



A STUDY ON FACTORS AFFECTING THE ADOPTION OF ERP FOR LOGISTICS OPERATIONS IN APPAREL MANUFACTURING INDUSTRY IN BIYAGAMA, SRI LANKAⁱ

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Abstract:

The study examines the factors affecting the adoption of ERP for logistics operations in apparel manufacturers in Biyagama, Sri Lanka. The investments in ERP solutions have become strategic decision which can have a wide range of advantages to business enterprises. The decision of adaptation or investment in ERP is influenced by many factors. These factors influence on the management behavior of ERP and technology investment. Then, the research problem is what are factors affecting the adoption of ERP in apparel manufacturers in Biyagama? The research objectives of the study are to identify the factors affecting the adoption of ERP by literature reviews and develop a conceptual framework to represent the adoption of ERP in Biyagama, Sri Lanka. The study caters a significant in term of practical, personal and academic significance to the industry; the study methodology of the study is the formal survey where 101 executive officers/managers were interviewed through the questionnaire survey. The comprehensive literature survey was conducted to identify the indicators for the study and 40 indicators were identified for developing the model. The exploratory factor analysis was performed to categorize the indicators. The study has defined the scope through sample size, study approach, time horizon. The study items are grouped under 6 variables including the level of organizational readiness for ERP, level of organizational fit for ERP, level of investment and business type, level of risk and failure, organizational intention and change management, etc.

Keywords: ERP, apparel manufacturers, adoption of ERP

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1. Introduction

“The business environment has been evolved in past few decades with the evolution of other environment forces and technology forces and factors in technological environment has been developed and changed dramatically by generating positive results to the business operations and stakeholder parties.” (Gardner, 1999). Enterprise Resource Planning (ERP) systems and technology development have become so popular among the business to have many advantages for business. Especially, Enterprise Resource Planning (ERP) systems facilitates to logistic operations including demand forecasting, product planning, purchasing decisions, customer management, production control and planning, wastage management, inventory management, data management, suppliers and information management in a real-time environment. Then, development and evolution of ERP systems facilitates to logistic operations significantly. Adaptation of ERP system for business operations is a strategic decision in which business managers have to consider factors to make ERP more efficient and effective. This study aims to study these factors which affect on adaptation of ERP.

1.1 Research problem

Adaptation of ERP system is a strategic decision which can have a wide range of advantages to business. Especially, ERP can be used to manage all logistic operations to achieve intended goals and objectives of logistic management. Adaptation of ERP system involves a critical management decision which involves cost and involvement of the management. the research problem is what are factors affecting the Adoption of ERP for logistics operation in apparel manufacturers in Biyagama?

1.2 Research questions of the study

There are two research questions to be answered by the study:

- 1) What are the factors affecting on adaptation of ERP for Logistics operation in respective apparel companies in Biyagama?
- 2) What is the possible conceptual framework to represent the adoption of ERP in Biyagama, Sri Lanka?

1.3 Research objectives of the study

This study aims to explore the factors affecting the adoption of ERP in apparel manufacturing industry in Biyagama. In these sense, following study objectives are set. The main objective of the study is to explore the factors affecting the adoption of ERP for logistics operations in apparel manufacturing industry in Biyagama.

The summary of specific objectives is as follows:

- 1) To identify the factors affecting the adoption of ERP by literature reviews.
- 2) To develop a conceptual framework to represent the adoption of ERP in Biyagama, Sri Lanka.

1.5 The significance of the study

This study attempted to identify the factors affecting the adoption of ERP in apparel manufacturing industry in Biyagama establishment of an effective and efficient ERP system is shaped by factors and it directly influences on achieving goals and objectives of logistic operations further this is significance for the industry stakeholders.

