Implementation and Performance of Enterprise Collaboration System in Small and Medium Enterprises

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Japan Advanced Institute of Science and Technology

Doctoral Dissertation

Implementation and Performance of Enterprise Collaboration System in Small and Medium Enterprises

中小企業におけるエンタープライズコラボレーションシステムの実装とパフォーマンス

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Abstract

This dissertation mainly focusing on the effect and performance of Enterprise Collaboration Systems (ECS) in Small and Medium Enterprises (SMEs). The dissertation includes three stages; Stage 1. Elucidating the ECS "SuccMail" design feature on the performance of SMEs. Stage 2. Focus on the effect of external support and internal support for implementing ECS. Stage 3. Develop and validate an instrument to measure the performance of linking ERP to ECS.

We knew that SMEs account for the primary source of employment in developed and developing countries, technological advancements, and competitive advantages. Besides, due to the Covid-19 Collaboration becomes increasingly valuable to the enterprise; also, a growing number of enterprises had implemented the Enterprise Collaboration Systems (ECS).

Nowadays, email and instant messages have become unproductive tools. The research indicates email and instant messages having issues of information overload, including a large amount of incoming information, inefficient workflow, and deficient communication quality. In terms of an enterprise, most of the current research result struggles to achieve specific and practical goals by proposed theoretical findings in the ERP domain. To enable the managers to get a fuller picture of all the messages generated from an ERP system with the Enterprise Collaboration System (ECS) and improve collaboration and communication, we propose a complete method to develop an artifact-SuccERP based on the Design Science approach to carry out the integration. This integration of ERP and ECS with the post-implementation process is proved a systematic approach. But it still needs to be measured with the performance of the implementation.

First, the researcher introduces elucidating the ECS SuccMail design feature on the performance of SMEs. There are 7 design features. Concerning discussing SMEs' performance issues using ECS, the researchers considered four aspects: human resources, customer complaints, time issues, and communication issues. The researcher examined the relationships among these effects and proposed our constructed framework for the investigation of the evaluation of ECS. To survey the effectiveness of each critical design feature of each performance, the questionnaire was designed to ask about the effectiveness of 7 design features on each of the 4 performances. The researcher found that the ECS of SuccMail is basically satisfied by the respondents, while not all of the features are used by the users. Even SuccMail has simplified the use of the system as much as possible; still, it is difficult for SMEs to fully exert the effectiveness of ECS without a dedicated consultant. This is actually the main reason that SMEs cannot successfully import ECS.

Stage 2 is focusing on the effect of performance from the supports of SuccMail. The supports are assorted into external support and internal support. The ECS company's supports are external supports, and the supports from the top manager or enterprise are internal supports. External support including; the ECS manual, online consultation and, external ECS expert consultant. Internal support

including; the enterprise fully depends on using ECS to manage and communicate, the enterprise offers sufficient resources for using ECS, the enterprise had hired a full-time consultant for implementing ECS, and the enterprise conflicts have been reduced by using ECS. The researcher proposed a survey questionnaire to evaluate how the internal and external supports of SuccMail can affect the performance of SMEs. Each support has a positive influence on the implementation of SuccMail and can affect the business performance of SMEs. Based on our result, the internal supports are more significant than the external to impact the business performance of SME.

The primary purpose of stage 3 is to evaluate the performance of linking ERP and ECS. Because the management of SMEs has many problems of duplications work. To solve the duplications work problems, the researcher linked SuccMail with ERP and conducted a series of evaluations on the linked SuccMail and ECS effectiveness. This research is based on previous research on the integration of artifacts with ERP systems and ECS. Since most SMEs who have implemented ERP complain about duplications of work caused by ECS implementation, the researcher linked SuccMail with the user's current ERP. The research results show that this solves the doubts and complaints caused by employees' duplications of work. And users are satisfied with the linking of ERP and ECS. At this stage, the validity of the link between ERP and ECS was verified. User satisfaction shows that the problems of independent ERP and ECS duplications of work have been solved. In addition, management support, absorptive capacity, and user satisfaction also have a positive impact on the performance of SuccMail.

This dissertation uses SuccMail to discuss various SME e-management issues. First of all, the researcher verified Steinhüser's 2011 research in practice; ECS implementation in SMEs has performance and management advantages. Besides, in the ECS field, which is hugely lacking in the literature, the researcher used questionnaires and actual interviews with users to discuss various internal and external support issues in SMEs implementing ECS. The researcher finds Internal support is far more critical than external support. This result allows the researcher to clearly understand SMEs' difficulties in introducing ECS under the current environment. After all, it is difficult for existing SMEs to find an expert who has good computer use capabilities and, at the same time, sufficient management capabilities.

Keywords: Small and Medium-Sized Enterprises (SMEs); Enterprise Collaboration System (ECS); SuccMail; Enterprise Resource Planning (ERP); Organization Internal Support; Organization External Support; Absorptive Capacity; User Satisfaction

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Content

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Abbreviation

AA	Administrative area, purchase plan, and payment request
CI	Communication Improvement
CL	Customizable labels based on business events/action for the search feature
CR	Customer Complaints Reduction
CRM	Customer Relationship Management
CSCW	Computer-Supported Cooperative Work
ECS	Enterprise Collaboration System
EFA	exploratory factor analysis
EIP	Enterprise Information Portal
ERP	Enterprise Resource Planning
ESM	Enterprise Social Media
ESS	Enterprise Social Software
FS	Group files sharing feature
HM	Accessibility of historical messages by any group member
HR	Human Resources Reduction
IM	Instant Messaging
IoT	Internet of Things
IS	Information Systems
IT	Information Technology
LE	Links to the past events URL
MRQ	Major Research Question
MSA	Measures of Sampling Adequacy
OC	Tracking event ongoing or completion
PCA	Principal Components Analysis
RS	Display of messages status (who and when read/unread the messages)
SMEs	Small and Medium-sized Enterprises
SRQ	Subsidiary Research Questions
TS	Time Saving
URL	Uniform Resource Locator

Chapter 1. Introduction

This chapter describes the general content of the dissertation and includes three stages; Stage 1. Elucidating the ECS "SuccMail" design feature on the performance of SMEs. Stage 2. Focus on the effect of external support and internal support for implementing ECS. Stage 3. Develop and validate an instrument to measure the performance of linking ERP to ECS.

1.1 Research Background

Along with the pandemic of the Covid-19, the enterprises have been compelled to embrace the new way of work from home. This has led to an increase in Enterprise Collaboration Systems (ECS) adoption across enterprises (Koceska and Koceski, 2020). In addition, with the development of Industry 4.0 and the Internet of Things (IoT), ECS is growing important for Small and Medium-sized Enterprises (SMEs) to take the first step of linking up Industry 4.0 in recent years.

The Enterprise Collaboration System (ECS) is a kind of application software that supports collaboration and enterprise management (Schubert and Glitsch, 2015). Before going more in-depth with ECS, the researcher has to establish the Information System (IS). Abbreviated as ECS, Enterprise Collaboration System is a type of IS (Beal, n.d.). An IS can be any organized combination of people, hardware, software, communications networks, data resources, and policies and procedures that stores, retrieves, transforms, and disseminates information in an organization (O'Brien and Marakas, 2010).

Schubert and Glitsch consider ECS to be socio-technical systems that include hardware and software as well as people, processes, and organizational aspects

(Schubert and Glitsch, 2015). IS has become a vital component of an organization's competitive practices (Ragu-Nathan et al., 2004). Social Media and ECS are both based on social software and are thus similar in functionality (Schubert and Williams, 2015), and according to Suh and Bock, the use of Enterprise Social Media (ESM) leads to better task performance (Suh and Bock, 2015).

1.2 The Motivation of Focusing on ECS and SMEs

SMEs account for the primary source of employment in developed and developing countries, technological advancements, and competitive advantages (Ghobakhloo et al., 2011). However, most of the prior researchers have focused more on Information Technology (IT) adoption in large organizations (Bharati and Chaudhury, 2015; Grandon and Pearson, 2004; Leyh, 2014). On the other hand, due to SMEs' limited resources, the process of IT adoption by SMEs is considerably different (Ghobakhloo et al., 2011). To improve the performance of SMEs, many features are provided from ECS to cost reduction, improve productivity, avoid potential failures, and defect diagnosis. Most SMEs use the features afforded by free applications (e.g., Line, Outlook, Dropbox, etc.). Nowadays, many systems are made for SMEs, and most of those systems have the following features: message, file sharing, search and cross-platform, etc. The system with those features is classified as ECS. Most of the ECS only provides basic features for free. Table 1.1 compares the features of some ECS, which including SuccMail, Slack, Teams, JANDI, WorkDo, Yammer, LINE, Outlook, and Dropbox. However, there is a lack of research on examining those ECS, not to mention the overall comparison. Compared to my master thesis, "A Study of the Impact of ECS Design Features on the performance of SMEs," three years ago, the only difference in Table 1 is that LINE improves their feature with the storage for files.

In this dissertation, the researcher focused on studies on an ECS software, "SuccMail." Therefore, in this dissertation, it is hard to distinguish between ECS and SuccMail. The researcher suggests it reasonable to consider SuccMail as ECS or ECS as SuccMail in this dissertation. The reason for choosing SuccMail instead of widely used Slack or Teams is because SuccMail has the same basic features that Slack and Teams have. Also, the SuccMail founder is an entrepreneur, and the core concept of SuccMail is started as managers and simplifying the complex. The most significant user interface challenges will be on the side of information input, reducing the additional effort to a bare minimum and allowing information to be entered in a manner comfortable to each worker. Equally important is that managers must know what information is needed, locate it, and interpret and use it without great effort (Grudin, 1988). In this dissertation, the researcher defined the employees in the SME who use ECS as 10 to 50. Here the employees are referred to who work in front of the computer or need to use the computer to work every day.

Table 1.1 The comparison of ECSs and freeware apps

	Message		File Sharing	Search			Administration		Cross-Platform			
	One-on-one	Group	File	Message	File	Filter	Invite	Remove	PC	Mac	Android	iOS
SuccMail	○	○	○	○	○	○	○	○	○	○	○	○
Slack	○	○	○	○	○	○	○	○	○	○	○	○
Teams	○	○	○	○	○	○	○	○	○	○	○	○
JANDI	○	○	○	○	○	○	○	○	○	○	○	○
WorkDo	○	○	○	○	○	○	○	○	○	○	○	○
Yammer	○	○	○	○	○	○	○	○	○	○	○	○
Line	○	○	○	○	○	×	○	×	○	○	○	○
Outlook	○	○	×	○	×	○	×	×	○	○	○	○
Dropbox	×	×	○	×	○	×	○	○	○	○	○	○

1.3 Research Questions

To attain the three stages of this dissertation, each stage will answer one Major Research Question (MRQ) and two or three Subsidiary Research Questions (SRQs).

1.3.1 Stage 1

MRQ: How the ECS of SuccMail can affect the performance of SMEs?

SRQ 1: What kind of features are needed in ECS?

SRQ 2: What kind of features can improve the collaborative efficiencies in SMEs?

SRQ3: How satisfy does the user feel about the ECS?

1.3.2 Stage 2

MRQ: How does the support of SuccMail can affect the performance of SMEs?

SRQ 1: How does the internal support from SMEs can affect the performance of SMEs?

SRQ 2: How does the external support (from SuccMail of the ECS) can affect the performance of SMEs?

1.3.3 Stage 3

MRQ: How does the integration of ERP to ECS affect the performance of SMEs.

SRQ1: How does management support affect the performance of SuccMail usage?

SRQ2: How does absorptive capacity affect the performance of SuccMail usage?

SRQ3: How does user satisfaction affect the performance of SuccMail usage?

1.4 Research Method

This dissertation adopted mixed research methods and multiple case studies to complementary advantages. Each stage is conducted with the quantitative analysis by questionnaire survey and feedback via the users' interview.

The primary purpose of stage 1 is to measure whether those seven design features improve the performance of SMEs. Also, the interviews were conducted after the analysis.

Stage 2 is focusing on the effect of performance from the supports of SuccMail. The supports are assorted into external support and internal support. The ECS company's supports are external supports, and the supports from the top manager or enterprise are internal supports.

The primary purpose of stage 3 is to measure the performance of link-up ERP with ECS. During the questionnaire survey, employees complain about repetitive work in the ERP and the ECS. Therefore, SuccMail conducted the link-up ERP with ECS.

Chapter 2. Literature review

This chapter reviews relevant literature on important concepts and definitions of ECS and ERP. The literature reviews' primary purpose is to explain what is known about the research topic, both in terms of research findings and theory. Firstly, it introduces the literature reviews of ECS; secondly, it discusses the literature of ERP.

2.1 Enterprise Collaboration Systems

The concept of the Enterprise Collaboration System (ECS) is arising from e-commerce development and application demand (Simpson and Docherty, 2004). The ECS has the essential knowledge management feature of a knowledge management system. Employees can easily understand today's work content and the required knowledge through ECS, and any employee can get in touch with other members of the team in real-time, find experts who can help, or quickly connect to the related portal (Wu and Wang, 2009).

The ECS allows people to work together on the internet in real-time. ECS is believed should have three basic concepts communication, coordination, and collaboration (Ellis et al., 1991; Fuks et al., 2008; O'Brien and Marakas, 2010). Some of the others argued the project management systems are ECS as well. However, it is hard to give a narrow definition of the ECS. Broadly speaking, ECS is the integration with Enterprise Social Software (ESS) components (e.g., search, links, post, tags) (McAfee, 2006), communication system, and knowledge management system to support collaboration and management in the organization.

2.1.1 The Reasons for Enterprises Having Email and Instant Messaging Still Need ECS

Nowadays, enterprises have a lot of different choices to communicate. Most companies use a wide variety of mediums to communicate with their employees and customers, such as email, Skype, LINE, WhatsApp, WeChat, etc. The most popular communication medium is email, while email has become an unproductive tool. The research introduces three facets of information overload in email communication: A large amount of incoming information, inefficient workflow, and deficient communication quality (Soucek and Moser, 2010). Besides, Chui points out that the typical corporate user spends 2 hours and 14 minutes every day reading and responding to email (Chui et al., 2012).

"Email has its place but not as a catch-all communications tool," says the global managing director for R&D at consultancy Accenture. For example, email was never designed for real-time communications, as anyone who has tried to get hold of a colleague by email urgently will know (Nairn, 2011). The extensive reliance on email has led to numerous problems, studied extensively by CSCW researchers. Users are difficulties dealing with the high number of messages - email overload, and email is often only indirectly useful for the actual task at hand.

These days there is a lot of Instant Messaging (IM) on the market. Most of them are free to use, even for the enterprise. Hence, many SMEs not only use IM to communicate in the enterprise but also with the customer. There is a lot of research about IM for enterprises, and most of them agreed that using IM has benefits for SMEs. As previous researches, the researcher agrees it has benefits for SMEs. However, the researcher believes to manage the SMEs only with IM is not enough. SMEs need other

software to work with IM to achieve better performance in management. Therefore, to improve the communication and management quality of the enterprise, an appropriate tool is essential and necessary.

2.2 Why the Enterprises Have ERP Still Need ECS

2.2.1 What does ERP can do for the Enterprise?

The Enterprise Resource Planning (ERP) system stresses that it can enhance various benefits for the organizations, such as share knowledge, share data, cut costs, and improve the management of business processes (Almajali et al., 2016; Park et al., 2007). However, most organizations are not functioning well after implementation from the literature and critical statistics. The complexity of ERP is one of the reasons why ERP implementation failed a lot.

According to Chou and Rouhani (Chou et al., 2014; Rouhani and Zare Ravasan, 2013), from their experience, a rate between 65% and 85% failure of ERP system, and less than 70% of the ERP system capabilities were used in the organizations. Furthermore, less than 35% of the promised benefits from the ERP system. From the literature and critical statistics, most organizations do not function well after implementing ERP systems (Lin et al., 2020).

