
# A STUDY OF THE RELATIONSHIP AND IMPACT OF FORECAST INFORMATION QUALITY TO SUPPLY CHAIN PERFORMANCE IN THAILAND AIR-CONDITIONING INDUSTRY

By
PONGPHAN PUTTHAMETHA

A Final Report of the Six-Credit Course
SCM 2202 Graduate Project

Submitted in Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE IN SUPPLY CHAIN MANAGEMENT

ABAC School of Management
Assumption University
Bangkok, Thailand

August 2008

# A STUDY OF THE RELATIONSHIP AND IMPACT OF FORECAST INFORMATION QUALITY TO SUPPLY CHAIN PERFORMANCE IN THAILAND AIR-CONDITIONING INDUSTRY

**By**

**PONGPHAN PUTTHAMETHA**

**A Final Report of the Six-Credit Course**
SCM **2202 Graduate Project**

**Submitted in Partial Fulfillment of the Requirements for the Degree of**

**MASTER OF SCIENCE IN SUPPLY CHAIN MANAGEMENT**

ABAC **School of Management**
**Assumption University**
**Bangkok, Thailand**

**August 2008**

| | |
|---|---|
| Project Title | A Study of the Relationship and Impact of Forecast Information Quality to Supply Chain Performance in Thailand Air-Conditioning Industry |
| Name | Pongphan Putthametha |
| Project Advisor | Asst. Prof. Dr. Mohammad Asif Salam |
| Academic Year | August 2008 |

---

ABAC School of Management, Assumption University has approved this final report of the six-credit course, SCM 2202 Graduate Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Supply Chain Management

Approval Committee:

(Dr. Chayakrit Charoensiriwath)
Committee

(Asst. Prof. Dr. Mohammad Asif Salam)
Advisor

(Dr.Ismail Ali Siad)
Chairman

August 2008

**Assumption University**
**ABAC School of Management**
**Master of Science in Supply Chain Management**

Form signed by Proofreader of the Thesis/Project

Asst. Prof. Brian Lawrence, have proofread this thesis/project entitled "A Study of the Relationship and Impact of Forecast Information Quality to Supply Chain Performance in the Thailand Air-conditioning Industry"

Mr. Pongphan Putthametha

and hereby certify that the verbiage, spelling and format is commensurate with the quality of internationally acceptable writing standards for a master degree in supply chain management.

Signed _____

(Asst. Prof. Brian Lawrence)

Contact Number / Email address blawrence@au.edu

Date: 12/_____

# ABSTRACT

This paper aims to conduct an empirical study of the perceived forecast quality of suppliers and also to explain the impact of forecast information access and forecast information quality (FIQ) on supply chain performance.

Forecast information quality (FIQ) is defined with four variables: In-time, Accurate, Convenient to Access, and Reliable, derived from a theoretical framework on FIQ (English, 1999; Petersen, 1999; Moberg et al., 2002). Supply chain performance deals with three dimensions: Corrective Actions, Preventive Actions, and Customer service; related to metrics reflecting cost, tied-up capital and customer service (Brewer and Speh, 2000).

The analysis in this research is based on a survey of the most important suppliers of Thailand Air-conditioning manufacturers. T-Test was used to analyze the significant differences in supply chain performance between suppliers with access to customer forecasts and suppliers without access to forecasts.Pearson correlation and Linear Regression were used to analyze the significance correlation between supply chain performance and FIQ.

Findings showed that supply chain performance was positively correlated with Forecast Information Quality but it was not significantly different in supply chain performance between suppliers with access to customer forecasts compared to suppliers without access to forecasts. The study also indicated that less than 40% variability in Supply Chain Performance was explained by perceived FIQ, and more than 60% could be explained by other factors.

FIQ also showed quality deficiencies on some variables, which indicates room for improvement from forecasting. Customers and Supplier Managers should consider the perceived forecast quality in order to reduce supplier cost, provide good customer service, and also reduce the total cost of a supply chain.

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# LIST OF APPENDICES

# Chapter 1

# Introduction

## 1.1 Background of the study.

Several studies and authors have emphasized the importance of sharing information between customers and suppliers in a supply chains, especially point-of-sale (POS) and forecast data (Stank et al., 1996; Kelle and Akbulut, 2005; Christopher and Towill, 2000; Cachon and Fisher, 2000; Lee et al., 1997). However, most studies discussed the general importance of having access to forecast information along the supply chain from the customer point of view, there were less studies of the impact of the quality of forecast information on supply chain performance and from the supplier point of view. As a supplier, it does not suffice to only have access to customers' forecasts The interpretation and possible use of the forecast data depend on the quality of forecast information.(Forslund, 2004). For example. the forecast could, be available too late to be used in the planning process, be changed so often that the supplier does not trust it, or exchanged in an inappropriate format (for example, as a faxed document that needs much further processing before the supplier can make use of it).

Supply chain performance is typically related to metrics reflecting cost, tied-up capital and customer service (Brewer and Speh, 2000). The supplier might need to use internal actions to compensate for poor customer service. Corrective actions, such as re-scheduling and overtime, or preventive actions, for example, higher safety stocks and extra capacity Using corrective actions (e.g.. overtime) can deal with increased costs, while using preventive actions (e.g.. higher finished goods keeping) can also deal with a characteristic that results in "increased" tied-up capital but also costs incurred to prevent

future deficiencies in customer service. The use of corrective and preventive actions allows for good customer service performance even though the planning environment is uncertain, for example, as a result of absent or quality deficient forecast information. Consequently, they combine with the effect of costs and tied-up capital in order to fulfill good customer service.

1.2 Thailand Air-Conditioning Industry Overview.

Air-conditioning is a high potential Thailand industry, competing in the global market. With a 9% share of the global market (from Figure 1), Thailand is the 2nd largest exporter in the world with 2,289 Million $ US (the highest exporter being China with a 24.7% share of the global market) (Kasikorn Research Center, 2007). The Thailand export volume contributed 2% of the total Thailand export segment in 2004 (with 2,000 Million $ US ), with growth of 40% over the past year and continuous growth of 10.27% in 2005 (2,200 Milton $ US.), and 10% in 2006 (Kasikorn Research Center, 2006).


Figure 1: Thailand Air-Conditioning export position.

The domestic market is also achieving continuous growth. With its geographic position and warmer weather situation, the Thailand Air-conditioning Market's growth has been 10 - 15% each year over the past 10 years (except only 2006 and 2007), while facing a lot of negative political factors, economics and fuel price factors (Kasikorn Research Center, 2007).

1.3 Statement of the problems.

Air-conditioning can be separated into four categories looking from the user point of view: Room Air, SKY air, Packaged Air and VRV (Appendix A). It really needs a lot of parts and close collaboration with suppliers in order to develop and assemble one set of finish product, Room Air for example, it is approximately 450 – 540 units of parts to complete one set of finished product. Room Air can be separated into indoor unit (sometimes called Fan Coils Unit) approximately 240 – 286 unit of parts, and outdoor unit (sometimes called Condensing Unit) approximately 210 – 254 unit of parts (Daikin Ltd., 2007). Suppliers really need demand forecast information from customers in order to fulfill customer's requirement at the right time, with the right quantity, at right place and with the right products.

Figure 2 shows a typical Air conditioning assembly line. The line pulls the main body to assemble on it all parts at each assembly point through the assembly line. The readiness of every part is important since they are needed to finish the first point before passing to the second point, and so on. If there is no part available at the assembly point then the process must stop and wait for the part to become available before proceeding further.

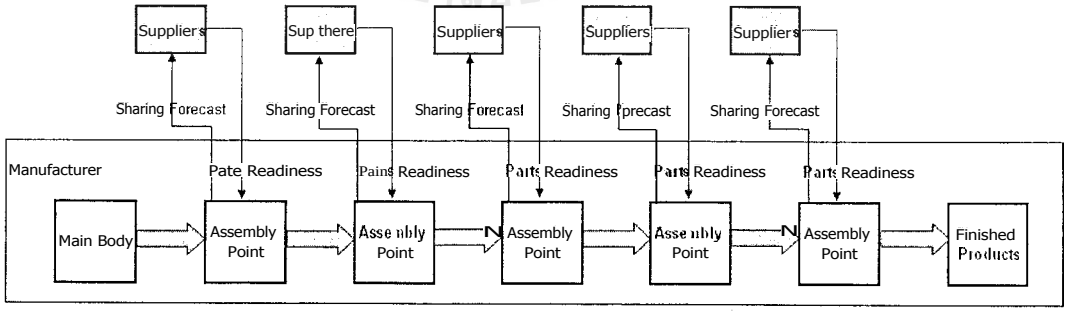


Figure 2: Air Conditioning Assembly Line.

From a suppliers point of view, suppliers produce the parts and deliver them to the and quality of forecast information from assembly point given to suppliers is important. If no forecast sharing or the quality of demand information sharing from assembly point to supplier is not good enough, for example, the forecast would not be released to a supplier at the time which the supplier wants, or is in time but not accurate, or changes so frequently, or the format needs to be modified or changed before processing, for example, then the supplier needs to take internal action to provide and serve the customer. This could include having more safety stock to be available for unpredicted demand, which will affect their tied up capital, or they need to have over-time job which will increase the cost to suppliers etc.

Some previous studies also indicated that suppliers are more aggressive and gain benefit in sharing information and collaborating in the forecast process (Holmstrom et al, 2002). So, suppliers who receive shared information from customers could gain better benefit and produce better performance than suppliers who do receive that. And as a supplier, it does not suffice to only have access to customers' forecasts; the interpretation and possible use of the forecast data depend on the quality of forecast information.(Forslund, 2004). The interpretation and possible use could affect how supplier can take action and fulfill what customers want.

`*The problem researched in this paper is: Are there any differences in supply chain performance between the suppliers who have access to customer's forecast and those who do not have access? And, what is the impact of forecast information* ***qualityon*** *supply chain performance, in the Thailand Air-Conditioning Industry'*

1.4 Research Objectives

This paper extends the study of Petersen, 1999, and Forslund, 2004, to deal with two objectives and answer the research problem, as below,

1) To explain and study the impact of forecast information access to supply chain performance, and
2) The impact of Forecast information quality (FIQ) on supply chain performance

of Air Conditioning manufactures' suppliers in Thailand.

1.5 Scope of the Study

This paper is developed to study the impact of forecast information access and the impact of Forecast information Quality (FIQ) on supply chain performance for the suppliers of major Thailand Air Conditioning manufacturers.

The forecast information access in this paper is the collaboration point between Air Conditioning manufacturers and their suppliers, as show in Figure 3 below:

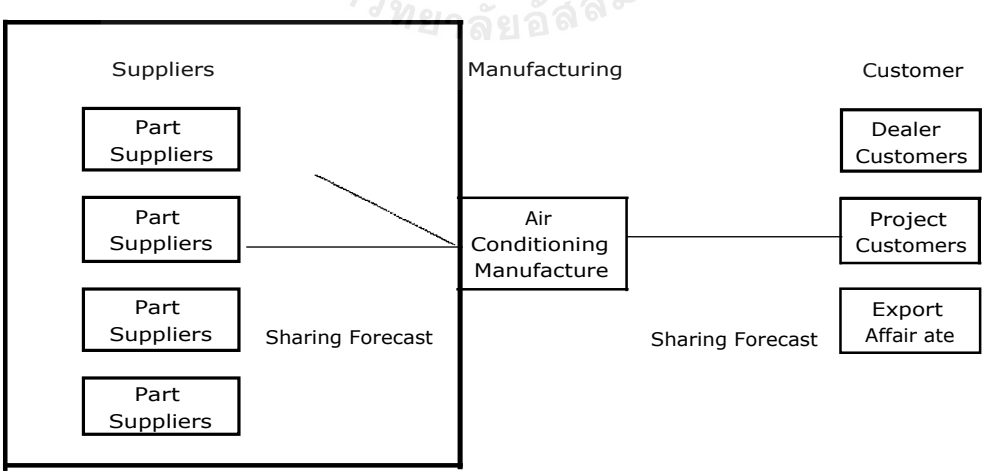


Figure 3: Scope of the study.

