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The Guideline of Optimizing Warehouse Management in Business and Industry Sector in Thailand

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Abstract

The purposes of this research were 1) to study the quality of general operations of warehouse industry, 2) to study the guideline of optimizing warehouse management in business and industry sector in Thailand, and 3) to develop a structure equation model of the guideline of optimizing warehouse management in business and industry sector in Thailand. Qualitative and quantitative research methods were employed in this study. The qualitative data was obtained from expert 9 persons, and the quantitative data was obtained from both entrepreneurs and executive in the business and warehouse industry 500 samples. The questionnaires that passed content validity value showed 0.60-1.00, reliability value 0.972. Results of the research showed that quality of general operations of warehouse industry composes of 5 aspects consisted of Coordination, Resource, Internal Process Control, Information Technology, and Transportation. Overall most important were average 3.86 and found that difference in side of recognized at .05 significant level. The analysis of the developed structure equation model showed that it was in accordance and fit with the empirical data and passed the evaluation criteria. Its Chi-square probability level, relative Chi-square, goodness of fit index, and root mean square error of approximation were .082, 1.149, 0.962, and .017 respectively.

Keywords*: Guideline of Optimizing, Warehouse Management, Business and Industry Sector*

1. Introduction

In the context of management of the Thai industrial sector today, it is widely known and accepted that the development of logistics and supply chain management is very important to the success of an organization. Therefore, in order to create an organization to have a competitive advantage over other organizations, that organization must define systematic concepts for bridging marketing needs and customer satisfaction with the management of logistics. In order to build relationships within the organization and between organizations, they are starting from procurement of raw material, delivery processing raw materials into products or services, and delivering products or services to final consumers. Every logistic activity that supports marketing activities is the cost of operations or logistics costs which will have a direct impact on the organization as a whole. Therefore, micro logistics costs are the costs of each logistics activity that encourages an organization to compete better than other organizations. Nowadays, many countries or organizations have applied the concept of micro logistics activities to calculate the cost of the logistics which consists of the group that is the main logistics activity and the group that is the logistics activity supporting the operation of a total of 14 activities (shown in Table 1), which is one of the main important activities in logistics is warehouse management. However, there are often misunderstandings between the word "inventory" and "warehouse". They will understand in the beginning that "inventory" means products or materials that are under the supervision of the organization and are temporarily stored for a period of time in order to respond to the needs of customers that are expected to occur in the future. It can be classified into various types, which are raw materials, work in process, finished goods and inventory that are used for maintenance repair and operating department (Department of Primary Industries and Mines, 2016, online)[1]. The "warehouse" means an area that has

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been defined and planned in order to be effective in the movement of goods and raw materials (Planned space for the efficient accommodation and handing of goods and materials)[2].

Table1 Micro Logistics Activities

Logistics Activities	
•Customer Service	•Packaging
•Demand Forecasting	•Parts and Service support
•Inventory Management	•Plant and Warehouse site selection
•Distribution Communications	•Procurement
•Material Handling	•Return Goods Handling
•Order Processing	•Traffic and Transportation
•Warehousing and Storage	•Salvage and Scrap disposal

Sources: Lambert, Stock, &Ellram, 1998, p. 5[3].

Logistics cost is the cost of a business related to activities and logistics management which means various work processes related to planning, operation and control of the organization including the management of data and financial transactions resulting in movement, collecting distribution of goods, raw materials, components and services for maximum efficiency and effectiveness. By considering the needs and satisfaction of customers, it consists of 3 important parts which are the cost of transportation of goods (Transportation cost), inventory holding cost, and management cost (Administrative cost) (Office of the National Economic and Social Development Council, 2014, online)[4]. Inventory holding cost consists of 2 parts which are inventory carrying cost and warehousing cost for product holding cost which has been studied to calculate the cost method. Logistics define it as a cost that is related to the amount of goods held or the opportunity cost that the capital drowns in the product as well as the costs incurred from operating the service activities within the warehouse, storage data transfer of warehouse including factory, and warehouse location selection. The activities that cause cost of product ownership consist of 4 main activities, namely warehousing and storage, plant and warehouse site selection, inventory management, and packaging (Office of the National Economic and Social Development Council, 2009, online)[5].

