ปัจจัยเชิงสาเหตุในการนำเทคโนโลยีอาร์เอฟไอดีมาใช้ที่มีอิทธิพลต่อประสิทธิภาพการจัดการโซ่อุปทานของธุรกิจผ่านกระบวนการจัดการด้านโลจิสติกส์ กรณีศึกษาอุตสาหกรรมอาหารแช่แข็ง ในประเทศไทย

CAUSAL FACTORS IN RFID TECHNOLOGY UTILIZATION INFLUENCING BUSINESS SUPPLY CHAIN MANAGEMENT EFFICIENCY THROUGH LOGISTICS MANAGEMENT PROCESS A CASE STUDY OF FROZEN FOOD INDUSTRY IN THAILAND

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บทคัดย่อ

งานวิจัยฉบับนี้นี้มีวัตถุประสงค์เพื่อศึกษาผลกระทบที่มีต่อประสิทธิภาพของห่วงโซ่อุปทาน โดยการใช้เทคโนโลยีอาร์เอฟไอดีถูกใช้เป็นตัวแปรอิสระ การจัดการโลจิสติกส์เป็นตัวแปรคั่นกลาง และประสิทธิภาพการจัดการโซ่อุปทานเป็นตัวแปรตาม กลุ่มตัวอย่างคือผู้บริหารหรือผู้เชี่ยวชาญด้านไอทีขนาดกลางและขนาดใหญ่จำนวน 315 คน คัดเลือกโดยการสุ่มตัวอย่างแบบแบ่งชั้นตามวัตถุประสงค์จากอุตสาหกรรมอาหารแช่แข็ง วิเคราะห์ข้อมูลโดยใช้แบบจำลองสมการโครงสร้าง (SEM) ซึ่งนำโครงสร้างแบบจำลองไปประยุกต์ใช้กับการทดสอบแบบจำลองสมมุติฐาน ผลลัพธ์ระบุว่าแบบจำลองมีสัดส่วนและการถดถอยของสมมติฐานทั้งหมดได้รับการยอมรับด้วยค่า $p < 0.05$ ส่วนผลการตรวจสอบความสอดคล้องและกลมกลืนมีความสอดคล้องกับข้อมูลเชิงประจักษ์และองค์ประกอบย่อยของโมเดลเชิงโครงสร้าง โดยมีค่า $\chi^2/df = 2.516$, GFI = 0.942, AGFI = 0.899 , RMR = 0.60, RMSEA = 0.69 , NFI = 0.975, CFI = 0.984 (p-value < 0.01 พบว่าการใช้เทคโนโลยีอาร์เอฟไอดีไม่มีผลกระทบโดยตรงต่อประสิทธิภาพของโซ่อุปทาน นอกจากนี้ผลกระทบทางอ้อมยังแสดงให้เห็นในการจัดการโลจิสติกส์ ซึ่งระบุว่าควรนำเทคโนโลยีอาร์เอฟไอดีมาใช้ในองค์กรร่วมด้วยการจัดการโลจิสติกส์ที่เหมาะสม

คำสำคัญ: เทคโนโลยีอาร์เอฟไอดี การดำเนินงานด้านโลจิสติกส์ ประสิทธิภาพโซ่อุปทาน

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Abstract

The objective of this research was to study the impact on supply chain efficiency. RFID technology utilization was an independent variable. Logistics management was an intermediary variable, while supply chain management efficiency was the dependent variable. Samples consisted of 315 medium- and large-sized IT executives or professionals in the frozen food industry selected by objective stratified sampling. Data were analyzed using structural equation modeling (SEM), which applied model structure in hypothetical models testing. Results indicated that the model was proportional where all the regression assumptions were accepted with p value < 0.05. The results of the consistency and harmony checked were consistent with the empirical data and the subcomponents of the structural model, with the value χ^2/df. = 2.516, GFI = 0.942, AGFI = 0.899, RMR = 0.60, RMSEA = 0.69, NFI = 0.975, CFI = 0.984 (p-value < 0.01). It was found that RFID technology utilization had no direct impact on the efficiency of supply chain however, indirect effects were also shown in logistics management. It was stated that RFID technology should be utilized in the organizations with proper logistics management.