2. Literature review

Logistics operations have become most important discipline and its validity and applications have been increased day by day. The main objective of logistics is to cater information, goods and services to relevant parties at the right time, the right quality, right quantity, and right cost and at the right place effectively and efficiently. Technology adaptation to logistics operations can gain the advantages of maximized customer satisfaction, operational competitiveness, increasing customer service, reduce costs, and streamline supply chains, increasing the market competitiveness, customer or supplier equity, brand loyalty etc. It is justified that adaptation of information technology for logistics operations has become the source for achieving the operational efficacy and effectiveness in the logistics operations are influences by many factors such as technological related factors (relative advantages, compatibility, complexity, cost, and image), organizational factors (awareness and willingness to adapt, organizational size, organizational readiness). environmental factors (government incentives and environmental uncertainty). In addition to above, studies found that relative advantages, perceived ease of use, cost, awareness of the management, perceived usefulness, attitudes, organizational structure, value delivery process, past experiences, complexity technology adaptation and usage, compatibility of technology, tradability of technology and observability of technology are also factors affecting to adaptation of information technology for logistics operations.

In addition to above, the literature review found that top management support and commitment, clear vision, goals and objectives of the ERP system, careful change management, the use of ERP implementation consultant, end user involvement, suitable IT legacy systems, organizational fit for ERP, business process re-engineering (BPR) and process management, project champion, on-going ERP vendor support, communication among the implementation team members, IT infrastructure, team work, IT department capability, technical issues, motivational factors to implement ERP systems, implementation strategies, minimal customization of packages, good project scope management, project management, experienced project manager-leadership, adequate resources, interdepartmental communication, interdepartmental cooperation, education on new business processes, adequate ERP software selection, resource availability, management expectation, risk and failure of system, user acceptance and customer supports, perceived ease of use (PEU), perceived usefulness (PU), perceived privacy & security (PPS) and awareness, project management, change management, involvement and end users and stakeholders, external consultants, ERP system

configuration, vendor relationship and supports, IT structure ad legacy and system, skills, knowledge and experts, project team leadership, available resources, measurement of performance, ERP system acceptance and resistance, ventor tools and implementation methods, data accuracy, operational culture, ERP system test, enviornment, troubleshooting, organizational structure, interdepartment cooperation, knowledge management, stateregic fit, use of steering committee etc.

Thus, it is evident that ERP adaptation is influenced by many factors and rationale. As shown in the table 2.1, the all identified items through litterateur review as tabulated.

Table 2.1: Summery of literature review

Items	Researchers	Article Name
Four factors technological related factors, Halal assurance related factors, organizational and environmental related factors	Razali (2012)	Factors that influence the adoption of Information and Communication Technology (ICT) in halal transportations and logistics
Relative advantages, perceived ease of use, cost, awereness of the management, perceivedusefulness, attitudes, organizational structure, value delivery process, past experiences and more other factors	James (1996)	Vinyl technology for non-scientists in the vinyl industry
Relative advantage of technology, complexity technology adaptation and usage, compatibility of technology, tradability of technology and observability of technology	Rogers (1995)	Innovation Diffusion Theory (IDT)
Top management support and commitment, clear vision, goals and objectives of the ERP system, careful change management, the use of erp implementation consultant, end user involvement, suitable IT legacy systems, organizational fit for ERP, business process re-engineering (BPR) and process management, project champion, on-going ERP vendor support, communication among the implementation team members, IT infrastructure, team work, IT department capability, technical issues, motivational factors to implement ERP systems, implementation strategies, minimal customization of packages, good project scope management, project management, experienced project manager-leadership, adequate resources, interdepartmental communication, interdepartmental cooperation, education on new business processes, adequate ERP software selection, resource availability, management expectation, risk and failure of system, User acceptance and customer supports.	Tarhini (2015)	Factors to be considered in ERP system adaptation
Perceived ease of use (PEU), perceived	Davis (1989)	Technology Acceptance Model (TAM)

usefulness (PU), perceived privacy & security (PPS) and awareness		
Top management support and involvement, project management, change management, communication, clear goals and objectives, organizational fit of ERP, involvement and end users and stakeholders, external consultants, ERP system configuration, vendor relationship and supports, IT structure and legacy and system, project championship, skills, knowledge and experts, project team leadership, available resources, measurement of performance, ERP system acceptance and resistance, vendor tools and implementation methods, data accuracy, operational culture, ERP system test, environment, trouble shooting, organizational structure, interdepartment cooperation, knowledge management, strategic fit, use of steering committee, etc	Leyh (2014)	Literatures on factors affecting to ERP adaptation and implementation
The cloud security and privacy, cost effectiveness, Internet reliability, top management support, competitive pressure, and SMEs' sector type	Qian (2016)	Factors affecting to ERP adaptation and implementation.

