# EVALUATING THE IMPACT OF LOGISTICS FACTORS TO THE BUSINESS SUCCESS OF THE FIRMS IN THE ELECTRICAL AND ELECTRONICS INDUSTRY IN THAILAND

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## Abstract

**The Electrical and Electronics Industry in Thailand is very important for Thailand's economy and exportation to other countries. It contributes nearly 5% of Gross Domestic Product (GDP). This study is an attempt to test a framework that looks into how relationships in logistics factors contribute to the success of firms in the Electrical and Electronics Industry in Thailand. It evaluates both internal and external logistics factors that significantly contribute to the firms' business performance. Questionnaires are used as a tool to collect data and Structural Equation Modeling (SEM) was used to analyze relationships among these factors. Data were collected from the 304 firms in the Electrical and Electronics Industry in Thailand. The results provide implications for managers who seek to improve their supply chain operations with limited resources and budgets.**

**Keywords: Electrical and electronic industry, internal and external logistics factors, structural equation modeling, performance evaluation, supply chain performance**

## Introduction

The term "Supply Chain" is defined by Mentzer *et al*. (2001) as a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer. Several independent firms are involved in manufacturing a product and placing it in the hands of the end user in a supply chain. Raw material and component producers, product assemblers, wholesalers, retailer merchants and transportation companies are all members of a supply chain. Thus, a supply chain is characterized by the flow of materials and information both within and between business entities including suppliers, manufacturers and customers.

This study focuses on analyzing internal and external logistics factors in the supply chain of the Electrical and Electronics industry in Thailand by investigating significant factors that have an impact on firms' business performance. There are many factors that

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could affect their performance, especially during this period when the economy is in a downturn. As a result, it is necessary for the firms to try to survive by concentrating only on the factors that really help improve their performance so managers can put more focus on them with limited resources and budgets. Questionnaires are used as a tool to collect data from the firms and Structure Equation Modeling (SEM) is employed as a tool to analyze the proposed relationship among these factors.

## Background of Electrical and Electronic Industry in Thailand

The Electrical and Electronics Industry is an important industry of Thailand. Its exports have accounted for approximately 25 percent of industrial products and 30 percent of total export values. Production in this sector has grown continuously and attracted a large amount of Foreign Direct Investment (FDI) each year, making the industry critical to the country's economic growth. The Royal Danish Embassy[1] has noted in their 2006 report that the electronics industry has played a significant role for Thailand's economy during the past two decades as an important export earner, aiding overall development. The electrical and electronics sector has contributed about one-third of Thailand's export revenue over the past five years. Thailand has become the largest production base for the electrical appliance industry in ASEAN with many international manufacturers engaged in expansion programs. The country is also the second largest hard-disk drive exporter in the world after Singapore. More than 370,000 people are employed in the industry. Foreign brands and manufacturers currently dominate this large and fast-growing sector. Multinational companies, mainly from Japan, USA, Netherlands and Taiwan, generally establish their production, testing and assembling facilities in Thailand. The government is committed to further developing this industry and consequently, the Board of Investment (BOI) has taken steps to ensure that the investment climate remains favorable and offers attractive incentives to foreign companies interested in setting up operations in Thailand.

According to the evaluating report in 2002 from the Office of Industrial Economics, Ministry of Industry[2], the strength of this industry is that Thailand is the strategic base for manufacturing and exportation of electrical and electronic products to USA, Singapore and Japan. Its nature, which requires neatness and skill, is a perfect match for Thai laborers, who have good attitudes and good knowledge in the field. In addition, Thailand has set up product testing centers, which conformed to global standards. This helped to boost trust and developed an excellent foundation for the industry.

However, Japan Overseas Development Cooperation (JODC)[3] reported a lack of Research and Development (R&D), which was the main weakness of the Electrical and Electronic Industry in Thailand. As products and technology in this industry change rapidly, without R&D, the firms in Thailand are mainly hired only to assemble parts, rather than develop and manufacture their own products. In addition, Thailand is now losing its competitiveness to neighboring countries such as China and Vietnam as its labor cost increases. Chiadamrong and Suppakitjarak (2010) also addressed in their findings that a lack of creativity has been a main roadblock to move industrial development to an upstream position for many manufacturers in Thailand. Past practices have demonstrated that many

[1] "Sector overview: The electronics industry in Thailand". Thailand, Bangkok: Ministry of Foreign Affairs of Denmark. Available from: http://www.ambbangkok.um.dk. Accessed date: Jan 13, 2008.

