Factors Influencing Innovative Inventory Pooling System (IIPS) Adoption for Retail Entrepreneurs in Thailand

Lilawadi Phatanarajata
Technopreneurship and Innovation Management Program, Chulalongkorn University, Bangkok, Thailand
Email: nupare@hotmail.com

Sukree Sinthupinyo, Achara Chandrachai and Thira Chavarnakul
Faculty of Engineering, Faculty of Commerce and Accountancy, Chulalongkorn University, Bangkok, Thailand
Email: sukree@gmail.com, chandrachai@hotmail.com, thira@cbs.chula.ac.th

Abstract—The problem of inventory management is considered to be a major factor which causes SMEs entrepreneurs to struggle with their business operations. Inventory pooling concept is considered to be an essential principle that can support the management of these businesses. The study of factors influencing entrepreneur adoption of an innovative inventory pooling system (IIPS) in Thailand has not been conducted yet by scholars. The purpose of this study is to fill this void. Through the investigation of the samples of 385 SMEs entrepreneurs and data analysis run by SPSS 18, we found that inventory management in term of time management and data system have a positive relationship with entrepreneur adoption, also collaboration and cooperation in term of trust, security and privacy have a position impact on entrepreneur adoption. Furthermore, research found that 45.7% of samples were interested in IIPS adoption, followed by 27.3% of entrepreneurs who were very interested in adoption and no sample was not interested in IIPS adoption.

Index Terms—inventory pooling, inventory management, collaboration, adoption

I. INTRODUCTION

In total, there are approximately 3,000,000 entrepreneurs in Thailand, of which 99.6% are small and medium enterprises [1]. Therefore, it can be seen that small and medium enterprises (SMEs) play an important role in the country’s economic development. The majority of SMEs have to close down owing to many causes, including: an inefficient marketing plan, low-quality staff, lack of competitor assessment and negligence concerning customer’s desires, etc. Another important factor, which contributes to the closure of a business, is the inventory management problem, which causes errors in product circulation, resulting in the remaining of products in stock and thus cash flow problems. Inventory pooling is an efficient solution for inventory management. It is the principle of sharing risks and benefits between the stakeholders in the supply chain, and it is a technique to reduce inventory costs and increase service levels.

Meanwhile, it seems that the study of inventory pooling adoption has been far lagging behind. Hence, the purpose of this study is to fill this void and the results will be used for IIPS design and development.

II. INVENTORY POOLING SYSTEM

The research on IIPS adoption can be conducted in accordance with the concept of inventory management and the concept of collaboration and cooperation.

A. Inventory Management

Inventory management is an activity, which is related to inventory carrying. It is an effective tool for cost reduction but the difficulty is the estimating and controlling inventory costs in practice [2]. Therefore, the role of an inventory greatly affects a business’s profits and losses. In every business, the reduction of inventory carrying costs under timely delivery, by getting rid of activities with the help of efficient inventory management, is vital. An efficient inventory management system involves having the least amount of inventory and no obsolete inventory, which helps to decrease opportunity costs, maintenance costs, costs of capital and storage space costs, as well as other expenses, which include interest and managing working capital smoothly. Therefore, the major role of a warehouse is to reduce the lead time and/or delays in production. It is an important activity in the logistics system as a procedure to manage the balance of time, place, and demands [3] and also cost perspective, in order to reach to collaborative decision-making [4].

According to this study, it has been discovered that there are many researches, which support the inventory management concept regarding the use of technologies to develop the system. Currently, executives have an increased desire to improve their positions in business competition, by reducing service costs for timely responses, data inquiry and the delivery of quality
products in order to create customer satisfaction [5]. In the traditional inventory model, the mismatch between demand and supply occurs due to customers are treated without considering their individual requirements. There are many service levels for different demand classes [6]. Therefore, service management is needed for obtaining the solution in the inventory system.

The methods and equipment for an Automatic Data Collection (ADC) have been available for almost 40 years, including card penetration and modern barcodes which help to encourage the online system, real time system and communication technology to cooperate with Radio Frequency Data Communication (RFDC) and hardware and software systems which have increased in the computer systems of companies [7].