Source: Developed by the researcher (2018).

3. Methodology design

The researcher decided what kind of research to be conducted to collect data and variety of research types and methodologies can be considered to conduct the study (Wilson, 2006). Two types of research including qualitative vs quantitative or primary vs secondary research methods were considered. Quantitative research focuses on providing quantitative feedback and answers to the decision makers and findings of the quantitative research can be applied to the final decision making, specially Statistical applications can be seen under this. Qualitative research aims to provide qualitative insight or understanding on the scenario and these types of research has to be supported by further studies. The findings of these types of research cannot be used for final decision making. The researcher has planned to use quantitative research (formal survey) and qualitative research (in-depth interview).

In addition to this, the researcher can use both primary and secondary studies to conduct the study. The primary is planned to achieve primary purpose of the study (formal survey) and (in-depth interview). Literature survey was conducted under secondary sources.

3.1 The type of the study

“The researcher needs to select a appropriate mix of research methodology for conducting the study” (Uma Sekaran, 2010). Based on nature of the problem and scenario, it has to be

decided. According to Sauder (2009), there are three research types such as mono method, multi method or mixed method to conduct the study.

“Mono method is an approach where the research team can select only one method to conduct the study” (Saunders, 2009). The availability of resources, research philosophy and the scope of the problem decide the selection of this type.

“Mixed-methods reresearch types where the researcher selects the research mix by using both qualitative and quantitative methods for the study purposes” (Saunders, 2009).The researcher can collect a wide range of data than mono method.

“Multi-methods is a research type where the researcher select more than one method by using available mix of research (e more than two research strategies” (Saunders, 2009).Multi method aims to collect a wide range of data in relation to the study. The researcher aims to use both primary surveys to conduct the study by taking multi method.

3.2 Sampling techniques of the study

“The researcher has to decide the most appropriate and suitable sampling method or methods to conduct the study by using suitable sampling techniques” (Feilzer, 2010). The rationale for selecting the sampling technique is to select a representative sample to collect data from them. The researcher can select two type of sampling techniques including random sampling and non-random sampling. *“Random sampling method is sampling method where every element of population has the equal opportunity to be selected and Non random sampling is the sampling method where every element of population has not equal opportunity to be selected”* (Uma Sekaran, 2010).

The researcher has selected simple Random Sampling Method is used in this study and the main focus is on the 101 of executives/managers were selected for formal survey those who engaged with ERP from 5 companies. By considering the quality of the study, sample size is calculated as follows:

Table 3.1: Sample size calculation table

Margin of error	5%
Confidence level needs	95%
Population size	150(C)
Response distribution	50%
Sample size	101(A)

Source: Developed by the researcher (2018).

This sample profile consists of 05 apparel industry various managerial and executives levels of the system. Therefore it is required to give fair attention over each company as per their population. According to the above calculation sample size is 101. Thereafter we need to calculate sample size requirement for each category. For that researcher has developed following simple formula to calculate sample size for each company.

(B)

(C)X (A): Sample requirement formula

Where:

(A)=Sample size

(B) =No. of ERP users in each category

(C)=Total no. of ERP users in apparel company-150

3.3 Data analyzing and presentation

“Data analysis and presentation is a one of main phase of research project and research needs to define relevant statistics and data analysis techniques” (Uma Sekaran, 2010). Before data analysis and presentation, the researcher needs to check the completeness and accuracy through the manual checking of all questionnaires. The incomplete and inaccurate questionnaires are selected and returned to the filed for data collection purpose again. Later, coding process is done for identification purpose.

For data analysis purpose, the researcher has selected both descriptive and inferential statics as needed. The rational for selecting descriptive statistics is to explain and discusses data distribution. Mean, median, mode, minimum and maximum values are descriptive statistics which are aimed to describe data distribution. Exploratory factor analysis using SPSS are used under inferential statistics. In addition to above, the researcher is in the process of measuring the goodness of data before final data collection. The accepted reliability level is checked through Cronbach’s Alpha of ≥ 0.70 and it is considered as adequate reliability or satisfactory reliability level.