[2] "Speed up the process of recovery and reconstruction in the electronic industry, and solve its weakness," Office of Industrial Economics" September 4, 2002. Available from: http://www.oie.go.th.

[3] "An interview with the president of Federation of Thai Industry," Journal of Electrical and Electronics Institute. June-August, 2002: 59.

firms depend on their foreign counterparts for new designs and ideas at the same time as focusing their effect mainly on manufacturing/ production/assembly.

Under more severe competition from both domestic and international markets with a recent launch of trade liberalization such as ASEAN Free Trade Area (AFTA), Thai manufactures must adapt themselves quickly by increasing their productivity. They cannot just rely on low-cost production since the possibility for additional cost reduction is less. Thus, it is necessary for managers of Thai firms to know the factors that really help improve their performance. Then, they can pay more attention to these factors with their limited resources and budgets, so their resources will not be utilized wastefully.

## Theoretical Framework and Hypotheses

There are three groups of main factors in the questionnaire, which are tested to find their impacts towards the firm's competitive capabilities and business performance. As seen in Figure 1, the first group is related to the external logistics factors while the second group evaluates the internal logistics factors. Finally, the last group evaluates the firm's business performance.

Internal Logistics Factors: These factors include Human Resource Management (HRM) and Internal Operational Activities of the firms (IO). These activities represent the firms' internal operations relating to manpower, human resource planning, and employee recruitment, as well as the day to day internal operations management of the firms.

External Logistics Factors: These factors include the fundamental Logistic Infrastructure (LI) and External Operational Activities of the firms (EO). Both factors are mainly linked to activities beyond the firms' internal operations. They represent fundamental logistic infrastructure, transportation and supplier linkages.

Business Performance: This includes the firm's operating performance such as return on investment, profits as a percentage of sales, net income before taxes, and present value of the firm. These performances are considered to be the main criteria for evaluating the business performance of the firms.

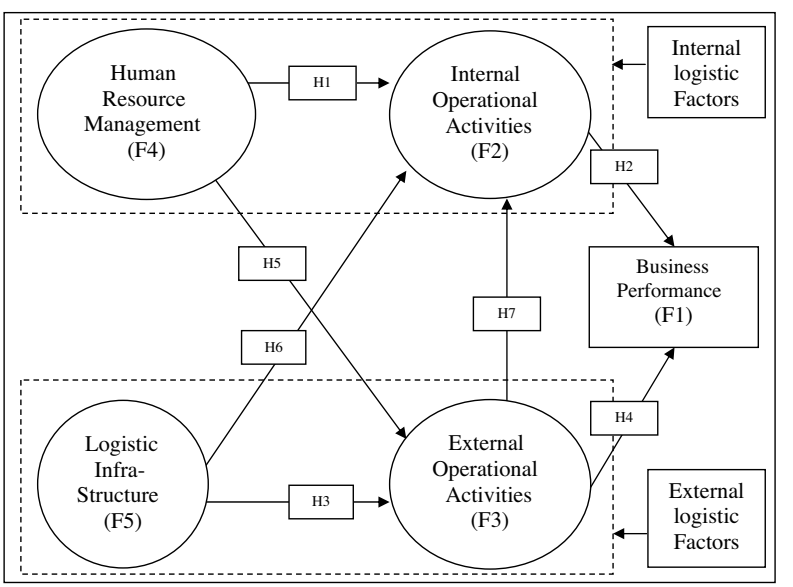


**Figure 1. Research hypothesis**

**Relationships of Human Resource Management (HRM) in Relation to Internal Operational Activities (IO) and External Operational Activities (EO)**

Hypotheses 1 and 5 propose that strategic Human Resource Management (HRM) has a positive impact on Internal Operational Activities (IO) and External Operational Activities (EO).

The basic goal of HRM is to build organization performance capacity by raising human capital to ensure that highly capable and enthusiastic people are always available. According to Schermerhorn (2004), HRM involves attracting, developing and maintaining a talented and energetic workforce. For IO and EO, there are multi-levels of culture that organizations must address, on the human aspect, to control and implement on effective organization. Without a proper human resource management program, both internal and external operational activities may not run effectively since operators would not properly be motivated and work at their full ability, as the right man would not be assigned to the right job. As a result, the following hypotheses are proposed.