The mutual integration of transactions and the original logistics with automatic data processing and image displays, which help to encourage paperless work, timely management and greater-quality data, are all necessary for inventory control, customer satisfaction and profitable operations. It can be seen that timely management and the consideration of customer satisfaction are able to generate greater profits in business, and are considered as important factors in inventory management. A future behavior forecasting needs to use clean data for analysis, and it is also rely on macro and micro environmental factors as well [2]. Data Quality includes some attributes such as accuracy, timeliness, precision, clearness, accessibility etc. [8] and [9]. There are four essential components for designing and implementing a success inventory system, which are a physical dimension, planning and control elements, an information dimension and organizational aspects [10]. Furthermore, the adoption of information system, which allows different members to share information on real time, would help to minimise inventory in a system [2]. Obviously seen that, trust is at the heart of cooperation. Many organizations try to create a team and stimulate cooperation at work for the accomplishment of work.

The Information Technology – Information Sharing and Analysis Center (IT-ISAC) focuses on facilitating the sharing of data regarding threats to security and loopholes. Another way to strengthen a company’s security is to increase the budget allocated for the security of data. For instance, a company can enhance the efficiency of its data security by investing in security technologies which involve: the use of different kinds of software, system access which requires complicated codes, the installation of a detection system and other types of hardware, etc.

According to a study, it was discovered that attitude, in terms of trust, is related to the acceptance and the feeling of security in usage; thus, trust is considered an essential factor which affects the exchange of knowledge and the revelation of information via the media [15]. Furthermore, attitudes concerning privacy also have an impact upon the behavior of the revealing of information [16]. According to the results of this study, it can be explained that positive users will enhance their knowledge exchange and information revelation.

Consistent with above arguments, five hypotheses are thus suggested between the variables of collaboration and IIPS adoption.

H1. Time management positively affects IIPS adoption of entrepreneurs.
H2. Cost and expense positively affects IIPS adoption of entrepreneurs.
H4. Data system positively affects IIPS adoption of entrepreneurs.
H5. Mutual interest/benefit positively affects IIPS adoption of entrepreneurs.
H6. Stakeholder’s participation positively affects IIPS adoption of entrepreneurs.
H7. Interaction positively affects IIPS adoption of entrepreneurs.
H8. Effective Communication positively affects IIPS adoption of entrepreneurs.
H9. Trust, security and privacy positively affect IIPS adoption of entrepreneurs.

The aforesaid investigated the factors influencing entrepreneurs adoption of IIPS from various perspectives. Yet no scholars can be found conduct the research on entrepreneurs adopting IIPS in Thailand. Therefore, our aim in this study is to investigate factors influencing SMEs entrepreneurs adoption.

III. PROPOSED RESEARCH MODEL

A. Proposed Research Model
Based upon the existing literature we built a research model (see Fig. 1).

|----------------------|---------------------|----------------------|------------------------|---------------|

Figure 1. The framework of factors influencing IIPS adoption of retail entrepreneurs in Thailand.

Our research model can be summed up in two parts. The first part is the inventory management. The issues that should be considered for optimal benefits include: time management, cost and expense, service management, and data system. The second part is the collaboration and cooperation which must consider the following: 1) mutual interests/benefits, 2) stakeholder’s participation, 3) interaction, 4) effective communication, and 5) trust, security and privacy.

The factors involved in this research will be apply for IIPS design and development by using mobile application as a tool for inventory management (New product development) in order to approach retail and wholesale traders. The design of a database has their major parts connected to the installation of IIPS. (see Fig. 2 and Fig. 3)

Figure 2. The design of a database and the system installation of IIPS entrepreneurs in Thailand.

IV. RESEARCH METHODOLOGY

The researcher uses purposive sampling method to find samples as ‘Non-probability’, by sampling SME retailers in Thailand and selecting targets from groups, location and SMEs criteria. A total of 385 retail entrepreneurs were recruited from 813,823 retail stores [16].

The questionnaire is divided into four parts, the first collected demographic information, the second collected the business characteristics and criteria, the third part aimed to identify the attitudes of retailers concerning ‘Inventory Pooling’ to solve inventory problems. The final part of the questionnaire asked about respondents suggestions in order to develop an effective shared inventory in the retail business, by allowing a third party to write a comment without any options.

We collected data from the research field and an online questionnaire using a sample of retailers in Thailand during the month of November, 2013.
V. RESULTS AND ANALYSIS

Data analysis about opinions and attitudes of the retailers in participating in the IIPS by means and standard deviation is shown in Table I. Also from a finding, we found that 45.7% of participants were interested in adopting the management of IIPS. 27.3% of these were very interested in adoption, only 27% of participants were uncertain to join the IIPS, and no participants was not interested in IIPS adoption.

