give high level of importance to the information that is necessary for company to achieve its objectives. According to Ouedraogo and Boyer (2010), information technology may be required to facilitate performance management.

Logistics performance management is an importance and widely ranged topic. The information reliability is necessary for making the decision (Phusavat et. al., 2009, pp. 267-285). However, the information reliability is not much taken into consideration. This problem addressed in the research is discussing the difficulty of the performance measurement in two industry (Institute of Electricity and Electronics, 2007 and Institute of Steel, 2007). This research is extended from gap analysis presented by Reed et. al. (1991, pp. 231-240) and Ennew et. al. (1993, pp. 59-70). The importance and information reliability of logistics measures is examined to understand the current situation about the performance measurement in the industry.

In addition, the contribution of this research leads to the logistics performance management in the company. Implementation of a performance management system must involve every level in the entire company and ensure that the company objectives are consistently achieved in an effective manner. The company may establish a plan including a set of logistics performance measures which are necessary to accomplish its logistics goals and different for each industry or company. For instance, the financial measures, especially logistics cost, may be taken into consideration by upstream industry while the quality measures may be preferred by the downstream industry. Subsequently, the way to be measured should be particularly developed in each industry or company. It is very important to prepare the system to measure the performance to view the necessities of the company.

Limitation and Future Research

This research has focused on only two industries that are considered as machine-based intensive. The results might not be applied to the other industries in the supply chain. Multiple industries would ensure the conceptual framework of this study. Moreover, the distinction between machine-based industry and labor-based industry might be addressed in the future research.

References

Arabatzis, G. and Grigoroudis, E. (2010). Visitors' satisfaction, perceptions and gap analysis: The case of Dadia-Lefkimi-Souflion national park. **Forest Policy and Economics.** Vol. 12 No. 3 pp. 163-172.

Beamon, B. M. (1999). Measuring supply chain performance. **Internation Journal of Operations and Production Management. Vol. 19** No. 3 pp. 275-292.

Balm G. J. (1996). Benchmarking and gap analysis: What is the next milestone?. **Benchmarking for Quality Management & Technology. Vol. 3.** No. 4 pp. 28-33.

Bowersox D.J. and Daugherty P.J. (1987). Emerging patterns of logistical organization. **Journal of Business Logistics, Vol. 8.** Winter. pp. 46-60.

Bredrup, Harald (1995). Performance Management: A Business Process Benchmarking Approach. Chapman & Hall. London. http://www.google.com/books?id=KmQW5bqhh9cC&printsec=frontcover &hl=th#v=onepage&q&f=false.

Caplice, C. and Sheffi, Y. (1995). A review and evaluation of logistics performance measurement systems. **The International Journal of Logistics Management. Vol. 6 No. 1** pp. 61-74.

Chan, F. T. S., Chan, H. K., Lau, H. C. W., and Ip, R. W. L. (2006). An AHP approach in benchmarking logistics performance of the postal industry. **Benchmarking: An International Journal. Vol. 13 No. 6** pp. 636-661.

Chow, G., Heaver, T. D., and Henriksson, L. E. (1994). Logistics Performance: Definition and Measurement. **International Journal of Physical Distribution & Logistics Management. Vol.24 No.1** pp. 17-28.

Closs, D. J., Goldsby, T. J., and Clinton, S. R. (1997). Information technology influences on world class logistics capability. **International Journal of Physical Distribution & Logistics Management. Vol. 27 No. 1** pp. 4-17.

Coyle, J.J., Bardi, E. J., and Langley C.J. (2003). **The Management of Business Logistics: A Supply Chain Perspective,** 7 edition. Thomson. Mason Ohio.

Cronin, Jr. J.J. and Taylor, S. A. (1992). Measuring service quality: A reexamination and extension. **The Journal of Marketing. Vol. 56 No. 3** pp. 55-68.