H1: Human Resource Management (HRM) has a positive impact on Internal Operational Activities (IO).

H5: Human Resource Management (HRM) has a positive impact on External Operational Activities (EO).

**Relationships of Logistic Infrastructure (LI) in Relation to External Operational Activities (EO) and Internal Operational Activities (IO)**

Hypotheses 3 and 6 propose that the Logistic Infrastructure (LI) has positive impact on External Operational Activities (EO) and Internal Operational Activities (IO).

Logistic infrastructure (airports, seaports, roads, electrical and water system, etc.) is a fundamental foundation for transportation. It is a critical factor for investors when they decide to locate their plants. Without proper established infrastructure, firms would find it difficult to ship their products on time as well as run their normal operations effectively. Sullivan (1999) reported that infrastructure improvements could lead to and support economic growth and the development of market opportunities in a country, while weak infrastructure could raise transaction and production costs. As a result, the following hypotheses are proposed:

H3: Logistic Infrastructure (LI) has a positive impact on External Operational Activities (EO).

H6: Logistic Infrastructure (LI) has a positive impact on Internal Operational Activities (IO).

**Relationships of External Operational Activities (EO) in Relation to Internal Operational Activities (IO)**

Hypotheses 7 suggests that positive relationships between the External Operational Activities (EO) have an impact on Internal Operational Activities (IO).

According to Lambert *et al*. (1998), Supply Chain Management is the integration of key business processes from end users through original suppliers that provide products, services, and information that add value for customers and other stakeholders. Thus, the linkage of EO to IO provides a chain which runs from downstream to upstream. However, it is quite a common notion to judge that the external operational activities would have an impact on the firms' internal operations. No matter how well the firms operate their internal activities, if the raw materials are not be delivered on time, it would be impossible for the firms to produce the products they had previously planned and eventually they would not be able to fulfill their customer orders on time. As a result, the following hypothesis is proposed:

H7: External Operational Activities (EO) has positive impact on Internal Operational Activities (IO).

**Relationships of Internal Operational Activities (IO) and External Operational Activities (EO) in Relation to Business Performance (BP)**

Hypotheses 2 and 4 support that positive relationships between the Internal Operational Activities (IO) and External Operational Activities (EO) have an impact on Business Performance (BP).

Gimenez and Ventura (2005) pointed out that SCM involves integration, co-ordination and collaboration across organizations and throughout the supply chain. It requires an integration between internal (intra organizational) and external (inter organizational) functions and all functions contribute to business success. Therefore, the following hypotheses are proposed:

H2: Internal Operational Activities (IO) have a positive impact on Business Performance (BP).

H4: External Operational Activities (EO) have a positive impact on Business Performance (BP).

## Research Methodology

A survey was undertaken to gather data for testing the research hypotheses. The surveys include multiple scale items for each of the factors. The respondents responded from a variety of firms in the Electrical and Electronics Industry that are listed by Electrical and Electronics Institution. From the 1100 surveys in the target samples, 336 responses were received. Thirty two surveys were excluded from the analysis because of incomplete information. Thus, the response rate was about 30.54%. The questionnaire's questions were pre-tested by a few respondents from an Electronic Manufacturing firm, Delta Electronics (Thailand) Plc. This is to ensure readability, eliminate ambiguity and make sure that close-ended questions have a complete array of possible responses and so on. The response samples were comprised of high ranking plant or production managers as well as logistic managers. The responses were recorded using a 5-point Likert-type scale (1 = strongly disagree to 5 = strongly agree) for each group of factors.

The study uses Structural Equation Modeling (SEM) with SAS to analyze the research hypotheses. SEM is performed by using a two-step procedure. First the measurement model is developed. Then, it is followed by development of the structural model (Anderson and Gerbing, 1988). The structural model differs from the measurement model because it includes causal paths based on hypothesized relationships between specific factors in the model.

