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ABSTRACT

The steel industry is an important sector in Taiwan. Because of intense competition, maintaining old customers is a crucial issue that the industry must address. Numerous studies regarding the service industry identified a relationship between profit and the concepts of service quality, customer satisfaction, and customer loyalty. However, few studies have examined the steel industry. Therefore, the purpose of this study is to explore the causal relationships between service quality, customer satisfaction, and customer loyalty in the B2B steel industry. In total, 218 participants voluntarily participated in this research. Questionnaires were used for data collection. Additionally, we employed the Structural Equation Modeling (SEM) method to test the causal relationship model. The results showed that the $\chi^2$ was 109.46 ($df = 57$), and the overall goodness-of-fit index (GFI) was 0.930, indicating an empirically good fit with the model. The results show that the service quality and customer satisfaction of the B2B steel industry is directly related to customer loyalty and service quality has an indirect effect on customer loyalty through customer satisfaction. The findings of this study can act as a reference for managers in the B2B industry.

Keywords: service quality, customer satisfaction, customer loyalty, steel industry

INTRODUCTION

The steel industry is a substantial industry that produces steel worldwide. Demand for steel fluctuates significantly. In recent years, the extremely competitive environment of Taiwan’s steel industry has provided downstream enterprises with a greater selection of raw steel material suppliers. Downstream enterprises have numerous opportunities to select their suppliers. Additionally, the steel industry has also increased competition in the service processes, e.g. fast delivery, true reliability, and modern tangibles. Therefore, in order to maintain the competition of steel industry, steel suppliers must provide high quality steel materials and offer excellent services. Numerous domestic and foreign studies have determined that for various trades and industries, service quality, customer satisfaction, and customer loyalty are related to greater market presence and interaction (Liao, 2007). Businesses that offer a high quality service and satisfy their customers remain competitive and boast high customer retention numbers (Parsuraman et al., 1996; Lee & Feick, 2001). For example, in leisure industry, drugstore service, and bank business, promoting service quality and customer satisfaction will then affect customer loyalty (Parsuraman et al., 1996; Grewal, et al., 1998; Etzel et al., 2001; Lee et al., 2001; Liao & Hsieh, 2011). However, regarding the steel industry, few studies have focused on service quality, customer satisfaction, and customer relationships. Understanding the significance and influence of service quality, customer satisfaction, and customer loyalty is extremely vital for the steel industry when planning marketing and management strategies. In Taiwan, steel industry is not only the steel producers but also the steel product servers. To remain competitive in the market, managers require detailed to consider two marketing strategies, product and service. The relationships between profit and the concepts of service quality, customer satisfaction, and customer loyalty in steel industry is now unknown. Therefore, the purpose of this study is to explore the causal relationships between service quality, customer satisfaction, and customer loyalty in the steel industry. A clearly model of the relationships between service quality, customer satisfaction, and customer loyalty in the steel industry can act as a reference for marketing strategies.
LITERATURE REVIEW

Service Quality in Business

The fiercely competitive environment of the service industry has demonstrated that service quality is the most crucial factor determining a business’ survival and competitiveness (Parsuraman et al., 1985; Reichheld & Sasser, 1990). Service is the process of interaction between customers and the service provider (Grönroos, 1998). Overall, when considering the steel industry, quality management appears to be an appropriate strategy for managing steel facilities because steel management enables efficiency and effectiveness. Effectiveness indicators based on principles of customer service quality first measure customer expectations, and then compared them to customer perceptions of the business’ actual performance.

Instruments for measuring the service quality, such as SERVQUAL and its related variants, have employed by several organizations in the service industry (Bindu et al., 2009). These instruments are designed for the service industry specifically. However, Saravanan and Rao (2007) found that certain important aspects of service quality were not included in the SERVQUAL model. Another instrument, SERVPERF, is now considered the most appropriate method for determining service quality (Grönroos, 2008). The perceived service quality of public utility services has a multilevel, multidimensional structure and comprises three primary dimensions: outcome, environment, and interaction (Changhong et al., 2008). This study employed the SERVPERF method to determine service quality in the steel industry. This method measures several aspects, namely, tangibles, reliability, responsiveness, assurance, and empathy (Sasser et al., 1978; Parasuraman et al., 1988; Changhong et al., 2008). Tangible indicates physical facilities, equipment, and personnel appearance. Reliability means that the enterprise can be able to execute the agreed services provided correctly and reliably. Responsiveness means the enterprise voluntarily wants to help customers and promptly provide services. Assurance means the professional service knowledge, courtesy, and trusted ability of employee makes customers feeling ease. Empathy means enterprise can provide individual service and care.