**TABLE I. MEANS AND STANDARD DEVIATION OF OPINIONS AND ATTITUDES OF THE PARTICIPATING RETAILERS**

<table>
<thead>
<tr>
<th>Opinions on participation in IIPS (in Average)</th>
<th>X</th>
<th>SD</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Time Management</td>
<td>4.24</td>
<td>0.65</td>
<td>Absolutely agree</td>
</tr>
<tr>
<td>2. Cost and Expense</td>
<td>4.00</td>
<td>0.88</td>
<td>Agree</td>
</tr>
<tr>
<td>3. Service Management</td>
<td>3.94</td>
<td>0.52</td>
<td>Agree</td>
</tr>
<tr>
<td>4. Data System</td>
<td>4.29</td>
<td>0.67</td>
<td>Absolutely agree</td>
</tr>
<tr>
<td>5. Mutual Interest/Benefit</td>
<td>4.08</td>
<td>0.90</td>
<td>Agree</td>
</tr>
<tr>
<td>6. Stakeholder’s participation</td>
<td>3.85</td>
<td>0.84</td>
<td>Agree</td>
</tr>
<tr>
<td>7. Interaction</td>
<td>4.22</td>
<td>0.76</td>
<td>Agree</td>
</tr>
<tr>
<td>8. Effective</td>
<td>4.10</td>
<td>0.73</td>
<td>Agree</td>
</tr>
<tr>
<td>9. Communication</td>
<td>4.10</td>
<td>0.73</td>
<td>Agree</td>
</tr>
<tr>
<td>10. Trust, Security and Privacy</td>
<td>4.45</td>
<td>0.67</td>
<td>Absolutely agree</td>
</tr>
</tbody>
</table>

*There is a statistical significance level of .05.

**TABLE II. CORRELATIONS BETWEEN INVENTORY MANAGEMENT AND IIPS ADOPTION**

<table>
<thead>
<tr>
<th>Inventory Management</th>
<th>Pearson Correlation</th>
<th>IPS Adoption</th>
<th>Sig.(2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Management</td>
<td>.107</td>
<td>.067</td>
<td>.036*</td>
<td>385</td>
</tr>
<tr>
<td>Data System</td>
<td>.114</td>
<td>.253</td>
<td>.025*</td>
<td>385</td>
</tr>
</tbody>
</table>

*There is a statistical significance level of .05.

Table II shows the problem of inventory management. Time Management (H1) and Data System (H4), had a positive relation with the IPS adoption at a statistical significance level of .05.

The analysis of the relation between the problem of inventory management and adoption of IIPS and the analysis of the relation between collaboration and corroboration, and the adoption of the IPS with Pearson Correlation were investigated and shown in Table II and Table III.

Table III shows that collaboration and cooperation in terms of Trust, security and Privacy (H9) has a positive relation with the adoption of IPS, at a statistical significance level of .05.

**TABLE III. CORRELATIONS BETWEEN COLLABORATION AND COOPERATION AND IIPS ADOPTION**

<table>
<thead>
<tr>
<th>Collaboration and Cooperation</th>
<th>Pearson Correlation</th>
<th>IPS Adoption</th>
<th>Sig.(2-tailed)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust, security and privacy</td>
<td>.158</td>
<td>.002*</td>
<td>385</td>
<td></td>
</tr>
</tbody>
</table>

*There is a statistical significance level of .05.

The assumptions of multiple regression (MR) are identified as primary concerns including linearity, independence of errors, homoscedasticity, collinearity and normality. We checked every assumption and tested normality using P-Plot. We have found that variables have normal distributions. Hence, the analysis of the regression between the inventory management and the adoption of IIPS was investigated and shown that the variables of the problem of inventory management can predict the adoption of IIPS at 2.6%. In addition, problem of inventory management in terms of time management and data system has a positive relation with the adoption of IIPS at a statistical significance level of .05. (See Table IV) This can be transposed into the following formula:

\[ Y_{\text{IIPS Adoption}} = 2.019 + 0.168 X_{\text{time management}} + 0.161 X_{\text{data system}} \]

Also, the analysis of the relation between Collaboration and Corroboration, and the adoption of IIPS, were investigated. (See Table V)

**TABLE IV. INVENTORY MANAGEMENT PREDICTORS OF IIPS ADOPTION**

<table>
<thead>
<tr>
<th>Inventory Management</th>
<th>B</th>
<th>S.E.</th>
<th>Beta</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed rate number</td>
<td>2.019</td>
<td>.457</td>
<td>4.420</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Time Management</td>
<td>.168</td>
<td>.077</td>
<td>.148</td>
<td>2.186</td>
<td>.029*</td>
</tr>
<tr>
<td>Data System</td>
<td>.161</td>
<td>.080</td>
<td>.104</td>
<td>2.010</td>
<td>.045*</td>
</tr>
</tbody>
</table>

R =0.161, R Square=0.26,F=2.515, Sig=0.041
* There is a statistical significance level of .05.