Keywords: RFID technology, Logistics Management, Supply chain Management Performance

Background and Significance of Problems

At present, the growth of global food industry has been rapidly expanded. Strategies such as Information Technology, RFID, ERP, or Robotic System have been brought to assist in the operation for the organization achievement.Haddara and Elragal (2015), especially, in Thailand where many food industries have produced and exported goods to support for both domestic and international consumption. Thus, in Thailand, food industry business is considered as the main industry with high potential production for domestic consumption and export. This is because Thailand has the firmly basis of agricultural production, as a result, the products can be used as raw materials for various and continuous transformations. There are many qualified workers, advanced technologies, and products development that conform more to the needs of market. Food industries with the core production in Thailand are fishery processing group such as shrimp, tuna, flour and grain processing group; livestock processing group; fruits and vegetables processing group; sugar processing group; and, processing group for domestic consumption such as vegetable oil, milk, animal food, etc. (Sapbamrer et al., 2023).

Bringing RFID technology to help in organization administration is considered as a part that can increase the operation efficiency in food supply chain in the former form (Angeles, 2005). Food quality and safety traceability system is a data management system that links between production, inspection, supervision, and consumption in order for the consumers to understand on the processes of production and distribution that conform to health and safety rules for the consumers' confidence. Food traceability relies on networking and database

technology to achieve data fusion, inquire, investigate, and offer reasonable decision for safety on each piece of product, food mixtures, and inventory control for each production and distribution process. It uses food safety early warning mechanism, production, transformation, circulation, and consumption; where all the processes are under strict controls. The complete food safety control system has been set within industrial supply chain for the confidence in supplying food quality to the community and guarantee for high quality data exchanging in food supply chain. Thus, for the food industry to follow up food sources in details to create full transparency in food industry supply chain. On the part of supply chain administration, under RFID technology utilization, efficient guideline for logistics operation has been brought and currently having greater role since food products contain different processes and procedures from other products. Starting form supplying raw materials into production process, storing, products distribution, and delivery to customers Regattieri (2007). Therefore, all processes of food products movement required efficient control procedures as the key variable to gain benefits and to remain on standard and quality that would help preserving freshness and extending food products' life, as well as adding more values to the products. According to the information, it can be seen that food industry achievement depends on number of factors either on technologies applying for the utmost benefits, plus such technology shall capable to increase the supply chain administration efficiency from the upstream production to the downstream. Thus, frozen food industry also has another key factor which is a transportation that could form up competitive advantages in the industrial operation in which higher at recent. (Akram et al., 2023).

According to such background and significance of problems, the researcher interested to study on the influence of RFID technology over the supply chain management performance through logistics management process: the case study of frozen food industry in Thailand. Thus, to be a guideline for organization adjustment in order to be able to form differences and for the organizations to achieve the business operation success. It is interesting to study and seek for the improvement to add more supply chain efficiency to support for further decision on either short term or long term strategic planning for businesses in frozen food industry.

Research Questions

1. How significant is RFID technology utilization in logistics management process by frozen food industry of Thailand?
2. How can RFID technology utilization increase supply chain management performance in the frozen food industry of Thailand?
3. How do logistics management processes affect on supply chain management performance in the frozen food industry of Thailand?

Research Objectives

1. To study the factors supporting RFID technology utilization with effects on supply chain management performance in the frozen food industry of Thailand.

2. To study on the relationship of RFID technology utilization in logistics management processes and the effects on supply chain management performance in the frozen food industry of Thailand.

3. To study on the success of RFID technology utilization with the effects on the current supply chain management performance in the frozen food industry of Thailand.

Literature Review

RFID Technology

Tikwayo and Mathaba (2023) state that RFID technology still be a technology that could be efficiently utilized in warehouse management because this allows for convenience in products movement control, details, and type of products. It also allows for more operational efficiency, while reducing the operation processes from products counting, receiving records, and adding more accuracy in products arrangement; including sales information in which facilitate for speed in supply chain management. Besides, real-time products status monitoring would allow for the production planning either on quality auditing, wastage monitoring, or production capacity in logistics process for the production plant. RFID technology plays a crucial role in production planning especially, in food industry that more of problems come from wastage during transportation, food processing, and food safety which are the three main issues. RFID technology has partly entered to make the production process visible and inspectable.

Botilias et al. (2023) state that RFID technology is useful for the traceability, especially in food industry. When observing the production process in Real Time, the entrepreneurs and the relevant would immediately see the condition of products. When it comes to chemical contamination and pathogenic microorganisms in food, RFID technology allows us to check whether where the mixtures come from, which date and time, and the remaining product's Shelf Life, or whether the food is safe for consumption or not. Since food industry importantly relies on freshness, RFID could answer the needs in both traceability, including visibility of safety, decision, FIFO, and accuracy.