## Results

Confirmatory Factor analysis (CFA) was used to validate measures of constructs for developing the measurement. CFA is a more effective method for assessing unidimensionality than exploratory factor analysis, coefficient alpha, and item-to-total correlation. The purpose is to ensure unidimensionality of the multiple-item constructs or low item-to-constructs and to eliminate unreliable items (Bollen, 1989). Items that loaded on multiple constructs were deleted from the model prior to testing. The measures underlying the constructs are given in Table 1. The measurement model was analyzed using the SAS program and CALIS procedure. An adequate fit was achieved for the measurement model. The chi-square to *df* freedom ratio = 1.823, the Bentler's Comparative Fit Index (CFI) = 0.9218, Bentler and Bonett's Non-normed Fit Index (NNFI) = 0.9115, all of the t-statistics for the indicator variables were greater than 2.576, significant at $p < 0.01$, and no standard errors were near zero. The confirmatory factor analysis resulted in the elimination of a few individual items (V6 and V7) because of low factor loadings or high residuals. This result was not surprising because many of the survey items had been developed specifically for the study, and other items had been adapted from other literature streams.

Table 2 provides unstandardized coefficients, standard errors, and t-values for each individual item. These numbers provide

**Table 1. Measures underlying the constructs**

| **Construct and measurement items** |
|---|
| *Business Performance (BP)* |
| V1: Market share of the firms |
| V2: Return on investment |
| V3: Profits as a percentage of sales |
| V4: Increasing the capacity of production recently |
| V5: The present value of the firm |
| *Internal Operational Activities (IO)* |
| V6: The firm is currently using effective production planning ,and inventory management software, such as MRP, ERP, SAP, etc. |
| V7: Demand forecasting of the firms is quite accurate and has a high potential to be used for its production planning. |
| V8: The firm has managed its inventory control system effectively so that its level of inventory is suitably set and managed. |
| V9: The firm has an ability to respond to the customer's order quickly and promptly. |
| V10: The firm can always produce its product with high quality and conform to the required standard. |
| *External Operational Activities (EO)* |
| V11: The firm always exchanges important information such as production and inventory level with key suppliers. |
| V12: The firm has never experienced late order delivery to customers in recent time. |
| V13: The firm can manage its transportation vehicles or its outsource firms to delivery its products promptly. |
| V14: The firm has suitable transportation methods to delivery its products effectively. |
| V15: The firm has an effective system to find the right materials from the right suppliers. |
| *Human Resource Management (HRM)* |
| V16: The firm can recruit new employees to fill its requirement perfectly. |
| V17: The firm always provides good and effective training programs for its employees. |
| V18: The firm always provides good return and appropriate welfare for its employees. |
| V19: The firm has maintained and kept good employees with the firm for a long period of time. |
| V20: The firm has an opened mind to receive recommendation from employees and respond to them. |
| V21: Every department in the firm is willing to participate and mutually join activities to strengthen their relationships. |
| *Logistic Infrastructure (IL)* |
| V22: Road network coverage is sufficient and appropriate. |
| V23: Multimode transportation such as land, water or air can be done to reduce the transportation cost. |
| V24: Ports for importing and exporting materials and products are sufficient and can offer good and quick service. |
| V25: Information technology network is reliable and provides good coverage throughout the country. |
| V26: Import and export tax systems for collecting and redemption are effective and well facilitated. |
| V27: Electrical and water infrastructures are reliable and can provide good coverage throughout the country. |