2.2.2 The Reasons of Enterprises Had ERP Still Need ECS

As an enterprise's financial and business management system, ERP has been widely used in various sizes of enterprises. The system is usually used in the internal finance, business operation management, and decision-making process of enterprises (Gattiker and Goodhue, 2005; May et al., 2013) and are expected to provide seamless

integration of processes across functional areas (Mabert et al., 2003). However, ERP can only be used within the enterprise and simplify and integrate the enterprise's internal financial and business processes (Davenport, 1998). According to the research of Huang, Nicolaou, Ram, Ruivo, and others, when supplementing other IT resources, ERP will have a better impact on business value (Huang and Yasuda, 2016; Nicolaou and Bhattacharya, 2006; Ram et al., 2013; Ruivo et al., 2012; Velcu, 2007). These findings are consistent with the early research results of Laframboise, Holland, and others. They believe that ERP alone is not enough to affect the business value of an enterprise significantly. Still, suppose other IT resources can be integrated with ERP (Holland and Light, 2001; Laframboise and Reyes, 2005). In that case, it can give full play to management advantages, thereby creating a unique system that can significantly improve management performance and business value. Researchers such as Francalanci, Liu, and Melville believe that system integration links databases between different software to collaboration (Francalanci and Morabito, 2008; Liu et al., 2013; Melville et al., 2004). Bharadwaj, Hsu, Laframboise, Ram, and others pointed out that system integration's primary value is data quality and data integration. Because this can avoid repeated input of data, improve data accuracy, and increase the transparency and visibility of these data within the enterprise, allowing enterprises to process information and data more efficiently(Bharadwaj et al., 2007; Hsu, 2013; Laframboise and Reyes, 2005; Ram et al., 2013). Narayanan, Samaranayake said that integrated business processes could save time and cost, allowing enterprises to make decisions faster and obtain better decision-making effects while reducing errors (Narayanan et al., 2011; Samaranayake, 2009). Chen, Hsu, Rai, and others also pointed out that system integration is the prerequisite and promoter of management and business process integration. The system integration between different departments or subsidiaries in the enterprise will be unwilling to share information, cause the phenomenon of varying

integration levels (Chen and Popovich, 2003; Hsu, 2013; Rai et al., 2006). The research results of Boulding, Dong, Hendricks, Rai, Ranganathan, and others pointed out that only by combining the enterprise's IT resources to measure the integration of systems and processes can it have a practical impact on management and business value (Boulding et al., 2005; Dong and Zhu, 2008; Hendricks et al., 2007; Hsu, 2013; Rai et al., 2006; Ranganathan and Brown, 2006).

Both the systems ERP and ECS require the skills of their users. Generally speaking, the skills required by ERP are stick and routine. In contrast, the skills required by the ECS user are more flexible, which requires the user to understand the suitability of a tool for a current task at hand and make appropriate selections. ERP systems are based on a process-oriented view (Davenport, 1998) to support clearly defined and repeatable business features following built-in business rules. ERP systems are critical to businesses because they support the core production process. The first essential difference concerns for ERP users are their application area and the structure of their content. ECS, on the other hand, is designed to support joint work among people in the workplace.

In today’s highly competitive environment, SMEs lack the resources compare with large enterprises. The ECS to SMEs is like the Enterprise Information Portal (EIP) system to large enterprises. Even though the SMEs successfully implement ERP and operate smoothly, they do not have enough resources to develop their own ECS (or EIP). By their very nature, SMEs lack resources, which effectively raises a barrier to IS adoption (Shiau et al., 2009).

They are a fundamental difference between the software of ECS and ERP. ECS supports collaborative communication in the enterprise. The user of ECS is often voluntary who must be convinced of the benefits of using these tools. This is why "user

acceptance" has traditionally played a much more significant role in research on collaboration systems (Riemer and Johnston, 2012). However, ERP data comprises highly structured master data and transactional data reflecting the enterprise's resources and business activities. Simultaneously, most parts of ECS contain unstructured content such as documents, mail messages, or enterprise instructions. They also differ in purpose and use. ERP systems give little room for creativity, and they impose their structure and their implemented order of events onto the user. The use of ERP systems usually is mandatory. On the other hand, ECS are tools for ad-hoc use that offer choice and thus entail uncertainty (Dourish, 2003). Fundamentally, ERP can be seen as a development objective of mapping all enterprise processes and data into a comprehensive integrative structure. ERP can also be seen as the critical element of an infrastructure that delivers a business solution (Klaus et al., 2000).

The next chapter will describe the design features of SuccMail.

Chapter 3. The Design Features of SuccMail

This chapter including the design features of SuccMail with the reasons and the snapshots of each feature. SuccMail is one of the popular Enterprise Collaboration Systems (ECS) in Taiwan. ECS are cross-functional information systems. People can communicate ideas through internet technologies, share resources, coordinate their work efforts, and collaborate with the team and workgroup, enhancing productivity (O'Brien and Marakas, 2010).

The design features of SuccMail are as follows:

3.1 Accessibility of Historical Messages by Any Group Member

As long as an employee is assigned as a group member, the employee has the accessibility to read any historical messages in the group, including the messages posted before the employee was in the group.

The purpose of this feature is for the employee to take office at any time to understand the relevant information from the past event.

3.2 Administrative Area, Purchase Plan, and Payment Request

The purpose of this feature is to prevent the drawbacks of the purchase and payment process. The progress of purchase and payment should be transparent and traceable. The purchase plan progress tracking allows staff to have a full discussion and

comparison before the purchase. The staff can track the payment request progress anytime and will not be targeted due to personal reasons.

Figure 3.1shows a purchase plan in the middle of progress; in this case, there are three stages verification, approval, and confirmation. The progress stages can be customizable by the system administrator, and each stage is assigned to a person to confirm. In Figure 3.1, the purchase plan has passed the first stage of verification and is waiting for the next stage of approval. Below the table is a descriptive statement of the reason for the purchase. In this case, the purchase reason uses the URL links to other past events. The attached file is the certification of each of the purchased items.

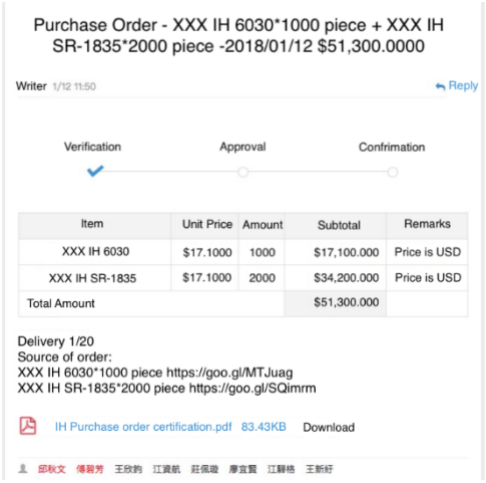

Figure 3.1 SuccMail snapshot of the progress tracking of a purchase plan

3.3 Customizable Labels Based on Business Events/Action for Search Feature

Every enterprise has some different unique event and object label. In order to unify the terminology in the organization, the labels are essential keywords. Users can easily search any historical messages by using the input of the event or object label.

Figure 3.2 shows a customizable search. There are some selections of filters to choose from. The filter selection, including keyword, date range, group, and document. Figure 3.3 shows the results of the search from Figure 3.2

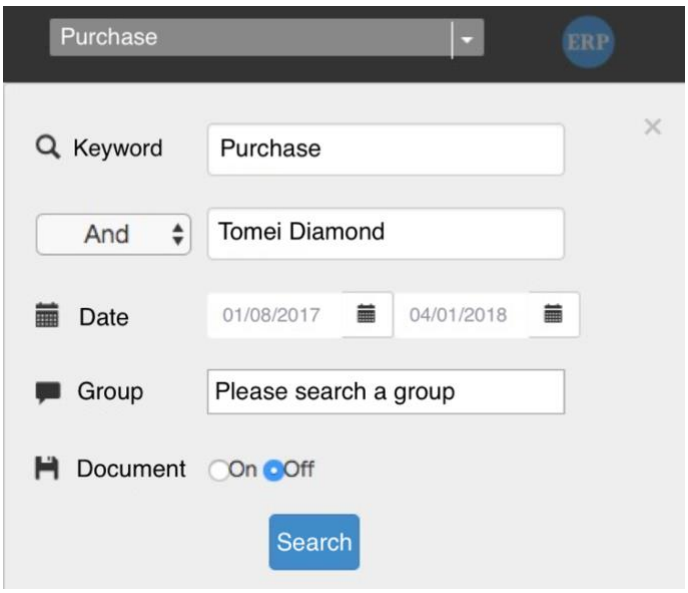

Figure 3.2 SuccMail snapshot of the customizable search

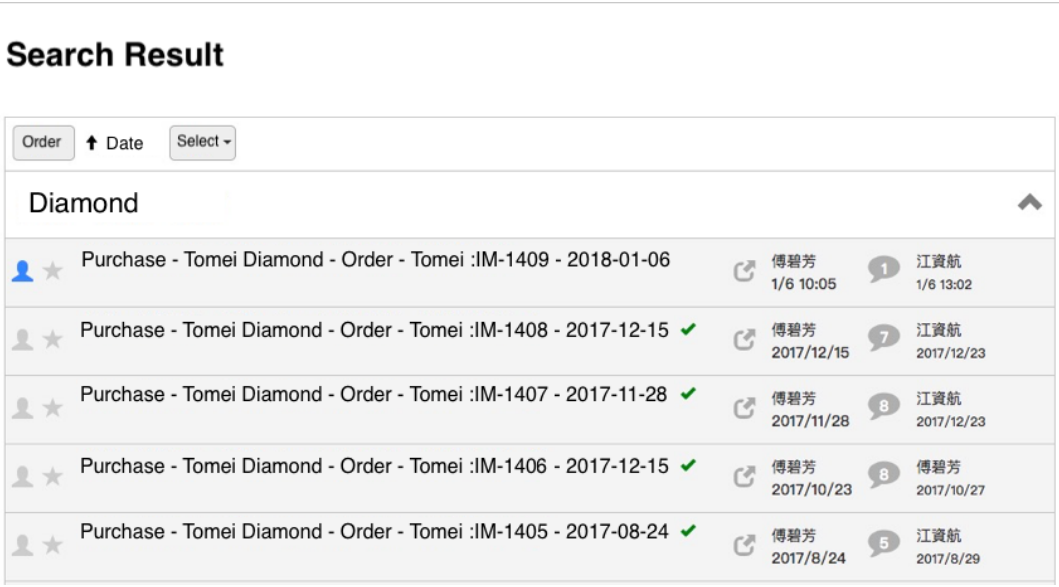

Figure 3.3 SuccMail snapshot of the search result of Figure 3.2

3.4 Display of Messages Status (who and when read/unread the messages)

Most of the time, people send out messages or email to expect a response as soon as possible. However, people do not know when does the other reads it or even receives it. Therefore, with the display of messages state, the user can clearly understand whether assigned co-workers have read the messages.

Figure 3.4 shows Member B answer Member A 1/12 14:32's message on 1/12 17:20, and Member A read this message at 1/12 17:33, while Member C has not read the message yet.

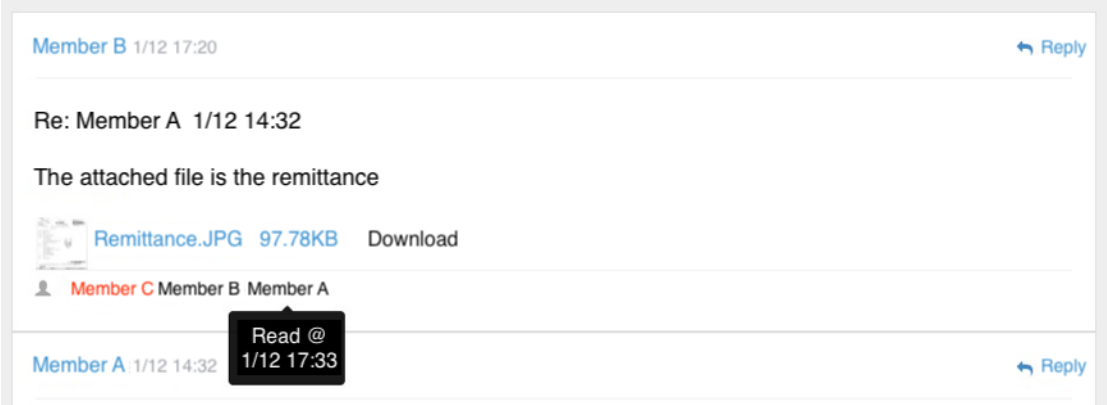

Figure 3.4 SuccMail snapshot of the messages state

3.5 Tracking Event Ongoing or Completion

The purpose of this feature is to prevent making all the events stack together. Classify the events that had been done to completion, and separate them from the ongoing events. All members can apply to file the event, while only the authorized platform manager can archive the completed events. Furthermore, any filed issue can be thrown back to the ongoing events area to discuss again.

Figure 3.5 shows the status of the ongoing events, and Figure 3.6 shows the status of the completion events.

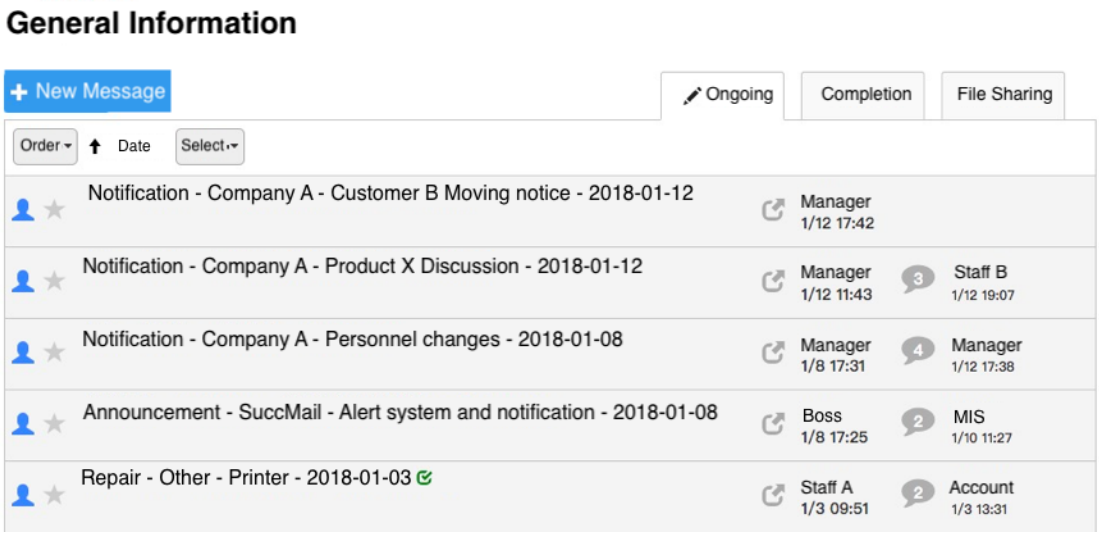

Figure 3.5 SuccMail snapshot of the ongoing events

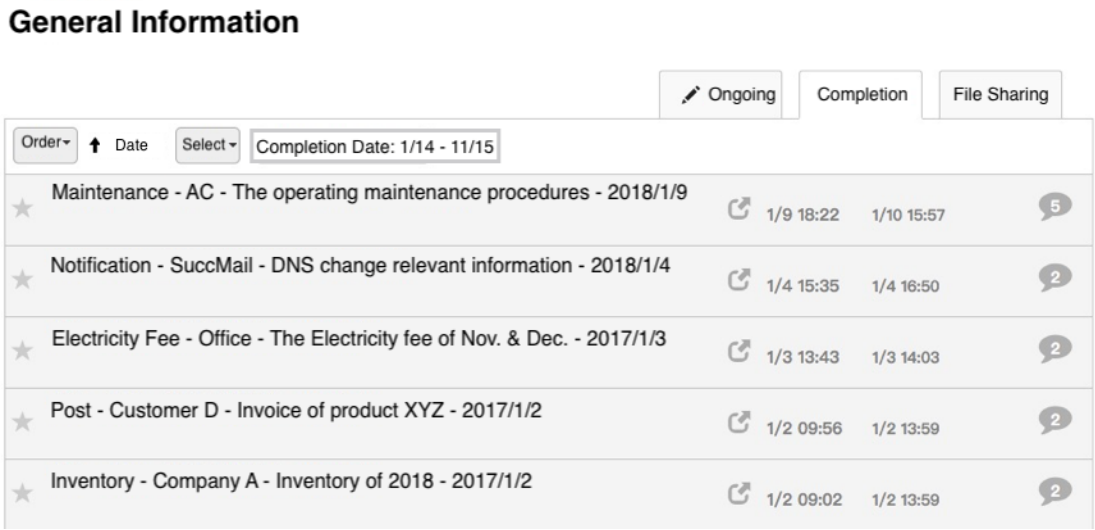

Figure 3.6 SuccMail snapshot of the completion events

3.6 Group Files Sharing Feature

There are a lot of documents that often been used in the group, such as application forms, order sheets, customer lists, working progress, meeting minutes,

etc. The upload file can be updated, and it will keep all versions with sort by time. Also, group file sharing can be customized.

Figure 3.7 shows the files in the file sharing block in the general information group.