**TABLE V. COLLABORATION AND COOPERATION PREDICTORS OF IIPS ADOPTION**

<table>
<thead>
<tr>
<th>Inventory Management</th>
<th>B</th>
<th>S.E.</th>
<th>Beta</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed rate number</td>
<td>1.662</td>
<td>.443</td>
<td>3.760</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Trust, security and privacy</td>
<td>.173</td>
<td>.065</td>
<td>.183</td>
<td>2.649</td>
<td>.008*</td>
</tr>
</tbody>
</table>

R =0.176, R Square=0.31,F=2.420, Sig=0.035
* There is a statistical significance level of .05.

Table V shows that the variables of collaboration and corroboration can predict the IIPS adoption at 3.1%, whereas collaboration and corroboration in terms of Trust, Security and Privacy has a positive relation with the adoption of IIPS, at statistical significance level of 05. This can be transposed into the following formula:

\[ Y_{\text{IIPS Adoption}} = 1.662 + 173 X_{\text{Trust, Security and Privacy}} \]

VI. CONCLUSION AND FUTURE RESEARCH

The contribution of the research is to construct a model describing entrepreneur adoption of IIPS in Thailand and investigate the significant factors adoption for design and developing IIPS in the future.

From the test assumptions, it is shown that the time management and data system has a positive relationship with the IIPS adoption. Time and quality information are necessary for inventory control, customer satisfaction and profitable operations. With regards to customer satisfaction, it could generate interest in the business and is considered to be an important factor in inventory management. We also found that trust, security and privacy have a positive relationship with the IIPS adoption [6]. Moreover, trust will bring confidence and
success when working with each other. These factors lead to the need to adopt IIPS. Trust between operators is of utmost importance.

Furthermore, the finding also suggested that the preparation of an IIPS can reduce lost sales opportunities and the value of stocks as well. Thus, such an operating system should consider the expenses incurred through participation/sharing services concerning inventories, as to whether they are worth more than their needs to stock goods on their own, or not.

Moreover, Segmentation and the allocation of interests are disclosed, as well as the classification of goods and services having different costs or % profits. Hence, it is important that the operators should consider the different types of goods that can result in differences of price, data and the inventory management. Some participants commented that if retailers have many types of goods, it may be difficult to use this system because the system must cover all types of goods.

The system may be established as an ‘association of retailers’, within which pricing is determined to remain at the same level and is accessible online via the Internet, throughout each of the operators. Additionally, the classification of same types of inventory should be controlled by the administrator of each unit of goods.

REFERENCES


Lilawadi Phatanarajata was born in Bangkok, Thailand, September 1986. She is a PhD student in Technopreneurship and Innovation Management program from Chulalongkorn University, Thailand. She holds Bachelor Degree in Information Communication and Technology from Mahidol University, Thailand and she also holds Master Degree in Design and Branding Strategies from Brunel University at London, UK. Her research interests include innovation, inventory management, inventory pooling, collaboration, cooperation, and adoption.

Sukree Sinthupinyo holds a Bachelor Degree in Commerce and Accountancy from Chulalongkorn University, Thailand. Currently he is working as a lecturer and he has been an Assistant Professor Doctor in the Department of Computer Engineering, Chulalongkorn University. His research areas are Artificial Intelligence, Machine Learning & Pattern Recognition, Engineering.

Achara Chandrachai holds a Bachelor Degree of Commerce and Accountancy from Chulalongkorn University, Master of Business Administration (2nd honor roll) from National Institute of Development Administration, Ph.D. (Quantitative Business Analysis) of Arizona State University. She has been a Professor Emeritus of Technopreneurship & Innovation Management Program since 2006 and Manager of IMET (Institute of Management Education

Thira Chavarnakul received his B.E. in civil engineering from Chulalongkorn University, Thailand, and his M.B.A. from Chulalongkorn University, Bangkok, Thailand and his M.Sc. and Ph.D. in Engineering Management from University of Missouri-Rolla (which is now the Missouri University of Science and Technology), USA. He is currently Assistant Professor and Head of Department of Commerce at the Faculty of Commerce and Accountancy, Chulalongkorn University, Thailand. His research interests are in the areas of financial engineering, operations management, quantitative analysis, and applications of artificial intelligence, particularly neural networks, fuzzy logic, and expert systems for business, financial forecasting, and investment.