**Table 2. Measurement Model**

| Individual items, their respective factors and coefficient alpha for each factor. (All scales were 5-point Likert scales where 1 = Strongly disagree - 5 = Strongly agree) | Unstandardized coefficient | Standard error | *t*-value | Standardized coefficient |
|---|---|---|---|---|
| **Business Performance (BP) (α = 0.8866)** | | | | |
| V1: Market share of the firms | 0.6024 | 0.0450 | 13.3734 | 0.7362 |
| V2: Return on investment | 0.6831 | 0.0392 | 17.4433 | 0.8807 |
| V3: Profits as a percentage of sales | 0.7168 | 0.0448 | 15.9903 | 0.8326 |
| V4: Increasing the capacity of production recently | 0.6912 | 0.0507 | 13.6374 | 0.7466 |
| V5: The present value of the firm | 0.6246 | 0.0500 | 12.4900 | 0.7003 |
| **Internal Operational Activities (IO) (α = 0.7391)** | | | | |
| V8: The firm has managed its inventory control system effectively so that its level of inventory is suitably set and managed. | 0.5290 | 0.0508 | 10.4065 | 0.6221 |
| V9: The firm has an ability to respond to the customer's order quickly and promptly. | 0.6136 | 0.0472 | 12.9969 | 0.7415 |
| V10: The firm can always produce its product with high quality and conform to the required standard. | 0.5426 | 0.0430 | 12.6142 | 0.7243 |
| **External Operational Activities (EO) (α = 0.8515)** | | | | |
| V11: The firm always exchanges important information such as production and inventory level with key suppliers. | 0.4333 | 0.0551 | 7.8663 | 0.4784 |
| V12: The firm has never experienced late order delivery to customers in recent time. | 0.5653 | 0.0441 | 12.8176 | 0.7119 |
| V13: The firm can manage its transportation vehicles or its outsource firms to deliver its product promptly. | 0.6903 | 0.0409 | 16.8757 | 0.8596 |
| V14: The firm has suitable transportation methods to delivery its products effectively. | 0.6546 | 0.0375 | 17.4401 | 0.8776 |
| V15: The firm has an effective system to find the right materials from the right suppliers. | 0.5229 | 0.0426 | 12.2655 | 0.6890 |
| **Human Resource Management (HRM) (α = 0.8554)** | | | | |
| V16: The firm can recruit new employees to fill its requirement perfectly. | 0.4465 | 0.0547 | 8.1622 | 0.5084 |
| V17: The firm always provides good and effective training programs for its employees. | 0.6321 | 0.0500 | 12.6384 | 0.7233 |
| V18: The firm always provides a good return and appropriate welfare for its employees. | 0.5496 | 0.0553 | 9.9328 | 0.5996 |
| V19: The firm has maintained and kept good employees with the firm for a long period of time. | 0.6014 | 0.0500 | 12.0302 | 0.6970 |
| V20: The firm has an open mind to receive recommendations from employees and respond to them. | 0.6234 | 0.0500 | 12.4677 | 0.7160 |
| V21: Every department in the firm is willing to participate and mutually join activities for strengthening their relationships. | 0.6570 | 0.0548 | 11.9895 | 0.6953 |
| **Logistic Infrastructure (IL) (α = 0.7718)** | | | | |
| V22: Road network coverage is sufficient and appropriate. | 0.6203 | 0.0601 | 10.3167 | 0.6390 |
| V23: Multimode transportation such as land, water or air can be done to reduce the transportation cost. | 0.6531 | 0.0642 | 10.1702 | 0.6315 |
| V24: Ports for importing and exporting materials and products are sufficient and can offer good and quick service. | 0.6510 | 0.0533 | 12.2031 | 0.7318 |
| V25: Information technology network is reliable and provides good coverage throughout the country. | 0.5406 | 0.0570 | 9.4821 | 0.5959 |
| V26: Import and export tax systems for collecting and redemption are effective and well facilitated. | 0.4740 | 0.0581 | 8.1524 | 0.5240 |
| V27: Electrical and water infrastructures are stable, reliable and can provide good coverage throughout the country. | 0.4438 | 0.0620 | 7.1556 | 0.4672 |

Note that V6, V7 were eliminated

information about the local fit, that is, how well each individual item is related to its respective factor. Each of the coefficients is large and significant at the $p < 0.01$ level. Table 2 also provides coefficient alphas for each factor after the measure purification process. The coefficient alphas are ranged from 0.7391 to 0.8866. De Vellis (2003) noted that alpha levels below 0.6 are unacceptable.

## Convergent Validity

Convergent validity is concerned with the similarity, or convergence, between individual questionnaire items that are measuring the same construct. For this study, convergent validity was assessed from the measurement model by testing whether each individual item's coefficient was significant, that is, greater than twice its standard error (Lemak *et al*., 1997). As can be seen from Table 2, the coefficients for all items are far greater than twice their standard errors. In addition, all coefficients are large and strongly significant. These results provide satisfactory evidence of convergent validity for these sets of items.

## Discriminant Validity

Discriminant validity is important to the discussion of model fit because it establishes that if two or more constructs are separate and distinct from one another, it can be proved whether or not a predictive or causal relationship exists between them. To assess discriminant validity, the confidence interval around the correlation for each pair of factors is determined. The confidence interval is equal to plus or minus two standard errors of the respective correlation coefficient. If the confidence interval does not include 1.0, then discriminant validity is demonstrated (Anderson and Gerbing, 1988). Table 3 shows that none of the confidence intervals for the factor correlations includes 1.0.