Logistics Management Process

Liu et al. (2023) state that the transportation of product materials and raw materials between manufacturers and consumers is a crucial step in the production process, the arisen cost is unavoidably important in product pricing. Efficient products transportation and distribution would partly help decreasing the production costs and price of products in which having direct effect on the consumers, community and national economy. Understanding the principle of products transportation and raw materials' quality preservation by using cold

chain principle in food and beverage industry would allow the organization to gain business competitive advantages. Thus, Logistics component has the role starting from raw materials supplier, production process, delivery to products distributors and sellers, then customers at the end; such movements generate higher values into the products. Judijanto et al. (2024) products distribution requires to apply logistics as it is the transportation management and products administration from the production until consumption. Products distribution business could also be divided into many types, no matter the products distribution for procurement, goods distribution for production and goods distribution for sale. In general, products distribution is related to three major tasks: products storing in warehouse, packaging, and products delivery.

Supply Chain Management Performance

Hugos (2024) states that supply chain management performance is the mixed between business processes from raw materials supplier through production process or manufacturing industry to the consumers. These processes transfer information and products altogether and would result on values added to such products before presenting to consumers. It can be seen that supply chain management system network has thoroughly covered the whole industry system. Supply chain has a key role toward the firms that aim at business competitive advantages by the firms add values to overall products using all the resources from across the company. Thus, supply chain working system will cover all the relevant either direct or indirect units to respond to the needs of customers in the supply chain including manufacturers and suppliers, transportation, warehouses, retailers, even or the customers themselves. Within each organization, all the functions are merged from raw materials receiving until the parts required by customers, including new products development, marketing, distribution and finance.

Theory of Decision Support Systems (DSS)

In an era of rapid technological changing and increasing business competition, a decision support system (DSS) plays the major role to assist the organization in decision making and solving complicate problems. According to (Bandyopadhyay, 2023). DSS system was mentioned as an efficient tool to gather, process, and analyze data in supporting for the management decision. Concepts and theories related to DSS system are then interesting and crucial for the organizations to apply for more efficiency in decision making and problem solving in digital era. Cantini et al. (2024) state that the key element here is database that gathered all necessary data for decision forming and the part of User Interface that allows users more conveniently and effectively to communicate with DSS system. The characteristic of DSS system has focused on helping in decision forming rather than replacing management's decision by information from diverse models. It provides support on decision making with flexibility and can be adjustable according to user's needs. There are two types of DSS system: 1) Specific-purpose DSS that aimed to help making decision on specific aspect or function;

and, 2) General-purpose DSS that can be applied for decision making on various aspects. Therefore, DSS system is an important tool for the organization to assist the management in forming efficient decision using data and various models.

Therefore, it can be seen that DSS theory or theory of Decision Support Systems helps reducing time, cost, and risk in decision making. It could also be applied in various business aspects such as planning, resources management, and supply chain management. Thus, understanding theories and application of DSS system are crucial for the organization to effectively make the decision and solve the problems in digital era (Talari et al., 2022).

Research Conceptual Framework and Hypotheses

Hypothesis 1 (H1): RFID technology utilization has positive effects on logistics management process.

Hypothesis 2 (H2): Logistics management process has positive effects toward supply chain management performance.

Hypothesis 3 (H3): RFID technology utilization has positive effects on supply chain management performance.