Thailand's logistics costing is based on the method of cost calculation of Robert V. Delaney of Cass Information System, USA. As it is a method that is widely accepted in many countries and is an international standard. Therefore, the aforementioned cost calculation method has been applied in accordance with the basic logistics information source and data storage structure in the context of Thailand. When considering the survey of basic logistics information of the Office of the National Economic and Social Development Board, it found that the cost of logistics in Thailand freight cost (Transportation cost) is the second largest component of cost, inventory holding cost and minimal logistics management cost (Administrative cost). Result from survey basic data of logistics indicated that warehousing cost has slightly adjusted increasingly higher every year as shown in Fig.1.

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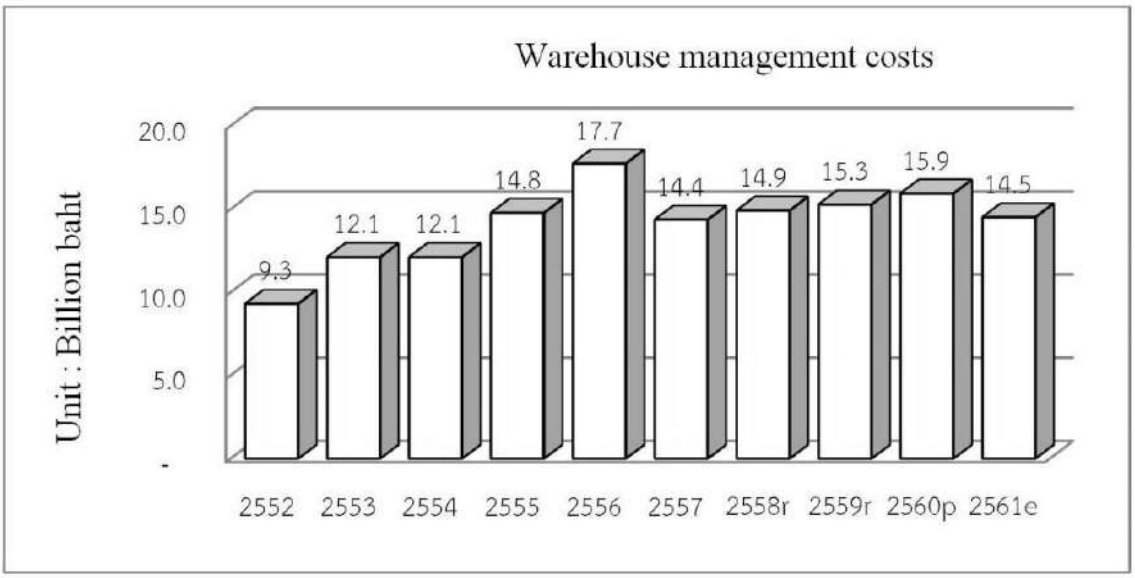

Fig.1 Graph of Warehouse management costs between years 2009-2018
Source: Office of the National Economic and Social Development Council, 2018, online[6]

From the issues discussed above, it can be seen that inefficient warehouse management will cause higher cost problems which will become more and more problems if every organization cannot solve the problem of warehouse management to be effective. Therefore, it is necessary to have a way to increase warehouse management efficiency into a model for warehouse management to be effective which is a factor that affects the organization to have lower management costs and increase management efficiency for the organization.

2. Research Objectives

The objectives of this research article were 1) to study the quality of general operations of warehouse industry, 2) to study the guideline of optimizing warehouse management in business and industry sector in Thailand, and 3) to develop a structure equation model of the guideline of optimizing warehouse management in business and industry sector in Thailand.

3. Conceptual Framework

This research was developed by using mixed methods research which divided into three parts consisted of qualitative research using in-depth interview, quantitative research using survey, and qualitative research using focus group discussion in order to confirm the validity of research model as shown in Fig.2.