4. Data analysis and presentation

For conducting the study through the survey, the researcher selected 101 of respondents (responsible managers/executives) who are responsible for adaption and implementation of ERP systems in respective apparel companies, Biyagama. The sample profile was analyzed through gender, marital status, age category, education qualifications, work experience.

4.1 Sample adequacy

Kaiser-Meyer-Olkin (KMO) test is a measure of how suited data is for factor analysis. The test measures sampling adequacy for each variable in the model and for the complete model. When the KMO values between 0.8 and 1 indicate the sampling is adequate. If the KMO values less than 0.6 indicate the sampling is not adequate and that remedial action should be taken. Following table of 4.6 explains the how suited data is for factor analysis in this research. Table 4.6 was also conducted to test the homogeneity of variances. KMO values should be more than 0.6 which indicate the significance of the values is acceptable in the study. This study meet the satisfactory KMO and sample adequacy level as represented at table 4.6.

Table 4.1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin measure of sampling adequacy		.765
Bartlett's test of sphericity	Approx. chi-square	10.255
	df	3
	Sig.	.017

Source: Survey data, 2018.

According to the Table 4.6 Kaiser-Meyer-Olkin measure of sampling adequacy of ERP users' respondent data is 0.765 (76.5 percent) and significance is 0.017. Therefore, the sampling of the ERP users are adequate. According to the Kaiser's value results this value range of 0.7 to 0.8 can be categorized as good value and it's confident that factor analysis is appropriate for these data.

4.2 Factor analysis of the study

The factor analysis can be used for grouping the similar variables into dimensions by identifying latent variables or constructs. The purpose of factor analysis is to reduce many individual items into a fewer number of dimensions. Factor analysis can be used to simplify data, such as reducing the number of variables in regression models. The idea of rotation is to reduce the number factors on which the variables under investigation have high loadings.

With the analysis of the rotated component matrix of factor analysis, it is shown that IT department capability, communication among the implementation team members, suitable IT legacy systems, organizational structure, cost of the investment, organizational readiness for ERP, past experiences, management willingness, reliability of the system, relative advantages, management expectation, attitudes of management are substantially loaded on factor (component) 1. Secondly, user acceptance, team work, skills, knowledge of users, end user involvement, organizational culture, technical issues, organizational fit for ERP and compatibility of technology are substantially loaded on factor (component) 2. thirdly, top management support and commitment, adequate resources, perceived usefulness, business process re-engineering (BPR), investment and business type and awareness of the management are substantially loaded on factor (component) 3. fourthly, customer supports, technological development, complexity technology adaptation and usage, IT infrastructure, perceived privacy & security, value delivery process and risk and failure of system are substantially loaded on factor (component) 4. fifthly, interdepartmental communication, leadership behavior, on-going ERP vendor support, perceived ease of use and clear vision, goals and objectives of the ERP system are substantially loaded on factor (component) 5 and the uses of ERP implementation, careful change management are substantially loaded on factor (component) 6.

4.3 Reliability analysis of the study

Before conducting the analysis, it is necessary to ensure the reliability of the survey questionnaire. The Cronbach alpha (α) is a popular method for examining whether all the items within the instrument measure the same thing. The closer the Cronbach α value is to 1.00 the greater reliability of the items in the instrument. As a rule of thumb, the Cronbach α value greater than 0.80 indicates that the questionnaire items in the instrument are reliable. *“Reliability is the extent to which an instrument consistently measures what it was intended to measure”* (Walliman, 2012). Reliability is a necessary condition to note during selection of the measurement approach. In order to calculate reliability Cronbach’s Alpha value is used. Cronbach’s Alpha ≥ 0.70 is considered as adequate reliability or satisfactory reliability level. Cronbach’s Alpha simply provides an overall reliability coefficient for the set of variables. For this study, six variables were the inputs to Cronbach’s Alpha test and obtained 0.717 which represents the reliability is “Good”. Further researcher checked the reliability of each variable individually by using Cronbach’s Alpha test and those results discussed below. It is indicated that reliability of each variables are ideal as the figures are above 70 percent.

