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# LOGISTICS CAPABILITIES EFFECT ON CUSTOMER SATISFACTION: EVIDENCE FROM TAIWANESE LOGISTICS PROVIDERS

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## ABSTRACT

*Due to the intensification of market competition, manufacturing enterprises have to focus on their core competence, and outsource the non-core businesses, such as logistics to professional logistics providers (i.e. 3PLs), to gain more competitive advantages. As a producer services, logistics providers should strive to improve their service capabilities, which is the guarantee of customer satisfaction and long-term cooperation relationship. This paper collected data from the customers who accepted the service of some Taiwanese logistics providers. The result of empirical study shows that logistics capabilities have positive effects on customer satisfaction.*

## KEYWORDS

taiwanese logistics providers; logistics capabilities; customer satisfaction.

## 1. INTRODUCTION

The competition among logistics providers, in essence, is the competition of their service capabilities. The customers of logistics providers may be corporate (i.e. suppliers, manufacturers, etc.), or be a natural person (Ke & Huang, 2006). Generally speaking, the corporate customers with respect to natural persons will be more rational in the selection of logistics service providers, because corporate customers usually have a complete measurement system to select logistics service providers. Therefore, the logistics providers should always pay attention to the changes in customer satisfaction, in order to establish long-term stable cooperative relations.

Recently, researches on the logistics capabilities gradually increased. With regard to logistics providers, logistics capability is the basis to provide logistics services for customers. Moreover, there are significant differences on the logistics capability composition between 3PLs and traditional logistics enterprises. The service capabilities of 3PLs is significantly higher than that of the traditional ones. Because of the different logistics capabilities, certainly, the degree of customer satisfaction is different. However, current studies focused on the necessity and feasibility of logistics providers to improve logistics capabilities. In addition, dimensions of logistics capabilities are not united, especially with the perspective of customer satisfaction. Therefore, identifying the components of logistics capabilities, based on customer satisfaction, is of great significance to the survival and development of logistics providers.

This paper discusses the key components of logistics capabilities from the perspective of customer satisfaction. It could not only expand the ideas for improving the logistics capabilities in the future, but also can be regarded as a theoretical reference for the transformation of traditional logistics enterprises to modern logistics providers (i.e. 3PLs).

## 2. LITERATURE REVIEW

### 2.1 Logistics capability

Logistics capability was first launched in 1995 by the global logistics research team, Michigan State University (MSUGLRT). From the perspective of global supply chain, the research identified 17 kinds of general logistics capabilities, and classified them into 4 groups, namely configuration ability, agility ability, measurement ability and integration ability (Anonymous, 1995).

Daugherty and Pittman (1995), Morash, droge and Vickery (1996), Faweett, Stanley and Smith (1997) identified some indicators, such as cost, service quality, the accuracy and reliability of distribution, the speed of responding order and service innovation.

Ma and Meng (2005) Ma and Shen (2005), Ma and Chen (2007) studied elements of logistics capabilities from the perspective of supply chain and divided logistics capabilities into three aspects respectively.

Bowersox and Closs (2002) proposed that the logistics capability was the evaluation of whether logistics enterprises can provide other enterprises with high level of logistics services and maintain the total cost of the system at a relatively low level at the same time. The research pointed out two tasks of logistics, namely the service and the total cost.

Lai (2004) argued that logistics capability referred to the capability that professional logistics providers optimized their own resources in order to meet the customer demand of diversified logistics services and excellence of the logistics service.

Wang and Feng (2002) proposed that logistics capability referred to the abilities of planning, organizing, coordinating and controlling the logistics activities in the process of meeting consumer demand value. Logistics capabilities was divided into dynamic capacity and static capacity. Dynamic capacity included management capabilities of enterprise logistics, and the static capacity included the capacity of logistics equipment and facilities and so on.

According to the conclusions above, it was found that Bowersox and Closs (2002), Lai (2004), and some other scholars had put forward the concept of logistics capabilities with customer orientation; Donald and David (2002) and Lai (2004) also concerned about the low cost. Most of definitions were focused on facilities, equipments and other hard capacities, as well as some soft capacities such as the level of enterprise management and organizational structure.