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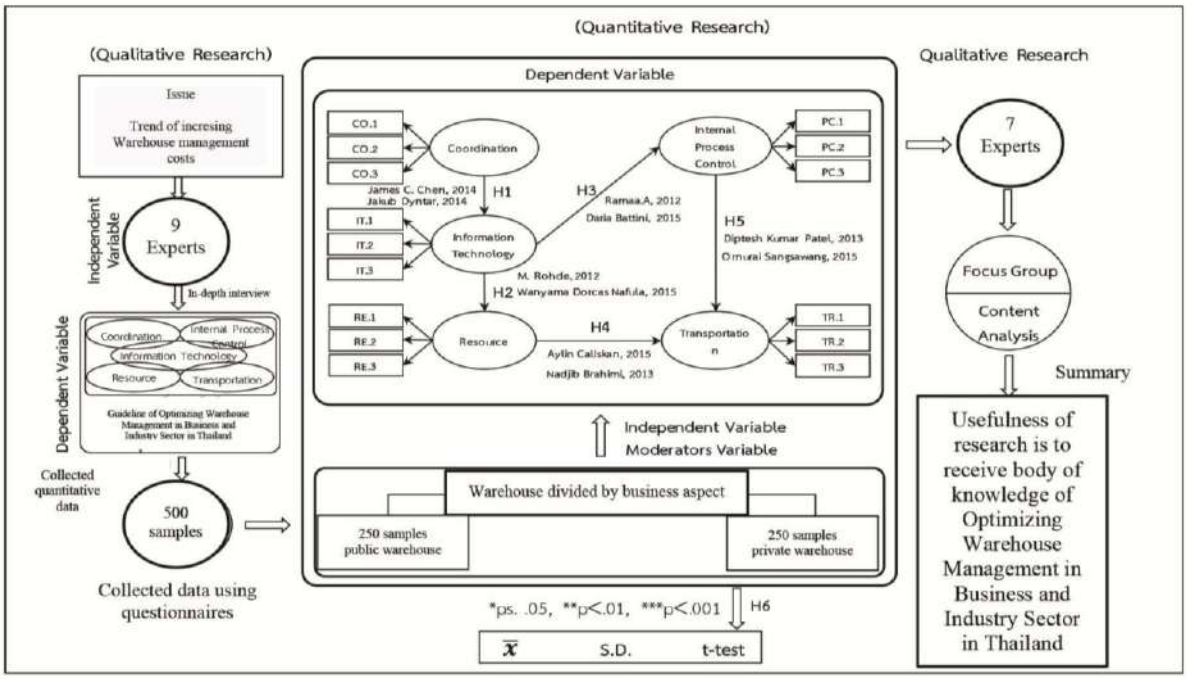

Fig.2 Conceptual Framework of guideline of optimizing warehouse management in business and industry sector in Thailand

4. Research Hypotheses

From research objectives and literature review, six hypotheses were set as follows:
Hypothesis 1 (H1): Composition of coordination has direct effect towards composition of resources
Hypothesis 2 (H2): Composition of information technology has direct effect towards resources composition.
Hypothesis 3 (H3): Composition of information technology has direct effect towards composition of internal process control
Hypothesis 4 (H4): Resources composition has direct effect towards composition of transportation
Hypothesis 5 (H5): Composition of internal process control compositionhas direct effect towards composition of transportation
Hypothesis 6 (H6): The hypothesis testing of significant level of guideline of optimizing warehouse management in business and industry sector in Thailand has shown the differences following warehouse types and business types

5. Research Methods

Qualitative and quantitative research methods were employed in this study. Details of reserach design conssited ofsampling design, measurement design and analysis design were as follows:

5.1Qualitative Research Approach

1. Key informants of this research were experts with the eligibility criteria of experts (Qualifications of experts) as specified by the curriculum administration committee. Purposive sampling method was used for selecting 9 people and divided into 3 groups which were warehouse operators, warehouse management group, and academic groups.

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2. The research tools used in the qualitative research were structured interview which has 5 aspects of interviewing consisted of the coordination, resource, internal process control, information technology, and transportation.
3. Data were collected by in-depth interview and recording opinions from focus group techniques.
4. Content analysis was used for data analysis and then summarizedfollowing the research framework and concluded by writing the questionnaire items for quantitative research.

5.2Quantitative Research Approach

1. Population was business operators and executives of industrial warehouse by classifying the warehouse into personal warehouse and public warehouse.The specifying of the sample size used criteria of the research in the category of factor analysis or structural equation model which specified a very good sample size of 500 samples (Comrey& Lee, 1992, cited in Siljaru, 2020, pp. 45-52)using the multi stage sampling method (Babbie , 2010 referred to in Siljaru, 2020, pp. 61-64)[7] consisted of the cluster sampling procedure, which divided the industrial business into two categories: personal warehouse business group and the public warehouse business group.Probability sampling method was used for sampling design and data collection from this sample group.