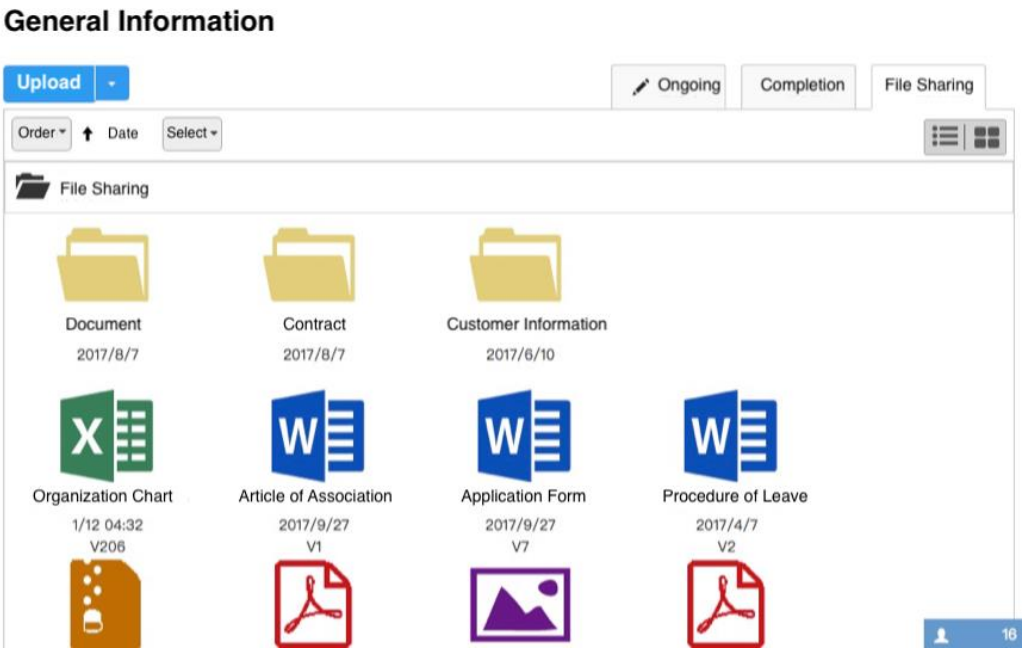

Figure 3.7 SuccMail snapshot of the group file sharing

3.7 Links to the Past Events URL

Every event has a unique Uniform Resource Locator (URL). The user can quickly provide any information from the past events, whether it is continued or relevant, through using the URL link.

Figure 3.8 shows the resume URL producing area, which can link to any event.

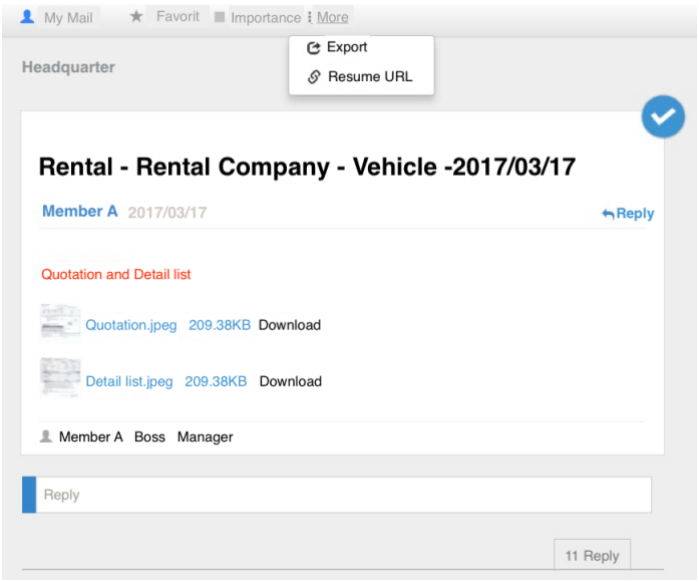

Figure 3.8 SuccMail snapshot of the URL link

Chapter 4. Stage 1 Elucidating the ECS SuccMail design feature on the performance of SMEs.

4.1 Research Strategy

The primary purpose of stage 1 is to measure whether those seven design features improve the performance of SMEs. Also, the interviews were conducted after the analysis.

4.2 Research Method

This stage selected four case studies. To consider the SMEs include different industries, the researcher contacted as many SMEs as possible. Ultimately, four different industries agreed with the survey and interviews, including a manufacturing enterprise, an international trading enterprise, an information technology enterprise, and an education center. As a return, the researcher will report the finding of the study.

Figure 4.1 shows the roadmap of the research methodology. From the methodology's perspective, the researcher tried to determine the overarching goal by Exploratory Factor Analysis (EFA) to identify the underlying relationships between measured variables (effectiveness), and also identified the features in ECS as a set of latent constructs in each performance. Furthermore, this methodology also gives an exploration to discuss the inter-related among the performance features. The primary purpose of this stage is to demonstrate the potential feature and benefit effect of featured elements and performance in the application and operation of ECS.

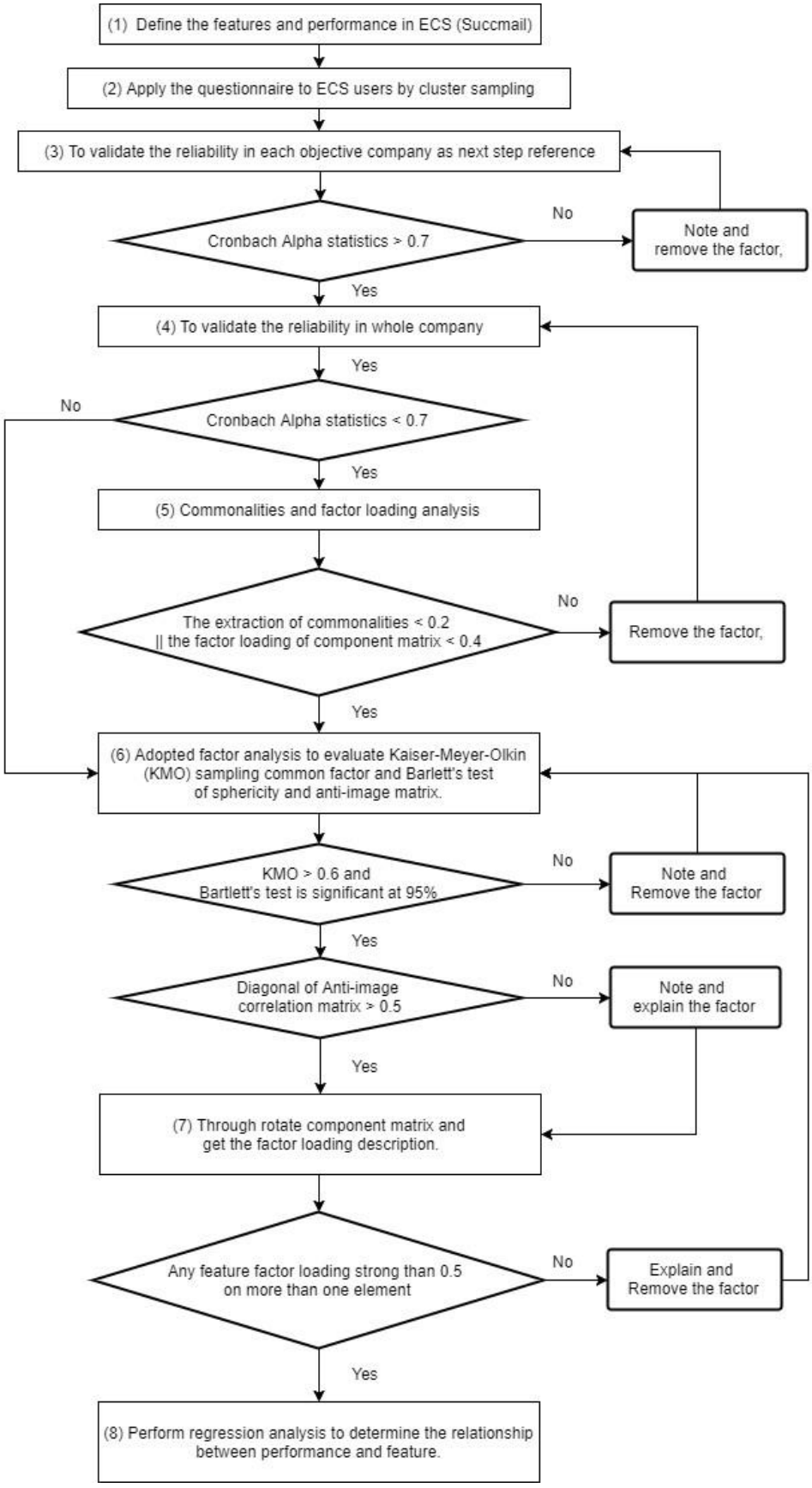

Figure 4.1 The research methodology roadmap of stage 1

Concerning discussing SMEs' performance issues using ECS, the researchers considered four aspects: human resources, customer complaints, time issues, and communication issues. Its performances are defined as follows:

4.2.1 Human Resource Reduction

Human resources are divided into two types: direct labor and indirect labor. The only labor involved in the hands-on production of goods and services is considered direct labor. All other labor is classified as indirect labor. Similarly, direct labor refers to labor allocated to the show or service of a specific product, cost center, or work order. When an enterprise produces products, direct labor refers to the labor of production personnel who have goods on the enterprise's production line, such as machine operators, assembly-line assemblers, and Packing members. When an enterprise provides services, direct labor is regarded as the labor of people who directly provide services to customers (such as consultants, teachers, restaurant waiters, etc.). Enterprises' basis for charging fees is the number of working hours used in the production process.

In contrast, indirect labor costs refer to the cost of any labor that supports the production process but does not directly participate in the active conversion of materials into finished products. Indirect work includes managers, site supervisors, and administrative personnel such as personnel, general affair, and Procurement staff. Therefore, minimizing indirect labor and maintaining high-quality goods and services is one of the critical issues for SMEs' profitability (Steven, 2015).

4.2.2 Customer Complaints Reduction

The consumers are treated unreasonably in the process of consumption or got the damaged goods, claims to the manufacturer for the compensation of the damages. These were caused by the negligence in the production process of the products or provided by the defective service, and produced an irrational situation for customers. This will result from the consumers' negotiation with the manufacturer or exchange behavior. On the other hand, without the customer complaints, the enterprise itself will not be able to know the reasons, but lose the customers. The loss of the customer is the loss of customers' loyalty and confidence for the enterprises. There is such scruple, so the enterprise will actively communicate with the customer, and more and more enterprises import the customer service department to deal with customer complaints to improve the product quality or prevent customer complaints. Of course, the major challenges faced by enterprises are to minimize the customer complaints; this will lead to greater customer loyalty and, ultimately, better financial performance (Heskett et al., 2008).

4.2.3 Time Savings

There are many different meetings in the enterprise, including status update meetings, information-sharing meetings, decision-making meetings, problem-solving meetings, innovation meetings, team-building meetings, etc. Meetings take time to discuss and look for the answer. It takes too much time for every meeting in all enterprises. Except for meetings, the managers of the enterprises spend a lot of time searching or find documents. Time is money; saving time in enterprises is one of the key factors to defeat opponents.

4.2.4 Communication Improvement

Nowadays, enterprises have a lot of different choices to communicate. Most companies use a wide variety of mediums to communicate with their employees and customers email, Skype, LINE, WhatsApp, WeChat, etc. The actual communication medium is usually determined by the content and target of the message. The main difference between internal and external communication in an enterprise is the content and the target. Intra-enterprise communication refers to the communication between relevant personnel in the enterprise organization and participants in business, production, and administrative operations. In contrast, an enterprise's external communication refers to communication between the company and other outside individuals, groups, or organizations. The most popular communication medium is email, while email has become an unproductivity tool. The typical corporate user spends 2 hours and 14 minutes every day reading and responding to email (Chui et al., 2012). The influx of a large amount of spam, inefficient work efficiency, and poor communication quality are the three fatal e-mail message communication injuries(Owen, 2013; Soucek and Moser, 2010). Therefore, to improve the communication quality of the enterprise, a good communication tool is essential.

4.3 Research Questionnaire

In order to answer the research questions, the structural questionnaire design for the SMEs is using the ECS (SuccMail). In the first, the researcher visited and had an interview with the owner of each sampling enterprise in order to smoothly conduct the survey and evaluate it. After that, the self-administered questionnaire was sent via google form or use the paper questionnaire.

4.3.1 Questionnaire Survey

This survey contains three parts. The first section included 5 fundamental profiles; these questions are the main data source of the descriptive statistics and ask who uses ECS on their workspace or enterprise.

The second part of this survey was designed to receive specific data on the objective measurement of human resource reduction and customer complaints reduction. The researcher asked the SMEs to provide the number of employees before and after using ECS, the number of complaints in 2017, and the average of complaints per year before ECS adoption.

In the third part, the researcher examined the relationships among these effects and proposed our constructed framework for the investigation of the evaluation of ECS in Figure 4.2. To survey the effectiveness of each critical design feature of each performance, the questionnaire was designed to ask about the effectiveness of 7 design features on each of the 4 performances. Each design feature is not entirely able to impact every performance, and this questionnaire to evaluate each performance by each feature is to ensure the respondents could be able to maintain objectivity. Appendix A shows the full questionnaire for this study. Table 4.1 shows the abbreviation of the questions from the questionnaire. The researcher also arranged seven features and four performances into a comprehensive list for the advanced analysis process in Table 4.2.

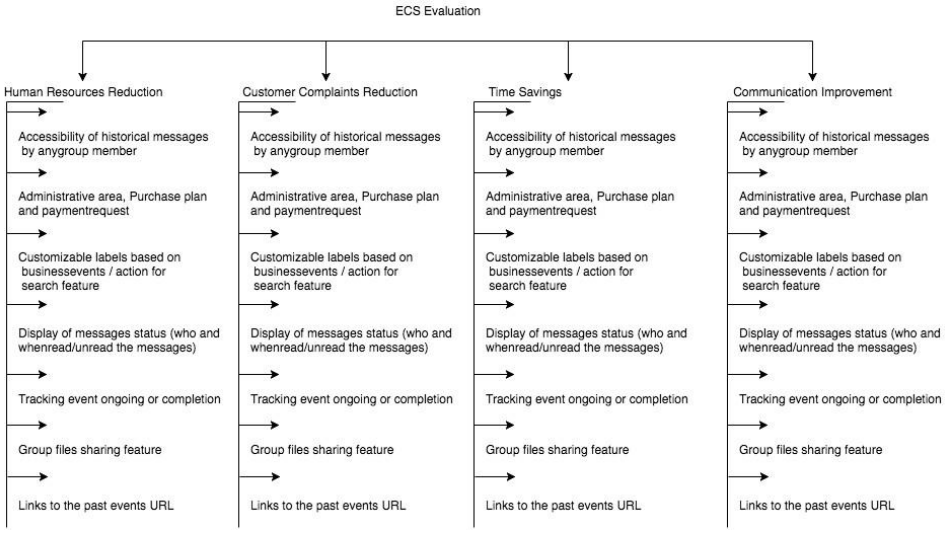

Figure 4.2 The conceptual framework for ECS 4 performances evaluation

Table 4.1 The abbreviations of the question from the questionnaire

No	Type	Code	Description
1	Question	HR01	**Accessibility of historical messages by any group member** is effective to reduce the size of human resources.
2	Question	HR02	**Administrative area, purchase plan, and payment request** is effective to reduce the size of human resources.
3	Question	HR03	**Customizable labels based on business events/action for the search feature** is effective to reduce the size of human resources.
4	Question	HR04	**Display of messages status (who and when read/unread the messages)** is effective to reduce the size of human resources.
5	Question	HR05	**Tracking event ongoing or completion** is effective in reducing the size of human resources.
6	Question	HR06	**Group file sharing feature** is effective in reducing the size of human resources.
7	Question	HR07	**Links to the past events URL** is effective to reduce the size of human resources.
8	Question	CR01	**Accessibility of historical messages by any group member** is effective to reduce customer complaints.
9	Question	CR02	**Administrative area, purchase plan, and payment request** is effective to reduce customer complaints.
10	Question	CR03	**Customizable labels based on business events/action for the search feature** is effective to reduce customer complaints.

No	Type	Code	Description
11	Question	CR04	**Display of messages status (who and when read/unread the messages)** is effective to reduce the customer complaints.
12	Question	CR05	**Tracking event ongoing or completion** is effective in reducing the customer complaints.
13	Question	CR06	**Group files sharing feature** is effective to reduce the customer complaints.
14	Question	CR07	**Links to past events** is effective to reduce the customer complaints.
15	Question	TS01	**Accessibility of historical messages by any group member** is effective to reduce the average time to complete events in this organization.
16	Question	TS02	**Administrative area, purchase plan, and payment request** is effective to reduce the average time to complete events in this organization.
17	Question	TS03	**Customizable labels based on business events/action for search feature** is effective to reduce the average time to complete events in this organization.
18	Question	TS04	**Display of messages status (who and when read/unread the messages)** is effective to reduce the average time to complete events in this organization.
19	Question	TS05	**Tracking event ongoing or completion** is effective in reducing the average time to complete events in this organization.
20	Question	TS06	**Group file sharing feature** is effective in reducing the average time to complete events in this organization.
21	Question	TS07	**Links to past events URL** is effective in reducing the average time to complete events in this organization.
22	Question	CI01	**Accessibility of historical messages by any group member** is effective to improve the collaborative communication in this organization.
23	Question	CI02	**Administrative area, purchase plan, and payment request** is effective to improve the collaborative communication in this organization.
24	Question	CI03	**Customizable labels based on business events/action for search feature** is effective to improve the collaborative communication in this organization.
25	Question	CI04	**Display of messages status (who and when read/unread the messages)** is effective to improve the collaborative communication in this organization.
26	Question	CI05	**Tracking event ongoing or completion** is effective in improving the collaborative communication in this organization.
27	Question	CI06	**Tracking event ongoing or completion** is effective in improving the collaborative communication in this organization.