### 2.2 The relationship between logistics capabilities and customer satisfaction

The research on the relationship between logistics capabilities and customer satisfaction, was first documented in the Council of logistics management (1998), it brought out the definition of logistics: "logistics is that a part of the supply chain process that plans, implements, and controls the efficient and effective forward and reverse flow and storage of goods, services and related information between the point of consumption in order to meet customers' requirements." Obviously, it can be seen the definition was based on the needs of customers.

The concept of customer satisfaction was formally proposed by Cardozo (1965). And then the researches on customer satisfaction were extensive and in-depth. By the end of the 20th century, the theory of customer satisfaction had been widely recognized all over the world, and more and more enterprises began to attach importance to customer satisfaction. Therefore this paper would not refer to the content of customer satisfaction.

There were some useful studies about the relationship between the logistics capabilities and customer satisfaction (Zhu & Liu, 2003; Du and Zhu, 2005; Ke and Huang, 2006; Xi and Liu, 2007), and most of the researches were carried out by analyzing the large amount of data from market survey previously.

## 3. RESEARCH DESIGN

### 3.1 Logistics capability

This paper takes the staffs of 3PLs as well as the customer enterprises in Taiwan as the object of the depth interview. Based on their rich work experience and sensitive customer perception, the tangible and intangible elements are classified, so as to identify logistics capabilities of logistics providers.

According to the results of the interview and with the literature summary, the logistics capabilities of logistics providers are divided into four dimensions, namely the element capability, the management capability, the innovation capability and the planning capability, respectively. The definitions of each capability are shown in Table 1.

TABLE 1: THE DEFINITIONS OF EACH LOGISTICS CAPABILITY

| Dimension                 | Definition  |
|---------------------------|---|
| The element capability    | The material basis for 3PLs to provide services to customers, including all kinds of logistics infrastructure (i.e. warehouse, distribution center), equipments (i.e. forklifts, roadway stackers, trucks), information systems, and human and financial resources. |
| The management capability | The use of certain management techniques and methods in the daily logistics operations.   |
| The innovation capability | The abilities of innovation in logistics technology and logistics service to meet the customers' needs  |
| The planning capability   | According to the actual needs of customers, 3PLs should have the ability to make an overall decision on integrated logistics solutions before carrying out logistics activities.  |

### 3.2 Customer satisfaction

Customer satisfaction is a measure of how products and services supplied by a company meet or surpass customer expectation. Customer satisfaction is defined as "the number of customers, or percentage of total customers, whose reported experience with a firm, its products, or its services (ratings) exceeds specified satisfaction goals" (Farris et al., 2010).

According to the reference of Yuan and Lee (2009), they divided customer satisfaction into six dimensions, the overall satisfaction, kind of attitude, customer demand, timely service, professional knowledge and relationship management, respectively. The overall satisfaction represents the evaluation of once or continuous products or services. Kind of attitude, customer demand and relationship management emphasize the customer's psychological perception of the logistics enterprise service, so these three dimensions are merged into customer's psychological satisfaction. Timely service and professional knowledge is a prerequisite for the customer demand, which is the functional attributes of the dimensions of customer satisfaction, so this paper divide the satisfaction of customer into psychological satisfaction and demand satisfaction.

### 3.3 Model and hypothesis

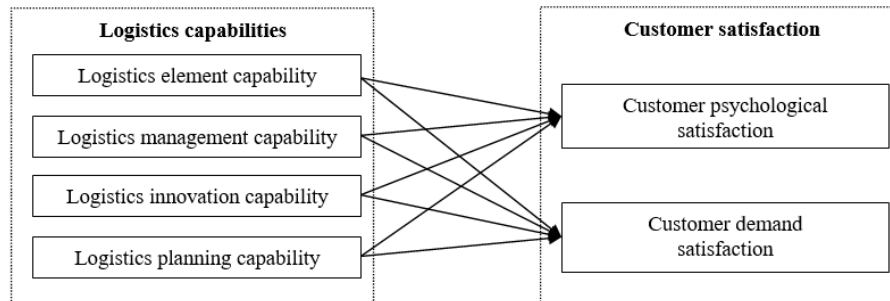
The American Association of supply chain invited customers to carry on the satisfaction survey to evaluate the service of logistics providers every year, and the results were compared and analyzed. The results showed that the service capability of logistics providers had significant effect on customer satisfaction (Wang & Li, 2006). So this paper put forward the assumption as shown in Table 2.