2. The research instrument was a questionnaire divided into 4 parts consisted of Part 1, a questionnaire about the general status of industrial business organizations, and the nature is a check list of 6 items. Part 2 was a questionnaire about the general operations of a warehouse business, and it was a check list of 20 items. Part 3 was a questionnaire about how to improve warehouse management efficiency, it wasa rating scale which has criteria for evaluating the weight of the assessment into 5 levels according to the Likert method (Siljuru, 2020, p. 456) of 100 items, and Part 4 was about ideas and suggestions for ways to increase warehouse management efficiency, and it was 4 items of open-end question. The validation of research instruments with content validity analysis was validated for quality by examining the Index of Item-Objective Congruence (IOC) by 5 experts, and it found that the value was between 0.60-1.00, which is greater than 0.50, and is considered to pass the evaluation criteria (Siljuru, 2020, p. 92). After that the questionnaires have been evaluated by experts andtry-out with a population of 30 people with similar characteristics to this study and the results were obtained. From the trial use to analyze In which the power distribution analysis results (discriminant) was a list of questions in the form of a scale estimation by analyzing Corrected Item – Total Correlation, the value was between 0.32-0.62, which is greater than 0.3, is considered to pass evaluation criteria (Siljuru, 2020, p. 415). As for the confidence analysis of the questionnaire by finding Cronbach's alpha coefficient Alpha Coefficient of 0.972 which is greater than 0.8, it is passed the evaluation criteria. The questionnaire has high reliability and can be used in practice to collect data with sample groups.

3. For data collection, the researcher request the samples for collecting data that consisted of entrepreneurs and executives of the warehouse industry both the private warehouse and the public warehouse of 500 people in Bangkok and the surrounding provinces. The researcher has also contacted for cooperation byanswering the questionnaires. If it is not convenient to meet, they can send questionnaires back by post or via electronic media.

4. Data analysis by analyzing general information including descriptive statistics, reference statistics and multiple statistics with the SPSS program (Statistical Packages for the Social Science) and AMOS (Analysis of Moment Structure) program are as follows:

4.1 Data analysis using descriptive statistics consisted frequency, percentage, mean and standard deviation (S.D.)

4.2 Inference statistics to analyze the relationship between variables in pairs of guideline of optimizing warehouse management in business and industry sector in Thailand with bivariate correlations with statistical significance at the level of .001, .01 and .05.

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4.3 The testing of the relationship between the general operations of a warehouse industrial organization is analyzed with Pearson Chi-square values, statistically significant at .05.

4.4 Testing the different ways of increasing warehouse management efficiency in the Thai industrial sector classify the warehouse according to the nature of business with the t-test value. Statistical significance is determined at the level of .05.

4.5 Analysis of structural equation models usesMultivariate statistic, the Structure Equation Model (SEM) of guideline of optimizing warehouse management in business and industry sector in Thailand by using the advanced statistical analysis program AMOS to get relevant statistical data including the interpretation of the test results of the research hypothesis. The model has to be completed by all components of the research.

4.6 Evaluation of the consistency of the model until every latent variable has the consistency with and empirical data by considering with the Chi-square probability level (CMIN-P), Relative Chi-square (CMIN/DF),Relative chi-square (χ^2/df), the Goodness of Fit Index (GFI), the Root Mean Square Error of Approximation (RMSEA), and the RMSEA as a basis for determining the accuracy that can be measured from the RMSEA index and must be less than .08.

6. Results

6.1 Result of general process of warehouse industrial business indicated that it can be divided into 5 compositions and these can be created 100 items of questionnaires that consisted of 20 items of coordination aspect, 20 items of resources aspect, 20 items of internal process, 20 items of information technology, and 20 items of transport aspect.

6.2 Result of guideline of optimizing warehouse management in business and industry sector in Thailand as shown in Table 2.