No	Type	Code	Description
28	Question	CI07	**Links to past events URL** is effective to improve the collaborative communication in this organization.

Table 4.2 The identification of features and performance

No	Type	Code	Description
1	Performance	HR	Human Resources Reduction
2	Performance	CR	Customer Complaints Reduction
3	Performance	TS	Time Saving
4	Performance	CI	Communication Improvement
5	Feature	HM	Accessibility of historical messages by any group member
6	Feature	AA	Administrative area, purchase plan, and payment request
7	Feature	CL	Customizable labels based on business events/action for the search feature
8	Feature	RS	Display of messages status (who and when read/unread the messages)
9	Feature	OC	Tracking event ongoing or completion
10	Feature	FS	Group files sharing feature
11	Feature	LE	Links to the past events URL

4.3.2 Evaluation Method

Due to the flexibility of this model, the researcher also demonstrated by identifying the features in 4 performances in order to pay attention to the connection between the useful effect of performance and features. In Figure 4.2, these features are distributed into 4 performances, which the researcher supposed are the primary determinants of performance related to a strong connection and weak connection. There are 7 features related to each of the 4 performances. About seven features and four effectiveness performances, the researcher arranged it into a comprehensive list for the advanced analysis process as Table 4.2. This will aim to investigate the effect of these features on human resource reduction, customer complaints reduction, time savings,

and communication improvement using exploratory factor analysis. The 5-point Likert scale is used in our designed questions, which based on the research experience of Douglas (1989) that he proposed the 5-point scale was more reliable than other feature (Douglas R., 1989). The evaluated data will be analyzed by IBM SPSS Statistics 18 for Windows.

4.4 Data Collection

The data were collected from 38 users of 4 SMEs that have deeply used ECS for work in their enterprise. The enterprises were identified from the ECS vendor SuccMail.

4.5 Data Source

All of the survey questionnaires were personally sent to 38 SuccMail users from 4 enterprises straight. For surveys of the questionnaire, the researcher had reached out to the owner or the person in charge of the enterprises and made an appointment with each enterprise. The overall recovery ratio of the questionnaire is 38 (100%). None of the questionnaires invalid, the effective recovery ratio of questionnaires is 38 (100%).

Demographics of the respondents and companies showed that 4 (10.5%) employers, 9 (23.7%) general managers or deputy general managers, 22 (57.9%) staff, 2 (5.3%) accountants, and 1 (2.6%) consultant.

Twenty-three (60.5%) of the respondents were female, and 15 (39.5%) were male. 10 (26.3%) respondents were in their twenties, 11 (28.9%) were in their thirties, 12 (31.6%) were in their forties, and 5 (13.1%) were over their fifties. 9 (23.7%) had

worked experience for under 5 years, 5 (13.2%) had 5-9 years, 7 (18.4%) had 10-14 years, 7 (18.4%) had 15-19 years, and 10 (26.3%) had over 20 years work experience.

3 (7.9%) were high school graduates, 22 (57.9%) had a bachelor's degree, 8 (21.1%) had a master's degree, 5 (13.1%) had a Ph.D. degree.

4.6 Reliability Tests of Features

The researcher validated the reliability in each objective enterprise as a reference for the next step through the Cronbach Alpha value from the measurement items of the questionnaire to test whether a scale is stable and reliable.

The researcher ran the interrelatedness and dimensionality test between the performances and the features to obtain a higher consistency and stability of the respondents' psychological characteristics. This is based on a feature to realize performance or effectiveness, or expected to gain the performance by using a feature or application. Every sampling enterprise took two sections of the reliability test. The first section is feature-oriented, that the researcher constructed a 7×4 matrix to present the Cronbach Alpha value to draw a comparison and relationship between features and performances. On the contrary, the next section is performance-oriented.

Reliability tests were run to ensure the results of the measurement items are stable and consistent. This study was adopted using the Cronbach Alpha value > 0.700 is reliable (Nunnally, 1978). In this study, the model the researcher proposed is flexible, therefore the reliability tests were run in two ways. The results of the reliability test of this questionnaire from both of the performances oriented and the features oriented were all over 0.700, therefore the overall measurement results have a certain degree of credibility. Most studies tend to test Cronbach Alpha values in the interval of 0.7 - 0.9

to verify its consistency and stability, but there are other scholars who support 0.6 (Nunnally and Bernstein, 1994). In the following tables, the status was checked, and the statistical analysis of subsequent factor analysis was taken into account. The decision to keep those items first was made, and all of the values are over 0.6.

Table 4.3 presents the result of the reliability test of 7 design features.

Table 4.3 Reliability Test of 7 Design Features

	Cronbach's Alpha	Items
HM	0.773	4
AA	0.768	4
CL	0.765	4
RS	0.748	4
OC	0.777	4
FS	0.728	4
LE	0.879	4
All	0.921	28

4.6.1 Reliability Test of Performance

This section is performance-oriented, the researcher constructed a 4×7 matrix to present the Cronbach Alpha value to draw a comparison and relationship between performances and features. This is starting from expected achievement to physical features.

The researcher will show the full process of the reliability test in the sampling companies, record and explain the results through the following results of the reliability test of each enterprise, which includes the orientations of features to performances and performances to features. In further, the researcher integrated every survey from each sampling enterprise bundle into another sample. In order to take into account, the consistency of the use of the entire sample confirmation, the researcher also ran the 7×4

matrix and 4×7 matrix. In the end, the researcher adopted 4×7 through considering the adequacy of extracted value from commonality and factor loading in the component matrix.

Table 4.4 Reliability Test of 4 Performances

	Cronbach's Alpha	Items
HR	0.752	7
CR	0.719	7
TS	0.810	7
CI	0.826	7
All	0.921	28

4.7 Validity Tests

In order to make the validity test from factorial analysis more certain. First of all, the researcher used the limited extraction component extraction method through the communality test and factor loading to consider remove or retain the factor for follow-up no limited extraction factor analysis.

According to Ming Long Wu. (2010), if the communality is below 0.20, the communality and the represents of the sum of the squares of each common factor load on each variable should consider being removed. Therefore, the researcher defined the threshold of communality value as 0.2 (Wu, 2010).

Spicer, J. (2005) propose that in order for each variable to be attributed to a clear principal factor, the loading factor should be above 0.4. Considering each item variable has to be classified as a clear main factor, the researcher defines the factor loading value threshold as 0.4 (Spicer and Spicer, 2005).

4.7.1 The Result of Limited Extraction Component Method

The researcher used the limited extraction component method. By extracting individual factors, the researcher can determine whether the item has a considerable degree of explanatory power. The researcher referred to the previous section as mentioned threshold value of communality and factor loading. As the basis of the no limited extraction component method for deleting or retaining the items.

Base on the limited extraction component method, the researcher removed the values of communality < 0.2 and factor loading < 0.4. In Table 4.5, Table 4.6, Table 4.7, Table 4.8 the researcher removed the items include FS_HR, AA_CR, FS_TS due to the lower communality and factor loading value. And the researcher also removed OC_CR and CL_CR because the respondents reflect there is no relationship between the features and the performance.

Table 4.5 Communality and factor loading values of each feature in human resource after factorability test

Element No	Communality values		Factor loading values
	Initial	Extraction	component
HM_HR	1	0.604	0.777
AA_HR	1	0.407	0.638
CL_HR	1	0.664	0.815
RS_HR	1	0.491	0.701
OC_HR	1	0.28	0.529
FS_HR	1	0.044	0.21
LE_HR	1	0.598	0.773

Table 4.6 Communality and factor loading values of each feature in customer complaints reduction after factorability test

Element No	Communality values		Factor loading values
	Initial	Extraction	component
HM_CR	1	0.472	0.687
AA_CR	1	0.113	0.337
CL_CR	1	0.365	0.604
RS_CR	1	0.715	0.845
OC_CR	1	0.270	0.520
FS_CR	1	0.288	0.537
LE_CR	1	0.405	0.637

Table 4.7 Communality and factor loading values of each feature in time saving after factorability test

Element No	Communality values		Factor loading values
	Initial	Extraction	component
HM_TS	1	0.685	0.828
AA_TS	1	0.597	0.772
CL_TS	1	0.527	0.726
RS_TS	1	0.536	0.732
OC_TS	1	0.473	0.688
FS_TS	1	0.060	0.245
LE_TS	1	0.580	0.762

Table 4.8 Communality and factor loading values of each feature in communication improvement after factorability test

Element No	Communality values		Factor loading values
	Initial	Extraction	component
HM_CI	1	0.656	0.810
AA_CI	1	0.598	0.773
CL_CI	1	0.581	0.762

RS_CI	1	0.552	0.743
OC_CI	1	0.458	0.677
FS_CI	1	0.214	0.462
LE_CI	1	0.486	0.697

4.7.2 The Result of the Rotated Component Matrix through limited extraction component method.

The researcher adopted analysis to run the no-limited extraction factor analysis and got Table 4.9. The feature HM had turned out of factor loading strong than 0.5 on 1, 2, and 3 components as an observation. Therefore, the researcher decided to remove the feature HM to retest the factor analysis. This is the result of the rotated component matrix according to step 5.

Table 4.9 The first-time factor analysis rotated-component matrix

	Component				
	1	2	3	4	5
AA_TS	0.899				
AA_HR	0.895				
AA_CI	0.856				
HM_CI	0.709				
OC_TS	0.676				
HM_TS	0.675				
CL_TS		0.782			
RS_CI		0.775			
HM_CR		0.73			
CL_CI		0.727			
CL_HR		0.669			
LE_CI			0.721		
FS_CR			0.72		
HM_HR			0.716		
LE_TS			0.696		
LE_HR			0.67		
LE_CR			0.668		

OC_HR		0.852	
OC_CI		0.844	
RS_CR			0.675
RS_TS	0.534		0.606
RS_HR	0.505		0.591
FS_CI			-0.518
Kaiser-Meyer-Olkin measure of sampling adequacy			0.706
Bartlett's Test of Sphericity		Approx. Chi-Square	674.686
		Df	253
		Sig.	0.000

4.7.3 The Result of KMO and Bartlett's Test

As mentioned, the researcher removed the features HM, AA_CR, CL_CR, OC_CR, FS_HR, FS_TS, and FS_CI to perform the following factorial analysis. According to Kaiser (1974), KMO values should be at least above 0.60 for the factor analysis process to be a reluctantly acceptable factorial analysis. Therefore, the researcher defined KMO as 0.6. Kaiser further states that if the KMO value is above 0.7, the representative is an acceptable medium-factor analysis, and the result is very close to this part (Kaiser, 1974).

Table 4.10 KMO and Bartlett's test results

Kaiser-Meyer-Olkin measure of sampling adequacy		0.724
Bartlett's Test of Sphericity	Approx. Chi-Square	507.436
	Df	153
	Sig.	0.000

In Table 4.10, the researcher showed the KMO measure of sampling adequacy of 0.724. The researcher made the measurement of the quality of the correlations

between variables in order to be able to continue the factorial analysis. The above KMO and Bartlett's test results are from the procedure 5 and 6 in Figure 4.1.

4.7.4 The Result of Anti-Image Correlation Matrices

Table 4.11 shows that each diagonal value represents a variance of Measures of Sampling Adequacy (MSA) in the anti-image matrix. MSA value is close to KMO value, and the feature turns to more adaptive as its MSA value got closer to 1. First, the researcher verified whether the questionnaire was adaptive to the factorial analysis or not by KMO value and then checked the adaptation in each item of feature via MSA value.

Table 4.11 The Anti-image correlation Matrices

	AA_HR	AA_TS	AA_CI	CL_HR	CL_TS	CL_CI	RS_HR	RS_CR	RS_TS	RS_CI	OC_HR	OC_TS	OC_CI	FS_CR	LE_HR	LE_CR	LE_TS	LE_CI
AA_HR	.688$^{\alpha}$																	
AA_TS	-.493	.708$^{\alpha}$																
AA_CI	-.225	-.541	.791$^{\alpha}$															
CL_HR	-.138	-.392	.476	.705$^{\alpha}$														
CL_TS	-.407	.410	-.191	-.280	.742$^{\alpha}$													
CL_CI	.371	.174	-.468	-.616	-.284	.632$^{\alpha}$												
RS_HR	.145	-.081	-.029	-.463	-.098	.442	.699$^{\alpha}$											
RS_CR	.244	.238	-.309	-.355	-.105	.315	.021	.592$^{\alpha}$										
RS_TS	-.124	.007	-.090	.199	-.019	-.194	-.567	-.150	.786$^{\alpha}$									
RS_CI	-.250	.079	.094	.245	.007	-.367	-.186	-.200	-.074	.721$^{\alpha}$								
OC_HR	-.290	.290	-.070	.111	.354	-.330	-.354	.030	.152	.453	.493$^{\alpha}$							
OC_TS	-.322	-.131	.117	.456	.163	-.454	-.316	-.121	.045	.192	.074	.738$^{\alpha}$						
OC_CI	.414	-.416	.097	-.136	-.274	.254	.290	-.225	-.045	-.498	-.793	-.279	.525$^{\alpha}$					
FS_CR	-.309	.427	-.248	-.252	.523	-.026	-.072	-.174	-.055	.258	.282	.036	-.237	.522$^{\alpha}$				
LE_HR	.053	.054	-.111	-.101	.006	-.014	.035	.062	-.069	.082	.118	-.087	-.097	.124	.937$^{\alpha}$			
LE_CR	.341	-.332	.285	.108	-.417	.179	.203	-.278	-.220	-.144	-.481	-.263	.520	-.315	-.290	.527$^{\alpha}$		
LE_TS	-.269	.070	.040	-.004	.148	-.259	-.117	-.170	.341	-.215	-.186	.006	.222	-.098	-.295	-.043	.812$^{\alpha}$	
LE_CI	.322	-.080	-.156	-.143	-.322	.415	.182	.402	-.282	.058	.066	-.064	-.156	-.155	-.111	.008	-.708	.751$^{\alpha}$

In the interview with the respondents, the researcher found that very few respondents used the feature of group file sharing. And the researcher realized the OC_HR is very close to 0.5. Owing to our respondents are not familiar with the feature of "Tracking event ongoing or completed." Therefore, the researcher kept the above 2 items to the next section to run the rotate component matrix.

4.7.5 The Eigenvalues of the Final Components and the Amount of Variance Explanation.

From Table 4.12, the researcher could realize that there are 5 eigenvalues treat as elements in the factorial analysis. Due to the default eigenvalue of SPSS is defined as1, and there are 5 eigenvalues larger than 1 in Table 4.12. At least each component had an eigenvalue above 1, which means that these components are stable according to Kaiser's criterion (eigenvalue > 1) (Kaiser, 1974, 1970). It was explained as identified 79.15% of the total variance.

Table 4.12 Initial eigenvalues of remaining 5 elements after factorability test

Element No.	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.788	43.266	43.266	7.788	43.266	43.266
2	2.167	12.037	55.303	2.167	12.037	55.303
3	1.621	9.007	64.310	1.621	9.007	64.310
4	1.380	7.665	71.975	1.380	7.665	71.975
5	1.292	7.175	79.150	1.292	7.175	79.150
6	0.812	4.513	83.663			
7	0.577	3.207	86.870			
8	0.521	2.892	89.762			
9	0.358	1.988	91.750			
10	0.317	1.760	93.510			
11	0.279	1.549	95.059			
12	0.229	1.275	96.334			

13	0.216	1.201	97.535
14	0.158	0.879	98.414
15	0.133	0.740	99.154
16	0.062	0.345	99.499
17	0.048	0.267	99.765
18	0.042	0.235	100.000

4.7.6 The scree plot of initial eigenvalues from 18 elements

In Figure 4.3, the researcher also used a scree plot to support the findings of the previous section, and the researcher found the eigenvalues of five components are larger than 1. Then the researcher will discuss the factor loading value of each component through the rotated-matrix component.