The major Thailand Air conditioning manufacturers are six leading companies who contribute 66% of the Thailand Air condition market share (Daikin Ltd, 2007), The list of suppliers was compiled from the views of the group of major air conditioning manufacturers. The distribution by product group (air-conditioning parts) and company size, varied.

# Chapter 2

# Literature Review

## 2.1 Sharing Forecast Information

The issue of sharing forecasts in the supply chain has been studied from some different perspectives, for example, the collaborative planning forecasting and replenishment (CPFR) approach and modeling-based approaches. A survey of Swedish manufacturers in different industries had been made by Sandberg (2005), which shows that 95% of the companies exchange forecast information at a monthly frequency. Aside from that study, no other broad descriptive study of Forecast information sharing was identified. The literature on CPFR discusses the inter-organization and intra-organization issues in the forecasting collaboration process. The major objective was to develop a common plan for the supply chain as a whole (Helms et al., 2000; McCarthy and Golicic,2002). But most of CPFR literature adopts a retailer perspective. A study was made by Holmstron et al. in 2002, and shows that suppliers are more interested in sharing information and collaborating in the forecast process than are the retailers. They also indicated that suppliers gain most of the benefits of increased information sharing. A model-based study was made by Cachon and Fisher in 2000. The analysis result shows that the performance effects of sharing information are low when demand is predictable, as compared to situations where demand is unpredictable. Zhao (2002) showed that the supplier capacity constraints impact the possibility of the supplier successfully using the customer forecast. These studies show that a forecast received from customers could result in positive results, but depends on different conditions on hand ie. how the forecast information should be used in a supplier's planning process.

## 2.2 Supply Chain Performance

Some of the modeling-based studies on sharing forecasts in supply chains, link forecast exchange to supply chain performance. Lee et al. (1997) and several others have shown that the demand variability can be amplified upstream in the supply chain when not sharing accurate forecasts with the suppliers. Zhao et al. (2002) concluded that the value of information sharing is significantly influenced by the demand pattern, forecasting model used and the supplier's capacity tightness (i.e. its total production capacity in relationship to the total demand to be satisfied), but that the suppliers usually can improve their total costs and customer service dramatically through information sharing under all conditions. Aviv (2001) compared local forecasting with exchange of collaborative forecasts and concluded that the supply chain costs were reduced when exchanging forecast information. McCarthy and Golicic (2002) made an exploratory study of collaborative forecasting, which was defined as a long-term relationship among organizations actively working together with forecasting (Mentzer et al., 2000), and identified a substantial impact on supply chain performance. They found that improvement in customer service performance, such as shorter lead times, improved inventory availability and better response to fluctuations in demand. Furthermore, improvements in cost and capital were found which could be related to reductions in safety stock. Supply chain performance is typically related to metrics reflecting cost, tied-up capital and customer service (Brewer and Speh, 2000). The supplier might need to take their internal actions in order to satisfy customers' requirement. Corrective actions such as overtime, Preventive actions, safety stocks and extra capacity, for example are mainly related to tied-up capital and costs for the supplier. The use of corrective and

preventive actions could allow for good customer service performance, even if the demand is uncertain as a result of lack of access to customer forecasts. The paper has defined supply chain performance with the three performance variables: corrective action, preventive action and customer service, as a goal to fulfill customers' requirements.

In the three dimensions of Supply Chain Performance: corrective action, preventive action and customer service, the corrective and preventive action variables are based on the works of Lindau and Lumsden (1993), Ericsson (1997), Fahle´n (1997), and Mattsson (2002) The Corrective action was defined with (a) subcontracting; (b) expediting; (c) part delivery; (d) re-scheduling; (e) reservation breaking; (1) overtime; and (g) express transports. The preventive action was defined as (a) safety stock in raw material inventory; (b) safety stock in finished goods inventory; (c) safety capacity; (d) safety lead time; and (e) over-planning. The customer service variables deals with (a) promised lead time; (b) on-time delivery; (c) use rush orders when needed; (d) promised inventory availability; (e) accurate orders; and (f) availability of delay information, which are based on Stock and Lambert (1992) and Mattsson (2002)

2.3 Forecast Information Quality

Besides Forecast Information Sharing and Supply Chain Performance, it is not sufficient for suppliers to only have access to customers' forecasts: the interpretation and possible use of the forecast information depends on the quality of the information (Forslund, 2004). The study also showed that information quality cannot be measured objectively, but must be judged by suppliers. A supplier might have a weakness regarding FIQ and forecast error. FIQ is not equal to forecast error, which can be measured by the difference

between forecast and actual demand. The information quality dimensions could be derived from the seven rights of logistics (Weld,1916), right place, time, quantity, quality, price, condition and customer. In Lindau and Lumsden's, 1993 study, they focus on three information quality dimensions derived from the rights: correct information, timely information and complete information. Petersen (1999) in his study, measured information quality in terms of whether it current, accurate, complete, compatible or convenient to access. Forslund (2004) has developed and defined a framework of describing and analyzing the FIQ derived from the theoretical framework of FIQ (English, 1999; Petersen, 1999; Moberg et al., 2002) as well as the definitions with the four information quality variables: in time, accurate, convenient to access, and reliable. In time means it is within the agreed time, when the information customer wants it. Accuracy concerns the degree of obvious mistakes in the information, Convenient to access, deals with the ease of accessing the data without further processing, and reliability refers to the probability that a forecast will remain unchanged. Hence, numerous studies emphasize the positive impact of forecast information exchange, but there is a lack of studies that empirically explain the performance impact of forecast exchange and quality of forecast information.

## Chapter 3

## Model Framework and Hypothesis Generation

**In accordance with the theoretical framework, a model framework and hypotheses have then been generated to analyze the impact of forecast information access and forecast information quality (FIQ) on supply chain performance, as in Figure 4.**

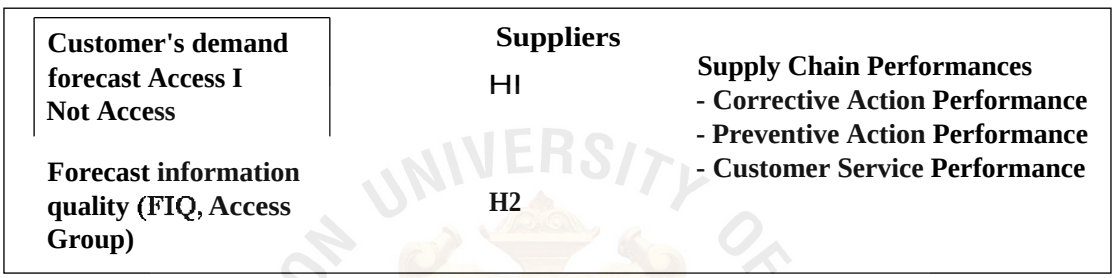


**Figure 4: Model of the study**

**Figure 4 deals with two main hypotheses. The first hypothesis deals with the performance impact of suppliers with access to customer forecasts compared to suppliers without access to forecasts.**

**H1. Supply chain performance is significantly different for suppliers with access to customer forecasts compared to suppliers without access to forecasts.**

**In accordance with the hypothesis HI, the paper deals with three sub hypotheses H1.1 — H1.3, with in-depth analysis of the performance impact of suppliers with access to customer forecasts compared to suppliers without access to forecasts, as in Figure 5.**

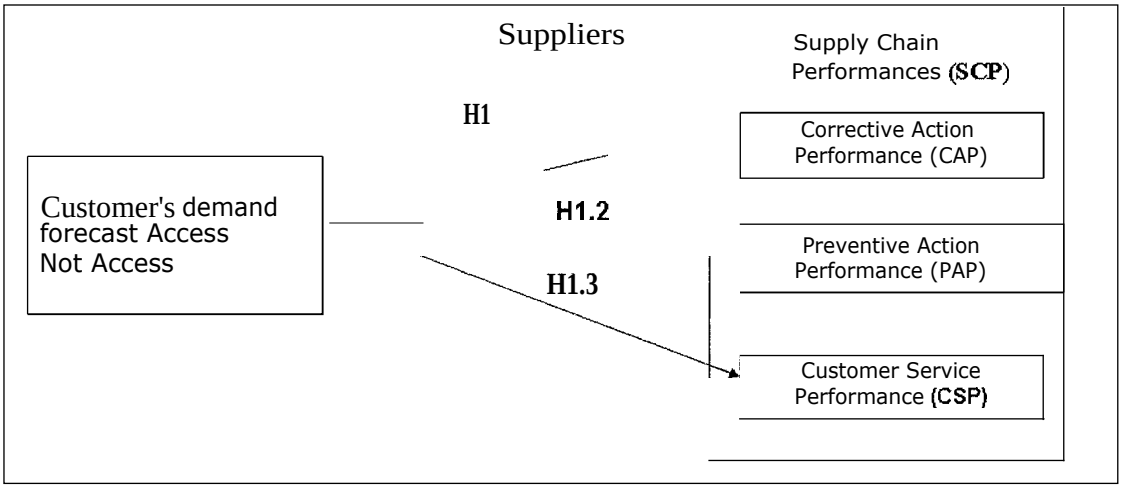


Figure 5: Sub Model H1 of the study

**H1.1** Corrective Action Performance (CAP) is significantly different for suppliers with access to customer forecasts compared to suppliers without access to forecasts.

111.2 Preventive Action Performance (PAP) is significantly different for suppliers with access to customer forecasts compared to suppliers without access to forecasts.

H1.3 Customer Service Performance **(CSP)** is significantly different for suppliers with access to customer forecasts compared to suppliers without access to forecasts.

Figure 6 show model framework of hypothesis H2. The paper also deals with three sub hypotheses H2.1 – H2.3 with in-depth analysis of the performance impact of the FIQ on each of Supply chain performance variables.

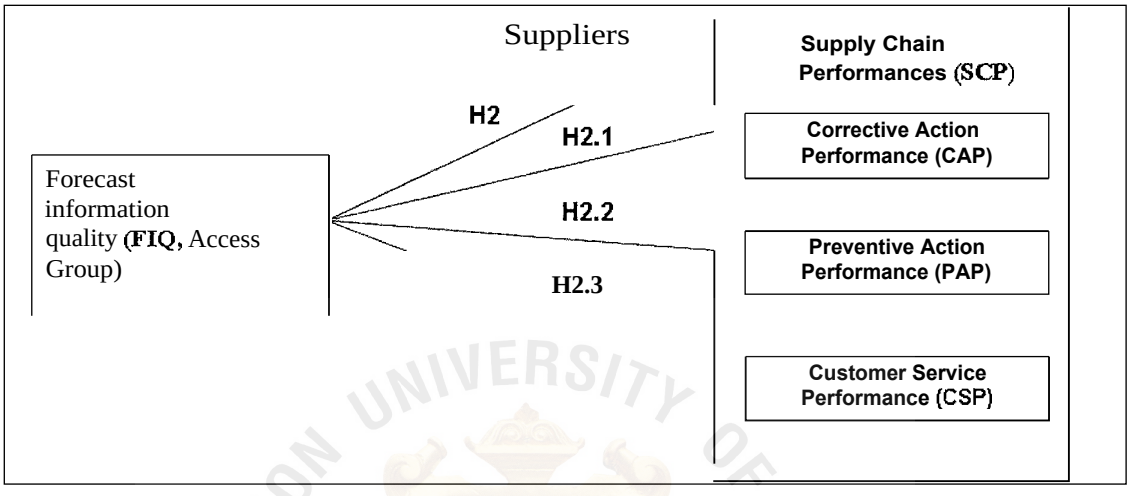


Figure 6: Sub Model **H2** of the study

H2.1 Corrective Action Performance (CAP) is positively correlated with **FIQ.**

112.2 Preventive Action Performance (PAP) is positively correlated with **FIQ.**

H2.3 Customer Service Performance **(CSP)** is positively correlated with **FIQ.**

# Chapter 4

# Methodology

## 4.1 Methodology

When deciding the research approach for a study, the researcher can choose between several approaches, all characterized by specific strengthens and weaknesses. The most important condition for choosing an appropriate approach is to identify the type of research questions that should be answered. Researchers in the area point out that there is a difference between surveys and survey research. While a survey can be made for many reasons not connected to research, such as political opinion investigations and TV viewing polls, survey research aims to increase the scientific knowledge in a research area. Thus, this paper applies a survey research, which aims to increase scientific knowledge, and uses statistical techniques analyze and describe, according to paper objectives, as recommend by McCarthy and Golicic (2002).