Davis, M. M. and Heineke, J. (1998). How disconfirmation, perception and actual waiting times impact customer satisfaction. **International Journal of Service Industry Management.** Vol. 9 No. 1 pp. 64-73.

Eccles, R. G. (1991). The performance measurement manifesto. **Harvard Business Review. Vol. 69 No. 1** pp. 131-137.

Ennew, C.T., Reed, G.V., and Binks, M.R.(1993). Importance-Performance analysis and the measurement of service quality. **European Journal of Marketing. Vol. 27 No. 2** pp. 59-70.

Ferguson, B.R., (2000). Implementing supply chain management. **Production and Inventory Management Journal, Vol. 2 No. 2** pp. 64-67.

Forslund, H. (2007). The impact of performance management on customers' expected logistics performance. **International Journal of Operations & Production Management. Vol. 27 No. 8** pp. 901-918.

Frazelle, E. (2002). **Supply chain strategy.** McGraw Hill. New York.

Globerson, S. (1985). Issues in developing a performance criteria system for an organization. **International Journal of Production Research. Vol. 23 No. 4** pp. 639-646.

Green Jr., K. W., Whitten, D., and Inman, R. A. (2008). The impact of logistics performance on organizational performance in a supply chain context. **Supply Chain Management: An International Journal. Vol. 13 No. 4** pp. 317-327.

Gustin C. M., Daugherty, P. J., and Stank, T. P. (1995) The effects of information availability on logistics integration. **Journal of Business Logistics. Vol. 16 No. 1** pp. 1-21.

Harrison, A. and New, C. (2002) The role of coherent supply chain strategy and performance management in achieving competitive advantage: an international survey. **Journal of the Operational Research Society,** Vol. 53 No.3 pp. 263-271.

Hervani, A. A., Helms, M. M., and Sarkis, J. (2005) Performance measurement for green supply chain management. Benchmarking, **A Internation Journal. Vol. 12 No. 3** pp. 330-353.

Hon, K. K. B. (2005). Performance and evaluation of manufacturing systems. **CIRP Annals. Vol. 54 No. 2** pp. 139-154.

Institute of Electricity and Electronics (2007). **Development of Comparative Industrial Information for Competitive Advantage.** Bangkok.

Institute of Steel (2007) **Development of Transportation Network of Steel Products for Competitive Advantage.** Bangkok.

Ittner, C. D. and Larcker, D. F. (2003). Coming up short on nonfinancial performance management. **Harvard Business Review. Vol. 81 No. 11** pp. 88-98.

Lau, R. S. M. (2002) Competitive factors and their relative importance in the US electronics and computer industries. **Internation Journal of Operations & Production Management. Vol. 22 No. 1** pp. 125-135.

Lebas, M. J. (1995). Performance measurement and performance management. **International Journal of Production Economics, Vol. 4 No. 1-3** pp. 23-35.

Lee, H. L., (2000). Creating value through supply chain integration. **Supply Chain Management Review 4** (4). pp. 30-36.

Lee, Y., Yen, T., and Tsai, C. (2008). **Modify IPA for quality improvement: Tagushi's signal-to-noise ratio approach. The TQM Journal. Vol. 20 No. 5** pp. 488-501.

Martilla, J. A. and James, J. C. (1977). Importance-Performance Analysis. **The Journal of Marketing. Vol. 41 No. 1** pp. 77-79.

Mentzer, J. T. and Konrad, B. P. (1991). An effieciency/ effectiveness approach to logistics performance analysis. **Journal of Business Logistics. Vol. 12 No. 1** pp. 33-61.

Min, H. and Min H. (1996). Competitive benchmarking of Korean luxury hotels using the analytic hierarchy process and competitive gap analysis. **Journal of Services Marketing. Vol. 10 No. 3** pp. 58-72.

Mokkhamakkul, Tartat (2009). Importance of logistics and supply chain measures of manufacturing industries. **Chulalongkorn Business Review. No. 119-120** pp. 149-164.