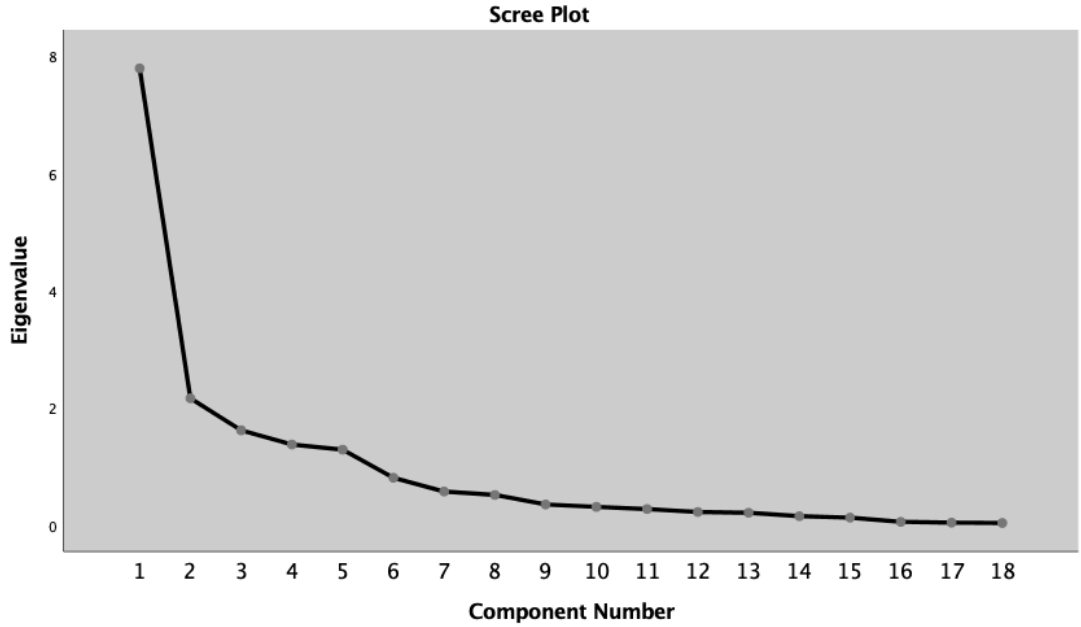

Figure 4.3 Scree plot of initial eigenvalues of 18 elements

4.7.7 The Result of the Rotated Component Matrix

In Table 4.13, three bold and underlined values need to note and explain.

- OC_TS: The reason why tracking event ongoing or completion was assigned to the same component of Administration area, the researcher

considered OC is the only one feature needs to run the process except for Administration area. Therefore, OC would be defined as the group or discussion functions with the Administration area generally.

- RS_CI: The reason why RS was assigned to the same component of CL is that RS itself is a kind of state to represent an event or message that is read or unread. Therefore, the researcher assumed RS is similar to CL.
- FS_CR: The reason why FS was assigned to the same component of LE, considering both of the programming implementations of FS and LE are based on hyperlinks to deliver the byte data or information. Due to that, the correspondents are considered the FS and LE as the same feature.

Table 4.13 The result of rotated component matrix of 19 elements

	Component				
	1	2	3	4	5
AA_HR	.904				
AA_TS	.893				
AA_CI	.818				
OC_TS	.658				
CL_TS		.828			
RS_CI		.762			
CL_CI		.758			
CL_HR		.687			
FS_CR			.738		
LE_CI			.710		
LE_CR			.707		
LE_HR			.706		
LE_TS			.690		
OC_HR				.905	
OC_CI				.836	
RS_CR					.715
RS_TS					.700
RS_HR					.689

4.8 Regression analysis

According to the results of regression analysis, the researcher performed the importance of the features. And also defined the equation to evaluate the performance. On the other hand, the researcher used the p-value to identify the significant factors in each performance.

4.8.1 The Regression Analysis of Human Resource Reduction

In Table 4.14, there are four significantly independent variables. According to the result, the researcher suggested that AA, RS, OC, and LE as the dependent variable of the human resource have a significant explanatory ability.

Table 4.14 Result of the Human resource reduction regression analysis with six factors (features)

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value	P (significance)
AA	0.208	0.050	0.305	4.115	0.000**
CL	0.143	0.079	0.165	1.822	0.078
RS	0.232	0.069	0.272	3.380	0.002**
OC	0.196	0.060	0.242	3.262	0.003**
FS	0.024	0.058	0.028	0.415	0.681
LE	0.176	0.068	0.225	2.597	0.014*
Constant	0.078	0.259		0.300	
Model Fit:	R=0.945[a]	R^2=0.893	Adj. R^2 =0.873	F=43.331	

Note. Dependent Variable = HR

$*\ p < .05$, Two-tailed. $**\ p < .01$, Two-tailed. $***\ p < .001$, *Two-tailed.*

4.8.2 The Regression Analysis of Customer Complaints Reduction

In Table 4.15, there are four significantly independent variables. However, some respondents reflect the AA variable has no relation with customer complaints. Due to that, the researcher assumed each of RS, FS, and LE as the dependent variable of customer complaints have a significant explanatory ability, and AA needs further research to discuss it.

Table 4.15 Result of the Customer complaints reduction regression analysis with six factors (features)

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value	P (significance)
AA	-0.320	0.083	-0.464	-3.871	0.001**
CL	-0.118	0.129	-0.135	-0.919	0.365
RS	0.572	0.113	0.661	5.085	0.000**
OC	0.055	0.098	0.067	0.556	0.582
FS	0.213	0.095	0.246	2.234	0.033*
LE	0.340	0.111	0.429	3.062	0.005**
Constant	0.558	0.424		1.315	0.198
Model Fit:	R=0.850[a]	R^2=0.722	Adj. R^2=0.668	F=13.406	

Note. Dependent Variable = CR

$* p < .05$, Two-tailed. $** p < .01$, Two-tailed. $*** p < .001$, Two-tailed.

4.8.3 The Regression Analysis of Time Saving

In Table 4.16, there are five significantly independent variables. According to the result, the researcher found that AA, RS, OC, FS, and LE as the dependent variable of time-saving have a significant explanatory ability. At the same time, FS is a significantly negative independent variable.

Table 4.16 Result of the Time saving regression analysis with six factors (features)

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value	P (significance)
AA	0.402	0.037	0.498	10.894	0.000**
CL	0.068	0.057	0.066	1.176	0.249
RS	0.240	0.050	0.236	4.774	0.000**
OC	0.113	0.044	0.117	2.565	0.015*
FS	-0.114	0.043	-0.112	-2.679	0.012*
LE	0.340	0.050	0.366	6.847	0.000**
Constant	0.008	0.189		0.043	0.966
Model Fit:	$R=0.980^a$	$R^2=0.960$	Adj. $R^2=0.952$	F=122.623***	

Note. Dependent Variable = TS

$* p < .05$, Two-tailed. $** p < .01$, Two-tailed. $*** p < .001$, Two-tailed.

4.8.4 The Regression Analysis of Communication Improvement

In Table 4.17, there are four significantly independent variables. According to the result, the researcher suggested that AA, CL, OC, and FS as the dependent variable of communication improvement have a significant explanatory ability. That means the respondents consider the CL and FS can improving communication significantly. There is an interesting phenomenon; most of the managers propose the function of RS is really helpful for them. In contrast, the employee does not think so.

Table 4.17 Result of the Communication improvement regression analysis with six factors (features)

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value	P (significance)
AA	0.152	0.052	0.214	2.918	0.007**
CL	0.384	0.081	0.423	4.719	0.000**
RS	-0.013	0.071	-0.015	-0.186	0.854
OC	0.216	0.062	0.255	3.471	0.002**

FS	0.302	0.060	0.337	5.006	0.000**
LE	0.066	0.070	0.081	0.946	0.352
Constant	-0.350	0.268		-1.308	0.201
Model Fit:	R=0.946[a]	R^2=0.896	Adj. R^2=0.876	F=44.368***	

Note. Dependent Variable = CI

$* p < .05$, Two-tailed. $** p < .01$, Two-tailed. $*** p < .001$, Two-tailed.

4.8.5 The Equation from Regression Analysis

According to the regression analysis result, the researcher proposed the following formula to determine the performance score from six factors in Table 4.18.

Table 4.18 The equation of each performance

$\mathrm{HR} = 0.035 * \mathrm{AA} + 0.165 * \mathrm{CL} + 0.272 * \mathrm{RS} + 0.242 * \mathrm{OC} + 0.028 * \mathrm{FS} + 0.225 * \mathrm{LE}$
$\mathrm{CR} = (-0.464) * \mathrm{AA} + (-0.135) * \mathrm{CL} + 0.661 * \mathrm{RS} + 0.067 * \mathrm{OC} + 0.246 * \mathrm{FS} + 0.429 * \mathrm{LE}$
$\mathrm{TS} = 0.498 * \mathrm{AA} + 0.066 * \mathrm{CL} + 0.236 * \mathrm{RS} + 0.117 * \mathrm{OC} + (-0.112) * \mathrm{FS} + 0.366 * \mathrm{LE}$
$\mathrm{CI} = 0.214 * \mathrm{AA} + 0.423 * \mathrm{CL} + (-0.015) * \mathrm{RS} + 0.255 * \mathrm{OC} + 0.337 * \mathrm{FS} + 0.081 * \mathrm{LE}$

4.9 Discussion

4.9.1 The Impact of Features on Human Resource Reduction Performance in SMEs

The finding shows “Administrative area for purchase plan and payment request”, “Display of messages status of who and when read or unread the messages”, “Tracking event ongoing or completion” and “Links to the past events URL” these 4 features are effective in human resource reduction. Especially the feature of “Administrative area for Purchase plan and payment request” is more effective in human resource reduction. This result is understandable. Compared with the simple and effective feature of purchase plan and payment request in SuccMail, for most SMEs, the process of purchase plan decision and payment request application is long-winded

and complicated, and often with no conclusion. The features of “Display of messages status of who and when read or unread the messages” and “Tracking event ongoing or completion” can clearly understand the status of the event to avoid unnecessary misunderstandings, the result has certain benefits for human resource reduction. Through the URL link, users can save the elaboration of events so that other members can understand the whole process of the incident immediately. This can save labor costs is understandable.

4.9.2 The Impact of Features on Customer Complaints Reduction Performance in SMEs

The result shows “Display of messages status of who and when read or unread the messages”, “Group file sharing feature”, and “Link to the past events URL” these 3 features that are effective in customer complaints reduction. This can be considered that clearly understand the reading status of the event can prevent the decision-maker from making the wrong response while the event is in progress. The feature “Link to the past events URL” provides the reference solution to handle the current customer complaints, therefore the effectiveness of the customer complaints reduction is understandable. To arrange a whole customer complaint content into a file and put it in the group file sharing area is a skill to reduce the customer complaints.

4.9.3 The Impact of Features on Time Saving Performance in SMEs

From the finding “Administrative area for purchase plan and payment request”, “Display of messages status of who and when read or unread the messages”, “Tracking event ongoing or completion”, and “Links to the past events URL” these 4 features are

effective in time saving. As earlier mentioned, the purchase plan decision and payment request application in most of the SMEs are long-winded and complicated. In contrast, the simple and effective feature of purchase plan and payment request in SuccMail can save time easily is easy to understand. Also, the features of "Display of messages status of who and when read or unread the messages", and "Links to the past events URL" let SuccMail users keep abreast of the situation of the event in time, and give instructions or make decisions just in time. This is no doubt can result in time saving. Through the ongoing and completed classification of events, users can clearly understand the ongoing events and will not be affected by completed events. Regarding the negative effective feature of "Group files sharing" on time saving, the researcher cannot explain the cause correctly. Perhaps it is considered repetitive work for the user.

4.9.4 The Impact of Features on Communication Improvement Performance in SMEs

The finding shows "Administrative area for purchase plan and payment request", "Customizable labels based on business events/action for search feature", "Group files sharing feature", and "Tracking event ongoing or completion" these 4 features are effective in communication improvement. Communication is one of the most important things in the management of the enterprise; the 4 features can provide the process of purchase plan decision and payment request application in time, customized labels for the company, archive related information, track the status of the message, and this will lead to good communication.

4.9.5 What kinds of features are requested for ECS

Dias, 2001 suggests that a corporate portal should contain 15 major characteristics Table 4.19 (Dias, 2001). The researcher considered that ECS is a kind of corporate portal, and checked the characteristics for SuccMail. The researcher found except for the characteristic of intelligent routing, the ECS platform of SuccMail basically meets the above requirements. As the intelligent routing request, the portal should be able to distribute reports and documents to selected users automatically, and it is quite difficult for ECS to route the external messages correctly. Because the messages from the external (e.g., Email) are very complicated and difficult to distribute to the selected users automatically. With the development of big data and artificial intelligence technologies, the researcher believed this feature would gradually be implemented in the future.

Table 4.19 Major characteristics of a corporate portal

Characteristic	Description
Easy to use	Users should easily locate and access the right information, with minimum training, wherever the information is stored. Finding business information through the portal should be as simple as using a web browser.
Intuitive classification and searching	The portal should be able to index and organize the corporate information. Its search engine should refine and filter information, support Boolean operators and keywords, and present the search results in intuitive categories.
Collaborative information sharing	The portal should allow users to publish, share and receive information from other users. When publishing into the corporate repository, the user should be able to specify which users and groups may access his documents/objects.
Universal connectivity to information resources	The portal should provide wide access to every information resource, and connect to heterogeneous systems, such as e-mail, databases, document management systems, web servers,

	groupware, audio and video systems. It must be able to manage different formats of structured and unstructured data.
Dynamic access to information resources	The portal should allow dynamic access to information and objects created by business intelligence and document management systems. It should always provide up-to-date information.
Intelligent routing	The portal should be able to automatically distribute reports and documents to selected users.
Integrated business intelligence tool	To fulfill user information needs, the portal should integrate search, report and analysis capabilities in its business intelligence component.
Server-based architecture	In order to support a great number of users, high volumes of information, simultaneous services and sessions, the portal should be based on a client-server architecture.
Distributed services	For load-balancing purposes, the portal should distribute its application services across multiple computers or servers.
Flexible permission granting	Portal administrators should be able to define permissions for users and groups within the enterprise, through flexible user profiles.
External interfaces	The portal should be able to communicate with other applications and systems.
Programmatic interfaces	The portal should also provide programmatic interfaces (APIF Application-Programming Interface) in order to be ‘‘callable’’ from other applications.
Security	For security purposes, the portal must support cryptography, authentication, firewalls, etc. to safeguard corporate information and prevent unauthorized access.
Easy deployment and maintenance	The portal should provide an easy and centralized way to manage all corporate information and to monitor portal’s functioning. It should be easy to install, configure, and maintain.
Customization and personalization	Administrators should be able to customize the portal according to enterprise polices and expectations. It should be allowed that individual users personalize their interfaces as well.

4.10 Conclusion

As a result, the researcher found that the ECS of SuccMail is basically satisfied by the respondents, while not all of the features are used by the users. Even SuccMail has simplified the use of the system as much as possible; still, it is difficult for SMEs to fully exert the effectiveness of ECS without a dedicated consultant. This is actually the main reason that SMEs cannot successfully import ECS.

Chapter 5. Stage 2 Effect of external support and internal support for implementing ECS.

Stage 2 is focusing on the effect of performance from the supports of SuccMail. The supports are assorted into external support and internal support. The ECS company's supports are external supports, and the supports from the top manager or enterprise are internal supports. The content is published on Mathematical Problems in Engineering: Link up Industry 4.0 with the Enterprise Collaboration System to Help Small and Medium Enterprises (Chiang et al., 2020).

5.1 Research Method

The structured questionnaire was used in stage 2 for data collection. Due to the research of the ECS literature reports were fragment (Greeven and Williams, 2017), the researcher adopted it from the literature reports of ERP, which have the same characters as ECS. Indeed, the researcher was aware there is a lack of samples. In order to ensure the validity and reliability of each sample, the researcher chose 3 different sizes of SMEs. The number of SuccMail users are 10, 18, and 34; also, they have been used SuccMail for over 2 years. The researcher kept tracking their usage of SuccMail. Meanwhile, besides this survey, the researcher conducted at least 3 times one-on-one interviews with all the respondents in the past year. To make the questionnaire following the ECS, the researcher modified it base on the uniqueness and specialty of the ECS. The draft of the questionnaire was pre-tested by five experts (e.g., ECS founder, ECS advisor...) to validate it, and the researcher sought all experts' opinions to improve it until all of them accepted it.