In the study, the questionnaire was selected as the suitable method to collect the empirical data, which was distributed via e-mails and fax to Air-conditioning manufacturers' suppliers. Air-conditioning manufacturing companies were selected from major Air-conditioning companies in the Thailand market which contributed about a 66% share of the total Thailand market (Daikin Ltd, 2007).

## 4.2 Survey Research instruments

Tables 1 to 4 show the questions and definitions of the variables related to FIQ, corrective actions, preventive actions and customer service, in order to analyze this paper. The FIQ variables are derived from the theoretical framework on FIQ (English, 1999; Petersen, 1999; Moberget al., 2002). The corrective and preventive action variables are

based on the works of Lindau and Lumsden (1993).. The customer service variables are based on Stock and Lambert (1992).

Likert scales from 1 to 7 were used for all these variables, measured on ordinal scales

The questions asked and definitions of scales for the respective variable are included in Tables 1 to 4.

The average of the four information quality variables was defined and used as an overall FIQ index (FIQ).

The average of the six corrective action variables was defined and used as an overall corrective action performance index (CAP).

The average of the five preventative action variables was defined and used as an overall preventative action performance index (PAP).

The average of the five customer service variables was defined and used as an overall customer service performance index (CSP).

A Cronbach's value of 0.70 is needed to be considered acceptable for a scale (Hair et al., 1998).

Table 1: Variables of **FIQ**

Question: forecasts received from the customer are: (a) in time; (b) accurate; (c) convenient to access; and (d) reliable; scale: seven point Likert scale from 1 (strongly disagree) to 7 (strongly agree)

| Variable | Definition |
|---|---|
| In time | Arriving in the agreed time – within the supplier's planning horizon |
| Accurate | Free from obvious mistakes |
| Convenient to | Easy access without further processing |

| | |
|---|---|
| access | |
| Reliable | The probability that a forecast remains Unchanged |

Table 2: Variables of Corrective Actions

Question: to perform the promised customer service we use: (a) subcontracting; (b) expediting; (c) part delivery; (d) re-scheduling; (e) reservation breaking; (f) overtime; and (g) express transports; scale: seven point Likert scale from 1 (to a very low extent) to 7 (to a very high extent)

| Corrective action variable | Definition |
|---|---|
| Subcontracting | Short-term, as a result of unforeseen overload |
| Expediting | Finding and rushing "hot" jobs through production |
| Part delivery | Smaller batches in production or delivery |
| Re-scheduling | Re-plan |
| Reservation breaking<br>Overtime | Already reserved material (for another customer) is used earlier<br>Short-term |
| Express transports | A faster and more expensive means of transportation is used to speed up a Delivery |

Table 3 : Variables of Preventive Actions

Question: to perform the promised customer service we use: (a) safety stock in raw material inventory; (b) safety stock in finished goods inventory; (c) safety capacity; (d) safety lead time; and (e) over-planning; scale: seven point Likert scale from 1 (to a very low extent) to 7 (to a very high extent)

| Preventive action variable | Definition |
|---|---|
| Safety stock in raw material inventory | Stock kept as a reserve to guard against material shortage because of |

| | |
|---|---|
| | uncertainties in supply, demand and lead time |
| Safety stock in finished goods inventory | Stock kept as a reserve to guard against material shortage because of uncertainties |
| Safety capacity | The reservation of extra capacity, i.e. plan with under-capacity utilization to protect against unforeseen events |
| Safety lead time | The order starts earlier to be finished before its due date |
| Over-planning (demand hedges) | Instead of safety stock or safety lead time, a larger quantity than known demand is planned |

Table 4 : Variables of Customer Service Performance

Question: for our most important customer we perform perfectly in: (a) promised lead time; (b) on-time delivery; (c) use of rush orders when needed; (d) promised inventory availability; (e) accurate orders; and (f) availability of delay information; scale: seven point Likert scale from 1 (strongly disagree) to 7 (strongly agree)

| Customer Service Performance variable | Definition |
|---|---|
| Promised lead time | the time between placing and receiving an order |
| On-time delivery | Orders are delivered at agreed time |
| Rush orders when needed | |
| Promised inventory availability | to what degree orders can be delivered from inventory |
| Accurate orders | the right number of items ordered arrives |
| Availability of delay information | |

4.3 Statistical Methods

In order to test H1 and H2 after collecting the data, T-tests was used to test H1 to computes the difference and the significant differences in supply chain performance

between suppliers with access to customer forecasts and suppliers without access to forecasts (H1).

To test H2, Pearson correlation and Linear Regression were used to analyze the significance correlation between supply chain performance and FIQ. Pearson Correlation was used to reflect the degree of linear relationship between FIQ and CAP, PAP, CSP at defined levels of significance; and Linear Regression attempts to explain this relationship with a straight line fit to the data at defined level of significance.

# Chapter 5

## Data Analysis

### 5.1 Data Collection

A supplier's questionnaire was developed. Suppliers' lists were compiled from views of customers. 97 Thai air-conditioning supplier companies were found, and it was decided to address the entire population. Some 54 usable responses were received, corresponding to a response rate of 56.2 percent. The distribution, by product group (air-conditioning parts) and company size, varied.

### 5.2 Data Analysis

About 43 of 54 supplier responses (79.63%) were receiving forecast information. The average perceived FIQ by suppliers for each variable is shown in Table 5.

Perceived FIQ by all suppliers

| FIQ Variable | N | Mean | SD |
|---|---|---|---|
| In Time | 43 | 5.07 | 1.28 |
| Accurate | 43 | 4.81 | 1.22 |
| Convenient to access | 43 | 4.65 | 1.29 |
| Reliable | 43 | 4.58 | 1.12. |
| Average FIQ | | 4.78 | 1.23 |

Table 5: Perceived FIQ by all suppliers

The in-time variable is significantly higher (ie. arriving in the agreed time – within the supplier's planning horizon) when compared to other variables, while the reliable variable (ie.the probability that a forecast remains unchanged) is the lowest one. This coul imply that since the planning horizon was agreed between suppliers and customers, forecast, to arrive in the agreed time is important for suppliers in order to proceed with further production planning and output. The reliable variable however, showed the lowest one, the reliability of FIQ, (i.e. the probability that a forecast will remain unchanged,

could be interpreted as a forecast error). It could be expected that although a forecast was submitted in the agreed planning horizon, the forecast still kept changing from customers.

*The performance impact of forecast information access and forecast information quality*

In order to test H1 (Supply chain performance is significantly different for suppliers with access to customer forecasts compared to suppliers without access to forecasts) and sub hypotheses, T-Tests were used to analyze the significant differences in supply chain performance between suppliers with access to customer forecasts and suppliers without access to forecasts. Tables 6 and 7 present the result from testing H1.

The findings of H1 (Table 6) indicated that suppliers without (not) access to forecasts use less corrective actions and preventive actions than suppliers with access to forecasts, for all variables (except only Safety stock in finished goods inventory), but most are not significant.

Only overtime and Safety stock in raw material inventor were significantly different, with suppliers without (not) access to forecasts using less than suppliers with access to forecasts.

However, results from Table 7 indicated that CAP (the average of the six corrective action) and PAP (the average of the five preventative action variables) are not significant (Sig 2 tailed > 0.05) between suppliers with access to forecasts and without (not) access. This result indicated that sub-hypotheses H1.1 and H1.2 were not verified. In terms of performing customer service, there were indications of suppliers with access to forecasts performing better than suppliers without (not) access to forecasts on Availability of delay

information (Sig 2 Tailed = 0.028* < 0.05), and Table 6(b) also indicated that suppliers with access to forecasts perform customer service (CSP-average of Customer Service) better than suppliers without (not) access to forecasts (Sig 2 Tailed of SCS = 0.026* < 0.05) which is verified for H1.3.

The explanation for this finding was that the extent of using corrective actions and preventive actions were not significantly different between suppliers without (not) access to forecasts and suppliers with access to forecasts. There was only significant different in performing customer service especially in providing Availability of delay information. Suppliers who received customers forecast can provide feedback to customers if it occurs to products or shipment delay compared to customer who not received order forecast that result in better customer satisfaction and higher result on SCS-average of Customer Service.

However, H1 was not verified since there is only a significant difference in H1.3, CSP-average of Customer Service but not significance for H1.1, CAP (the average of the six corrective action) and H1.2, PAP (the average of the five preventative action variables).

Table 6: Result from Testing **H1(details)**

*(* Significant at the p <0.05 level)*

| | | Mean Suppliers access to Customer's Forecast | Mean Suppliers not access to Customer's Forecast | Mean Difference | T-Value | Sig 2 Tailed |
|---|---|---|---|---|---|---|
| **Corrective Action Variable** | | | | | | |
| Subcontracting | **4.1** | 3.8372 | 3.1818 | 0.655 | 1.062 | 0.293 |
| Expediting | **4.2** | 4.8372 | 4.6364 | 0.201 | 0.408 | 0.685 |
| Part delivery | **4.3** | 3.7674 | 3.5455 | 0.222 | 0.331 | 0.742 |
| Re-scheduling | **4.4** | 2.4419 | 2.0000 | 0.442 | 1.445 | 0.155 |
| Reservation Break | **4.5** | 4.3023 | 3.9091 | 0.393 | 0.612 | 0.543 |
| Overtime | **4.6** | 5.1860 | 3.9091 | 1.277 | 2.215 | 0.031* |
| Express **transport:** | **4.7** | ***Take Out | | | | |
| **Preventive Action Variable** | | | | | | |
| Safety stock in **ray** | **5.1** | 5.2326 | 4.0909 | 1.142 | 2.070 | 0.043* |
| Safety stock in fini | **5.2** | 3.7907 | 3.9091 | -0.118 | -0.189 | 0.851 |
| Safety capacity | **5.3** | 4.8605 | 4.4545 | 0.406 | 0.778 | 0.440 |
| Safety lead time | **5.4** | 5.1628 | 4.3636 | 0.799 | 1.638 | 0.107 |
| Over-planning | **5.5** | 4.6977 | 4.1818 | 0.516 | 0.922 | 0.361 |
| **Customer Service Performance Variable** | | | | | | |
| Promised lead tim | **6.1** | 6.0000 | 5.5455 | 0.455 | 1.266 | 0.211* |
| On-time delivery | **6.2** | 6.2558 | 5.7273 | 0.529 | 1.733 | 0.089 |
| **Rush orders when** | **6.3** | ***Take Out | | | | |
| Promised inventor | **6.4** | 5.3023 | 5.0000 | 0.302 | 0.826 | 0.413 |
| Accurate orders | **6.5** | 5.9070 | 5.2727 | 0.634 | 1.695 | 0.096 |
| Availability of dela | **6.6** | 5.5116 | 4.5455 | 0.966 | 2.257 | 0.028* |

Table 7: Result from Testing H1

*(* Significant at the p <0.05 level)*

| | | CAP | PAP | SCP |
|---|---|---|---|---|
| **Mean** | Suppliers access to Customer's Forecast | 4.0620 | 4.7488 | 5.7953 |
| | Suppliers **not** access to Customer's Forecast | 3.5303 | 4.2000 | 5.2182 |
| **Mean Differnce** | | 0.5317 | 0.5488 | 0.5771 |
| **1-Value** | | 1.4800 | 1.3410 | 2.2920 |
| **Sig 2 Tailed** | | 0.1450 | 0.1860 | 0.026* |

Note: CAP-average of Corrective Action Variable(except Express transports)
PAP-average of Preventive Action Variable
CSP-average of Customer Service(except Rush orders when needed)

Table 8 **:** Result from Testing H2

*(* Significance at the p < 0.05 level)*

| | | CAP | PAP | SCP |
|---|---|---|---|---|
| FIQ | **Pearson Correlation** | -0.352 | -0.326 | 0.387 |
| | **Sig 2 Tailed** | 0.020* | 0.033* | 0.010* |
| | **N** | 43 | 43 | 43 |

**FIQ** average of the four information quality
**CAP** average of Corrective Action Variable(except Express transports)
**PAP** average of Preventive Action Variable
**CSP** average of Customer Service(except Rush orders when needed)

Table 8: The result from Testing H2 indicates that significant correlation existed for all 3 sub hypotheses H2.1 (FIQ->CAP), H2.2 (FIQ->PAP), and H2.3 (FIQ->CSP) at the $p < 0.05$. The Pearson correlation shows negative value —0.352 and —0.326 for H2.1 (FIQ->CAP) and H2.2 (FIQ->PAP) respectively, which means that Suppliers used less Corrective action and Preventive action when suppliers perceived a better quality forecast. There was also a positive Pearson correlation ($0.387 > 0$) for H2.3 (FIQ->CSP) meaning that suppliers can perform better in order to satisfy customers if they perceive better quality forecasts. On the other hand, it showed better supply chain performance by using less cost, tied-up capital and increase more customer service (Brewer and Seph, 2000) when suppliers perceived better-forecast quality.