TABLE 2: THE HYPOTHESIS OF THIS PAPER

| No.             | Hypothesis  |
|-----------------|---|
| H <sub>0</sub>  | Logistics capability of logistics providers has positive effect on customer satisfaction                          |
| H <sub>1</sub>  | Logistics capability of logistics providers has positive effect on customer psychological satisfaction            |
| H <sub>1a</sub> | Logistics element capability of logistics providers has positive effect on customer psychological satisfaction    |
| H <sub>1b</sub> | Logistics management capability of logistics providers has positive effect on customer psychological satisfaction |
| H <sub>1c</sub> | Logistics innovation capability of logistics providers has positive effect on customer psychological satisfaction |
| H <sub>1d</sub> | Logistics planning capability of logistics providers has positive effect on customer psychological satisfaction   |
| H <sub>2</sub>  | Logistics capability of logistics providers has positive effect on customer demand satisfaction                   |
| H <sub>2a</sub> | Logistics element capability of logistics providers has positive effect on customer demand satisfaction           |
| H <sub>2b</sub> | Logistics management capability of logistics providers has positive effect on customer demand satisfaction        |
| H <sub>2c</sub> | Logistics innovation capability of logistics providers has positive effect on customer demand satisfaction        |
| H <sub>2d</sub> | Logistics planning capability of logistics providers has positive effect on customer demand satisfaction          |

The model of this paper is shown in Figure 1:

FIGURE 1: THE RESEARCH MODEL



#### 4. EMPIRICAL STUDY

##### 4.1 Validity and reliability

Bartlett test of sphericity and Kaiser-Meyer-Olkin of KMO was used to test the validity. Table 3 showed KMO and Bartlett's test of logistics element capability.

TABLE 3: KMO AND BARTLETT'S TEST OF LOGISTICS ELEMENT CAPABILITY

|  |                    |         |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. |                    | .776    |
| Bartlett's test Sphericity                       | Approx. Chi-Square | 512.063 |
|  | df                 | 72      |
|  | Sig.               | .000    |

According to Table 3, the value of KMO was 0.776; Meanwhile,  $\chi^2=512.063$  (df =72), the result was very significant, so there was a strong correlation between the variables, which indicated that the variable was suitable for factor analysis.

In this paper, principal component analysis was applied to extract common factors which were summed up the representative logistics capabilities. The variables were requested that eigenvalues greater than 1 be extracted, so the first three principal components form the extracted solution, as shown in Table 4.

TABLE 4: TOTAL VARIANCE EXPLAINED OF LOGISTICS ELEMENT CAPABILITY

| Component | Extraction Sums of Squared Loadings |               |             | Rotation Sums of Squared Loadings |               |             |
|-----------|-------------------------------------|---------------|-------------|-----------------------------------|---------------|-------------|
|           | Total                               | % of Variance | Cumulative% | Total                             | % of Variance | Cumulative% |
| 1         | 3.124                               | 30.532        | 30.532      | 3.125                             | 27.893        | 27.893      |
| 2         | 1.715                               | 13.219        | 43.751      | 1.807                             | 18.356        | 46.249      |
| 3         | 1.116                               | 9.693         | 53.444      | 1.162                             | 7.195         | 53.444      |

According to Table 4, 3 common factors in the dimension of logistics element capability were generated. The value of cumulative variance rate was 53.444%, and each eigenvalue was greater than 1, which indicated that this scale had a high construct validity.

Tables 5-8 showed the KMO and Bartlett's test of logistics management capability, logistics innovation capability, logistics planning capability and customer satisfaction, respectively.