According to Greeven and Williams (Greeven and Williams, 2017), SMEs that implement ECS will face a lot of challenges. The top management support influences successful IS implementation (Raghunathan and King, 1988). The successful implementation of CSCW is complex without the strong management commitment to ensuring a new system's success (Grudin, 1988). It is indispensable for the organizational support to a successful implementation of any system (Park et al., 2007). Therefore, the researcher considered the supports and resources that can help SMEs to face the challenges while implementing ECS as our hypothesis. The researcher classified the supports and resources into internal support and external support. Figure 5.1 is our research model. The supports that employees can gain from inside SMEs are the internal support, and the supports that employees can gain from the ECS side is external support. The benefit of using ECS can be expected (Steinhüser et al., 2011), while SMEs often lack a clear vision of benefit (Schubert and Williams, 2015). Since the benefits are not always reflected in finances, in our hypothesis, the researcher considered the benefits of using ECS as the performance of using ECS. The researcher believed that the performance of using ECS, including:

(1) Using SuccMail is easier to perform tasks. (P1)

(2) SuccMail is helpful to improve communication. (P2)

(3) SuccMail is helpful to reduce the cost of Human Resources. (P3)

(4) SuccMail is helpful to reduce customer complaints. (P4)

(5) Using SuccMail can enhance working efficiency. (P5)

(6) Using SuccMail can increase production efficiency. (P6)

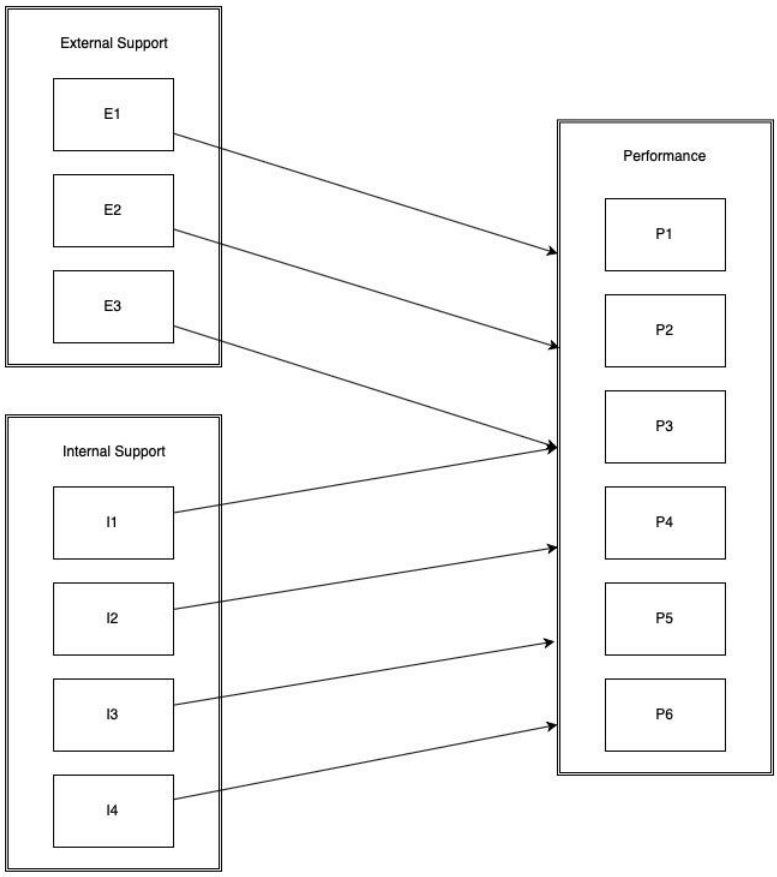

Figure 5.1 The research model

5.2 Hypotheses

ECS is flexible and malleable software, and the working of ECS dependent on employees' skills and experience (Herzog and Richter, 2016; Richter and Riemer, 2013). If the employees do not have enough relevant skills and experience, or while they are facing any challenge, the external support can be able to help them get through the challenge in the implementation of ECS. The supports that can be provided from the ECS, including software manuals, online consultation, and consultants. Therefore, the researcher had the following hypothesis:

(1) Hypothesis 1 (E1). The SuccMail manual is helpful to use, which has a positive effect on the performance of implementing ECS.

(2) Hypothesis 2 (E2). Online consultation is helpful to solve users' problems with SuccMail, which has a positive effect on the performance of implementing ECS.

(3) Hypothesis 3 (E3). An external SuccMail expert consultant helps use SuccMail, which has a positive effect on the performance of implementing ECS.

The management of SMEs supports employees and helps them to use ECS, as well as the usage rate, which was initially high, can increase the chance of success in the implementation of ECS (Greeven and Williams, 2017). Therefore, the researcher hypothesized:

(4) Hypothesis 4 (I1). The enterprise fully depends on using SuccMail to manage and communicate, which has a positive effect on the performance of implementing ECS.

(5) Hypothesis 5 (I2). The enterprise offers sufficient resources for using SuccMail, which has a positive effect on the performance of implementing ECS.

(6) Hypothesis 6 (I3). The enterprise had hired a full-time consultant for implementing SuccMail, which has a positive effect on the performance of implementing ECS.

(7) Hypothesis 7 (I4). The enterprise conflicts have been reduced by using SuccMail, which has a positive effect on the performance of implementing ECS.

5.3 Data Collection

The data were collected from 62 users of three SMEs that implemented "SuccMail" (ECS) over one year before our study. The enterprises were identified from the ECS vendor SuccMail.

5.4 Data Source

All of the survey questionnaires were personally sent to 62 SuccMail users from 3 enterprises straight. For surveys of the questionnaire, the researcher had reached out to the owner or the person in charge of the enterprises and made an appointment with each enterprise. The overall recovery ratio of the questionnaire is 62 (100%). None of the questionnaires invalid, the effective recovery ratio of questionnaires is 62 (100%).

Demographics of the respondents and companies showed that 34 (54.8%) of respondents were from A: the multinational trading company, 18 (29.1%) were from B: the education center, and 10 (16.1%) were from C: the trading company. There were 10 (16%) employers, 19 (31%) general managers or deputy general managers, 24 (36%) staff, and 9 (14%) teachers. The reason why there were only three enterprises but having 10 employers is because they were co-financing and operating. Twenty-four (39%) of the respondents were male, and 38 (61%) were female. 40 (64%) respondents were in their twenties and thirties, 12 (20%) were in their forties, and 10 (16%) were over their fifties. 2 (3%) had worked experience for under 5 years, 12 (20%) had 5-9 years, 9 (14%) had 10-14 years, 22 (36%) had 15-19 years, and 17 (27%) had over 20 years work experience. 12 (20%) were high school graduates, 33 (53%) had a bachelor's degree, 15 (24%) had a master's degree, 2 (3%) had a Ph.D. degree.

5.5 Measurement of items

The full questionnaire is given in Appendix B, which contains two parts. The first section has 5 fundamental profiles that are the main data source of the descriptive statistics and asking who uses the SuccMail. The second part has 3 dimensions. One is the evaluating of external support for SuccMail, which has three questions including

E1, E2, and E3, another is the internal support from the enterprise, which has four questions including I1, I2, I3, and I4, and the other relates to the performance of implementing SuccMail, which has six questions from P1 to P6.

5.6 Validity and Reliability Tests

All the questions from the three dimensions had conducted the validity and reliability tests as a reference for the next step. The researcher adopted analysis to run the Varimax rotation to test the convergent validity.

5.6.1 Validity Test

Table 5.1 shows the KMO value is 0.822 and Bartlett's test of Sphericity is significant (Kaiser, 1974), and Table 5.2 shows all the loading values of dimensions for the relevant latent factors were greater than 0.4, verifying the convergent validity of all the questions (Spicer and Spicer, 2005).

Table 5.1 KMO and Bartlett's test results

Kaiser-Meyer-Olkin measure of sampling adequacy		0.822
Bartlett's Test of Sphericity	Approx. Chi-Square	447.469
	Df	78
	Sig.	0.000

Table 5.2 The exploratory factor analysis rotated-component matrix

Item	Factor Loading			
	F3	F1	F2	Communality
P6	**0.868**	0.082	0.006	0.629
P5	**0.800**	0.246	0.332	0.814
P1	**0.736**	0.170	0.290	0.866
P3	**0.704**	0.153	0.295	0.810
P2	**0.630**	0.390	0.198	0.818

	P4	**0.462**	0.268	0.193	0.591
	E3	0.101	**0.912**	0.155	0.439
	E2	0.216	**0.873**	-0.070	0.655
	E1	0.312	**0.714**	0.149	0.588
	I2	0.079	-0.114	**0.894**	0.606
	I1	0.343	0.161	**0.817**	0.323
	I3	0.389	0.289	**0.597**	0.811
	I4	0.352	0.352	**0.438**	0.760
Eigenvalues	3.595	2.694	2.422	8.711	
% of Total Variance	27.65%	20.72%	18.63%	67.01%	

5.6.2 Reliability Test

Table 5.3 shows the results of Cronbach's alpha values are 0.859, 0.842, and 0.776. Through the Cronbach Alpha value from the measurement items of the questionnaire to test whether the scales are stable and reliable. Reliability tests were run to ensure the results of the measurement items are stable and consistent. This research adopts the Cronbach Alpha value > 0.700 as reliable (Nunnally, 1978).

Table 5.3 Reliability test

	Cronbach's Alpha	Items
F1 External Support	0.842	3
F2 Internal Support	0.776	4
F3 Performance	0.859	6
All	0.892	13

5.7 Result

The questionnaires were evaluated by SPSS. Multiple regressions were used to test our hypotheses. The researcher used multiple regressions to test the variables of external and internal supports on the performance of implementing ECS (SuccMail).

5.7.1 Correlation tests

Before testing the hypothesis by multiple regressions, the researcher ran the correlations between the external support (3 questions), internal support (4 questions), and the performance of implementing SuccMail (7 questions). Table 5.4 shows the results. Correlations between 35 of the 42 bivariate correlations are significant and ranged from .277 ($p < 0.05$) to .604 ($p < 0.01$).

Table 5.4 The correlation Matrices

	E1	E2	E3	I1	I2	I3	I4
P1	.345**	.295*	.277*	.531**	.221	.406**	.604**
P2	.478**	.414**	.449**	.430**	.271*	.392**	.393**
P3	.345**	.332**	.255*	.423**	.270*	.594**	.483**
P4	.356**	.194	.355**	.469**	.115	.344**	.190
P5	.504**	.378**	.349**	.590**	.352**	.542**	.458**
P6	.329**	.286*	.213	.318*	.168	.408**	.242

$*$ $p < .05$, Two-tailed. $**$ $p < .01$, Two-tailed.

5.7.2 Multiple regressions

For a more comprehensive test, the standard multiple regression (enter method) analysis was conducted to provide different outcomes to test the hypotheses.

Table 5.5 shows the results of D1 and D2 dimensions are significantly and positively affecting the dimension of performance.

Table 5.5 Regression analysis summary for dimensions

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value
Constant	1.079	0.347		3.122**
DE	0.257	0.083	0.310	3.114**
DI	0.474	0.089	0.529	5.326***
Model Fit	R=0.707	R^2=0.500	Adj. R^2=0.483	F=20.546***

Note. Dependent Variable = DP

$*\ p < .05$, Two-tailed. $**\ p < .01$, Two-tailed. $***\ p < .001$, Two-tailed.

Table 5.6 shows the results I1 and I4 are significantly and positively affecting P1; the results provide support for Hypothesis 4 and Hypothesis 7. As the whole details will be recorded in the system by SuccMail, there is barely any internal conflict inside the enterprise. Hence, using SuccMail to manage and communicate inside the enterprise can reduce friction and make tasks easier are reasonable and match our expectations.

Table 5.6 Regression analysis summary for P1

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value
Constant	1.132	0.518		2.186*
E1	0.046	0.125	0.048	0.364
E2	0.130	0.159	0.141	0.82
E3	-0.159	0.152	-0.181	-1.046
I1	0.343	0.138	0.385	2.484**
I2	-0.178	0.124	-0.199	-1.433
I3	0.116	0.105	0.150	1.105
I4	0.425	0.121	0.425	3.523**
Model Fit:	R=0.697	R^2=0.486	Adj. R^2=0.419	F=7.289***

Note. Dependent Variable = P1

$*\ p < .05$, Two-tailed. $**\ p < .01$, Two-tailed. $***\ p < .001$, Two-tailed.

Table 5.7 shows there is no factor significantly and positively affects P2, which surprised us. It is because, in the correlation analysis, the researcher found that every item is significantly related to communication improvement. In the interviews, the researcher realized that those employees who rely on SuccMail are sure SuccMail can help to improve communication. With further discussions, the researcher found that although the SME support using SuccMail (ECS), it is the employer or the top managers of the SMEs who are the main barrier to implementing SuccMail. In other words, they seldom or even barely use SuccMail. Whether this is the reason that causes none of the

factors is significantly and positively affects P2, or it because that SuccMail itself is a communication platform is deserved our further study.

Table 5.7 Regression analysis summary for P2

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value
Constant	0.608	0.586		1.038
E1	0.229	0.142	0.234	1.616
E2	0.184	0.179	0.195	1.027
E3	0.046	0.172	0.051	0.265
I1	0.166	0.156	0.183	1.062
I2	0.103	0.14	0.113	0.736
I3	0.017	0.119	0.021	0.142
I4	0.091	0.137	0.089	0.667
Model Fit:	R=0.607	R^2=0.368	Adj. R^2 =0.286	F=4.494**

Note. Dependent Variable = P2

$* p < .05$, Two-tailed. $** p < .01$, Two-tailed. $*** p < .001$, Two-tailed.

Table 5.8 shows the result I3 and I4 are significantly and positively affecting P3. These results provide support for Hypothesis 6 and Hypothesis 7. After six months, the enterprise the researcher had been joined had reduced almost 50% of the human resource. Implementing SuccMail into SMEs and hiring the consultant at the same time would be more able to help the employees to adapt using SuccMail. Even hiring the consultant has an extra expense, comparing the cost of human resource reduction, it is a worthwhile investment. In the meanwhile, after implementing SuccMail, the enterprise inside frictions was reduced, the researcher found that there were redundant employees inside the enterprise. This ultimately allows companies to reduce personnel costs.

Table 5.8 Regression analysis summary for P3

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value

Constant	0.978	0.555		1.762
E1	0.012	0.134	0.012	0.088
E2	0.219	0.17	0.223	1.291
E3	-0.225	0.163	-0.240	-1.377
I1	0.041	0.148	0.043	0.279
I2	-0.056	0.133	-0.059	-0.424
I3	0.419	0.113	0.506	3.715***
I4	0.357	0.129	0.334	2.761**
Model Fit:	R=0.649	R^2=0.482	Adj. R^2=0.414	F=7.164***

Note. Dependent Variable = P3

$* p < .05$, Two-tailed. $** p < .01$, Two-tailed. $*** p < .001$, Two-tailed.

Table 5.9 shows that I1 is significantly and positively affecting P4. This result provides support for Hypothesis 4. As the researcher mentioned, once SMEs are fully dependent on SuccMail for enterprise management and communication, the whole details of the event were recorded in the system. All the related employees could timely access information and update progress which reduces the possibility of having an error. As a result, customer complaints will be reduced. On the other hand, the result shows that I2 is significantly and negatively affects P4; this is confusing. The correlation test shows that I2 and P4 have no significant relation. Therefore, the researcher ruled out the possibility of the suppressor variable (Tabachnick and Fidell, 2013). As the current data is insufficient to discuss this phenomenon, the researcher will focus our further study on this phenomenon in the future.

Table 5.9 Regression analysis summary for P4

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value
Constant	2.277	0.657		3.466
E1	0.172	0.159	0.158	1.079
E2	-0.230	0.201	-0.220	-1.142
E3	0.275	0.193	0.276	1.42
I1	0.573	0.175	0.567	3.269**
I2	-0.330	0.157	-0.326	-2.102**

I3	0.098	0.134	0.111	0.732
I4	-0.132	0.153	-0.116	-0.861
Model Fit:	R=0.597	R^2=0.356	Adj. R^2=0.272	F=4.262**

Note. Dependent Variable = P4

$*\ p < .05$, Two-tailed. $**\ p < .01$, Two-tailed. $***\ p < .001$, Two-tailed.

Table 5.10 shows that E1 and I1 are significantly and positively affecting P5; the results provide support for Hypothesis 1 and Hypothesis 4. When SME fully depends on SuccMail as an internal collaboration and management system, the SuccMail user guide will make it easier for users to adapt. This leads to enhancing the efficiency of performing tasks, which match our expectations.

Table 5.10 Regression analysis summary for P5

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value
Constant	0.673	0.488		1.378
E1	0.257	0.118	0.272	2.174*
E2	0.276	0.150	0.304	1.843
E3	-0.233	0.144	-0.270	-1.626
I1	0.345	0.130	0.395	2.653**
I2	0.019	0.117	0.022	0.163
I3	0.116	0.099	0.151	1.164
I4	0.101	0.114	0.103	0.889
Model Fit:	R=0.726	R^2=0.527	Adj. R^2=0.466	F=8.597***

Note. Dependent Variable = P5

$*\ p < .05$, Two-tailed. $**\ p < .01$, Two-tailed. $***\ p < .001$, Two-tailed.