Table 2 Mean and Standard Deviation of Significant level of Guideline of Optimizing Warehouse Management in Business and Industry Sector in Thailand in overall

Guideline of Optimizing Warehouse Management in Business and Industry Sector in Thailand	$\bar{X}$	S.D.	t-value
Total	3.86	0.44	-3.79*
1. Coordination	3.84	0.47	-3.87*
2. Resource	3.86	0.50	-3.34*
3. Internal Process Control	3.85	0.49	-3.68*
4. Information Technology	3.85	0.46	-3.14*
5. Transportation	3.89	0.51	-3.03*

*p< .05

From Table 2 indicated that the overall of significance was at high level ($\bar{X}$=3.86; SD=.44), Considering each items, it found that all aspects have shown high levels which 1) Coordination ($\bar{X}$=3.84; SD=.47), 2) Resource ($\bar{X}$=3.86; SD=.50), Internal Process Control ($\bar{X}$=3.85; SD=.49), Information Technology ($\bar{X}$ =3.85; SD=.46), and Transportation ($\bar{X}$=3.89; SD=.51).

6.3 Result of model development of guideline of optimizing warehouse management in business and industry sector in Thailand showed as the following analysis.

6.3.1 Analysis result of structural equation model of guideline of optimizing warehouse management in business and industry sector in Thailandbefore and after model improvement was shown as in Fig.3 and Fig.4.

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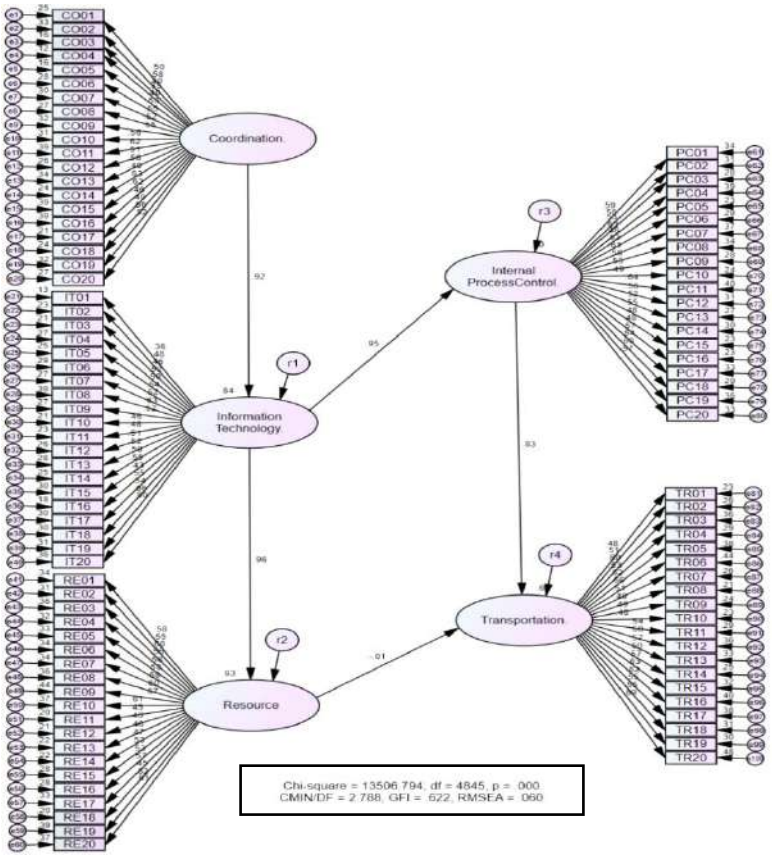

Fig.3 Structural equation model of guideline of optimizing warehouse management in business and industry sector in Thailandbefore model improvement