4.4 The level of organizational readiness for ERP

According to the using SPSS the Cronbach’s value is generated for the latent factors in the theoretical framework. The ERP users responses Cronbach’s values is 0.764 It means that the items available in the questionnaire are reliable can be generalized to the population as a percentage of 76.4 percent.

4.5 The level of organizational fit for ERP

The ERP users responses Cronbach’s values is 0.715 It means that the items available in the questionnaire are reliable can be generalized to the population as a percentage of 71.5 percent.

4.4.3 The level of investment and business type

According to the using SPSS the Cronbach’s value is generated for this latent factors in the ERP users responses Cronbach’s values is 0.735 It means that the items available in the questionnaire are reliable can be generalized to the population as a percentage of 73.5 percent.

4.4.4 The level of risk and failure

The ERP users responses Cronbach’s values is 0.704 It means that the items available in the questionnaire are reliable can be generalized to the population as a percentage of 70.4 percent.

4.4.5 Organizational intention

As per the Cronbach's values is 0.820 It means that the items available in the questionnaire are reliable can be generalized to the population as a percentage of 82.0 percent.

4.4.6 Change management

The individual reliability coefficients for this factor the Cronbach's values is 0.751 It means that the items available in the questionnaire are reliable can be generalized to the population as a percentage of 75.1 percent.

4.5 Discussion of the findings of the study

The literature review found that logistics operations have become the central function in the value delivery process and it has influenced on the operational efficacy and effectiveness. The main focus of logistics is to cater information, goods and services to relevant parties at the right time, the right quality, right quantity, and right cost and at the right place effectively and efficiently. It is evident that technology environment has been evolved and developed through the technology investment.

The technology adaptation to logistics operations can gain the advantages of maximized customer satisfaction, operational competitiveness, increasing customer service, reduce costs, and streamline supply chains, increasing the market competitiveness, customer or supplier equity, brand loyalty etc. It is justified that adaptation of information technology for logistics operations has become the source for achieving the operational efficiency and effectiveness in the logistics operations.

A. To identify the factors affecting the adoption of ERP by literature reviews

Through the literature review, it is shown that there are many factors affecting to adaptation of ERP system. These factors are IT department capability, communication among the implementation team members, suitable IT legacy systems, organizational structure, cost of the investment, organizational readiness for ERP, past experiences, management willingness, reliability of the system, relative advantages, management expectation, attitudes of management, user acceptance, team work, skills, knowledge of users, end user involvement, organizational culture, technical issues, organizational fit for ERP, compatibility of technology, top management support and commitment, adequate resources, perceived usefulness, business process re-engineering (BPR), investment and business type, awareness of the management, customer supports, technological development, complexity technology adaptation and usage, IT infrastructure, perceived privacy & security, value delivery process, risk and failure of system, interdepartmental communication, leadership behavior, on-going ERP vendor support, perceived ease of use, clear vision, goals and objectives of the ERP system, the use of ERP implementation and careful change management etc.

B. To develop a conceptual framework to represent the adoption of ERP in Biyagama, Sri Lanka

Through the factor analysis, items are grouped into 6 variables as shown below. Then, the study found six variables of the level of organizational readiness for ERP, level of organizational fit for ERP, level of investment and business type, level of risk and failure, organizational intention and change management. The factor grouping process is depicted below.