Goodness of fit is determined by comparing the structural model (full maintained model) to alternative models. One tests alternative models by sequentially deleting or adding paths. The measures of goodness-of-fit are shown in Table 4. After deleting 2 paths representing Hypothesis 4 and Hypothesis 6, the results of the test of the overall fit of the model can be shown in Figure 2 and are provided below. The chi-square statistic is significant. Other goodness-of-fit indices indicate an acceptable fit of the structural model to the data, especially given the exploratory nature of the study. Bentler's Comparative Fit indices (CFI) and Bentler and Bonett's Non-normed Index (NNFI) are above the desired 0.90 level (Hair *et al*., 1995;

**Table 3. Covariance among exogenous variables**

| Correlated factors | | *t*-value | Confidence interval: two standard errors around the correlation |
|---|---|---|---|
| BP | IO | 6.40 | $0.28635 \le 0.41661 \le 0.54687$ |
| BP | EO | 5.31 | $0.20632 \le 0.33084 \le 0.45536$ |
| IO | EO | 28.45 | $0.82869 \le 0.89135 \le 0.95401$ |
| BP | HRM | 8.11 | $0.35463 \le 0.47067 \le 0.58671$ |
| IO | HRM | 12.76 | $0.56541 \le 0.67051 \le 0.77561$ |
| EO | HRM | 11.71 | $0.49107 \le 0.59217 \le 0.69237$ |
| BP | LI | 3.25 | $0.08806 \le 0.22864 \le 0.36922$ |
| IO | LI | 5.70 | $0.26281 \le 0.40505 \le 0.54729$ |
| EO | LI | 6.94 | $0.30863 \le 0.43349 \le 0.55835$ |
| HRM | LI | 6.12 | $0.27437 \le 0.40743 \le 0.54049$ |

Byrne, 2006) and thus indicate good fit. The ratio of chi-square to degrees of freedom is 1.85, which is below the recommended 3.0 threshold (Hartwick and Barki, 1994; Hair *et al*., 1995), which also indicates a good fit. The adjusted goodness of fit index is above the desired 0.80 threshold (Wheaton *et al*., 1977; Segars and Grover, 1993; Hartwick and Barki, 1994), although below the conservative 0.90 thershold recommended by Bagozzi and

**Table 4. Measures of goodness of fit for the structural model**

| Model | $\chi 2$ | *df* | $\chi^2/df$ ratio* | CFI** | NNFI*** |
|---|---|---|---|---|---|
| Null model | 3090.8 | 300 | - | - | - |
| Uncorrelated factors | 871.091 | 275 | - | 0.7864 | 0.7670 |
| Full maintained model | 489.9252 | 267 | 1.83 | 0.9201 | 0.9102 |
| H 4 path deleted | 489.9253 | 268 | 1.82 | 0.9205 | 0.9110 |
| H 6 path deleted | 497.522 | 269 | 1.85 | 0.9181 | 0.9080 |
| Measurement model | 483.1587 | 265 | 1.82 | 0.9218 | 0.9115 |