Customer Satisfaction

Customer satisfaction is another factor that affects customer loyalty to service enterprises. The definition of satisfaction is a person’s approval or disappointment when comparing their opinion of services received with their original service expectations (Kotler & Keller, 2006). Therefore, customer satisfaction is a customer’s rational and emotional perceptions, which are based on service experiences (Matthew & Christine, 2000). In a service context, quality and value are proposed as antecedents of satisfaction; their effects on loyalty are mediated by satisfaction (Xiang, & James, 2010). Determining customer satisfaction includes consumers’ total satisfaction of service performance, consumer opinion, and national conditions (Singh, 1991; Manfred & Grund, 2000; Dermanov & Eklöf, 2001; Chang & Yuan, 2002; Miguel, 2009). Kano developed a two-way quality model (now know as Kano’s model) to define and categorize web community service quality dimensions, and understand user demands (Kuo, 2004). Kano found an increase in satisfaction and a decrease in dissatisfaction when analyzing improvements to certain quality elements. He used the results of his study as a reference to improve services provided to the web community. Combining the findings of previous studies, this research adopted five aspects for determining customer satisfaction, namely, service, product, situation, individual, and price (Zeithaml & Bitner, 1996).

Customer Loyalty

The mean of customer loyalty is customers’ continuous purchasing behavior toward the merchandise or services of a specific company (Day, 1977; Lutz, 1986). However, Bhote (1996) believed that if a customer was satisfied with a company’s commodities or services, they would want to promote that company positively through word-of-mouth. Improving customer loyalty in the service sector will increase economic returns (Reichheld, 1996). Therefore, competition in the service industry and the improved management and marketing strategies must be designed to retain and not acquire customers (Dwyer et al., 1987). Regarding evaluating customer loyalty, Parsuraman et al. (1994) believed that customer behavior, intent to repurchase, and recommendations through positive word-of-mouth should be
assessed (Jones & Sasser, 1995; Srinivasan et al., 2002) classified customer loyalty to three primary categories: primary behavior, secondary behavior, and intent to repurchase.

**RESEARCH METHODOLOGY**

**Framework**

Based on a literature review, this study establishes a structured framework, as shown in Fig. 1. This framework explores the causal relationships among service quality, customer satisfaction, and customer loyalty, and is further employed to test the LISREL model (Jöreskog & Sörbom, 1993; Bagozzi & Yi, 1998). The framework explores the relationships among 3 latent variables and 13 observed variables. The three latent variables are service quality (Sq), customer satisfaction (Cs), and customer loyalty (Cl). The 13 observed variables are tangibles (TAN), reliability (REL), responsiveness (RES), assurance (ASS), empathy (EMP), service (SER), product (PRO), situation (SIT), individual (IND), price (PRI), primary behavior (PB), secondary behavior (SB), and intent to repurchase (ITR). In this study, the structural model assumes that service quality not only directly influences customer satisfaction and customer loyalty, but through customer satisfaction also indirectly influences customer loyalty.

![Proposed linear structural relationships model](image)

**Figure 1: Proposed linear structural relationships model**

**Hypotheses**

This study uses the Linear Structural Relationships (LISREL) method to probe the hypotheses. Researcher identifies the relationship between service quality and customer satisfaction, and then determine their joint influence on consumer loyalty. The results of this study will provide a reference for the steel industry management strategies. Researcher proposes the following hypotheses on the directional relationships among service quality, customer satisfaction, and customer loyalty. The proposed model for the casual relationships among service quality, customer satisfaction, and customer loyalty is as shown in Fig. 1.

H 1. A company’s service quality correlates with customer loyalty.
H 2. Customer satisfaction of a company correlates with customer loyalty to the company.
H 3. A company’s service quality correlates with customer satisfaction.
H 4. Service quality has an indirect effect on customer loyalty through customer satisfaction.

**Sampling Method**

For this study, 218 employees from 200 downstream firms of Quintain Steel Company in Taiwan voluntarily participated in LISREL testing. The subjects had at least one commercial experience with Quintain Steel Company.
Data were collected using a questionnaire designed based on past research studies (Parasuraman et al., 1988; Jones & Sasser, 1995; Zeithaml & Bitner, 1996; Srinivasan et al., 2002), which comprised four sections: service quality, customer satisfaction, customer loyalty, and basic information. The aim of the questionnaire was to understand the general conditions of the steel industry through employee responses regarding service quality, satisfaction, and loyalty. The questionnaire items were scored using a six-point Likert scale.