Table 4.2: Factor grouping process of factor analysis

Group	Number of items
Group 1: The level of organizational readiness for ERP	(I) IT department capability (II) Communication among the implementation team members (III) Suitable IT legacy systems, organizational structure (IV) Cost of the investment (V) Organizational readiness for ERP (VI) Past experiences (VII) Management willingness (VIII) Reliability of the system (IX) Relative advantages (X) Management expectation (XI) Attitudes of management
Group 2: Level of organizational fit for ERP	(I) Top management support and commitment (II) Adequate resources (III) Perceived usefulness (IV) Business process re-engineering (BPR) (V) Investment and business type (VI) Awareness of the management
Group 3: Level of investment and business type	(I) Top management support and commitment (II) Adequate resources (III) Perceived usefulness (IV) Business process re-engineering (BPR) (V) Investment and business type (VI) Awareness of the management
Group 4: Level of risk and failure	(I) Customer supports. (II) Technological development (III) Complexity technology adaptation and usage, (IV) IT infrastructure (V) Perceived privacy & security (VI) Value delivery process (VII) Risk and failure of system
Group: 5 Organizational intention	(I) Interdepartmental communication (II) Leadership behavior (III) On-going ERP vendor support (IV) Perceived ease of use (V) Clear vision, goals and objectives of the ERP system
Group 6: Change management	(I) The use of ERP implementation (II) Careful change management

Source: Developed by the researcher (2018)

Through the factor analysis, items are grouped into 6 variables. Then, the study found six variables of the level of organizational readiness for ERP, level of organizational fit for ERP, level of investment and business type, level of risk and failure, organizational intention and change management. The factor grouping process to develop a conceptual framework to represent the adoption of ERP in Biyagama, Sri Lanka is shown in the figure 4.1.