Table 5.11 shows there is no variable significantly and positively affecting P6. As the earlier correlation tests, the researcher found that E1 and E3 are very significantly and positively related to P6; also, E2 and I1 are significantly and positively related. However, based on this research does not have the case of a manufacturing company; there has no so-call producing product. Further research will focus on

contacting the manufacturing companies using SuccMail to study these phenomena in the future.

Table 5.11 Regression analysis summary for P6

Independent Variable	Unstandardized coefficients B	Unstandardized coefficient std. Error	Standardized coefficients (Beta)	t-value
Constant	1.700	0.605		2.809
E1	0.147	0.147	0.159	1.001
E2	0.248	0.185	0.280	1.335
E3	-0.214	0.178	-0.254	-1.203
I1	0.154	0.161	0.180	0.955
I2	-0.037	0.145	-0.043	-0.253
I3	0.184	0.123	0.247	1.491
I4	0.027	0.141	0.028	0.188
Model Fit:	R=0.486	R^2=0.236	Adj. R^2=0.137	F=2.83*

Note. Dependent Variable = P6

$* p < .05$, Two-tailed. $** p < .01$, Two-tailed. $*** p < .001$, Two-tailed.

After all the multiple regressions were tested, the researcher found that E2, E3, and I2 are not significantly or positively affect any performance of implementing ECS. Therefore, the results do not provide support for Hypothesis 2, Hypothesis 3, and Hypothesis 5. Through the interviews, the researcher found SuccMail provides online consultation while it is not instant consultation. Although an external consultant could give advice, it is also not a real-time service. The researcher considered that Hypothesis 2 and Hypothesis 3 could not be supported; this is because they are not considered real-time services. As for Hypothesis 5, when the researcher considered all the variables, the degree of supports that the companies offer will not affect the performance. The researcher inferred it might because while SMEs fully rely on SuccMail, SMEs have often provided a certain degree of supports already.

5.8 Discussion

The competitiveness of SMEs can come from using ECS. For smoothly implementing ECS and improving the competitiveness of SMEs, employees should have a certain level of support in implementing ECS. the researcher explored whether the supports or resources available to SMEs have an impact on their performance in using SuccMail. After verification and analysis, the researcher concluded the following results:

(1) All supports are positive and influential for the implementation of ECS to improve management efficiency. This meets the initial expectations, as there are many challenges in the process of implementing ECS, and previous researches show that the supply of supports can help solve the challenges of implementing ECS.

(2) The researcher distinguished the supports into external supports (from ECS "SuccMail") and internal supports (from inside of SME), both of which proved to have an impact on whether enterprises can successfully implement ECS and improve management efficiency, which also meets our expectations. Although support from ECS software is completely different from the supports inside the enterprise, the researcher believed that both are equally important. However, after actual research, the researcher found that the impact of internal supports from enterprises is far more significant than the impact of the supports from ECS software.

Through the interviews, the researcher found that supports provided within the enterprise are more important for employees to use ECS than supports supplied by ECS. Further analysis, the researcher found that for the users of SuccMail, the immediateness

and convenience provided by the internal supports of the enterprise are the most important reasons. The next step is to analyse each support and every benefit when all support variables are considered.

(1) With the SuccMail user manual, it is not surprising that the work efficiency can be improved.

(2) When companies fully rely on SuccMail for management and communication, it can improve work efficiency, reduce task difficulty, and reduce customer complaints. This is very much in line with the expectations.

(3) Due to instant communication and clear information, when an enterprise fully relied on using SuccMail to manage and communicate can more easily perform tasks, reduce human resources, and reducing internal friction.

(4) Hiring an exclusive SuccMail consultant inside the enterprise can ultimately reduce human resources. According to the experience, when the company fully relies on SuccMail for management, communication, and hires a dedicated SuccMail consultant, it can ultimately help SMEs reduce human resources by 30-40%.

(5) The online consultation and the external SuccMail expert consultant are not a significantly positive effect on the performance of SuccMail. The most important reason is both online consultations and external SuccMail expert consultants are not real-time services. Most of the circumstances require timeliness services in the workplace, and the non-real-time services are often not effective. Hence, the researcher suggested that the ECS service company should consider real-time services for its software.

(6) As for the enterprise offer sufficient resources of using the SuccMail has a significantly negative effect on the performance of implementing SuccMail; in chapter 5, the researcher mentioned that the currently existing data is not sufficient to discuss it. The researcher will focus on this phenomenon in the following study.

(7) Since the research objects did not have a manufacturing company, there has no so-call producing product. It was not surprising that none of the variables is affecting production efficiency. The performance of implementing SuccMail into a manufacturing company also requires a further research subject in future work.

(8) In Chapter 5, the researcher found the supply of any support has a certain degree of influence on the use of SuccMail for improving communication. While putting all the variables together, no variable has a positive and significant impact. Whether this has a certain relationship with the lack of active participation of SME managers in the use of SuccMail is an interesting research topic.

Due to the lack of academic research about ECS, the researcher spent two years with three SMEs to do the in-depth research oration. The researcher expected more academic research about the relation between ECS and SMEs in the future. Nowadays, most of the certain size SMEs had implemented ERP. The Workflow system is developed by DATA SYSTEMS CONSULTING CO., LTD., which is a widely used ERP system in Taiwan. The researcher had linked the Workflow system with SuccMail and published a conference paper (Lin et al., 2020). With this linking, the user can input the information with a drop-down list without login into the Workflow system, and the SuccMail will automatically produce the purchase order, bill of sale, etc. Also, the

system will automatically update the stock in the Workflow system. After this linking, the number of users of SuccMail has massively increased. Currently, the researcher had recalled over 400 questionnaires, and the researcher will publish the research in the recent. Second, the researcher was just about to submit another paper using Latent Dirichlet Allocation with the visual attention to identification email topic. Also, the researcher will get to collect the feedback and test the performance of it from the users.

Despite the fact that the researcher mentioned the ERP and ECS are fundamental differences, there are some similarities. Especially in the progress of implementation and post-implementation. Like the ERP, ECS often faces customization requests from the users. Therefore, the ECS needs to consider customization requests. An overladen ECS will cause the failure of implementation. Also, whether it is ERP or ECS, the usage of it is unique to each enterprise. This reasonably explains all the knowledge to be transferred in the context of successful ECS implementation will not explicit nor externalized. This is what SuccMail always emphasized, the importance of how to let each enterprise maximize freely operate based on the basic skeleton of SuccMail. Furthermore, during the implementation of ECS, one of the key factors affecting the success of the implementation is the user's absorptive capacity. However, nowadays, the managers of SMEs in Taiwan are too senile to be familiarised with the personal computer. Solving the user's absorptive capacity requires the familiarity of the personal computer. This means those managers have to get familiar with it ECS to a certain degree.

5.9 Conclusion

In this stage, the researcher proposed a survey questionnaire to evaluate how the internal and external supports of SuccMail can affect the performance of SMEs.

Each support has a positive influence on the implementation of SuccMail and can affect the business performance of SMEs. Based on our result, the internal supports are more significant than the external to impact the business performance of SME. Industry 4.0 is seen as the beginning phase where computers and automation become connected and as an opportunity to increase the efficiency and effectiveness in the manufacturing industry. There are many challenges related to the integration of Industry 4.0. To catch up with Industry 4.0, it has become inevitable for the SME to implement e-management. The findings of this study will help the SME better carry out e-management by implementing ECS with the internal supports.

Chapter 6. Stage 3 Develop and validate an instrument to measure the performance of linking ERP to ECS.

6.1 Research Strategy

The primary purpose of stage 3 is to evaluate the performance of linking ERP and ECS. Because the management of SMEs has many problems of duplications work. During the implementation of ECS and the questionnaire survey, the researcher found that for enterprises that have already implemented ERP, employees complained that after implementing ECS, many duplications work with the original ERP. To solve the duplications work problems, the researcher linked SuccMail with ERP and conducted a series of evaluations on the linked SuccMail and ECS effectiveness.

6.2 Research Method

The research model is shown in Figure 6.1. The researcher assumed the management support, absorptive capacity, and user satisfaction positively affecting the performance of SuccMail usage. In addition, management support was assumed to affect the performance of SuccMail usage via the absorptive capacity and user satisfaction. Also, the absorptive capacity was assumed to affect the performance of SuccMail usage via user satisfaction.

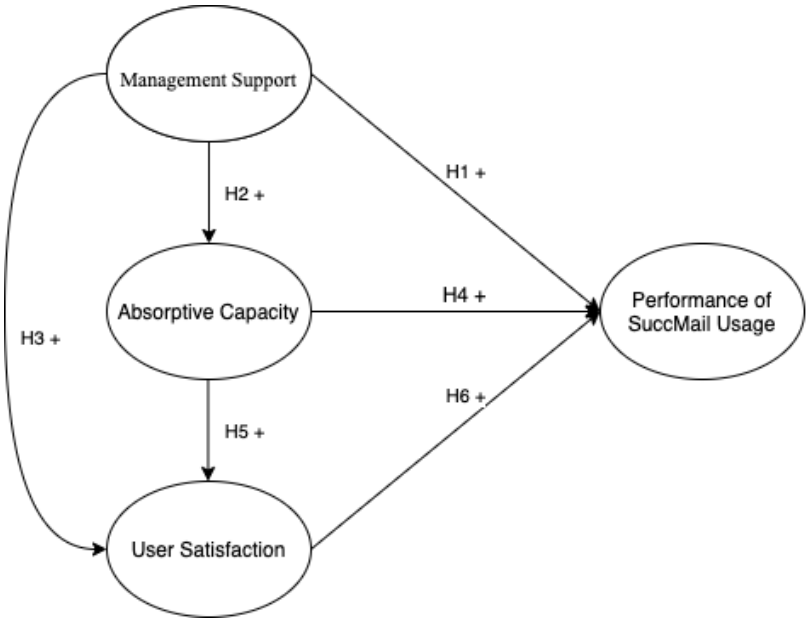

Figure 6.1 Research model

6.3 Hypotheses

Based on prior researches, one of the greatest reasons for an impediment to IT success is insufficient top management support (Hou, 2012). The top management support affects the IS function in an enterprise (Ragu-Nathan et al., 2004). The higher degree of organizational support affects the performance of ERP (Park et al., 2007). Top management support, directly and indirectly, influenced ERP usage, which indicates the importance of top management support in the ERP implementation (Wang and Song, 2017). It is therefore hypothesized that:

Hypothesis 1: Management support is positively related to the performance of SuccMail usage.

Hypothesis 2: Management support is positively related to the absorptive capacity.

Hypothesis 3: Management support is positively related to the user satisfaction.

Absorptive capacity is the ability of an enterprise to recognize, assimilate, transform, and apply valuable external knowledge (Cohen and Levinthal, 1990). Robert et al. pointed out that the development and maintenance of enterprise absorptive capacity plays a vital role in modern information technology and is considered a top priority for enterprise success(Roberts et al., 2012). The individual user's absorptive capacity of ERP influences its performance (Park et al., 2007). Based on the above, it is therefore hypothesized that:

Hypothesis 4: Absorptive capacity is positively related to the performance of SuccMail usage.

Hypothesis 5: Absorptive capacity is positively related to the user satisfaction.

Previous studies reveal that user satisfaction had been widely used to measure the IS success (DeLone and McLean, 2016). Generally, user satisfaction is regarded as one of the most important measures of IS (Rouibah et al., 2009). User satisfaction affects the performance of IS (Calisir and Calisir, 2004; Li et al., 2018). It is therefore hypothesized that:

Hypothesis 6: User satisfaction is positively related to the performance of SuccMail usage.

6.4 Data Collection

Data were collected from 200 users of 18 Taiwan small and medium enterprises that implemented SuccMail for at least 2 years and used the linking ERP to SuccMail for at least over 1 year.

The structured questionnaire was used in the research for data collection. The questionnaire items were developed from the literature view. Due to the research of the

ECS literature report were fragment and insufficient, the researcher had to make a lot of modifications to the questionnaire items. The draft of the questionnaire was examined by five experts and had their full approval.

6.5 Data Source

The survey questionnaire was directly sent to the 263 users via the SuccMail system. After a month, the researcher received 217 responses from 18 SMEs. The recovery ratio of the questionnaire was 82.5%. There were 17 invalid questionnaires. In the final, the researcher used 200 questionnaires for the analysis.

Demographics of the respondents and companies showed that 24 (12%) employers, 51 (25.5%) general managers or deputy general managers, 108 (54%) staffs, and 17 (8.5%) others. Forty-seven (23.5%) of the respondents were female, and 153 (76.5%) were male. 18 (9%) respondents were in their twenties, 93 (46.5%) were in their thirties, 78 (39%) were in their forties, and 11 (5.5%) were over their fifties. 21 (10.5%) had worked experience for under 5 years, 85 (42.5%) had 5-9 years, 79 (39.5%) had 10-14 years, 10 (5%) had 15-19 years, and 5(2.5%) had over 20 years work experience. 12 (6%) were high school graduates, 107 (53.5%) had a bachelor's degree, 56 (28%) had a master's degree, 25 (12.5%) had a Ph.D. degree.

6.6 Measurement of items

All the questions had conducted the validity and reliability test as a reference for the next step. The Principal Components Analysis (PCA) was used as the extraction technique, and varimax was used as a method of rotation. Table 6.1 shows all the

loading values of dimension for the relevant latent factor were greater than 0.4, verifying the convergent validity of all the questions.

Table 6.1 The Exploratory Factor Analysis

	Management Support	Absorptive Capacity	User Satisfaction
MS4	0.835		
MS1	0.811		
MS2	0.807		
MS3	0.790		
AC2		0.857	
AC3		0.849	
AC1		0.791	
AC4		0.764	
US3			0.785
US2			0.726
US1			0.689

Through the Cronbach Alpha value from the measurement items of the questionnaire to test whether the scales were stable and reliable. The results of Cronbach's alpha show in Table 6.2

Table 6.2 Reliability Test

	Cronbach's Alpha	Items
Management Support	0.866	4
Absorptive Capacity	0.872	4
User Satisfaction	0.665	3
Performance of Succmail Usage	0.856	5

6.7 Result and Discussion

The questionnaire was evaluated by SPSS. The regression analysis was used to test the hypotheses.

To examine the significance of each hypothesis with the performance of SuccMail usage via the multiple regressions. Table 6.3 shows the result. Management support, absorptive capacity, and user satisfaction are significantly and positively affecting the performance of Succmail usage. Therefore, support hypothesis 1, hypothesis 4, and hypothesis 6.

Table 6.3 Regression Analysis Dependent Variable Performance of SuccMail

Independent Variable	Unstandardized coefficients B	Std. E	Std. coefficients (Beta)	t-value
Constant	2.308	0.293		7.875***
Management Support	0.130	0.052	0.177	2.515*
Absorptive Capacity	0.137	0.068	0.141	2.020*
User Satisfaction	0.310	0.060	0.345	5.190***
Model Fit	R=0.513	R^2=0.263	Adj. R^2=0.252	F=23.345***

Note. Dependent Variable = Performance of SuccMail

$* p < .05$, Two-tailed. $*** p < .001$, Two-tailed.

The implement of IS in SMEs is difficult to succeed without management support. Limited by managers insufficient of the IS knowledge, ability, and skills, even though they have high acceptance and support with the implementation of IS, there exist many difficulties in the implementation of IS. From the prior research, management support is identified as a critical factor for the success of implement IS. Of course, some other researchers have different opinions. Their researches conclude that the influence of the performance from management support is not critical, even unrelated. This can be explained that different IS affects the management support influence on the performance. Mainly, the initial design of SuccMail is based on easy-to-use and easy to operate. Also, the design concepts of SuccMail have considered the understanding and ability skills of the SME managers. The result of management support affects the performance of SuccMail usage is reasonable.

There is plenty of research about the absorptive capacity of the performance, the researchers have concluded a substantial difference. As the absorptive capacity is the ability of an enterprise to recognize, assimilate, transform, and apply valuable external knowledge. There has a huge difference between the age group of absorptive capacity. Although the young age group has a better absorptive capacity, they are insufficient in the working experience. On the other hand, the senior managers have affluent working experience but lower absorptive capacity. Therefore, the researcher found out that the absorptive capacity has a certain impact on the performance of SuccMail usage, but it is not as impactful as the researcher thought. The researcher believed it has to do with the age group. This is an interesting research topic for the enterprise on how to inherit the working experience from the senior managers to the young age group; meanwhile, the young age group transmits the knowledge from the absorptive capacity to senior managers. Furthermore, the complementary effect will be the critical factor for SMEs to success implement IS.