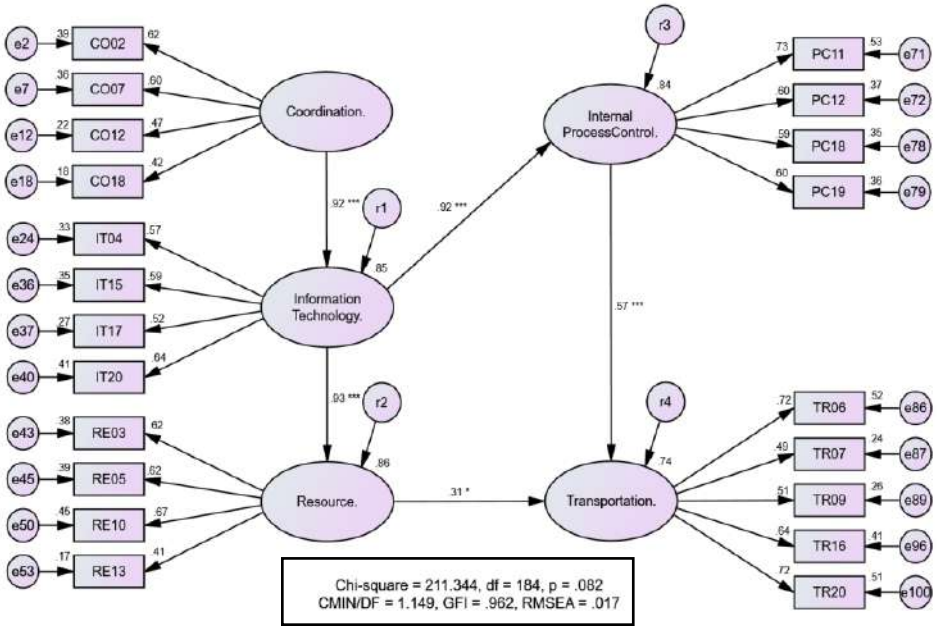

Fig.4 Structural equation model of guideline of optimizing warehouse management in business and industry sector in Thailandafter model improvement

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6.3.2 Result of validated model of structural equation modelof guideline of optimizing warehouse management in business and industry sector in Thailandbefore and after model improvement, and was shown in Table 3.

Table 3 The valuation statistics of the goodness of fit of the structural equation modeling before and after model improvement

Statistics	Criteria to be considered	Before	After
p of Chi–Square	More value than .05	0.000	0.082
CMIN/DF	Less value than2	2.788	1.149
GFI	More value than.90	0.622	0.962
RMSEA	Less value than .08	0.060	0.017

From Table 3 found that The valuation statistics of the goodness of fit of the structural equation modeling before model improvement showed that Root mean square error of approximation (RMSEA) was at .060, Chi–Square Probability Level was.000, CMIN/DF was2.788, and Goodness of Fit Index (GFI) was at .622, it was not pass the criteria of the goodness of fit of model validation. Therefore, the adjustment model was usedModification Indices (M.I.) following the advice of Arbuckle (2016) [8]. Considering the value from analysis program and eliminate observed variables. Then, analyzed and validated the model until have got 4 values of statistical criteria which mean that the model fit with empirical data. Analysis result after model fit showed that p of Chi–Squarewas082. that was greater than .05. It means that this model was not shown significant level. The value of CMIN/DF was at 1.149which less than 2, Goodness of Fit Index (GFI) was at 962. (more value than.90), and Root mean square error of approximation (RMSEA) was at .017 (less value than.08). In summary, this model passed the 4 criteria values of model validation. Therefore, Structural Equation Model of guideline of optimizing warehouse management in business and industry sector in Thailandafter model improvement has the consistency with and empirical data.

Table 4 The statistics of the structural equation modeling after model improvement

Variable	Estimate	R^2	Variance	C.R.	P
Coordination			0.26		
Information Technology	0.92	0.85	0.04	9.28	***
Information Technology		0.85	0.04		
Resource	0.93	0.86	0.04	10.26	***
Internal Process Control	0.92	0.84	0.07	11.32	***
Resource		0.86	0.04		
Transportation	0.31	0.74	0.11	2.20	0.030
Internal Process Control		0.84	0.07		
Transportation	0.57	0.74	0.11	3.96	***

From Table 4, structural equation modelof guideline of optimizing warehouse management in business and industry sector in Thailandafter model improvement consisted of 5 latent variables and was divided into 1 exogenous latent variable which was coordination, and 4 endogenous latent variables which were information technology,resource, internal process control, and transportation.

Coordination found the variance at 0.26affecting direct effect toInformation technology by having Standardized regression weight at 0.92 with statistical significance at .001, Multiple Correlation (R^2) at 0.85, and Variance at 0.04.

Information technology found the variance at 0.04 affecting direct effect to resource by having

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Standardized regression weight at 0.93 with statistical significance at .001, Multiple Correlation (R^2) at 0.86, and Variance at 0.04. Information technology also found direct effect to internal process controlby having Standardized regression weight at 0.92 with statistical significance at .001, Multiple Correlation (R^2) at 0.84, and Variance at 0.07.