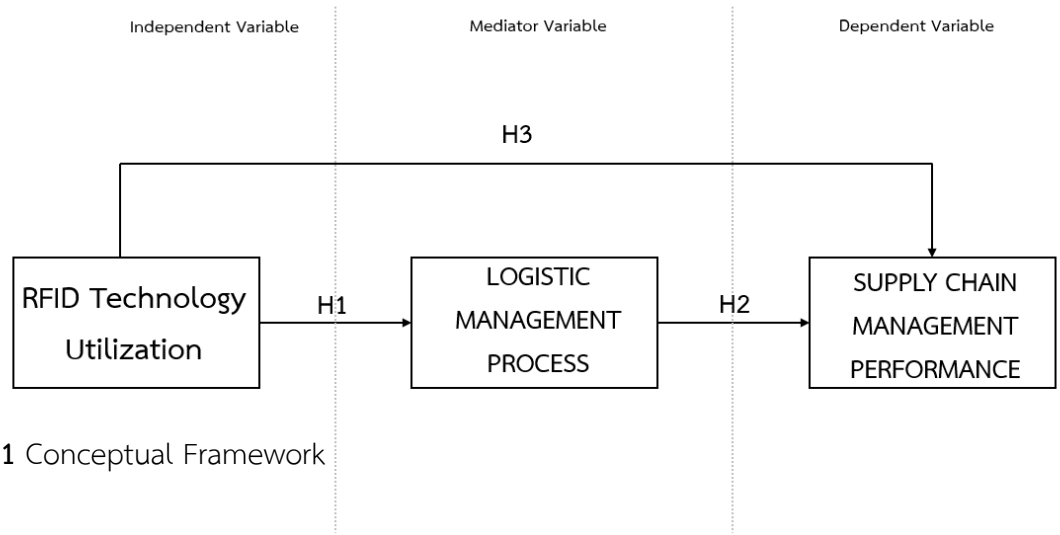

Figure 1 Conceptual Framework

Research Methodology

Populations and Samples

Populations were selected from the organizations with registered capital in frozen food business more than 50 million baht onward and utilized RFID technology in their operation. Sample populations were those information technology management and CIOs in the frozen food industry organizations. Populations could be divided into 14 groups from the amount of 1,094 places. Sample size was defined by considering on the proper size of samples by SEM : Structural equation model analysis (Sarstedt et al., 2014). According to literature review, it was found that appropriate sample size for SEM : Structural equation model

analysis should be about 20 times fold of the observed variables (Hair et al., 2012) This research contained with 15 observed variables, therefore, the research sample size should not be less than 300 samples. Stratified Random Sampling was applied.

Research Instruments

The researchers in this study designed questionnaire as a tool for data collection. This tool was divided into three main parts.

1) General information of the respondents in form of Multiple Choice.

2) Opinion toward level of causal factors in RFID technology utilization that have influence toward the business supply chain management performance via logistics management process using Mean and Standard Deviation. When Mean was obtained, it would be interpreted. The characteristic of the questionnaire was in form of Rating Scale for 30 items. These covered all the research concepts such as paying attention to the significance of RFID technology utilization, logistics management process, and supply chain management performance. The assessment weight values were set into 7 levels comparing with Likert 7 Scale (Joshi et al., 2015).

3) Recommendations from respondents were separated into each aspect and concluded into items, in case of repeated recommendation, only one item was written with explanation. Testing the reliability and validity of measuring instrument was done via Content Validity method which was to test on the validity of question items by calculating on an Index of item Objective Congruence: IOC. As the questionnaire was sent to three specialists, it was found that the mean of an Index of item Objective Congruence: IOC value was acceptable at 0.92 since the acceptable criteria was set to be greater than 0.50. Next, the researcher brought the draft of questionnaire that passed the specialists' revised to try-out on the group of population with similarity to the group to be studied for 30 sets. The researcher checked on the confidence by Cronbach's Alpha Coefficient, α (Cronbach, 1951) and found that an Alpha Coefficient value was acceptable at 0.935 from the acceptable criteria that was set to be greater than 0.70.

This referred that the questions contained high confidence and be able to further use as a questionnaire for data collection. This research had passed the human research ethics approval according to the consideration on document COE No.003/2023 and URU-REC No.064/2566 dated 29 August 2023, Uttaradit Rajabhat University. It took four months to gather data from September – December 2023. There were 326 questionnaire respondents. Next, Data Cleaning was conducted to form appropriate data for the analysis and 315 respondents found having complete information and to be further proceeded.

Data Analysis

1. Descriptive statistics were used to describe the results of preliminary data analysis to consider the data from samples in different contexts using statistics such as percentage, mean, and standard deviation.

2. Inferential statistics analyzed data via Structural Equation Model: SEM analyzed data to check on the variables' reliability via the method of Convergent Validity and Discriminant Validity. Later, there was an assessment on the appropriateness of data model.

Research Results

According to this research, the researcher studied on casual factors of bringing RFID technology to use with effects on business supply chain management performance through logistics management processes: case study of frozen food industry in Thailand. The researchers divided the analysis results into two parts as follows.

Part 1 General information of questionnaire respondents

It was found from the results that most of questionnaire respondents or 220 of them were male accounted to be 69.8 percent, while 95 were female accounted to be 30.2. Most of respondents aged around 31-40 years old, or accounted to be 44.8 %. Most of respondents or 238 of them were graduated with Bachelor's degree accounted to be 73.2 percent, and most of them were married at about 79.8 percent. Considering on an education aspect, it was found that respondents with Bachelor's degree had most responded to the questionnaire at 63.8 percent. Mostly, they had around 11-15 years of working experience or accounted to be 47.6. And, most of them or 34.3 percent worked as division managers.

Part 2 Structural Equation Model: SEM

1. After collecting 315 questionnaires, the next step was to test reliability, which is one of the requirements in the structural equation model. Observed variable should be reliable therefore Cronbach's Alpha Coefficient was under an acceptable criteria or more than 0.7. After the reliability testing, results of variable groups were shown as in Table 1.