* *$\chi^2/df$ ratio < 3 (Hartwick and Barki, 1994; Hair et al., 1995)*

** *CFI > 0.9 indicates a good fit of the data to the model (Bentler and Bonet, 1980)*

*** *NNFI > 0.8 indicates an acceptable fit (Wheaton et al.,1977; Segars and Grover, 1993; Bagozzi and Yi, 1988)*

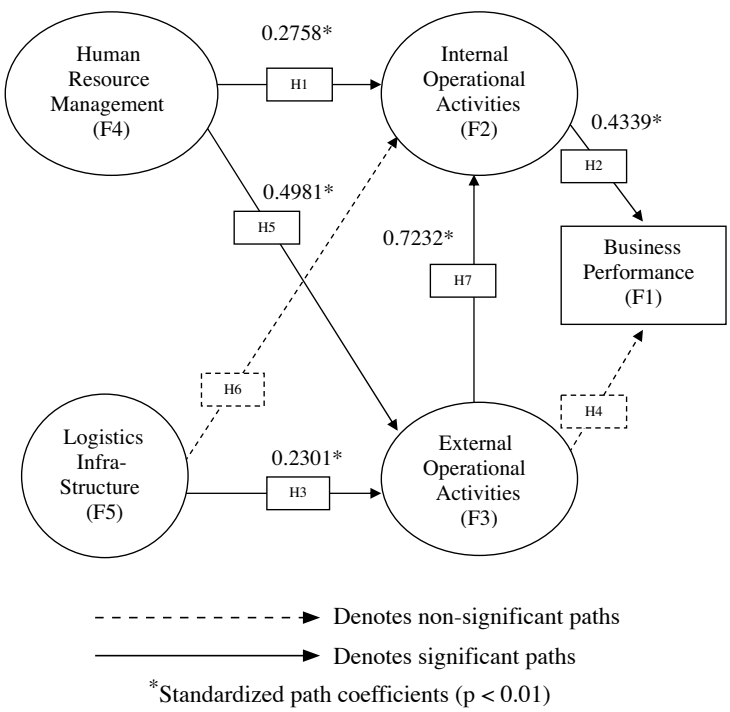


**Figure 2. Structural model**

Yi (1988).

These results are indicative of an acceptable fit of the model to the data, especially given that many of the measures used in this study were either developed for the study, or adapted from other studies. The R2 values for the three structural equations, which represent the variance explained by the endogenous factors of BP, IO, and EO, are 0.19, 0.84, and 0.39, respectively. For example, 0.39 is the variance in External Operational Activities (EO) explained by Logistic Infrastructure (LI). The results of the hypothesis tests, represented by individual paths between factors within the model, are included in Table 5 as well as shown in Figure 2. The discussion is addressed in the following section.

## Discussion and Managerial Implications

### Significant Paths

Five paths tested positive and significant ($p < 0.01$). These paths consist of H1, representing the path from HRM to IO; H2, testing the effect of the IO factor on the factor of BP; H3, testing the effect of the LI on the factor of EO; H5, representing the path from HRM to EO, and finally H7, representing the path from EO to IO.

### The Effect of Human Resource Management (HRM), on Both Internal Operational Activities (IO) and External Operational Activities (EO), was Positive (H1 and H5)

The paths from HRM to both IO and EO were positive and significant ($p < 0.01$). Human Resource Management (HRM) refers to the personnel related practices and policies an organization needs to develop its current employees. Developing the human resources of a firm would seem to be a key to improving both internal and external operational functions. Businesses in this industry that have made training, education, and development of HRM a priority have seen it pay off through greater profitability and increased worker job satisfaction. Cabibi (1997) also pointed out that HRM activities cover multi cultural internal and external environments and they were the root cause for the success of the successfully implemented organizations. Our finding also suggests that an improvement in HRM is critical for building fundamental supports to all operational activities, especially in the electrical and electronics industry in Thailand, where it requires a large number of skillful operators. In this industry where skill and technical knowledge are the number one requirements, there has always been a shortage of the skill laborers in which the firms must try to motivate, maintain and keep as good employees.

### The Effect of Logistic Infrastructure (LI), on External Operational Activities (EO), was Positive (H3)

The path from LI to EO was positive and significant ($p<0.01$). This finding supports the notion that the term "logistics" can be defined as having the right item with the right quantity at the right time for the right price at

**Table 5. Test results of the structural model**

| Hypothesis | Path from | To | Regression weight | Standard error | *t*-value |
|---|---|---|---|---|---|
| 1 | HRM | IO | 0.2656 | 0.0687 | 3.8647* |
| 2 | IO | BP | 0.4907 | 0.0806 | 6.0889* |
| 3 | LI | EO | 0.2323 | 0.0725 | 3.2060* |
| 5 | HRM | EO | 0.5211 | 0.0799 | 6.5186* |
| 7 | EO | IO | 0.6658 | 0.0728 | 9.1485* |

* *Singnificant at p < 0.01*

the right conditions to the right customer. Even though, the logistic infrastructure does not have an impact on internal operations (discussed later), it has proved to have a strong effect on the external operational activities. Especially, as the industry relies every much on exportation, the logistic infrastructures must be able to support its external logistic operations. They are critical for the firms to exchange information and export their products to overseas customers. Jiang and Peng (2008) proposed that the logistic infrastructures such as hubs, distribution centers, roads and railways networks, airports, seaports as well as information systems, contributed to the flexible and effective transportation and product shipment. As a result, prompt delivery and strong supply chain relationships among members would not be possible without good and reliable infrastructures.