The result from Table 9:ANOVA result, and Figure 7, 8 ,9 after testing with linear relationship at $P<0.05$, also indicated that all SubHypotheses (H2.1, H2.2 , H2.3) and H2 can be verified. There were linear relationships with the same result with Pearson correlation analysis. There is also the given model to represent linear equation between FIQ and each of CAP, PAP and CSP, relationships and equations were significantly accepted with ANOVA testing at significance $F<0.05$.

Table 9: ANOVA result.

| | | CAP | PAP | SCP |
|---|---|---|---|---|
| FIQ | **Significance F** | 0.020* | 0.033* | 0.010* |
| | **R Square** | 0:352 | 0.326 | 0.387 |
| | **Coefficients** | | | |
| | Intercept | 5.91 | 6.384 | 4.523 |
| | X Variable 1 | -0.387 | -0.342 | 0.266 |

*Note: * Significant at significance F<0.05*

Figure 7: Linear Regression **CAP-FIQ**

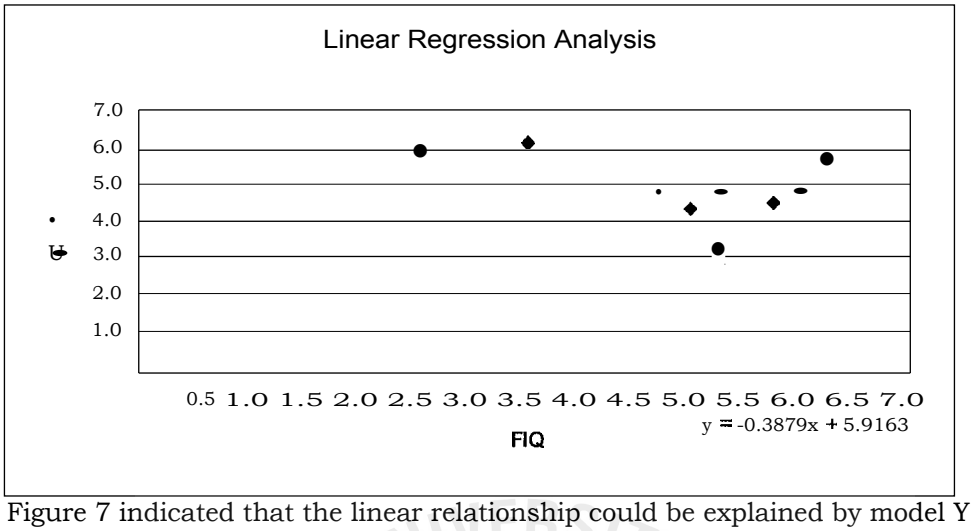


Figure 7 indicated that the linear relationship could be explained by model Y = -0.3879X + 5.9163 (Y = SCA, X=FIQ), the model can be accepted at significance F<0.05

Figure 8: Linear Regression **PAP-FIQ**

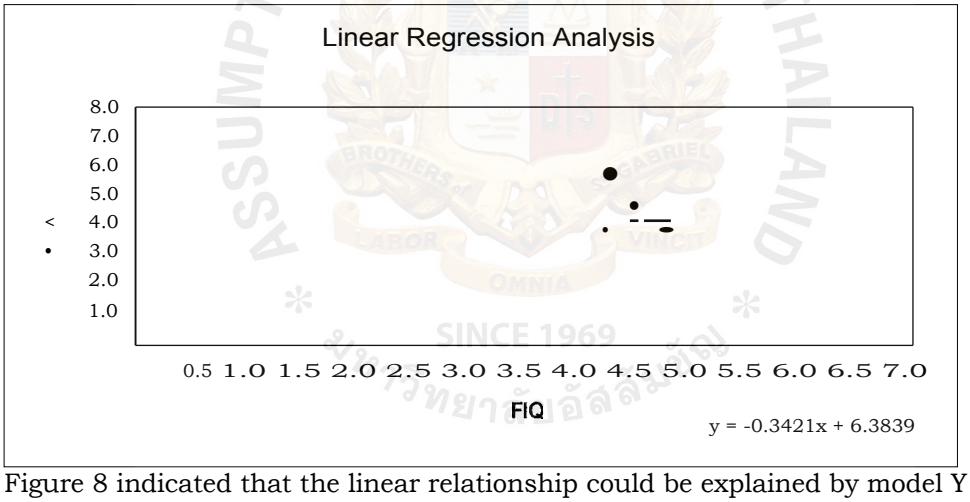


Figure 8 indicated that the linear relationship could be explained by model Y = -0.3421X + 6.3839 (Y = SPA, X=FIQ), at significance F<0.05

Figure 9: Linear Regression **CSP-FIQ**

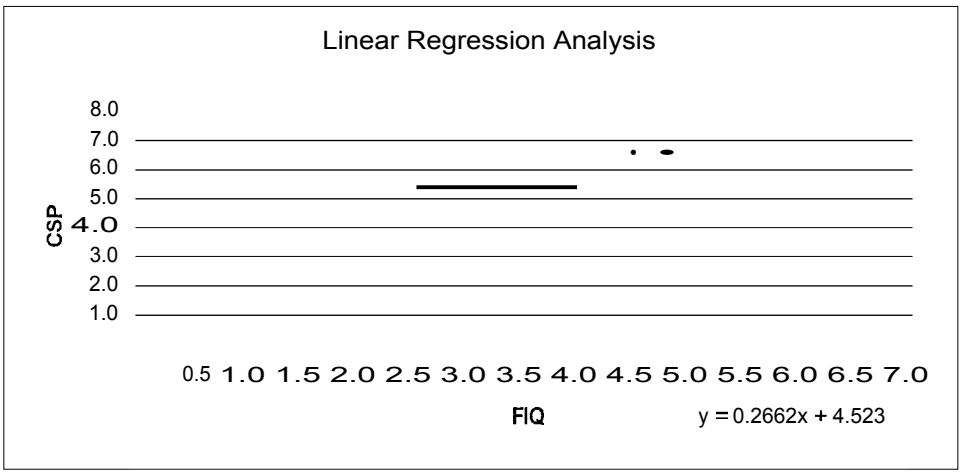


Figure 9 indicated that the linear relationship could be explained by model Y = 0.2662X + 4.523 (Y = SCS, X=FIQ), at significance F<0.05.

In conclusion, the study from this paper indicated that for H1: Supply chain performance is higher for suppliers with access to customer forecasts compared to suppliers without access to forecasts, it could not be verified at p<0.05, while for H2: Supply chain performance is positively correlated with FIQ, it could be verified at significance F<0.05.

# Chapter 6

## Conclusion and Research implication

In this chapter, the researcher concludes the results from the data analysis of the previous chapter. The chapter will include the conclusions, the research implications, research limitations and directions for future research.

### 6.1 Conclusion

Answers were sought for the research objectives as mentioned in Chapter 1:

1) The impact of forecast information access on supply chain performance and

2) The Impact of Forecast information quality (FIQ) on supply chain performance in Thailand Air Conditioning industry.

The measures were tested and used with reliable results in this empirical study. The empirical findings indicated a large proportion of suppliers (79.63%) received customer forecasts. They also show that the reliable variable was considered as the biggest forecast deficiency, while in time was considered as the highest forecast quality variable. The performance between suppliers with access to forecast and those without access was not significantly different. There is only a significant difference in performing customer service, especially in providing Availability of delay information. Suppliers who received customers forecast can provide feedback to customers if it affects products or shipment delay compared to customers' order forecast; which results in better customer satisfaction and higher results on SCS-average of Customer Service. But the empirical findings indicated that a significant correlation existed for all three sub-hypotheses H2.1 (FIQ->CAP), H2.2 (FIQ->PAP), and H2.3 (FIQ->CSP), which indicated a significant positive relationship of supply chain performance with forecast information quality (FIQ).

## 6.2 Intended theoretical Contributions and Managerial Implication

The findings from this empirical study give a result for understanding the performance impact of forecast information quality (FIQ) that relates to organization metrics reflecting cost, tied-up capital and customer service (Brewer and Speh, 2000). FIQ also shows quality deficiencies in all variables, which indicates room for improvement from forecasting. Customers and Supplier Managers should consider the perceived forecast quality in order to reduce supplier cost, provide good customer service and affect the total cost of the supply chain.

The findings were also useful for practitioners or managers in the following ways:

1. The findings from this empirical study give a result for understanding the performance impact of forecast information quality (FIQ) that relatedsto organization metrics reflecting cost, tied-up capital and customer service (Brewer and Speh, 2000).
2. FIQ also shows quality deficiency in each forecast quality variable, which indicates room for improvement from forecasting. Customers and Supplier Managers should consider the perceived forecast quality in order to reduce supplier cost, provide good customer service, and also affect the total cost of the supply chain.
3. It is a guide for the manager for better understanding of Forecast Information quality (FIQ) characteristics and the performance impact of FIQ in the Thailand air-conditioning industry.

## 6.3 Research Limitations

This research paper has the following limitations.

It is very rare for research to be available on the Forecast Information Quality topic in Thailand. This paper is the first attempt to try to explain Forecast Information Quality (FIQ) derived from Theory, the impact of forecast information access, and the impact of forecast information quality (FIQ), which may lead to lack of understanding and cooperation and difficulty in data collection.

All supplier companies in the Air-conditioning industry could not be covered because of time limitation and data available. The questionnaires were distributed to 97 Air-Conditioning suppliers based on a 60% market share of Air-conditioning finished products covering all four products categories. As samples were drawn from only one industry, it cannot be representative of other industries because of the differences in context.

This study covering a lot of products variations (air conditioning parts) e.g.. compressor, panel, pipes, and does not focus on homogeneous companies, and varies in company size. This paper also does not consider the customer's own forecasting process and process of production or assembly, which may vary in the usage objective of forecast information and the perceived quality of forecast.

6.4 Potential areas for future Research.

For the potential areas for future research, since this study has not revealed information about the customer's own forecasting process, it is also worth repeating that this study was not focused on collaborative forecasting, but merely asked if forecast information was transferred or not

The completion of study still reveals the need for more studies in the area of FIQ and Supply Chain Performance. The potential areas of future research should deal with,

Explaining the causes of high or low perceived FIQ and

How FIQ contribute to Supply Chain Performance.

More detailed research questions in these two areas could be related to the conditions of the actual demand pattern and the processes related to forecasting at the customer; transmission of the information from the customer to the supplier; registration of the data at the supplier and the characteristics of the processes and actors using the forecast data. As well as the other factors from the result of R-square from Table8 (Result from ANOVA testing), the result of R-square indicated less than 40% variability in Supply Chain Performance (Corrective Action (35.2%), Ppreventive action (32.6%) and Customer service (38.7%)) were explained by perceived FIQ, and more than 60% would be explained by other factors.

## BIBLIOGRAPY


Aviv, Y. (2001), The effect of collaborative forecasting on supply chain performance, *Management Science*, Vol. 47 No. 10, pp. 1326-43.

Brewer, P.C. and Speh, T.W. (2000), Using the balanced scorecard to measure supply chain performance, *Journal of Business Logistics*, Vol. 21 No. 1, pp. 75-93.