Table 1 Reliability Testing

Observed Variable	Item	Cronbach's Alpha	M	S.D.
Utilizing RFID technology to increase speed	RFSP_Avg	.888	6.25	.696
Utilizing RFID technology in management	RFMA_Avg	.883	6.26	.705
Utilizing RFID technology in strategic planning	RFPL_Avg	.887	6.26	.731
Utilizing RFID technology in decision making	RFDS_Avg	.886	6.25	.724
Utilizing RFID technology for maintenance	RFMT_Avg	.882	6.26	.710
Logistics operations Inspection and Tracking	LOCHK_Avg	.884	6.24	.620
Logistics operations in terms of speed and customer satisfaction	LOSATI_Avg	.879	6.27	.686
Reliable logistics operations	LOTRU_Avg	.879	6.15	.687
Competitive logistics operations	LOCOMP_Avg	.881	6.21	.721
Logistics operations in terms of quality control and time management	LOTIM_Avg	.877	6.19	.716

Table 1 Reliability Testing (Cont.)

Observed Variable	Item	Cronbach's Alpha	M	S.D.
Supply chain management in terms of planning work processes and managing resources	SPSTE_Avg	.880	6.27	.591
Efficiency of supply chain management in reducing costs	SPCOST_Avg	.879	6.26	.695
Efficiency of supply chain management in terms of revenue	SPINC_Avg	.885	6.22	.869
The effectiveness of supply chain management in terms of profit	SPPROF_Avg	.885	6.29	.833
The effectiveness of supply chain management in terms of sustainability	SPSUST_Avg	.881	6.29	.832
Total average results		.889	6.24	.721

From table 1, researchers defined the meaning of variables in all three groups from the literature review and according to the above conceptual framework as follows: Independent Variable consisted of RFSP_Avg, RFMA_Avg, RFPL_Avg, RFDS_Avg, and RFMT_Avg; Mediator Variable consisted of LOCHK_Avg, LOSATI_Avg, LOTRU_Avg, LOCOMP_Avg, and LOTIM_Avg; and, Dependent Variable consisted of SPSTE_Avg, SPCOST_Avg, SPINC_Avg, SPPROF_Avg, and SPSUST_Avg. Thus, all the variables in the reliability testing showed with score of Cronbach's Alpha that higher than 0.7 which referred to that they were reliable.

2. Construct Validity was to create the Structural Equation Model including the Convergent Validity for values testing that could reveal the latent variable, as well as Discriminant Validity, the test could reveal the observed variable to the same latent variable. This was not related to the observed variable of other latent variables as can be seen in Figure 2.

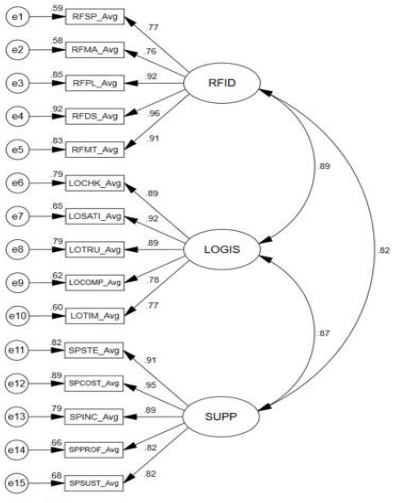

Figure 2 Confirm Factor Analysis: CFA

Table 2 Factor loading weight of the independent variable, Average Variance Extracted: AVE value, values of R2 and Composite Reliability: CR.

FACTOR	Factor Loading	R^2	CR	*AVE*
RFID TECHNOLOGY			0.938	0.867
RFSP_Avg	0.77	0.592		
RFMA_Avg	0.76	0.577		
RFPL_Avg	0.92	0.846		
RFDS_Avg	0.96	0.921		
RFMT_Avg	0.91	0.828		
LOGISTICS MANAGEMENT PROCESS			0.930	0.852
LOCHK_Avg	0.89	0.792		
LOSATI_Avg	0.92	0.846		
LOTRU_Avg	0.89	0.792		
LOCOMP_Avg	0.78	0.608		
LOTIM_Avg	0.77	0.592		
SUPPLY CHAIN MANAGEMENT PERFORMANCE			0.944	0.879
SPSTE_Avg	0.91	0.828		
SPCOST_Avg	0.95	0.902		
SPINC_Avg	0.89	0.792		
SPPROF_Avg	0.82	0.672		
SPSUST_Avg	0.82	0.672		

According to table 2, the results of accuracy testing on the values of Factor Loading, Average Variance Extracted: AVE, R^2, and Composite Reliability: CR of the model that the researchers assessed for the accuracy was divided into two types: Convergent Validity and Discriminant Validity. The results of Convergent Validity test of Factor Loading must higher than 0.6, while the test showed that Factor Loading value was between 0.6 and 0.9, or in appropriate criteria. Besides, the value of R^2 from the test was around 0.577 to 0.921 which was acceptable, while Composite Reliability: CR value of the latent variable was in the range between 0.930 - 0.944, which was also acceptable. Lastly, Construct reliability value of the latent variable and its Average Variance Extracted: AVE was in the range between 0.852 - 0.879 or higher than 0.5 which was considered as proper.