Data Analysis

Data analysis was conducted using LISREL 8.8 and SPSS 17.0 statistical software packages (Jöreskog & Sörbom, 1993). The analyzed content was categorized according to the descriptive statistics and Pearson’s correlation coefficient for all variables undergoing reliability, validity, and LISREL model testing. The LISREL structural model is written using the following matrix equation:

$$
\eta = B \eta + \Gamma \xi + \zeta
$$

(1)

The latent dependent variables are denoted by \( \eta \) (eta) as a vector \( (m \times 1) \) of \( m \) such variables. The latent independent variables are denoted by \( \xi \) (xi) as a vector \( (n \times 1) \) of \( n \) such variables. The relationships among the latent variables are denoted by \( B \) (capital beta) and \( \Gamma \) (capital gamma). The error term \( \zeta \) is a vector that contains the equation prediction errors or disturbance terms.

The LISREL measurement models are written as the following set of matrix equations:

$$
Y = \Lambda_y \eta + \varepsilon
$$

(2)

for the latent dependent variables and

$$
X = \Lambda_x \xi + \sigma
$$

(3)

for the latent independent variables. The observed variables are denoted by the vector \( Y \) \((p \times 1)\) for the measures of the latent dependent variables \( \eta \) \((m \times 1)\), and by the vector \( X \) \((q \times 1)\) for the measures of the latent independent variables \( \xi \) \((n \times 1)\). The relationships between the observed variables and latent variables are denoted by the \((p \times m)\) matrix \( \Lambda_y \), for \( Y \); and by the \( q \times n \) matrix \( \Lambda_x \), for \( X \). Finally, the measurement errors for \( Y \) are denoted by \( p \times 1 \) vector \( \varepsilon \) and for \( X \) by the \( q \times 1 \) vector \( \sigma \) (Jöreskog & Sörbom, 1988; Jöreskog & Sörbom, 1993; Bagozzi & Yi, 1998).

RESULTS

Basic Information

Participants’ basic information is statistically presented in a distribution of firms and demographics. Of the participants, 197 were employed at a screw factory, 3 at a screw nut factory, 4 at a hardware factory, 7 in commercial trade, and 7 at other companies. The total number of participants in this study was 218 (156 men and 62 women). The age distribution was between 20 and 50. For the distribution of academic credentials, the undergraduate group accounted for the majority, constituting 44.5%; the junior college group accounted for 35.3%. The distribution of commercial steel amounts were between 1.2 \((10^3 \text{ kg/year})\) and 4,800 \((10^3 \text{ kg/year})\). The distribution of commercial frequencies was between 10 (times/month) and 30 (times/month).

Reliability and Validity

Cronbach’s (\( \alpha \)) coefficient for the internal consistency of service quality, customer satisfaction, and customer loyalty, were 0.929, 0.910, and 0.835, respectively. All reliabilities were greater than 0.70, which indicates the questionnaire possessed excellent reliability. Questionnaire validity was combined with content validity to determine item validity. This study used content validity and a two-way detailed catalogue table (TDCT) to construct the questionnaire contents. The TDCT method was first employed to define the variables, and then list the corresponding questionnaire items. Finally, experts assessed the items to verify reasonable content validity.

Correlations

Pearson’s correlation coefficients were used to show the relevant relationships among the 13 observed variables. Table I shows the descriptive statistics and Pearson’s correlation coefficients. Because the variables required an interval
scale, this study used Pearson’s correlation coefficient analysis. Table I shows that the correlation coefficients of the 13 observed variables all exceed 0.30 ($p < .01$), which reveals that tangibles and secondary behavior are positively related. This result supports Hypothesis 1, Hypothesis 2, and Hypothesis 3 completely. H1: A company’s service quality correlates with customer loyalty. H2: Customer satisfaction of a company correlates with customer loyalty to the company. H3: A company’s service quality correlates with customer satisfaction.