TABLE 5: KMO AND BARTLETT'S TEST OF LOGISTICS MANAGEMENT CAPABILITY

|  |                    |         |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. |                    | .831    |
| Bartlett's test Sphericity                       | Approx. Chi-Square | 692.856 |
|  | df                 | 115     |
|  | Sig.               | .000    |

TABLE 6: KMO AND BARTLETT'S TEST OF LOGISTICS INNOVATION CAPABILITY

|  |                    |         |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. |                    | .813    |
| Bartlett's test Sphericity                       | Approx. Chi-Square | 472.359 |
|  | df                 | 43      |
|  | Sig.               | .000    |

TABLE 7: KMO AND BARTLETT'S TEST OF LOGISTICS PLANNING CAPABILITY

|  |                    |         |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. |                    | .751    |
| Bartlett's test Sphericity                       | Approx. Chi-Square | 503.521 |
|  | df                 | 36      |
|  | Sig.               | .000    |

TABLE 8: KMO AND BARTLETT'S TEST OF CUSTOMER SATISFACTION

|  |                    |         |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. |                    | .879    |
| Bartlett's test Sphericity                       | Approx. Chi-Square | 782.479 |
|  | df                 | 32      |
|  | Sig.               | .000    |

Tables 9-12 showed the total variance explained of logistics management capability, logistics innovation capability, logistics planning capability and customer satisfaction, respectively.

TABLE 9: TOTAL VARIANCE EXPLAINED OF LOGISTICS MANAGEMENT CAPABILITY

| Component | Extraction Sums of Squared Loadings |               |             | Rotation Sums of Squared Loadings |               |             |
|-----------|-------------------------------------|---------------|-------------|-----------------------------------|---------------|-------------|
|           | Total                               | % of Variance | Cumulative% | Total                             | % of Variance | Cumulative% |
| 1         | 3.904                               | 57.247        | 57.247      | 2.667                             | 44.632        | 44.632      |
| 2         | 1.221                               | 20.769        | 78.016      | 2.245                             | 33.384        | 78.016      |

**TABLE 10: TOTAL VARIANCE EXPLAINED OF LOGISTICS INNOVATION CAPABILITY**

| Component | Extraction Sums of Squared Loadings |               |             | Rotation Sums of Squared Loadings |               |             |
|-----------|-------------------------------------|---------------|-------------|-----------------------------------|---------------|-------------|
|           | Total                               | % of Variance | Cumulative% | Total                             | % of Variance | Cumulative% |
| 1         | 3.872                               | 53.495        | 53.495      | 2.559                             | 47.524        | 47.524      |
| 2         | 1.541                               | 25.874        | 79.369      | 2.733                             | 31.845        | 79.369      |

**TABLE 11: TOTAL VARIANCE EXPLAINED OF LOGISTICS PLANNING CAPABILITY**

| Component | Extraction Sums of Squared Loadings |               |             | Rotation Sums of Squared Loadings |               |             |
|-----------|-------------------------------------|---------------|-------------|-----------------------------------|---------------|-------------|
|           | Total                               | % of Variance | Cumulative% | Total                             | % of Variance | Cumulative% |
| 1         | 3.162                               | 54.789        | 54.789      | 2.457                             | 43.396        | 43.396      |
| 2         | 1.997                               | 19.748        | 74.537      | 2.697                             | 31.141        | 74.537      |

**TABLE 12: TOTAL VARIANCE EXPLAINED OF CUSTOMER SATISFACTION**

| Component | Extraction Sums of Squared Loadings |               |             | Rotation Sums of Squared Loadings |               |             |
|-----------|-------------------------------------|---------------|-------------|-----------------------------------|---------------|-------------|
|           | Total                               | % of Variance | Cumulative% | Total                             | % of Variance | Cumulative% |
| 1         | 4.578                               | 60.104        | 60.104      | 3.774                             | 57.981        | 57.981      |
| 2         | 2.306                               | 14.588        | 74.692      | 1.117                             | 16.711        | 74.692      |

Similarly available, according to Tables 5-12, the scales used in this paper had a high construct validity.

In order to test the reliability of the scale, Cronbach's  $\alpha$  coefficient was applied to verify whether the scale has internal consistency. Table 13 displayed the values of Cronbach's  $\alpha$ .