Moberg, C. R., Cutler, B. D., Gross, A., and Speh, T. W. (2002). Identifying antecedents of information exchange within supply chains. **Internation Journal of Physical Distribution & Logistics Management. Vol. 32 No. 9** pp. 755-770.

Mukherjee, A. and Nath, P. (2005). An empirical assessment of comparative approaches to service quality measurement. **Journal of Services Marketing. Vol. 19 No. 3** pp. 174-184.2

Neely, A., Gregory, M., and Platts, K. (2005). Performance measurement system design. **International Journal of Operations & Production Management. Vol. 25 No. 12** pp. 1228-1263.

Olugu, E. U., Wong, K. Y., and Shaharoun, A. M. (2010). **Development of key performance measures for the automotive green supply chain.** Resources, Conservation and Recycling. www.elsevier.com

Ouedraogo, A. and Boyer, M. (2010) The impact of IT on the growth and development of insular firms. **Journal of Systems and Information Technology. Vol. 12 No. 4** pp. 289-304.

Parasuraman, A., Zeithaml, V. A., and Berry, L. L. (1985). A conceptual model of service and its implications for future research. **Journal of Marketing. Vol. 49 No. 4** pp. 41-50.

Perrin, B. (1998). Effective use and misuse of performance management. **American Journal of Evaluation, Vol.19 No. 3** pp. 367-379.

Phusavat, K., Kanchana, R., and Lin, Binshan.(2009). Information requirements for managerial decisions in manufacturing. **Business Process Management Journal. Vol. 15 No. 2** pp. 267-285.

Reed, G. V., Binks, M. R., and Ennew, C.T. (1991). Matching the characteristics of a service to the preferences of customers. **Managerial and Decision Economics. Vol. 12 No. 3** pp. 231-240.

Rho, B., Park, K., Yu, Y. (2001). An international comparison of the effect of manufacturing strategy-implementation gap on business performance. **International Journal of Production Economics. Vol. 70** No.1 pp. 89-97.

Shepherd, C. and Gunter, H. (2006). Measuring supply chain performance: current research and future directions. **International Journal of Productivity and Performance Management.** Vol. 55 No. 3-4 pp. 242-258.

Simchi-Levi, D., Kaminsky, P., and Simchi-Levi, E. (2000). **Designing and managing the supply chain: Concepts, Strategies, and Case Studies, 3 Edition, Mcgraw-Hill,** New York.

Stock, J. R. and Lambert, D. M. (2001). **Strategic Logistics Management, 4 Edition, Mcgraw-Hill,** Singapore.

Tonge, J. and Moore, S. A. (2007). Importance-satisfaction analysis for marine-park hinterlands: A Western Australian case study. **Tourism Management. Vol. 28 No. 3** pp. 768-776.

Toyli, J., Hakkinen, L., Ojala, L., and Naula, T. (2008). An analysis of 424 Finnish small and medium-sized enterprises. **Internation Journal of Distribution & Logistics Management. Vol. 38 No.1** pp. 57-80.

Vickery, S. K., Droge, C., and Markland, R. E. (1997). Dimensions of manufacturing strength in the furniture industry. **Journal of Operations Management. Vol. 15** pp. 317-330.

Yilmaz, Y. and Bititci, U. (2006). Performance measurement in the value chain: manufacturing v. tourism. **International Journal of Productivity and Performance Management. Vol. 55 No. 5** pp. 371-389.

Zailani, S., Premkumar, R., and Fernando, Y (2008). Factors influencing the effectiveness of operational information sharing within supply chain channels in Malaysia. **Operations and Supply Chain Manamgent. Vol. 1 No.2** pp. 85-100.

Zelbst, P. J., Green Jr., K. W., Sower, V. E., and Baker, G. (2010). RFID utilization and information sharing: the impact on supply chain performance. **Journal of Business & Industrial Marketing. Vol. 25 No. 8** pp. 582-589.