3. Discriminant Validity of explainable response variable or squared correlation value was around 0.82 to 0.89, in which the acceptable range was equal or higher than 0.2 but not more than 1.00. Discriminant Validity can be checked by the comparison between the values of Average Variance Extracted: AVE and Squared correlation Hair Jr. et al. (2021). Also, the researchers had proofed on the tool's Discriminant Validity from the Average Variance Extracted: AVE value that should be higher than Squared correlation as suggested by Fornell and Larcker (1981). Results of Discriminant Validity test were shown in table 3.

Table 3. Discriminant Validity

FACTOR	RFID	LOGIS	SPCM
RFID	0.867		
LOGIS	0.795	0.852	
SPCM	0.682	0.756	0.879

Discriminant validity square root of AVE on the diagonal line

4. Construct Model, the results of SEM testing can be explained as follows: the value of Chi-Square = 130.828, Degree of freedom = 52, Relative Chi-square = 2.516, Chi-square of fit Statistic P=0.000, Goodness of Fit index : GFI = 0.942, Adjusted Goodness of Fit Index: AGFI = 0.899, Root mean square residual : RMR = 0.060, Root Mean Square Error of Approximation: RMSEA = 0.069, Normed Fit Index: NFI = 0.975, Comparative Fit Index: CFI = 0.984, and Hoelter model = 189 (0.01).

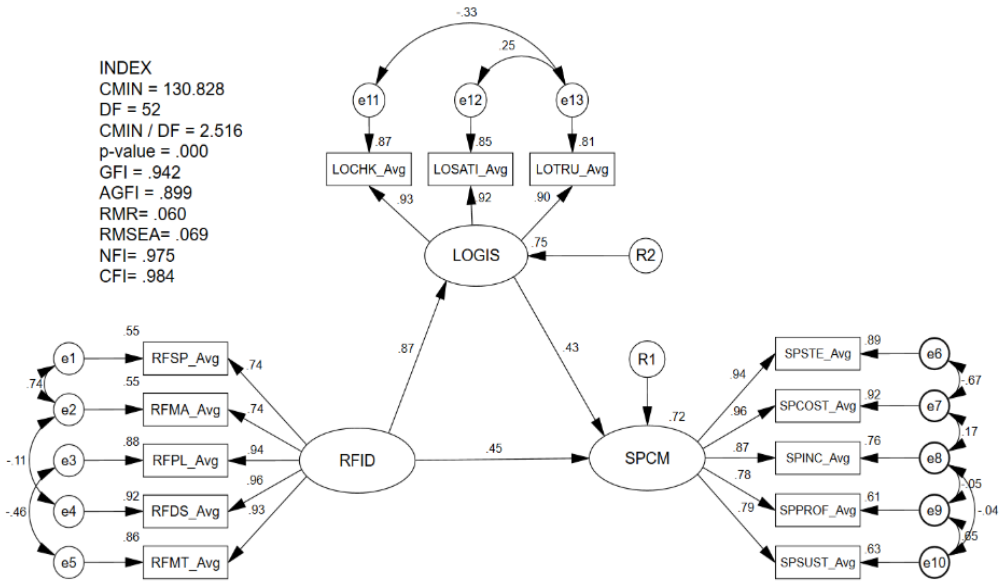

Figure 3 RFID technology utilization structural model has an influence on the business supply chain management through logistics management processes.

5. Direct Effect and Indirect Effect

From the analysis on the effects between an independent variable which was RFID technology utilization with direct effect on the dependent variable which was the supply chain management performance, besides, independent variable also had indirect effect on dependent variable by transferred through Mediator Variable which was the logistics management process as can be seen in Table 4.

Table 4 Direct Effect and Indirect Effect

Dependent Variable	R^2	Direct Effect			Indirect Effect			Total Direct Effect		
		RFID	LOGIS	SPCM	RFID	LOG	SPCM	RFID	LOG	SPCM
RFID										
LOG	0.75	0.865***						0.865***		
SPCM	0.72	0.447***	0.428***		0.370***			0.818***	0.428***	

*** Statistically significant at the level 0.001

6. Conclusion of Model Analysis

According to model analysis, results revealed positive effect from bringing RFID technology to use toward supply chain management performance. RFID technology utilization had direct positive results toward supply chain management performance and logistics management process as shown in figure 4.