Table I: Means, standard deviations, minimum values, maximum values, and Pearson’s correlations

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mea</th>
<th>s.d.</th>
<th>1</th>
<th>2</th>
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<th>12</th>
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<tbody>
<tr>
<td>1. Tangibles</td>
<td>4.35</td>
<td>0.856</td>
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<tr>
<td>2. Reliability</td>
<td>4.63</td>
<td>0.723</td>
<td>0.80**</td>
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<tr>
<td>3. Responsiveness</td>
<td>4.39</td>
<td>0.846</td>
<td>0.66**</td>
<td>0.79**</td>
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<td>4. Assurance</td>
<td>4.89</td>
<td>0.810</td>
<td>0.68**</td>
<td>0.78**</td>
<td>0.76**</td>
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<td>5. Empathy</td>
<td>4.70</td>
<td>0.861</td>
<td>0.64**</td>
<td>0.76**</td>
<td>0.73**</td>
<td>0.75**</td>
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<tr>
<td>6. Service</td>
<td>4.65</td>
<td>0.756</td>
<td>0.58**</td>
<td>0.65**</td>
<td>0.67**</td>
<td>0.71**</td>
<td>0.80**</td>
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<tr>
<td>7. Product</td>
<td>4.41</td>
<td>0.773</td>
<td>0.60**</td>
<td>0.70**</td>
<td>0.76**</td>
<td>0.70**</td>
<td>0.76**</td>
<td>0.73**</td>
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<tr>
<td>8. Situation</td>
<td>4.60</td>
<td>0.805</td>
<td>0.53**</td>
<td>0.63**</td>
<td>0.67**</td>
<td>0.59**</td>
<td>0.70**</td>
<td>0.54**</td>
<td>0.76**</td>
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<tr>
<td>9. Individual</td>
<td>4.81</td>
<td>0.817</td>
<td>0.59**</td>
<td>0.69**</td>
<td>0.66**</td>
<td>0.67**</td>
<td>0.72**</td>
<td>0.69**</td>
<td>0.74**</td>
<td>0.69**</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>10. Price</td>
<td>4.74</td>
<td>0.780</td>
<td>0.41**</td>
<td>0.53**</td>
<td>0.60**</td>
<td>0.56**</td>
<td>0.65**</td>
<td>0.59**</td>
<td>0.70**</td>
<td>0.65**</td>
<td>0.63**</td>
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<tr>
<td>11. Primary behavior</td>
<td>4.41</td>
<td>0.737</td>
<td>0.45**</td>
<td>0.50**</td>
<td>0.51**</td>
<td>0.50**</td>
<td>0.55**</td>
<td>0.55**</td>
<td>0.52**</td>
<td>0.50**</td>
<td>0.52**</td>
<td>0.54**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Secondary behavior</td>
<td>4.56</td>
<td>0.838</td>
<td>0.30**</td>
<td>0.42**</td>
<td>0.53**</td>
<td>0.48**</td>
<td>0.57**</td>
<td>0.47**</td>
<td>0.60**</td>
<td>0.59**</td>
<td>0.50**</td>
<td>0.57**</td>
<td>0.59**</td>
<td></td>
</tr>
<tr>
<td>13. Intent to repurchase</td>
<td>4.87</td>
<td>0.842</td>
<td>0.38**</td>
<td>0.45**</td>
<td>0.54**</td>
<td>0.51**</td>
<td>0.56**</td>
<td>0.49**</td>
<td>0.53**</td>
<td>0.55**</td>
<td>0.57**</td>
<td>0.50**</td>
<td>0.68**</td>
<td>0.63**</td>
</tr>
</tbody>
</table>

*aN = 218 employees. **$p < 0.01$. 

Linear Structure Model Analysis

The LISREL model was used to analyze the reciprocal and complementary influence among service quality, customer satisfaction, and customer loyalty (Jöreskog & Sörbom, 1993; Bagozzi & Yi, 1998). The LISREL model, including the overall model and the internal model, was examined as described below. This study used the maximum likelihood method to test the overall model fitness (Jöreskog and Sörbom, 1988). The results of the overall model fitness test are shown in Fig. 2. For the fit indices, as shown in Fig. 2, the chi-square ($\chi^2$) was 109.46, with 57 degrees of freedom; goodness-of-fit index (GFI) = 0.930; adjusted goodness-of-fit index (AGFI) = 0.890, and root mean square error of approximation (RMSEA) = 0.065. Hence, this model fits the data extremely well. The fit estimates were all with a reasonable range (Jöreskog and Sörbom, 1988; Jöreskog and Sörbom, 1993; Bagozzi and Yi, 1998). Table II shows the fitness results of the internal structure model. The outputs can be expressed by estimates and t-values. The parameter of Gamma ($\gamma$) and Beta ($\beta$) expressed the relationships between latent variables. The parameter of Lambda ($\lambda_x$) and Lambda ($\lambda_x$) expressed the relationships between latent variables and observed variables.
As shown by their output, all the parameter coefficients of completely standardized solutions nearly fit the indices, except Gamma (γ_{11}) (Sq→Cl). Overall, all error covariances were positive, the \( t \)-value of error co-variances was significant, and all the estimated parameters were > 3.29 (\( p < .001 \)). These results indicate that the internal structure model fits the data extremely well. However, the path of service quality to customer loyalty was not significant (\( p > .05 \)).