Cachon, G.P. and Fisher, M. (2000), Supply chain inventory management and the value of shared information, *Management Science*, Vol. 46 No. 8, pp. 1032-48.

Christopher, M. and Towill, D. (2000), Supply chain migration from lean and functional to agile and customized, *Supply Chain Management: An International Journal*, Vol. 5 No. 4, pp. 206-13.

Daikin Ltd. (2007), www.daikin.co.th

English, L.P. (1999), *Improving Data Warehouse and Business Information Quality*, Wiley, New York, NY.

Ericsson, J. (1997), "Storningsanalys av tillverkningssystem – ett viktigt verktyg inom lean production", doctoral thesis, Department of production and materials engineering, Lund University, Lund.

Forslund, H. (2004), The existence of logistics quality deficiencies and the impact of information quality in the dyadic order fulfillment process, Dissertation No. 62, Linko¨ping University, Linko¨ping, EKI.

Fahle´n, K. (1997), Storningars konsekvenser for tillverkande foretags effektivitet – identifiering, analys och hantering av storningar, Handelshogskolan, Goteborgs universitet, Goteborg (in Swedish).

Helms, M., Ettkin, L. and Chapman, S. (2000), Supply chain forecasting: collaborative

forecasting supports supply chain management, *Business Process Management Journal,* Vol. 6 No. 5, pp. 392-407.

Holmstrom, J., Framling, K., Kaipia, R. and Saranen, J. (2002), Collaborative planning forecasting and replenishment: new solutions needed for mass collaboration, Supply Chain Management: *An International Journal,* Vol. 7 No. 3, pp. 136-45.

Kasikorn Research Center (2006, 2007), www.kasikornresearch.com

Kelle, P. and Akbulut, A. (2005), The role of ERP tools in supply chain information sharing, cooperation and cost optimizing, *International Journal of Production Economics,* Vol. 93-94, pp. 41-52.

Lee, H., Padmanabhan, V. and Whang, S. (1997), Information distortion in a supply chain: the bullwhip effect, *Management Science,* Vol. 46 No. 4, pp. 546-58.

Lindau, R. and Lumsden, K. (1993), *Disturbance Absorption Actions Used in Material Flow Systems* – A Pilot Study, Department of Transportation and Logistics, Chalmers University of Technology, Goteborg.

Lindau, R.A. (1995), The impact of high-quality information on performance in manufacturing, doctoral thesis, Chalmers University of Technology, Goteborg.

Mattsson, S-A. (2002), Logistik i fo¨rso rjningskedjor, Studentlitteratur, Lund (in Swedish).

McCarthy, T. and Golicic, S. (2002), Implementing collaborative forecasting to improve supply chain performance, *International Journal of Physical Distribution & Logistics Management,* Vol. 32 No. 6, pp. 431-54.

Moberg, C.R., Cutler, B.D., Gross, A. and Speh, T.W. (2002), Identifying antecedents of information exchange within supply chains, *International Journal of Physical*

***Distribution & Logistics Management,*** Vol. 32 No. 9, pp. 755-70.

Petersen, K.J. (1999), The effect of information quality on supply chain performance: an interorganizational information system perspective, dissertation, Michigan State University, East Lansing, MI.

Sandberg, E. (2005), Logistics collaboration in supply chains – a survey of Swedish manufacturing companies, Thesis No. 1180, Linkoping Studies in Science and Technology, Linko¨ping University, Linkoping.

Stank, T.P., Emmelhainz, M.A. and Daugherty, P.J. (1996), The impact of information on supplier performance, *Journal of Marketing Theory and Practice*, Fall, pp. 94-105.

Stock, J. and Lambert,D. (1992), *Strategic Logistics Management,* Irwin Professional, NewYork,NY.

Weld, L. (1916), *The Marketing of Farm Products, Macmillan,* New York, NY.

Zhao, Y. (2002), The value of information sharing in a two-stage supply chain with production capacity constraints: the infinite horizon case, *Manufacturing & Service Operations Management,* Vol. 4 No. 1, pp. 21-4.

# APPENDICES

Appendix 1: Four categories of Air-conditioning (From usage point of view).

(source: www.daikin.co.th)

1) Room air: Set of air —conditioning in Wall, Ceiling and Floor with less than 28,000 BTU.
2) SKY air: Set of air-conditioning in Duct, Ceiling and Cassette type with more than 28,000 BTU.
3) Packaged Air: Air-conditioning in Duct and High Floor with more than 47,000 BTU used in factory.
4) VRV: Variable Refrigeration Volume air-conditioning with high technology in energy savings and one unit control

Appendix 2: Raw data (response from Suppliers

| No. | Company/Question | Access | In Time | Accurate | Convenient to access | Reliable | Subcontracting | Expediting | Part delivery | Re-scheduling | Reservation Breaking | Overtime | Express transports |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Enginerring Service | 2 | - | - | - | - | 1.00 | 6.00 | 2.00 | 2.00 | 7.00 | 5.00 | 7.00 |
| 2 | Samruay Enguneering | 1 | 6.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 6.00 | 4.00 | 4.00 | 7.00 | 4.00 |
| 3 | P.S.A Inter-Cooling | 1 | 6.00 | 2.00 | 3.00 | 3.00 | 6.00 | 7.00 | 6.00 | 4.00 | 7.00 | 7.00 | 3.00 |
| 4 | Total Industial Solution | 2 | - | - | - | - | 2.00 | 5.00 | 5.00 | 2.00 | 1.00 | 1.00 | 6.00 |
| 5 | Fasco Thainland | 1 | 6.00 | 6.00 | 5.00 | 5.00 | 4.00 | 5.00 | 2.00 | 2.00 | 4.00 | 3.00 | 2.00 |
| 6 | Honeywell Chemical | 2 | - | - | - | - | 1.00 | 1.00 | 1.00 | 2.00 | 1.00 | 1.00 | 4.00 |
| 7 | Johnson Control | 2 | - | - | - | - | 5.00 | 5.00 | 2.00 | 2.00 | 7.00 | 4.00 | 5.00 |
| 8 | Sisiean Sale+Service | | 3.00 | 3.00 | 5.00 | 5.00 | 6.00 | 7.00 | 7.00 | 2.00 | 7.00 | 7.00 | 7.00 |
| 9 | Omron Electronic | | 7.00 | 6.00 | 7.00 | 4.00 | 1.00 | 4.00 | 7.00 | 2.00 | 3.00 | 3.00 | 2.00 |
| 0 | Samwha Thailand | | 5.00 | 4.00 | 5.00 | 5.00 | 6.00 | 6.00 | 7.00 | 2.00 | 7.00 | 6.00 | 4.00 |
| | Rocket Thai | | 4.00 | 4.00 | 4.00 | 4.00 | 5.00 | 5.00 | 5.00 | 3.00 | 3.00 | 4.00 | 4.00 |
| 12 | Asahi Sangyo | | 6.00 | 5.00 | 6.00 | 5.00 | 3.00 | 3.00 | 3.00 | 1.00 | 3.00 | 3.00 | 4.00 |
| 13 | Panfoss | | 7.00 | 4.00 | 4.00 | 4.00 | 3.00 | 3.00 | 3.00 | 2.00 | 4.00 | 4.00 | 4.00 |
| 14 | Amnuayart Press | | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 3.00 | 2.00 | 7.00 | 5.00 | 5.00 |
| 15 | Bay Corporation | | 4.00 | 5.00 | 5.00 | 5.00 | 1.00 | 5.00 | 5.00 | 2.00 | 2.00 | 2.00 | 3.00 |
| 16 | Kruger Ventiliation | | 5.00 | 3.00 | 6.00 | 3.00 | 4.00 | 4.00 | 4.00 | 2.00 | 5.00 | 3.00 | 4.00 |
| 17 | SKF Thailand | 2 | | - | - | | 3.00 | 5.00 | 4.00 | 2.00 | 3.00 | 3.00 | 4 00 |
| 18 | CB Tact Thailand | 1 | 7.00 | 6.00 | 6.00 | 6.00 | 6.00 | 4.00 | 6.00 | 3.00 | 7.00 | 7.00 | 7.00 |
| 19 | Bronson and Jacobs | 1 | 3.00 | 3.00 | 3.00 | 3.00 | 4.00 | 4.00 | 5.00 | 3.00 | 4.00 | 4.00 | 5.00 |
| 20 | Cowell | 1 | 2.00 | 6.00 | 2.00 | 3.00 | 4.00 | 6.00 | 300 | 3.00 | 5.00 | 4.00 | 7.00 |
| 21 | Symisrise | 2 | - | - | | | 3.00 | 4.00 | 4.00 | 2.00 | 4.00 | 4.00 | 5.00 |
| 22 | Catalent Australia | | 4.00 | 4.00 | 5.00 | 5.00 | 1.00 | 5.00 | 5.00 | 2.00 | 3.00 | 1.00 | 6.00 |
| 23 | Green Leaf Chemical | | 3.00 | 3.00 | 2.00 | 2.00 | 7.00 | 7.00 | 7.00 | 6.00 | 7.00 | 6.00 | 3.00 |
| 24 | saginomiya ( Thailand) co.,ltd | | 5.00 | 5.00 | 5.00 | 5.00 | 6.00 | 7.00 | 7.00 | 2.00 | 7.00 | 7.00 | 4.00 |
| 25 | Daikin trading ( Thailand) Ltd | | 4.00 | 4.00 | 4.00 | 4.00 | 5.00 | 7.00 | 7.00 | 2.00 | 4.00 | 5.00 | 3.00 |
| 26 | Ukkarit Rungreung ( 2000) | | 6.00 | 5.00 | 3.00 | 4.00 | 1.00 | 4.00 | 1.00 | 2.00 | 3.00 | 5.00 | 3.00 |
| 27 | Kultron Electric co.,Ltd | | 5.00 | 5.00 | 5.00 | 5.00 | 1.00 | 6.00 | 3.00 | 2.00 | 7.00 | 7.00 | 4.00 |
| 28 | Thai toyo foam industry Co.,Ltd | | | - | - | - | 1.00 | 5.00 | 4.00 | 2.00 | 6.00 | 6.00 | 4.00 |
| 29 | P.c.takashima(Thailand) Co.,Ltd | 1 | 6.00 | 5.00 | 5.00 | 5.00 | 1.00 | 3.00 | 5.00 | 2.00 | 5.00 | 2.00 | 3.00 |
| 30 | SNC Pyongsan Evolution Co.,Ltd | 1 | 5.00 | 6.00 | 5.00 | 5.00 | 3.00 | 7.00 | 2.00 | 3.00 | 7.00 | 7.00 | 7.00 |
| 31 | Chaichareon Engineering | 1 | 6.00 | 6.00 | 6.00 | 6.00 | 4.00 | 6.00 | 2.00 | 2.00 | 6.00 | 4.00 | 5.00 |
| 32 | Siam Product group Co.,Ltd | 1 | 5.00 | 6.00 | 6.00 | 6.00 | 3.00 | 5.00 | 3.00 | 4.00 | 5.00 | 7.00 | 7.00 |
| 33 | Perfect Element Co.,Ltd | 1 | 5.00 | 4.00 | 5.00 | 5.00 | 6.00 | 6.00 | 6.00 | 2.00 | 2.00 | 7.00 | 2.00 |
| 34 | Siam screw Co.,Ltd | | | | - | | 3.00 | 4.00 | 6.00 | 2.00 | 2.00 | 5.00 | 4.00 |
| 35 | Sumproduct Co.,Ltd | 1 | 6.00 | 6.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 2.00 | 5.00 | 6.00 | 3.00 |
| 36 | Siam compressor Co.,Ltd | 1 | 6.00 | 6.00 | 6.00 | 6.00 | 7.00 | 7.00 | 1.00 | 2.00 | 5.00 | 7.00 | 5.00 |
| 37 | Hydro part Co.,Ltd | 1 | 4.00 | 5.00 | 5.00 | 4.00 | 2.00 | 3.00 | 2.00 | 2.00 | 3.00 | 7.00 | 3.00 |
| 38 | Thai container chonburi Co.,Ltd | 1 | 6.00 | 6.00 | 5.00 | 5.00 | 2.00 | 3.00 | 3.00 | 2.00 | 2.00 | 7.00 | 3.00 |
| 39 | Ashi Sangyo Thailand Co.,Ltd | 1 | 5.00 | 4.00 | 4.00 | 5.00 | 5.00 | 1.00 | 2.00 | 2.00 | 5.00 | 3.00 | 4.00 |
| 40 | Abb Limited Co.,Ltd | 1 | 6.00 | 6.00 | 5.00 | 5.00 | 3.00 | 4.00 | 1.00 | 2.00 | 2.00 | 6.00 | 3.00 |
| 41 | Advance control Co.,Ltd | 1 | 6.00 | 5.00 | 5.00 | 5.00 | 5.00 | 4.00 | 5.00 | 2.00 | 5.00 | 5.00 | 5.00 |
| 42 | BIT WIST HEAT EXCHANGER | 2 | | - | | | 6.00 | 6.00 | 3.00 | 2.00 | 5.00 | 3.00 | 3.00 |
| 43 | Nice shop | 2 | - | - | - | - | 5.00 | 5.00 | 5.00 | 2.00 | 4.00 | 5.00 | 4.00 |
| 44 | Faninternational Co.,Ltd | 1 | 5.00 | 4.00 | 5.00 | 5.00 | 2.00 | 5.00 | 3.00 | 200 | 3.00 | 6.00 | 3.00 |
| 45 | Thaireain Manufacturing | 1 | 6.00 | 6.00 | 5.00 | 5.00 | 2.00 | 3.00 | 1.00 | 2.00 | 2.00 | 6.00 | 3.00 |
| 46 | Grand dk export Co.,Ltd | 1 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 4.00 | 1.00 | 2.00 | 2.00 | 6.00 | 3.00 |
| 47 | Rs rubber Co.,Ltd | 1 | 6.00 | 6.00 | 6.00 | 6.00 | 2.00 | 5.00 | 1.00 | 2.00 | 3.00 | 4.00 | 5.00 |
| 48 | Unipro Manufacturing | 1 | 4.00 | 4.00 | 4.00 | 5.00 | 4.00 | 5.00 | 3.00 | 2.00 | 2.00 | 6.00 | 2.00 |
| 49 | Central Hardware | 2 | - | - | | | 5.00 | 5.00 | 3.00 | 2.00 | 3.00 | 6.00 | 5.00 |
| 50 | Ratchata Engineering | 1 | 6.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 3.00 | 2.00 | 3.00 | 6.00 | 3.00 |
| 51 | Emerson Electric Thailand | 1 | 5.00 | 6.00 | 6.00 | 6.00 | 3.00 | 4.00 | 1.00 | 200 | 1.00 | 5.00 | 3.00 |
| 52 | Larbsopha Co.,Ltd | 1 | 6.00 | 6.00 | 5.00 | 5.00 | 4.00 | 500 | 1.00 | 2.00 | 3.00 | 7.00 | 2.00 |
| 53 | Centasia | 1 | 3.00 | 3.00 | 2.00 | 2.00 | 6.00 | 5.00 | 6.00 | 6.00 | 6.00 | 5.00 | 1.00 |
| 54 | Bottlemate Taiwan | 1 | 2.00 | 6.00 | 2.00 | 3.00 | 4.00 | 6.00 | 3.00 | 3.00 | 5.00 | 4.00 | 7.00 |