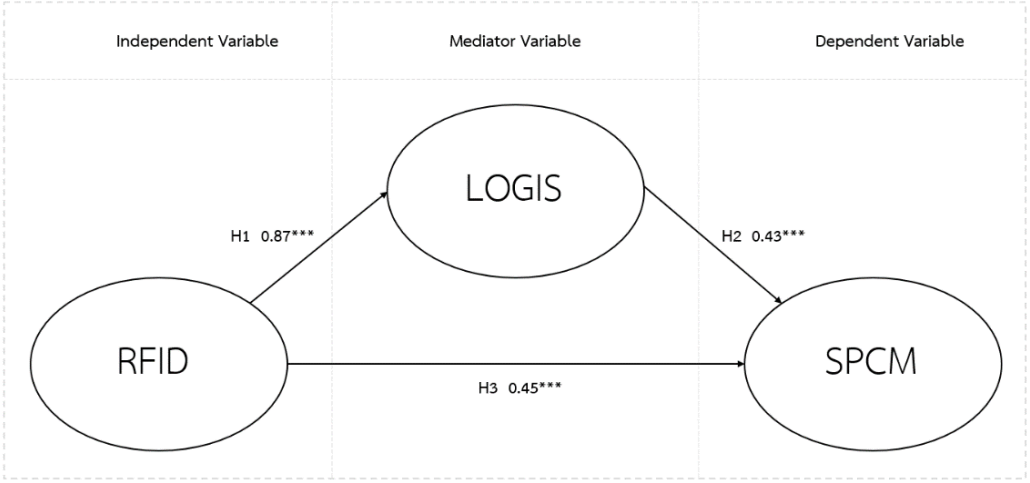

Figure 4 Summary of model analysis

7. Hypotheses testing

The analysis of hypotheses from figure 4 can be concluded as follows:

Hypothesis 1 (H1): RFID technology utilization has positive effects on logistics management process. From the analysis on the relationship, it was found that RFID technology utilization had positive effect on LOGIS with path coefficient = 0.87. Therefore, hypothesis H1 was accepted. Next, Hypothesis 2 (H2): logistics management process had positive effect toward supply chain management performance. From the relationship analysis, it was found that LOGIS had positive effect toward supply chain management performance (SPCM) with the value of path coefficient = 0.43. Therefore, hypothesis H2 was acceptable. Hypothesis 3 (H3): RFID technology utilization had positive effect on supply chain management performance and from the relationship analysis, it was found that RFID technology utilization had positive effect on supply chain management performance (SCMP) with the value of path coefficient = 0.45). Thus, hypothesis H3 was accepted.

Research Conclusion and Discussion

This research aimed to study on factors supporting RFID technology utilization in which having the influence on supply chain management performance through logistics management processes in frozen food industry in Thailand. Hypotheses stated that RFID technology utilization had positive effect toward supply chain management performance through logistics management processes. Independent variable was the RFID technology utilization in the operation, supply chain management performance was the dependent variable, logistics management process was the mediator variable. Populations in this study were the frozen food business organizations with registered capital that higher than 50 million baht onward and utilized RFID technology in the operation. According to the data from Department of Business Development of Thailand (2023), overall there were about 1,094 companies. Sample populations were the information technology management or CIOs officers of the organizations in the frozen food industry. Sample size was calculated using Stratified Random Sampling method. After the questionnaire distribution and retrieved them back by Data Cleaning, there were about 315 samples.

Research results as considering from research question no. 1 "How significant is RFID technology utilization in logistics management process by frozen food industry of Thailand?" in which conformed with Hypothesis 1 (H1) RFID technology utilization has positive effects on logistics management process found with conformity to the study by Melski et al. (2008) who studied on data management of RFID system in transportation sector. According to such research, it was found that logistics management system was designed to attach with tags and specific code of product to link product information with an ID, then, sending data to administrative server for higher storing efficiency. While logistics management was crucial for the success in retail industry especially, the growing e-commerce sector. This conformed with Hunt et al. (2007) who found that RFID technology had been applied in commercial ways including supply chain management that allowed for real-time tracking and product inventory management to improve the operational efficiency, adding customers' experiences, and assisting for better inventory control. Next, it conformed with the research by Voipio et al. (2008) in which found that RFID technology could help improving accuracy, tracking efficiency, and tag inventory management. By RFID technology could easily scan and read, reducing necessity of human counting and mistake. Moreover, it resulted on more inventory circulation by RFID tags allowed for quick inventory products searching and data retrieving. This led to faster purchasing order management, while reducing out of stock situation.