**Table 2: Parameter estimates and \( t \)-value**

<table>
<thead>
<tr>
<th>LISREL Parameters</th>
<th>Estimates</th>
<th>( t )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gamma (γ_{21}) (Sq → Cs)</td>
<td>0.92</td>
<td>9.43***</td>
</tr>
<tr>
<td>Gamma (γ_{11}) (Sq → Cl)</td>
<td>0.15</td>
<td>0.88</td>
</tr>
<tr>
<td>Beta (β_{12}) (Cs → Cl)</td>
<td>0.65</td>
<td>3.59 ***</td>
</tr>
<tr>
<td>Lambda (λ_{x11}) (Sq → TAN)</td>
<td>0.62</td>
<td>12.17***</td>
</tr>
<tr>
<td>Lambda (λ_{x21}) (Sq → REL)</td>
<td>0.65</td>
<td>15.68***</td>
</tr>
<tr>
<td>Lambda (λ_{x31}) (Sq → RES)</td>
<td>0.69</td>
<td>16.77***</td>
</tr>
<tr>
<td>Lambda (λ_{x41}) (Sq → ASS)</td>
<td>0.65</td>
<td>15.02***</td>
</tr>
<tr>
<td>Lambda (λ_{x51}) (Sq → EMP)</td>
<td>0.72</td>
<td>16.83***</td>
</tr>
<tr>
<td>Lambda (λ_{y11}) (Cs → SER)</td>
<td>0.66</td>
<td>10.78***</td>
</tr>
<tr>
<td>Lambda (λ_{y21}) (Cs → PRO)</td>
<td>0.67</td>
<td>11.38***</td>
</tr>
<tr>
<td>Lambda (λ_{y31}) (Cs → SIT)</td>
<td>0.70</td>
<td>10.61***</td>
</tr>
<tr>
<td>Lambda (λ_{y41}) (Cs → IND)</td>
<td>0.70</td>
<td>10.70***</td>
</tr>
<tr>
<td>Lambda (λ_{y51}) (Cs → PRI)</td>
<td>0.65</td>
<td>9.92***</td>
</tr>
<tr>
<td>Lambda (λ_{y62}) (Cl → PB)</td>
<td>0.57</td>
<td>10.95***</td>
</tr>
<tr>
<td>Lambda (λ_{y72}) (Cl → SB)</td>
<td>0.65</td>
<td>10.60***</td>
</tr>
<tr>
<td>Lambda (λ_{y82}) (Cl → ITR)</td>
<td>0.67</td>
<td>11.26***</td>
</tr>
</tbody>
</table>

*\( *** p < 0.001 \)
DISCUSSION

The study used the LISREL method to test the proposed model. The results of the overall model fitness test and the internal structure model fitness test indicated a good fit with the data. In summary, the hypothetical model proposed by this study, Fig. 1, and tested using the LISREL method, provided an accurate verification. This result supports Hypothesis 4 entirely. Therefore, the model of the casual relationships among service quality, customer satisfaction, and customer loyalty is as shown in Fig. 1. Finally, the results of the internal structure model fitness test showed that the observed variables service quality, customer satisfaction, and customer loyalty were appropriate.

CONCLUSION

The study used the LISREL method to test the proposed model. The results showed that the overall model fit the data extremely well (chi-square is 109.46 with 57 degrees, goodness-of-fit index (GFI) = .930). The results of the internal structure model fitness test were also suitable ($t > 3.29, p < .001$). Therefore, this study concludes that, in the steel industry, service quality and customer satisfaction is directly related to customer loyalty. These findings agree with those of previous studies (Reichheld & Sasser, 1990; Liao, 2007; Bindu et al., 2009; Xiang, & James, 2010; Liao & Hsieh, 2011). Finally, this study infers that service quality may be the most significant factor influencing customer satisfaction. Regarding the steel industry, service quality may be considered the antecedent of satisfaction, and its effect on loyalty is mediated by satisfaction. These finding are consistent with those of authors (Yieh et al., 2007; Subhash et al., 2010).

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