Resource found the variance at 0.04 affecting direct effect to transportation by having Standardized regression weight at 0.31 with statistical significance at .05, Multiple Correlation (R^2) at 0.74, and Variance at 0.11.

Internal process control found the variance at 0.07 affecting direct effect to transportation by having Standardized regression weight at 0.57 with statistical significance at .001, Multiple Correlation (R^2) at 0.74, and Variance at 0.11.

7. Discussions

Important issues found in research findings on the guideline of optimizing warehouse management in business and industry sector in Thailand, the researcher has brought the discussion by using relevant research documents to support or contradict 3 items as follows:

7.1 According to the research of the importance level of the guideline of optimizing warehouse management in business and industry sector in Thailand, it was found that the aspect with the highest average value was transportation with an average score of 3.89, and having a high level of importance. This result corresponds to the study of Sangsawang, O. and Somthong, S. [9] studied about Capacitated Vehicle Routing for the Transportation of Construction Materials that able to use Heuristic Algorithm to help in the planning Routing. The result of this method was that it can reduce the overall transportation distance by 10.91%.

7.2 According to the research, it was found that the guideline of optimizing warehouse management in business and industry sector in Thailand when considering each item showed that the manager or supervisor should be informed of the product entry plan from the purchasing department with an average score of 3.99 (S.D. = 0.79) with a high level of importance and also has the highest average value. This was consistent with the Dyntar[10] study of Application of Agent-based Supply Chain Modeling in Intralogistics System Design and Optimization. It was found that the data flow and material flow are caused by good managementrelying on the collaboration of people in the organization. In this research, the simulation uses representatives from 5 parts consisted of procurement, warehousing, production, transportation, and retail.

7.3 According to the research, it was found that the importance level of the guideline of optimizing warehouse management in business and industry sector in Thailand as a whole, the classification of warehouses by business type is different, statistically significant at the 0.05 level. This result was in accordance with the research hypothesis set and related to the study of Daraei's[11]of Warehouse Redesign Process: A Case Study at Enics Sweden AB found that the development of warehouse system design, all of the design topics can be used to design different types of warehouse systems according to the characteristics of the products to be stored and maintained.

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8. Recommendations

8.1 Recommendations from research results

Guidelines to increase warehouse management efficiency in the Thai industrial sector, it is a business practice that focuses on the competitive advantage strategy for the industrial sector and increases the country's competitiveness. The researcher has suggested 4 directions as follows:

1. Government agencies can be used as guidelines for determining measures or related laws as well as determining the development plan for logistics management In order to improve the ability to compete at the international level.
2. The business sector can apply guidelines to increase the efficiency of warehouse management in the Thai industrial sector in order to apply as a strategic plan or business plan to drive the business in various situations efficiently and with stability.
3. Business sectors can use components and variables obtained from the study of the guidelines for increasing the efficiency of warehouse management in the Thai industrial sector and applied to be able to compete in the business.
4. In education context, it can be used as an academic curriculum document or as a case study by including additional content in related subjects such as business administration and logistics management.

8.2 Recommendations for further research

1. Should extend more study about ways to increase warehouse management efficiency in the Thai industrial sector about how to develop models to be more effective.
2. Should study more about inventory management because it is a major factor that directly affects warehouse management.

9. Conclusion

The guideline of optimizing warehouse management in business and industry sector in Thailand is a business practice that focuses on the competitive advantage strategy for the industrial sector and increases the country's competitiveness. From the studied found that general process of warehouse industrial business can be divided into 5 compositions consisted of Coordination, Information technology,Resource, Internal process control, and Transportation, and these can be created 100 items of questionnaires. After model improvement, there were 5 latent variables and were divided into 1 exogenous latent variable which was Coordination, and 4 endogenous latent variables which were Information technology,Resource, Internal process control, and Transportation. Structural Equation Model of guideline of optimizing warehouse management in business and industry sector in Thailandafter model improvement has the consistency with and empirical data.Analysis result after model fit showed that p of Chi–Squarewas0.082 , the value of CMIN/DF was at 1.149, Goodness of Fit Index (GFI) was at 962., and Root mean square error of approximation (RMSEA) was at .017. Recommendations for further research, it should extend more study about ways to increase warehouse management efficiency in the Thai industrial sector about how to develop models to be more effective, and should study about inventory management which is a major factor that directly affects warehouse management.

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