**The Effects of External Operational Activities (EO), on Internal Operational Activities (IO) Towards Business Performance (BP), were Positive (H2 and H7)**

The path from EO to IO was positive and significant ($p < 0.01$). This supports the fact that external operational activities have shown to contribute to the success of firms' internal management. As the firms try to improve their internal operations, their external operational activities also need to be simultaneously improved. One setback would impede the effectiveness of another. External operations refer to all logistic activities relating to the flows of goods outside the company boundary, and usually involve transportation or freight management in various transportation modes. Hong *et al*. (2004) pointed out that on time delivery performance is important for external operational activities to provide trust and satisfaction to customers. As a result, the internal operational activities of the firms will affect the time scheduling of production planning and other internal operations managements. As the path from IO to BP is positive and significant ($p < 0.01$), this provides empirical evidence to achieve business success. It is imperative for the firms to excel in their internal operations on which the efficient and effective flow of goods and information in supply chains depend. Sabóia *et al*. (2006) stated that internal logistics are responsible for input of products, storage of raw materials, internal transportation, and storage of partly finished and finished products, preparation of orders and return of packaging to suppliers. These improvements would contribute to the success of the firms.

**Non-significant Paths**

There are 2 paths which were not significant and are recommended to be dropped during the Wald test. These paths included H4, testing the effect of the EO on BP and H6, representing the path from LI factor to IO.

The proposed hypothesis H6 was rejected because LI has shown no direct influence on IO. Even though the logistic infrastructure may have some impacts on the firm's internal operations, it is not a direct relationship, as compared to the external operations, which pretty much rely on the country's infrastructure. Referring the rejection of proposed hypothesis H4, where EO has shown no impact on BP, it seems that an improvement in external operational activities without improving on its internal management would lead to little impact on the firms' performance. Therefore, emphasizing on building good infrastructure and external operational activities without strengthening its own HRM and internal management does not significantly help the business performance of the firm. Hence, competitive advantage for many manufacturing companies now lies in their ability to effectively implement superior manufacturing, continual improvement of reliability of existing production processes, and developing a continual stream of quality products.

## Conclusions

The research outcomes indicate that there are relationships among internal logistics factors, external logistics factors as well as the firm's business performance. The results show some supports for some of the hypotheses which

have been formulated in our theoretical framework. However, it also shows that the logistic infrastructure does not have a direct impact on the firm's internal operation activities as well as that external operational activities do not have a direct impact on business performance. As the industry is an important export earner, these infrastructures are critical for their external logistic activities.

Human resource management shows its significant impact on both internal operational activities and external operational activities and it is the key factor for successful integration between external and internal logistics. To manage firms successfully, the firms need to develop a strategy of attracting a quality workforce (involving good human resource planning and effective employee recruitment and selection programs), developing a quality work force (involving proper training and development, and fair performance appraisal) and maintaining a quality workforce (involving employee orientation as well as compensation and benefits).

External operational activities have been shown to contribute to the effectiveness of the firm's internal management. Even though, the external operational activities do not have a direct impact on the firm's business performance, they can indirectly impact on the firm's business performance through improving the internal operations management. As a result, without a good and sound support from the external operational activities (such as sufficient and reliable transportation vehicles or good methods to deliver products to the customers) the firms would not be able to manage their internal logistics and operations effectively. This would eventually impede the success of their business performances.

The study also made a contribution to the understanding of the influence of internal and external logistics factors on business performance. It highlighted the importance of the interactions between individual practices, forming internally coherence among activities in the firms. However, two important study limitations should be highlighted. First, this study's sample was only drawn from the manufacturing firms listed as members of Electrical and Electronics Institution. Therefore, the conclusions inferred could only be generalized to the population of medium to large manufacturing firms in Thailand and must exclude other small or non-manufacturing firms. Second, all participants responded within a particular time frame and were only given a single opportunity to respond. Therefore, it could not be reliably established whether such data would hold true over time, especially in an unstable business environment, like the time the survey was taken place. In particular, different firms have distinct strategic goals in the short-term, such as market share, growth, etc. Moreover, firms may enhance their market share by sacrificing short-term profit in order to acquire long-term profit or investing more budgeting in advertising and promotion. The performance items in this study may not reflect these varying situations.

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