Note: In Access Column

-1 to represent Supplier with access customers' forecast

-2 to represent Supplier without access customers' forecast

| No. | Company/Question | Access | Safety stock in raw material inventory | Safety stock in finished goods inventory | Safety capacity | Safety lead time | Over-planning | Promised lead time | On-time delivery | Rush orders when needed | Promised inventory availability | Accurate orders | Availability of delay information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Enginerring Service | | 2.00 | 1.00 | 2.00 | 2.00 | 1.00 | 3.00 | 3.00 | 4.00 | 3.00 | 5.00 | 5.00 |
| 2 | Samruay Enguneering | | 6.00 | 5.00 | 4.00 | 4.00 | 3.00 | 7.00 | 7.00 | 5.00 | 5.00 | 6.00 | 4.00 |
| 3 | P.S.A Inter-Cooling | | 7.00 | 5.00 | 7.00 | 7.00 | 4.00 | 6.00 | 6.00 | 6.00 | 5.00 | 6.00 | 7.00 |
| 4 | Total Industial Solution | | 1.00 | 6.00 | 4.00 | 4.00 | 4.00 | 7.00 | 7.00 | 6.00 | 6.00 | 7.00 | 6.00 |
| 5 | Fasco Thainland | | 6.00 | 4.00 | 5.00 | 3.00 | 6.00 | 6.00 | 5.00 | 6.00 | 5.00 | 2.00 | 4.00 |
| 6 | Honeywell Chemical | | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 7.00 | 7.00 | 5.00 | 5.00 | 6.00 | 2.00 |
| 7 | Johnson Control | | 4.00 | 1.00 | 1.00 | 2.00 | 2.00 | 4.00 | 5.00 | 5.00 | 4.00 | 2.00 | 5.00 |
| 8 | Sisiean Sale+Service | | 7.00 | 6.00 | 6.00 | 6.00 | 6.00 | 7.00 | 7.00 | 7.00 | 7.00 | 6.00 | 6.00 |
| 9 | Omron Electronic | | 7.00 | 3.00 | 4.00 | 6.00 | 3.00 | 7.00 | 7.00 | 4.00 | 4.00 | 7.00 | 7.00 |
| 10 | Samwha Thailand | | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 4.00 | 5.00 | 6.00 | 6.03 | 5.00 | 3.00 |
| 11 | Rocket Thai | | 4.00 | 5.00 | 5.00 | 4.00 | 3.00 | 3.00 | 3.00 | 4.00 | 4.00 | 5.00 | 5.00 |
| 12 | Asahi Sangyo | | 4.00 | 2.00 | 3.00 | 3.00 | 2.00 | 6.00 | 6.00 | 5.00 | 4.00 | 6.00 | 6.00 |
| 13 | Panfoss | | 4.00 | 5.00 | 3.00 | 4.00 | 3.00 | 6.00 | 6.00 | 4.00 | 4.00 | 5.00 | 4.00 |
| 14 | Amnuayart Press | | 3.00 | 4.00 | 2.00 | 2.00 | 4.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 |
| 15 | Bay Corporation | | 5.00 | 1.00 | 7.00 | 7.00 | 4.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 5.00 |
| 16 | Kruger Ventiliation | | 4.00 | 4.00 | 3.00 | 4.00 | 4.00 | 6.00 | 6.00 | 5.00 | 6.00 | 6.00 | 5.00 |
| 17 | SKF Thailand | | 4.00 | 4.00 | 4.00 | 3.00 | 3.00 | 6.00 | 6.00 | 6.00 | 6.00 | 7.00 | 2.00 |
| 18 | CB Tact Thailand | | 7.00 | 4.00 | 7.00 | 7.00 | 2.00 | 7.00 | 7.00 | 5.00 | 6.00 | 7.00 | 5.00 |
| 19 | Bronson and Jacobs | | 5.00 | 4.00 | 4.00 | 5.00 | 4.00 | 4.00 | 5.00 | 2.00 | 3.00 | 4.00 | 5.00 |
| 20 | Cowell | | 5.00 | 7.00 | 5.00 | 3.00 | 5.00 | 5.00 | 6.00 | 5.00 | 5.00 | 6.00 | 3.00 |
| 21 | Symisrise | | 1.00 | 2.00 | 2.00 | 4.00 | 4.00 | 5.00 | 5.00 | 4.00 | 4.00 | 3.00 | 3.00 |
| 22 | Catalent Australia | | 3.00 | 3.00 | 3.00 | 5.00 | 1.00 | 7.00 | 7.00 | 6.00 | 5.00 | 7.00 | 7.00 |
| 23 | Green Leaf Chemical | | 7.00 | 7.00 | 4.00 | 6.00 | 6.00 | 7.00 | 7.00 | 7.00 | 3.00 | 7.00 | 4.00 |
| 24 | saginomiya ( Thailand) co.,ltd | | 3.00 | 3.00 | 5.00 | 5.00 | 5.00 | 5.00 | 7.00 | 3.00 | 6.00 | 6.00 | 6.00 |
| 25 | Daikin trading ( Thailand ) Ltd | | 4.00 | 4.00 | 5.00 | 5.00 | 5.00 | 5.00 | 6.00 | 3.00 | 5.00 | 6.00 | 6.00 |
| 26 | Ukkarit Rungreung ( 2000) | | 5.00 | 5.00 | 5.00 | 6.00 | 6.00 | 7.00 | 7.00 | 4.00 | 4.00 | 6.00 | 4.00 |
| 27 | Kultron Electric co.,Ltd | | 3.00 | 3.00 | 3.00 | 7.00 | 6.00 | 7.00 | 7.00 | 5.00 | 6.00 | 6.00 | 6.00 |
| 28 | Thai toyo foam industry Co.,Ltd | | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 7.00 | 7.00 | 3.00 | 6.00 | 6.00 | 6.00 |
| 29 | P.c.takashima(Thailand) Co.,Ltd | | 7.00 | 3.00 | 4.00 | 5.00 | 4.00 | 7.00 | 7.00 | 2.00 | 5.00 | 6.00 | 5.00 |
| 30 | SNC Pyongsan Evolution Co.,Ltd | | 7.00 | 3.00 | 6.00 | 6.00 | 6.00 | 7.00 | 7.00 | 5.00 | 5.00 | 6.00 | 6.00 |
| 31 | Chaichareon Engineering | | 3.00 | 1.00 | 2.00 | 2.00 | 3.00 | 7.00 | 7.00 | 4.00 | 6.00 | 6.00 | 6.00 |
| 32 | Siam Product group Co.,Ltd | | 7.00 | 2.00 | 6.00 | 6.00 | 6.00 | 5.00 | 6.00 | 5.00 | 5.00 | 6.00 | 5.00 |
| 33 | Perfect Element Co.,Ltd | | 6.00 | 6.00 | 5.00 | 6.00 | 1.00 | 6.00 | 6.00 | 1.00 | 6.00 | 5.00 | 5.00 |
| 34 | Siam screw Co.,Ltd | | 7.00 | 7.00 | 7.00 | 6.00 | 6.00 | 6.00 | 6.00 | 5.00 | 6.00 | 6.00 | 6.00 |
| 35 | Sumproduct Co.,Ltd | | 6.00 | 2.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 2.00 | 4.00 | 5.00 | 5.00 |
| 36 | Siam compressor Co.,Ltd | | 4.00 | 1.00 | 3.00 | 3.00 | 4.00 | 7.00 | 7.00 | 5.00 | 5.00 | 7.00 | 6.00 |
| 37 | Hydro part Co.,Ltd | | 6.00 | 3.00 | 4.00 | 6.00 | 6.00 | 6.00 | 5.00 | 3.00 | 6.00 | 5.00 | 6.00 |
| 38 | Thai container chonburi Co.,Ltd | | 6.00 | 1.00 | 6.00 | 6.00 | 7.00 | 6.00 | 6.00 | 2.00 | 6.00 | 6.00 | 6.00 |
| 39 | Ashi Sangyo Thailand Co.,Ltd | | 5.00 | 3.00 | 4.00 | 5.00 | 5.00 | 6.00 | 6.00 | 4.00 | 6.00 | 6.00 | 6.00 |
| 40 | Abb Limited Co.,Ltd | | 6.00 | 6.00 | 6.00 | 5.00 | 6.00 | 5.00 | 6.00 | 2.00 | 7.00 | 7.00 | 7.00 |
| 41 | Advance control Co.,Ltd | | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 4.00 | 4.00 | 6.00 | 6.00 |
| 42 | BIT WIST HEAT EXCHANGER | | 4.00 | 3.00 | 6.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| 43 | Nice shop | | 6.00 | 3.00 | 6.00 | 5.00 | 4.00 | 5.00 | 6.00 | 3.00 | 5.00 | 6.00 | 5.00 |
| 44 | Faninternational Co.,Ltd | | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 5.00 | 7.00 | 2.00 | 7.00 | 7.00 | 7.00 |
| 45 | Thaireain Manufacturing | | 5.00 | 6.00 | 6.00 | 6.00 | 5.00 | 5.00 | 6.00 | 2.00 | 6.00 | 5.00 | 6.00 |
| 46 | Grand dk export Co.,Ltd | | 1.00 | 4.00 | 4.00 | 4.00 | 3.00 | 6.00 | 6.00 | 3.00 | 5.00 | 5.00 | 5.00 |
| 47 | Rs rubber Co.,Ltd | | 5.00 | 2.00 | 5.00 | 6.00 | 6.00 | 6.00 | 6.00 | 3.00 | 6.00 | 6.00 | 6.00 |
| 48 | Unipro Manufacturing | | 6.00 | 1.00 | 6.00 | 7.00 | 7.00 | 5.00 | 6.00 | 2.00 | 6.00 | 6.00 | 7.00 |
| 49 | Central Hardware | | 6.00 | 6.00 | 7.00 | 7.00 | 7.00 | 6.00 | 6.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| 50 | Ratchata Engineering | | 6.00 | 2.00 | 6.00 | 5.00 | 5.00 | 7.00 | 7.00 | 4.00 | 6.00 | 6.00 | 7.00 |
| 51 | Emerson Electric Thailand | | 7.00 | 2.00 | 6.00 | 7.00 | 7.00 | 6.00 | 6.00 | 2.00 | 6.00 | 5.00 | 7.00 |
| 52 | Larbsopha Co.,Ltd | | 3.00 | 3.00 | 4.00 | 4.00 | 3.00 | 6.00 | 6.00 | 6.00 | 6.00 | 7.00 | 7.00 |
| 53 | Centasia | | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 3.00 | 7.00 | 4.00 |
| 54 | Bottlemate Taiwan | | 6.00 | 4.00 | 6.00 | 4.00 | 6.00 | 5.00 | 6.00 | 5.00 | 5.00 | 6.00 | 3.00 |