**TABLE 13: THE VALUES OF CRONBACH'S  $\alpha$** 

| Scale                  | Variable                            | Cronbach's $\alpha$ | Reliability of the scale |
|------------------------|-------------------------------------|---------------------|--------------------------|
| Logistics capabilities | logistics element capability        | 0.701               | 0.748                    |
|                        | logistics management capability     | 0.756               |                          |
|                        | logistics innovation capability     | 0.674               |                          |
|                        | logistics planning capability       | 0.713               |                          |
| Customer satisfaction  | Customer psychological satisfaction | 0.824               | 0.830                    |
|                        | Customer demand satisfaction        | 0.833               |                          |

According to Table 13, the Cronbach's alpha coefficients of logistics capabilities and customer satisfaction are 0.748 and 0.830, respectively, which showed that the reliability of the scales were good. Cronbach's alpha coefficients of logistics element capability, logistics management capability and logistics planning capability were greater than 0.70, indicating good reliability; the Cronbach's alpha coefficient of logistics innovation capability was 0.674 (0.65, 0.70), so the reliability of the items were acceptable. In summary, the scale of logistics capability had a high internal consistency. What's more, the Cronbach's alpha coefficients of customer psychological satisfaction and customer demand satisfaction were greater than 0.8, indicating a good reliability.

#### 4.2 Hypothesis test

In order to measure the strength of the correlations among the variables, this paper introduced the Pearson correlation coefficient. Pearson correlation coefficient is a value between +1 and -1 inclusive, where 1 is total positive correlation, 0 is no correlation, and -1 is total negative correlation. Table 14 showed the correlation among all dimensions of logistics capabilities and customer satisfaction.

**TABLE 14: THE CORRELATIONS AMONG ALL DIMENSIONS OF LOGISTICS CAPABILITIES AND CUSTOMER SATISFACTION**

| Variable                        | Customer satisfaction           |                           |
|---------------------------------|---------------------------------|---------------------------|
|                                 | Pearson correlation coefficient | Significance (Two-tailed) |
| Logistics capabilities          | .597**                          | .000                      |
| logistics element capability    | .478**                          | .000                      |
| logistics management capability | .556**                          | .000                      |
| logistics innovation capability | .539**                          | .000                      |
| logistics planning capability   | .513**                          | .000                      |

As shown in the table above, the Pearson correlation coefficients are greater than 0, which means logistics capability has a positive impact on customer satisfaction; the dimensions of logistics capability has a positive impact on customer satisfaction.

Table 15 showed the correlation among all dimensions of logistics capabilities and customer psychological satisfaction.

**TABLE 15: THE CORRELATIONS AMONG ALL DIMENSIONS OF LOGISTICS CAPABILITIES AND CUSTOMER PSYCHOLOGICAL SATISFACTION**

| Variable                        | Customer psychological satisfaction |                           |
|---------------------------------|-------------------------------------|---------------------------|
|                                 | Pearson correlation coefficient     | Significance (Two-tailed) |
| Logistics capabilities          | .618**                              | .000                      |
| logistics element capability    | .489**                              | .000                      |
| logistics management capability | .551**                              | .000                      |
| logistics innovation capability | .523**                              | .000                      |
| logistics planning capability   | .457**                              | .000                      |

According to Table 15, the Pearson correlation coefficients are greater than 0, which means logistics capability has a positive impact on customer psychological satisfaction; the dimensions of logistics capability has a positive impact on customer psychological satisfaction.

Table 16 showed the correlation among all dimensions of logistics capabilities and customer demand satisfaction.

**TABLE 16: THE CORRELATIONS AMONG ALL DIMENSIONS OF LOGISTICS CAPABILITIES AND CUSTOMER DEMAND SATISFACTION**

| Variable                        | Customer demand satisfaction    |                           |
|---------------------------------|---------------------------------|---------------------------|
|                                 | Pearson correlation coefficient | Significance (Two-tailed) |
| Logistics capabilities          | .517**                          | .000                      |
| logistics element capability    | .358**                          | .000                      |
| logistics management capability | .486**                          | .000                      |
| logistics innovation capability | .473**                          | .000                      |
| logistics planning capability   | .469**                          | .000                      |

According to Table 16, the Pearson correlation coefficients are greater than 0, which means logistics capability has a positive impact on customer demand satisfaction; the dimensions of logistics capability has a positive impact on customer demand satisfaction.