When considering on research question no. 2 "How can RFID technology utilization increase supply chain management efficiency in the frozen food industry of Thailand?" in which conformed to Hypothesis 3 (H3) that RFID technology utilization has positive effects on supply chain management performance, from the research results, it was found to support the study by Delen et al. (2007) who suggested that RFID technology had the potential to

help us see and real-time products inspection that would lead to higher efficiency and lower cost of supply chain operation. For example, on traceability and inventory management, applying RFID technology could help the manager in tracking and managing inventory in more efficient way. It has no need to scan barcode like in other technologies or on the aspect of reducing error in products or materials tracking by making the relevant information in automatic form. This would easily reduce slow data feeding and errors, including the issue of adding more precision in purchasing prediction. Later, it was found to conform to the research by Smith (2020) who studied on the relationship between RFID technology and supply chain. The research found that RFID technology was widely adopted in any industries such as production, retailers, sale and marketing.

When considering on research question no. 3 "How do logistics management processes affect on supply chain management performance in the frozen food industry of Thailand?" that conformed to Hypothesis 2 (H2) "Logistics management process has positive effects toward supply chain management performance", the study found to support Min et al. (2016) research who studied on the role and relationship between logistics management processes and supply chain management performance. They found that logistics supply chain management system that consisted of management module and data receiving module seemed possible to track the amount of products at each link of supply chain. It would also improve the overall efficiency of the supply chain by urgently adjusting the product usage by paying attention to the study on the issue to reduce delay. It was found that logistics process improvement such as reducing transportation time, or to increase higher flexibility in products delivery could lower the operation delay. This has directly resulted on supply chain performance and on the issue of cost saving, it was found to add more logistics processes efficiency such as reducing wastage from transportation or the need to storing products.

Research Suggestion

Thus, to bring the results from the research on RFID technology utilization influencing business supply chain management performance through logistics management process in frozen food industry to apply for the usefulness and to develop the appropriateness and benefits for businesses in the frozen industry, the researchers would like to suggest some guidelines and recommendations for the operational adjustment to increase the supply chain efficiency. This could be done through various methods as follows.

1. Frozen food industry shall focus on policy launching based on the operational objectives toward the strategic planning for the RFID technology utilization that suite for work processes. Next the organization shall focus on an administrative supporting via RFID technology utilization. This shall include the focusing on RFID technology applying in deciding for further operation. Moreover, to require the organization to pay importance on maintenance and backup of data from RFID technology operation. Besides, the focus should be on the

management of products quantity and at the end focusing more on logistics management performance.

2. The organization shall have both short-term and long-term plan for RFID technology investment. It should be included in the organization strategy to allow for the flexibility to accept changes in higher competitive economic and environmental conditions. According to the operation planning for the Development of Thailand's Logistics System of year 2023-2027 in which developed under 20-year strategic and National Economic and Social Development Plan No. 13 which is a continuation of the Strategic Plan for the Development of Thailand's Logistics System No. 3 year 2018-2022. The aim is to push logistics system as the key mechanism to drive Thailand toward a main sub-regional and regional trading gateway. The results from this study should be brought for further consideration and analysis for the utmost benefits of the strategic planning by the government in the future.

3. The government or government units can bring this research on logistics management to apply in the future to develop the national policy on logistics system in order to support the entrepreneurs to have higher efficiency in logistics management. Since logistics are the important part of economics infrastructure and having significant influences on trade and economic development of the nation. Therefore, the growth of logistics in Thailand has some factors affected on the continuing growth such as logistics infrastructure development for instance, ports, airports, and public transportation.

Recommendations for Future Research

For researches in the future, researchers suggested to study on the relationship of brining RFID technology to apply and supply chain performance in each aspect, especially in strategic planning, planning for production, transportation, and resources management that conformed and suited to changes in current condition. Since this was a cross-sectional study that specifically aimed at the frozen food industry, thus future research should conduct a long-term study for high level of knowledge such as EDI technology, Cloud Computing, BIG DATA Technology and Block Chain with partly logistics management to support in other industries for example, automotive industry, electronic industry, etc. Besides, an issue of logistics management consists of various patterns of transportation, thus, future researcher shall study on the specific types of transportation such as air transportation, high speed rail transportation, and sea transportation in order to seek whether which modes could join to enhance toward the highest efficiency in supply chain performance.

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