Note: In Access Column

-1 to represent Supplier with access customers' forecast

-2 to represent Supplier without access customers' forecast

Appendix 3: Data Reliable Testing

1) Forecast Information Quality **(FIQ)**

## Scale: ALL VARIABLES

Case Processing Summary

| | | N | % |
|---|---|---|---|
| Cases | Valid | 43 | 79.6 |
| | Excluded(a) | 11 | 20.4 |
| | Total | 54 | 100.0 |

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

| Cronbach's Alpha | N of Items |
|---|---|
| 0.829 | 4 |

Item Statistics

| | Mean | Std. Deviation | N |
|---|---|---|---|
| InTime | 5.0698 | 1.27979 | 43 |
| Accurate | 4.8140 | 1.21999 | 43 |
| Convenienttoaccess | 4.6512 | 1.28885 | 43 |
| Reliable | 4.5814 | 1.11766 | 43 |

Item-Total Statistics

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| InTime | 14.0465 | 10.093 | 0.520 | 0.846 |
| Accurate | 14.3023 | 10.121 | 0.561 | 0.826 |
| Convenienttoaccess | 14.4651 | 8.445 | 0.782 | 0.723 |
| Reliable | 14.5349 | 9.302 | 0.794 | 0.728 |

Scale Statistics

| Mean | Variance | Std. Deviation | N of Items |
|---|---|---|---|
| 19.1163 | 15.962 | 3.99529 | 4 |

2) Corrective Actions Performance (CAP)

## Scale: ALL VARIABLES

Case Processing Summary

| | | N | % |
|---|---|---|---|
| Cases | Valid | 54 | 100.0 |
| | Excluded(a) | 0 | 0.0 |
| | Total | 54 | 100.0 |

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

| Cronbach's Alpha | N of Items |
|---|---|
| 0.686 | 7 |

Item Statistics

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Subcontracting | 3.7037 | 1.82880 | 54 |
| Expediting | 4.7963 | 1.44561 | 54 |
| Partdelivery | 3.7222 | 1.96590 | 54 |
| Rescheduling | 2.3519 | 0.91440 | 54 |
| ReservationBreaking | 4.2222 | 1.89006 | 54 |
| Overtime | 4.9259 | 1.76819 | 54 |
| Expresstransports | 4.0926 | 1.53289 | 54 |

Item-Total Statistics

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Subcontracting | 24.1111 | 32.629 | 0.507 | 0.617 |
| Expediting | 23.0185 | 34.585 | 0.582 | 0.607 |
| Partdelivery | 24.0926 | 35.520 | 0.307 | 0.682 |
| Rescheduling | 25.4630 | 41.084 | 0.397 | 0.664 |
| ReservationBreaking | 23.5926 | 29.755 | 0.642 | 0.570 |
| Overtime | 22.8889 | 36.818 | 0.309 | 0.677 |
| Expresstransports | 23.7222 | 41.638 | 0.130 | 0.715 |

Scale Statistics

| Mean | Variance | Std. Deviation | N of Items |
|---|---|---|---|
| 27.8148 | 46.569 | 6.82414 | 7 |

3) Preventive Actions Performance (PAP)

## Scale: ALL VARIABLES

Case Processing Summary

| | | N | |
|---|---|---|---|
| Cases | Valid | 54 | 100.0 |
| | Excluded(a) | 0 | 0.0 |
| | Total | 54 | 100.0 |

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

| Cronbach's Alpha | N of Items |
|---|---|
| 0.798 | 5 |

Item Statistics

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Safetystockinrawmate | 5.0000 | 1.68232 | 54 |
| Safetystockinfinishedg | 3.8148 | 1.83338 | 54 |
| Safetycapacity | 4.7778 | 1.53778 | 54 |
| Safetyleadtime | 5.0000 | 1.46661 | 54 |
| Overplanning | 4.5926 | 1.65425 | 54 |

Item-Total Statistics

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Safetystockinrawmate | 18.1852 | 23.739 | 0.649 | 0.737 |
| Safetystockinfinishedg | 19.3704 | 28.011 | 0.301 | 0.853 |
| Safetycapacity | 18.4074 | 23.189 | 0.787 | 0.696 |
| Safetyleadtime | 18.1852 | 25.022 | 0.684 | 0.732 |
| Overplanning | 18.5926 | 25.114 | 0.565 | 0.765 |

Scale Statistics

| Mean | Variance | Std. Deviation | N of Items |
|---|---|---|---|
| 23.1852 | 37.210 | 6.10003 | 5 |

4) Customer Service Performance (CSP)

## Scale: ALL VARIABLES

Case Processing Summary

| | | N | |
|---|---|---|---|
| Cases | Valid | 54 | 100.0 |
| | Excluded(a) | 0 | 0.0 |
| | Total | 54 | 100.0 |

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

| Cronbach's Alpha | N of Items |
|---|---|
| 0.640 | 6 |

Item Statistics

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Promisedleadtime | 5.9074 | 1.06874 | 54 |
| Ontimedelivery | 6.1481 | 0.91954 | 54 |
| Rushorderswhenneed | 4.2963 | 1.59752 | 54 |
| Promisedinventoryava | 5.2407 | 1.08045 | 54 |
| Accurateorders | 5.7778 | 1.12714 | 54 |
| Availabilityofdelayinfor | 5.3148 | 1.31499 | 54 |

Item-Total Statistics

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Promisedleadtime | 26.7778 | 12.704 | 0.633 | 0.506 |
| Ontimedelivery | 26.5370 | 13.234 | 0.686 | 0.507 |
| Rushorderswhenneed | 28.3889 | 14.997 | 0.091 | 0.737 |
| Promisedinventoryava | 27.4444 | 14.629 | 0.348 | 0.606 |
| Accurateorders | 26.9074 | 12.576 | 0.604 | 0.511 |
| Availabilityofdelayinfor | 27.3704 | 15.256 | 0.164 | 0.678 |

Scale Statistics

| Mean | Variance | Std. Deviation | N of Items |
|---|---|---|---|
| 32.6852 | 18.673 | 4.32118 | 6 |

Appendix 4: T-Test: Supply Chain Performance Variables

Group Statistics

| | Access | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| CorrectiveAction | 1.00 | 43 | 4.0620 | 1.09594 | .16713 |
| | 2.00 | 11 | 3.5303 | .91536 | .27599 |
| PreventiveAction | 1.00 | 43 | 4.7488 | 1.04935 | .16002 |
| | 2.00 | 11 | 4.2000 | 1.73205 | .52223 |
| CustomerService | 1.00 | 43 | 5.7953 | .68659 | .10470 |
| | 2.00 | 11 | 5.2182 | .95270 | .28725 |

Note: In Access Column

-1 to represent Supplier with access customers' forecast

-2 to represent Supplier without access customers' forecast

Independent Samples Test

| | | Levees Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| CorrectiveAction | Equal variances assumed | 1.634 | .207 | 1.480 | 52 | .145 | .53171 | .35937 | -.18942 | 1.25284 |
| | Equal variances not assumed | | | 1.648 | 18.099 | .117 | .53171 | .32265 | -.14588 | 1.20931 |
| PreventiveAction | Equal variances assumed | 5.495 | .023 | 1.341 | 52 | .186 | .54884 | .40915 | -.27217 | 1.36985 |
| | Equal variances not assumed | | | 1.005 | 11.941 | .335 | .54884 | .54620 | -.64188 | 1.73956 |
| CustomerService | Equal variances assumed | 1.821 | .183 | 2.292 | 52 | .026 | .57717 | .25178 | .07192 | 1.08241 |
| | Equal variances not assumed | | | 1.888 | 12.780 | .082 | .57717 | .30574 | -.08450 | 1.23883 |

Appendix 5: T-Test: Corrective Action Variables, Preventive Action Variables, Customer Service Variables

Group Statistics

| | Access | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Subcontracting | 1.00 | 43 | 3.8372 | 1.82483 | .27828 |
| | 2.00 | 11 | 3.1818 | 1.83402 | .55298 |
| Expediting | 1.00 | 43 | 4.8372 | 1.47890 | .22553 |
| | 2.00 | 11 | 4.6364 | 1.36182 | .41060 |
| Partdelivery | 1.00 | 43 | 3.7674 | 2.07980 | .31717 |
| | 2.00 | 11 | 3.5455 | 1.50756 | .45455 |
| Rescheduling | 1.00 | 43 | 2.4419 | 1.00717 | .15359 |
| | 2.00 | 11 | 2.0000 | .00000 | .00000 |
| ReservationBreaking | 1.00 | 43 | 4.3023 | 1.83270 | .27948 |
| | 2.00 | 11 | 3.9091 | 2.16585 | .65303 |
| Overtime | 1.00 | 43 | 5.1860 | 1.69391 | .25832 |
| | 2.00 | 11 | 3.9091 | 1.75810 | .53009 |
| Safetystockinrawmaterialinventory | 1.00 | 43 | 5.2326 | 1.50929 | .23016 |
| | 2.00 | 11 | 4.0909 | 2.07145 | .62457 |
| Safetystockinfinishedgoodsinventory | 1.00 | 43 | 3.7907 | 1.78029 | .27149 |
| | 2.00 | 11 | 3.9091 | 2.11918 | .63896 |
| Safetycapacity | 1.00 | 43 | 4.8605 | 1.37289 | .20936 |
| | 2.00 | 11 | 4.4545 | 2.11488 | .63766 |
| Safetyleadtime | 1.00 | 43 | 5.1628 | 1.39609 | .21290 |
| | 2.00 | 11 | 4.3636 | 1.62928 | .49125 |
| Overplanning | 1.00 | 43 | 4.6977 | 1.62620 | .24799 |
| | 2.00 | 11 | 4.1818 | 1.77866 | .53629 |
| Promisedleadtime | 1.00 | 43 | 6.0000 | 1.00000 | .15250 |
| | 2.00 | 11 | 5.5455 | 1.29334 | .38996 |
| Ontimedelivery | 1.00 | 43 | 6.2558 | .81920 | .12493 |
| | 2.00 | 11 | 5.7273 | 1.19087 | .35906 |
| Promisedinventoryavailability | 1.00 | 43 | 5.3023 | 1.10270 | .16816 |
| | 2.00 | 11 | 5.0000 | 1.00000 | .30151 |
| Accurateorders | 1.00 | 43 | 5.9070 | .97135 | .14813 |
| | 2.00 | 11 | 5.2727 | 1.55505 | .46887 |
| Availabilityofdelayinformation | 1.00 | 43 | 5.5116 | 1.20262 | .18340 |
| | 2.00 | 11 | 4.5455 | 1.50756 | .45455 |