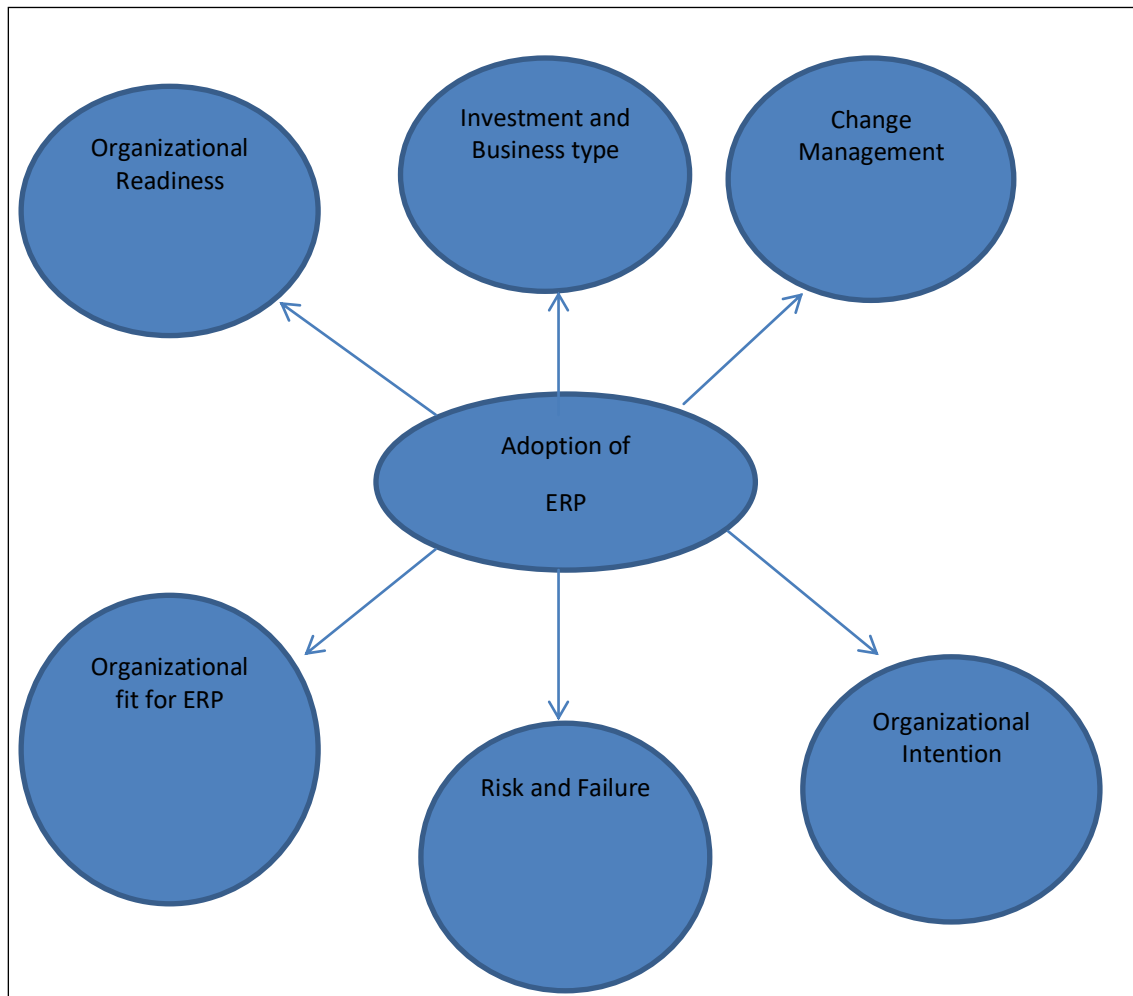


Figure 4.1: Proposed conceptual framework for adoption of ERP
(Source: Constructed by the author)

5. Conclusion and Recommendation

This study aims to explore the factors affecting the adoption of ERP for logistics operations in apparel manufacturing industry in Biyagama. In these sense, following study objectives are set. The primary objective of the study is to explore the factors affecting the adoption of ERP in apparel manufacturing industry in Biyagama, Sri Lanka.

5.1 Conclusion of the study

Based on the study findings, it is concluded that the technology has become the competitive force which can have the wide range of advantages to the enterprises including maximized customer satisfaction, operational competitiveness, increasing customer service, reduce costs, and streamline supply chains, increasing the market competitiveness, customer or supplier equity, brand loyalty. In addition to this, It is concluded that investment in Enterprise Resource Planning (ERP) is a strategic decision of the firms and it has been influenced by many factors including IT department capability, communication among the implementation team members, suitable IT legacy systems, organizational structure, cost of the investment, organizational readiness for ERP, past experiences, management willingness, reliability of the system, relative advantages, management expectation, attitudes of management, user acceptance, team work, skills, knowledge of users, end user involvement, organizational culture, technical issues, organizational fit for ERP, compatibility of technology, top management support and commitment, adequate resources, perceived usefulness, business process re-engineering (BPR), investment and business type, awareness of the management, customer supports, technological development, complexity technology adaptation and usage, IT infrastructure, perceived privacy & security, value delivery process, risk and failure of system, interdepartmental communication, leadership behavior, on-going ERP vendor support, perceived ease of use, clear vision, goals and objectives of the ERP system, the use of ERP implementation and careful change management etc.

Based on the study findings, it is concluded that the development of proposed conceptual model needs to be further examined and this study proposed six variables including level of organizational readiness for ERP, level of organizational fir for ERP, level of investment and business type, level of risk and failure, organizational intention and change management.

5.2 Recommendations

Based on the literature review and primary survey, it is recommended for the enterprises to examine the competitive advantages of ERP adaption and implementation.

Secondly, it is recommended for the management to examine and consider the factors affecting to ERP adaptation. Based on the literature review and primary survey, It is recommended to consider the level of organizational readiness for ERP before the adaptation of ERP. Because, the management and organizational readiness is highly important for achieving ERP goals and objectives.

It is recommended that level of organizational fit for ERP is a key concern in adapting the ERP solutions. Because, ERP solution needs to be fit with organizational setup. It is recommended that level of investment and business type is a key concern in adapting the ERP solution and these factors effect on management decision on ERP adaptation. It is recommended that level of risk and failure is one of main concern in

adapting ERP solution to the firms and it decided the level of success and effectiveness of ERP adaption and implementation.

It is recommended that organizational intention is also a crucial concern and the investment decision on ERP needs to analyze the enterprises intentions before the adaptation and implementation. It is recommended that change management and innovation is a critical forces and invention in adapting ERP solution to the firms.

5.5 Suggestions for the further research

The proposed research project has focused on many areas to identity the factors affecting the adoption of ERP by literature reviews and the development of the conceptual framework to represent the adoption of ERP in Biyagama, Sri Lanka. Thus, the future researchers have to look at on following areas.

- 1) To plan and conduct the comprehensive research study by using the proposed variables under different industries and scope.
- 2) To increase the sample size and scope to examine the wider range of data and facts.
- 3) To develop the methodological design and arrangement for the future studies.

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