**4.3 Result**

Based on the analysis above, the results of hypothesis testing are shown in Table 17.

**TABLE 17: THE RESULTS OF HYPOTHESIS TESTING**

| No.             | Hypothesis  | Result  |
|-----------------|---|---------|
| H <sub>0</sub>  | Logistics capability of logistics providers has positive effect on customer satisfaction                          | support |
| H <sub>1</sub>  | Logistics capability of logistics providers has positive effect on customer psychological satisfaction            | support |
| H <sub>1a</sub> | Logistics element capability of logistics providers has positive effect on customer psychological satisfaction    | support |
| H <sub>1b</sub> | Logistics management capability of logistics providers has positive effect on customer psychological satisfaction | support |
| H <sub>1c</sub> | Logistics innovation capability of logistics providers has positive effect on customer psychological satisfaction | support |
| H <sub>1d</sub> | Logistics planning capability of logistics providers has positive effect on customer psychological satisfaction   | support |
| H <sub>2</sub>  | Logistics capability of logistics providers has positive effect on customer demand satisfaction                   | support |
| H <sub>2a</sub> | Logistics element capability of logistics providers has positive effect on customer demand satisfaction           | support |
| H <sub>2b</sub> | Logistics management capability of logistics providers has positive effect on customer demand satisfaction        | support |
| H <sub>2c</sub> | Logistics innovation capability of logistics providers has positive effect on customer demand satisfaction        | support |
| H <sub>2d</sub> | Logistics planning capability of logistics providers has positive effect on customer demand satisfaction          | support |

**5. DISCUSSION AND CONCLUSIONS**

Since there are some essential differences between modern logistics and traditional logistics, the 3PLs have much more capabilities than the traditional ones. According to the results of empirical study, a 3PL with strong logistics capabilities is more likely to be satisfied with the customers. Because the logistics element capability, logistics management capability, logistics innovation capability and logistics planning capability have different influence on customer satisfaction, 3PLs should pay attention to the following measurements to improve the level of customer satisfaction.

First, logistics management capability and logistics innovation capability are the key dimensions, which requires the 3PLs should pay more attention to the actual needs of customers. For instance, in addition to providing customers with high-quality basic services, 3PLs should also provide customers with customized value-added logistics services. Furthermore, 3PLs should strengthen their management abilities and pay attention to the construction of after-sales service system.

Second, the logistics industry belongs to the production service. The products of logistics providers are logistics service, so the capabilities to serve the customers is the core competitiveness of the logistics providers. As known to the empirical study, the capabilities of logistics providers have directly positive effect on customer psychological satisfaction and customer demand satisfaction. The current threshold of logistics market access in Taiwan is low, and many logistics providers with low services capacity, low safety and poor credit occupy the market using low-cost strategy. With modern logistics concept has been widely accepted, low-end logistics enterprises will gradually be eliminated in market competition. 3PLs should pay attention to the cultivation of logistics capabilities.

Third, logistics providers should pay attention to the importance of logistics planning capability. According to the results of empirical study, logistics planning capability has a positive effect on customer satisfaction, especially on customer psychological satisfaction. One of the main characteristics of modern logistics is emphasizing the systematic operation of the logistics, so only the logistics providers who can provide a comprehensive and systematic logistics services would be the protagonist of market. It requires logistics providers should not only have a global planning and coordination ability of supply chain, but also a scientific capability in logistics planning and design.

Fourth, logistics providers should increase investment in logistics element capability. Differently from other services, customers usually cannot visually see the entire process of logistics services, but can only experience the logistics services at the moment goods served or transferred, when the customer perception of service just affects customer psychological satisfaction. Logistics element capability can most directly reflect the strength of the logistics provider. Advanced logistics equipments and professional logistics operators, will give customers a good impression about the logistics providers, thus logistics element capability will also have a direct effect on customer satisfaction.

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