Note: In Access Column

-1 to represent Supplier with access customers' forecast

-2 to represent Supplier without access customers' forecast

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test fo Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| Subcontracting | Equal variances assumed | .011 | .916 | 1.062 | 52 | .293 | .65539 | .61718 | -.58307 | 1.89385 |
| | Equal variances not assumed | | | 1.059 | 15.470 | .306 | .65539 | .61905 | -.66061 | 1.97139 |
| Expediting | Equal variances assumed | .848 | .361 | .408 | 52 | .685 | .20085 | .49234 | -.78710 | 1.18879 |
| | Equal variances not assumed | | | .429 | 16.585 | .674 | .20085 | .46846 | -.78942 | 1.19111 |
| Partdelivery | Equal variances assumed | 3.909 | .053 | .331 | 52 | .742 | .22199 | .66990 | -1.12226 | 1.56623 |
| | Equal variances not assumed | | | .401 | 20.927 | .693 | .22199 | .55426 | -.93091 | 1.37488 |
| Rescheduling | Equal variances assumed | 10.612 | .002 | 1.445 | 52 | .155 | .44186 | .30584 | -.17185 | 1.05557 |
| | Equal variances not assumed | | | 2.877 | 42.000 | .006 | .44186 | .15359 | .13190 | .75182 |
| ReservationBreaking | Equal variances assumed | .234 | .631 | .612 | 52 | .543 | .39323 | .64242 | -.89588 | 1.68234 |
| | Equal variances not assumed | | | .554 | 13.888 | .589 | .39323 | .71032 | -1.13141 | 1.91788 |
| Overtime | Equal variances assumed | .027 | .871 | 2.215 | 52 | .031 | 1.27696 | .57658 | .11997 | 2.43394 |
| | Equal variances not assumed | | | 2.166 | 15.111 | .047 | 1.27696 | .58968 | .02089 | 2.53302 |
| Safetystockinrawmaterialinventory | Equal variances assumed | 1.053 | .309 | 2.070 | 52 | .043 | 1.14165 | .55160 | .03479 | 2.24851 |
| | Equal variances not assumed | | | 1.715 | 12.844 | .110 | 1.14165 | .66563 | -.29812 | 2.58142 |
| Safetystockinfinishedgoodsinventory | Equal variances assumed | .587 | .447 | -.189 | 52 | .851 | -.11839 | .62518 | -1.37291 | 1.13612 |
| | Equal variances not assumed | | | -.171 | 13.829 | .867 | -.11839 | .69424 | -1.60912 | 1.37233 |
| Safetycapacity | Equal variances assumed | 5.349 | .025 | .778 | 52 | .440 | .40592 | .52153 | -.64062 | 1.45245 |
| | Equal variances not assumed | | | .605 | 12.238 | .556 | .40592 | .67115 | -1.05324 | 1.86508 |
| Safetyleadtime | Equal variances assumed | .360 | .551 | 1.638 | 52 | .107 | .79915 | .48786 | -.17980 | 1.77811 |
| | Equal variances not assumed | | | 1.493 | 13.992 | .158 | .79915 | .53540 | -.34922 | 1.94753 |
| Overplanning | Equal variances assumed | .030 | .864 | .922 | 52 | .361 | .51586 | .55974 | -.60734 | 1.63906 |
| | Equal variances not assumed | | | .873 | 14.575 | .397 | .51586 | .59085 | -.74671 | 1.77843 |
| Promisedleadtime | Equal variances assumed | 1.750 | .192 | 1.266 | 52 | .211 | .45455 | .35907 | -.26599 | 1.17508 |
| | Equal variances not assumed | | | 1.086 | 13.219 | .297 | .45455 | .41871 | -.44851 | 1.35760 |
| Ontimedelivery | Equal variances assumed | 1.956 | .168 | 1.733 | 52 | .089 | .52854 | .30499 | -.08346 | 1.14054 |
| | Equal variances not assumed | | | 1.390 | 12.524 | .189 | .52854 | .38017 | -.29596 | 1.35304 |
| Promisedinventoryavailability | Equal variances assumed | .822 | .369 | .826 | 52 | .413 | .30233 | .36617 | -.43244 | 1.03709 |
| | Equal variances not assumed | | | .876 | 16.802 | .394 | .30233 | .34523 | -.42671 | 1.03136 |
| Accurateorders | Equal variances assumed | 3.787 | .057 | 1.695 | 52 | .096 | .63425 | .37429 | -.11682 | 1.38532 |
| | Equal variances not assumed | | | 1.290 | 12.067 | .221 | .63425 | .49171 | -.43643 | 1.70493 |
| Availabilityofdelayinformation | Equal variances assumed | .745 | .392 | 2.257 | 52 | .028 | .96617 | .42809 | .10715 | 1.82520 |
| | Equal variances not assumed | | | 1.971 | 13.436 | .070 | .96617 | .49015 | -.08925 | 2.02159 |

Appendix 6: Pearson Correlation Testing

1) Forecast Information Quality **(FIQ)** and Corrective Actions (CAP)

Correlations

| | | FIQ | Corrective Action |
|---|---|---|---|
| FIQ | Pearson Correlation | 1 | -.352* |
| | Sig. (2-tailed) | | .020 |
| | N | 43 | 43 |
| CorrectiveAction | Pearson Correlation | -.352* | 1 |
| | Sig. (2-tailed) | .020 | |
| | N | 43 | 54 |

*. Correlation is significant at the 0.05 level (2-tailed).

2) Forecast Information Quality **(FIQ)** and Preventive Actions (PAP)

Correlations

| | | FIQ | Preventive Action |
|---|---|---|---|
| FIQ | Pearson Correlation | 1 | -.326" |
| | Sig. (2-tailed) | | .033 |
| | N | 43 | 43 |
| PreventiveAction | Pearson Correlation | -.326" | 1 |
| | Sig. (2-tailed) | .033 | |
| | N | 43 | 54 |

• Correlation is significant at the 0.05 level (2-tailed).

### 3) Forecast Information Quality (FIQ) and Customer Service (CSP)

**Correlations**

| | | FIQ | Customer Service |
|---|---|---|---|
| FIQ | Pearson Correlation | 1 | .387* |
| | Sig. (2-tailed) | | .010 |
| | N | 43 | 43 |
| CustomerService | Pearson Correlation | .387* | 1 |
| | Sig. (2-tailed) | .010 | |
| | N | 43 | 54 |

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 7: Linear Regression

1) Forecast Information Quality **(FIQ)** and Corrective Actions (CAP)

Variables **Entered/Removed**[b]

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | FIQ[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: CorrectiveAction

Model **Summary**[b]

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change | |
| 1 | .352' | .124 | .103 | 1.03806 | .124 | 5.814 | 1 | 41 | .020 | 2.039 |

a. Predictors: (Constant), FIQ

b. Dependent Variable: CorrectiveAction

**ANOVA**[b]

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 6.265 | 1 | 6.265 | 5.814 | .020[a] |
| | Residual | 44.180 | 41 | 1.078 | | |
| | Total | 50.446 | 42 | | | |

a. Predictors: (Constant), FIQ

b. Dependent Variable: CorrectiveAction

**Coefficients**[a]

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Correlations | | | Collinearit Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Zero-order | Partial | Part | Tolerance | VIF |
| 1 | (Constant) | 5.910 | .783 | | 7.552 | .000 | | | | | |
| | FIQ | -.387 | .160 | -.352 | -2.411 | .020 | -.352 | -.352 | -.352 | 1.000 | 1.000 |

a. Dependent Variable: CorrectiveAction

**Collinearity Diagnostics**

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | |
|---|---|---|---|---|---|
| | | | | (Constant) | FIQ |
| 1 | 1 | 1.979 | 1.000 | .01 | .01 |
| | 2 | .021 | 9.785 | .99 | .99 |

a. Dependent Variable: CorrectiveAction

**Residuals Statistic?**

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | 3.4932 | 4.9433 | 4.0620 | .38623 | 43 |
| Residual | -1.50326 | 2.02341 | .00000 | 1.02563 | 43 |
| Std. Predicted Value | -1.473 | 2.282 | .000 | 1.000 | 43 |
| Std. Residual | -1.448 | 1.949 | .000 | .988 | 43 |

a. Dependent Variable: CorrectiveAction

2) Forecast Information Quality (FIQ) and Preventive Actions (PAP)

Variables Entered/Removed[b]

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | FIQ | . | Enter |

a. All requested variables entered.

b. Dependent Variable: PreventiveAction

Model Summary[b]

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change | |
| 1 | .326[a] | .106 | .084 | 1.00417 | .106 | 4.864 | 1 | 41 | .033 | 1.933 |

a. Predictors: (Constant), FIQ

b. Dependent Variable: PreventiveAction

ANOVA[b]

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 4.905 | 1 | 4.905 | 4.864 | .033[a] |
| | Residual | 41.343 | 41 | 1.008 | | |
| | Total | 46.247 | 42 | | | |

a. Predictors: (Constant), FIQ

b. Dependent Variable: PreventiveAction

Coefficients[a]

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Correlations | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Zero-order | Partial | Part | Tolerance | VIF |
| 1 | (Constant) | 6.384 | .757 | | 8.433 | .000 | | | | | |
| | FIQ | -.342 | .155 | -.326 | -2.206 | .033 | -.326 | -.326 | -.326 | 1.000 | 1.000 |

a. Dependent Variable: PreventiveAction

**Collinearity Diagnostics**

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | |
|---|---|---|---|---|---|
| | | | | (Constant) | FIQ |
| 1 | 1 | 1.979 | 1.000 | .01 | .01 |
| | 2 | .021 | 9.785 | .99 | .99 |

a. Dependent Variable: PreventiveAction

**Residuals Statistics'**

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | 4.2456 | 5.5286 | 4.7488 | .34174 | 43 |
| Residual | -2.13111 | 1.47140 | .00000 | .99214 | 43 |
| Std. Predicted Value | -1.473 | 2.282 | .000 | 1.000 | 43 |
| Std. Residual | -2.122 | 1.465 | .000 | .988 | 43 |

a. Dependent Variable: PreventiveAction

3) Forecast Information Quality (FIQ) and Customer Service (CSP)

**Variables Entered/Removed[b]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | FIQ[a] | . | Enter |

a. All requested variables entered.

b. Dependent Variable: CustomerService

Model Summary'

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change | |
| 1 | .387[a] | .150 | .129 | .64067 | .150 | 7.236 | 1 | 41 | .010 | 1.883 |

a. Predictors: (Constant), FIQ

b. Dependent Variable: CustomerService

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2.970 | 1 | 2.970 | 7.236 | .010a |
| | Residual | 16.829 | 41 | .410 | | |
| | Total | 19.799 | 42 | | | |

a. Predictors: (Constant), FIQ

b. Dependent Variable: CustomerService

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Correlations | | | Collinearit Statistics | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Zero-order | Partial | Part | Tolerance | VIF |
| 1 | (Constant) | 4.523 | .483 | | 9.364 | .000 | | | | | |
| | FIQ | .266 | .099 | .387 | 2.690 | .010 | .387 | .387 | .387 | 1.000 | 1.000 |

a. Dependent Variable: CustomerService

**Collinearity Diagnostics[a]**

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | |
|---|---|---|---|---|---|
| | | | | (Constant) | FIQ |
| 1 | 1 | 1.979 | 1.000 | .01 | .01 |
| | 2 | .021 | 9.785 | .99 | .99 |

a. Dependent Variable: CustomerService

**Residuals Statistics[a]**

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| Predicted Value | 5.1886 | 6.1870 | 5.7953 | .26593 | 43 |
| Residual | -1.58793 | 1.01207 | .00000 | .63300 | 43 |
| Std. Predicted Value | -2.282 | 1.473 | .000 | 1.000 | 43 |
| Std. Residual | -2.479 | 1.580 | .000 | .988 | 43 |

a. Dependent Variable: CustomerService