Although, some research indicates that user satisfaction and the performance of IS usage do not existing correlation. Most of the research results show a positive correlation between user satisfaction and the performance of IS usage (Hou, 2012). From the research result, user satisfaction is positively affecting the performance of SuccMail usage. Besides, in this research, user satisfaction is most significantly affecting the performance of SuccMail usage. Which consistent with the prior research and meet our expectation. It is understandable that if the users consider SuccMail as the tool of working, the working efficiency and productivity will spontaneously get better. Also, it consistent with the past research with the user interviews. Although the researcher did not examine whether the performance of SuccMail usage affects user

satisfaction, according to the previous user interviews, these two factors are mutually positive.

Table 6.4 shows the result of two hypotheses with the user satisfaction via the multiple regressions. The results of the analysis show that management support and absorptive capacity are significantly and positively affecting the user satisfaction. Therefore, support hypothesis 3 and hypothesis 5.

Table 6.4 Regression Analysis Dependent Variable User Satisfaction

Independent Variable	Unstandardized coefficients B	Std. E	Std. coefficients (Beta)	t-value
Constant	2.590	0.297		8.735***
Management Support	0.203	0.060	0.248	3.380**
Absorptive Capacity	0.221	0.079	0.204	2.778**
Model Fit	R=0.384	R^2=0.147	Adj. R^2=0.139	F=17.040***

Note. Dependent Variable = User Satisfaction

$** p < .01$, Two-tailed. $*** p < .001$, Two-tailed.

About the research of management support affecting user satisfaction existing significant correlation (Wang and Song, 2017). Nevertheless, there also have research indicates there does not have a correlation between management support and user satisfaction (Rouibah et al., 2009). In the research of linking ERP to ECS, the management support is significantly positively affecting the user satisfaction in SuccMail. Even though the result is insufficient to prove management support and user satisfaction existing correlation, but it shows management support is a critical factor for the performance of IS usage. Especially for the SME, without management support, it is unlikely to have the revolution of the management. Moreover, management support not only directly affects the performance of SuccMail usage but also indirectly affects the performance of SuccMail usage via user satisfaction.

The literature on the correlation between absorptive capacity and user satisfaction is lacking. Calisir and Calisir discussed the user satisfaction of ERP with different factors. They indicate that both perceived usefulness and learnability are determinants of user satisfaction with ERP systems (Calisir and Calisir, 2004). Besides, perceived ease of use and system capability affect perceived usefulness, while user guidance influences both perceived usefulness and learnability. The result shows that absorptive capacity is positive affects user satisfaction, which is not in the expectation. The researcher believed the main reason for this result is because compared with other IS, SuccMail is relatively easy to use. Also, the essential prior knowledge of SuccMail is easier to acquire. Although there has no evidence that supports this inference, from the result there is the possibility.

Table 6.5 shows the result of management support is significantly and positively affecting the absorptive capacity. Therefore, support hypothesis 2.

Table 6.5 Regression Analysis Dependent Variable Absorptive Capacity

Independent Variable	Unstandardized coefficients B	Std. E	Std. coefficients (Beta)	t-value
Constant	2.717	0.182		14.935***
Management Support	0.333	0.048	0.442	6.924***
Model Fit	R=0.442	R^2=0.195	Adj. R^2=0.191	F=47.948***

Note. Dependent Variable = Absorptive Capacity
$*** p < .001$, Two-tailed.

The SME managers normally are lacking prior knowledge and absorptive capacity. Therefore, the initial design of SuccMail had considered this key point, and take the flat design on the organization. Li et al. found the positive effect of top management support of learning and employee learning orientation on absorptive capacity and subsequent firm innovative performance (Li et al., 2018). Also, they indicate that the effect was significant when decentralization was higher. The flat

design of the organization makes the managers and employees could learn from each other. For the employees through SuccMail could learn the management method and the skill of handling from managers. On the other hand, managers through SuccMail could learn the skill of using IS. Due to this characteristic, the management support has a significantly positively affecting absorptive capacity. The result is in our expectation and verifies the research of Li et al. (Li et al., 2018).

In the researcher's opinion, SMEs' managers or operators are too low in computer use and familiarity, which might be why the low R^2 value in Table 6.5. This deserves in-depth study.

6.8 Conclusion

This research is based on previous research on the integration of artifacts with ERP systems and ECS. Since most SMEs who have implemented ERP complain about duplications of work caused by ECS implementation, the researcher linked SuccMail with the user's current ERP. The research results show that this solves the doubts and complaints caused by employees' duplications of work. And users are satisfied with the linking of ERP and ECS, which is beyond my imagination. At this stage, the validity of the link between ERP and ECS was verified. User satisfaction shows that the problems of independent ERP and ECS duplications of work have been solved. In addition, management support, absorptive capacity, and user satisfaction also have a positive impact on the performance of SuccMail.

The main result is the completion of the first work of ERP and ECS integration. Of course, this is just the beginning. Researchers believe that this result will lead more researchers to study the link between ERP and ECS.

Chapter 7. Discussion, Contribution, Limitation, Future Work, and Conclusion

7.1 Discussion

The reason for doing this series of studies is because, after an extended period of time, the researcher discovered that SMEs previously used e-mail as management is a problem. The problem of loss of costs, such as time cost, labor cost, and data processing cost. Also, due to the bad internal communication and management by email, such as; information overload, too many messages over too many channels, too many spam messages, repeat mail to separate staffs, non-desk workers are left out of the information, etc. Therefore, the researcher thought of getting SMEs to use ECS as the E-management system. Just as Microsoft provides Microsoft Teams, Stewart Butterfield developed Slack, and Salesforce purchased Slack with $25 billion.

After a series of studies, the researchers found several significant problems.

1. As Grudin proposed in 1988, the successful implementation of CSCW is very complicated without a strong management commitment to ensure the new system's success (Grudin, 1988).

2. Usually, the operators and managers of SMEs are too lacking in using computers and software. This is the fatal injury to the successful implementation of ECS.

3. Before implementing ECS, you need to develop a clear corporate collaboration strategy. If the use of ECS is overly complicated, employees will avoid using ECS. Instead, they will find a way to accomplish tasks without it. Said Matthew Fox of Valiant Technology.

4. If there is no professional consultant in the implementation phase, it will increase implementation difficulty. However, this is also a cost issue for SMEs. Researchers admit that hiring experienced consultants to implement ECS at the beginning of the show will increase costs. In the long run, this decision can still help SMEs save labor costs, time costs, and management costs. Therefore, in terms of long-term investment, the implementation of ECS is worthwhile and necessary.

7.2 Contribution

This dissertation uses SuccMail to discuss various SME e-management issues. First of all, the researcher verified Steinhüser's 2011 research in practice; ECS implementation in SMEs has performance and management advantages. Besides, in the ECS field, which is hugely lacking in the literature, the researcher used questionnaires and actual interviews with users to discuss various internal and external support issues in SMEs implementing ECS. The researcher finds Internal support is far more critical than external support. This result allows the researcher to clearly understand SMEs' difficulties in introducing ECS under the current environment. After all, it is difficult for existing SMEs to find an expert who has good computer use capabilities and, at the same time, sufficient management capabilities.

7.3 Limitation

Although there are hundreds of ECSs on the market, there are very few research papers on ECS, which significantly limits the research process. Many times the researcher has to cross the river on a stone like a blind man. For example, the researcher had no questionnaire questions that can use directly. At this time, the researcher can only use questionnaire questions with similar functions as ECS as a reference, but there

are many differences between the two. In addition, the number of SMEs who agreed with conducting the survey was few. Hence, the samples for the data analysis were few. The researcher spent five years dividing it into three stages, using SuccMail as a research tool to make an in-depth discussion on SMEs' e-management, and worked with another researcher, Lin Yong-Yu, and published four papers and three conferences. Although this process has been quite hard, we have achieved a lot of results relatively.

Due to the outbreak of the COVID-19 epidemic, SMEs have more urgent needs for remote management, co-work, and e-management. The researcher believes this will bring vigorous development to ECS-related academic discussions.

7.4 Future Work

In the third stage of integrating with the ERP system and the ECS to examine the SuccMail usage performance, this primary result completes the first work on the integration of ERP with ECS. Of course, this is just the beginning; the researcher believed that the product would lead to more researches linking ERP with ECS. For future work, the researchers should consider what kinds of performance of link-up ERP and ECS can improve.

Another issue worthy of in-depth discussion is that the managers or operators of SMEs are too low in computer use and familiarity. Is this the reason for the low R^2 value in Chapter 6.7? This issue deserves in-depth study.

Regarding another problem in SMEs' operation, the vast majority of SMEs still use email as one of the primary operations and management tools. However, email also brings fatal damage to the operation and management of SMEs. As mentioned in the previous section 2.1.1, to solve this annoying problem, our researchers have used the

Latent Dirichlet Allocation integrated with the Visual Attention method to identify the source and attribution of email to a certain extent. For another future work should consider using the link of ERP and ECS and combine email identification, which will significantly enhance SMEs' e-management capabilities.

7.5 Conclusion

In this study of the first stage, the researcher found that the ECS of SuccMail is basically satisfied by the respondents, while not all of the features are used by the users. Even SuccMail has simplified the system's use as much as possible; it is difficult for SMEs to exert the effectiveness of ECS without a dedicated consultant fully. This is actually the main reason that SMEs cannot successfully import ECS. The finding shows the feature "Administrative area for purchase plan and payment request" effectively reduces human resource reduction, time-saving, and communication improvement. The feature "Display of messages status of who and when read or unread the messages" effectively reduces human resource reduction, customer complaints reduction, and time-saving. The feature "Tracking event ongoing or completion" effectively reduces human resource reduction, time-saving, and communication improvement. The feature "Links to the past events URL" effectively reduces human resource reduction, customer complaints reduction, and time-saving. The feature "Group file sharing feature" is effective in customer complaints reduction and communication improvement. The feature "Customizable labels based on business events/action for search feature" effectively improves communication.

Through proposed a survey questionnaire to evaluate how the internal and external supports of SuccMail can affect SMEs' performance in the second stage, the researcher found each support has a positive influence on the implementation of

SuccMail and can affect the business performance of SMEs. Based on the result, the internal supports are more significant than the external to impact the business performance of SME. Industry 4.0 is seen as the beginning phase where computers and automation become connected and as an opportunity to increase the efficiency and effectiveness in the manufacturing industry. There are many challenges related to the integration of Industry 4.0. To catch up with Industry 4.0, it has become inevitable for the SME to implement e-management. This study's findings will help the SME better carry out e-management by implementing ECS with internal supports.

Most SMEs have already introduced ERP, so employees will refuse to use ECS and think that this is a duplication of work. Although ERP is a relatively fixed software to a certain extent, it is an indispensable software because it involves financial issues. However, for the management of SMEs, ECS is more critical than ERP. SMEs that do not introduce ECS will lose their competitiveness in control and will have a management crisis in the foreseeable future, which has undoubtedly been revealed after the outbreak of COVID-19. From the research results and the interview process, the research found that ECS and ERP's link solved users' doubts about duplication of work. The satisfaction that users felt about the connection between ERP and ECS was far beyond our imagination. For this reason, another researcher, Lin Yong-Yu, and I have started to write a general-purpose ERP to link the existing SuccMail. We have high expectations for other research results on this topic.

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Appendix A: Questionnaire to measure the impact of ECS design features on the performance of SMEs

The questionnaire asks your opinion about the effectiveness and actual use of the following design features of SuccMail:

1. Accessibility of historical messages by any group member
2. Administrative area, Purchase plan and payment request
3. Customizable search feature based on business events/action labels
4. Display of messages status (who and when read/unread the messages)
5. Tracking event ongoing or completion
6. Group files sharing feature
7. Links to the past events URL

I. General Information

For each question below, please tick or put a mark on one of the options to indicate your answer.

- Your gender:
  - Male
  - Female
- Your age:
  - 20 – 29 years
  - 30 – 39 years
  - 40 – 49 years
  - 50 – 59 years

- Above 60 years

- Your position:
  - CEO
  - General Manager
  - Manager
  - Section Chief (Team Leader)
  - Other
- Your overall work experience:
  - Below 5 years
  - 5 – 9 years
  - 10 – 14 years
  - 15 – 19 years
  - Above 20 years
- Your highest level of education:
  - High school graduate
  - Bachelor Degree
  - Master
  - Ph.D.

II. Organizational Characteristics

To answer the following question, please ask HR department and Customer Service department in your organization:

- How many employees ARE there NOW in this organization?

  _____

- How many employees WERE there BEFORE (when you didn't have SuccMail) in this organization?

  _____

- What IS the number of customer complaints IN 2017 in this organization?

  _____

- What WAS the average number of customer complaints PER YEAR WHEN YOU DIDN'T HAVE SUCCMAIL in this organization?

  _____

III. Effectiveness of Features

For the following questions, please answer according to the following scale:

1=Strongly disagree, 2=Disagree, 3=Neither agree / disagree, 4=Agree, 5=Strongly agree

i. Effectiveness for Reduction of Human Resources:

- “Accessibility of historical messages by any group member” is effective to reduce the size of human resources.
- “Administrative area, Purchase plan and payment request” is effective to reduce the size of human resources.
- “Customizable labels based on business events/action for search feature” is effective to reduce the size of human resources.
- “Display of messages status (who and when read/unread the messages)” is effective to reduce the size of human resources.
- “Tracking event ongoing or completion” is effective to reduce the size of human resources.
- “Group files sharing feature” is effective to reduce the size of human resources.
- “Links to the past events URL” is effective to reduce the size of human resources.

ii. Effectiveness for Reduction of Customer Complaints:

- “Accessibility of historical messages by any group member” is effective to reduce customer complaints.

- “Administrative area, Purchase plan and payment request” is effective to reduce customer complaints.
- “Customizable labels based on business events/action for search feature” is effective to reduce customer complaints.
- “Display of messages status (who and when read/unread the messages)” is effective to reduce the customer complaints.
- “Tracking event ongoing or completion” is effective to reduce the customer complaints.
- “Group files sharing feature” is effective to reduce the customer complaints.
- “Links to the past events URL” is effective to reduce the customer complaints.

iii. Effectiveness for Time Saving

- “Accessibility of historical messages by any group member” is effective to reduce the average time to complete events in this organization.
- “Administrative area, Purchase plan and payment request” is effective to reduce the average time to complete events in this organization.
- “Customizable labels based on business events/action for search feature” is effective to reduce the average time to complete events in this organization.
- “Display of messages status (who and when read/unread the messages)” is effective to reduce the average time to complete events in this organization.
- “Tracking event ongoing or completion” is effective to reduce the average time to complete events in this organization.
- “Group files sharing feature” is effective to reduce the average time to complete events in this organization.
- “Links to the past events URL” is effective to reduce the average time to complete events in this organization.

iv. Effectiveness for Communication Improvement

- “Accessibility of historical messages by any group member” is effective to improve the level of communication in this organization.
- “Administrative area, Purchase plan and payment request” is effective to improve the level of communication in this organization.
- “Customizable labels based on business events/action for search feature” is effective to improve the level of communication in this organization.
- “Display of messages status (who and when read/unread the messages)” is effective to improve the level of communication in this organization.
- “Tracking event ongoing or completion” is effective to improve the level of communication in this organization.
- “Group files sharing feature” is effective to improve the level of communication in this organization.
- “Links to the past events URL” is effective to improve the level of communication in this organization.

IV. Your Actual Use of Features (Final Section)

Instruction:

For the following questions, please answer according to the following scale:

1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Very Often

- How often do you use this feature: “Accessibility of historical messages by any group member”?
- How often do you use this feature: “Administrative area, Purchase plan and payment request”?
- How often do you use this feature: “Customizable labels based on business events/action for search”?

- How often do you use this feature: “Display of messages status (who and when read/unread the messages)”?
- How often do you use this feature: “Tracking event ongoing or completion”?
- How often do you use this feature: “Group files sharing feature”?
- How often do you use this feature: “Links to the past events URL”?
- What other new features of SuccMail could be effective to improve the performance of this organization? (Please write freely below).

Appendix B: Questionnaire to measure the impact and performance with External and Internal Support of ECS

I. General Information

For each question below, please tick or put a mark on one of the options to indicate your answer.

- Your gender:
  - Male
  - Female
- Your age:
  - 20 – 29 years
  - 30 – 39 years
  - 40 – 49 years
  - 50 – 59 years
  - Above 60 years
- Your position:
  - CEO
  - General Manager
  - Manager
  - Section Chief (Team Leader)
  - Other
- Your overall work experience:
  - Below 5 years
  - 5 – 9 years

- 10 – 14 years
- 15 – 19 years
- Above 20 years

 Your highest level of education:

- High school graduate
- Bachelor Degree
- Master
- Ph.D.

II. External supports and Internal Supports

The questions below are about the supports that make you get easier on using SuccMail.

For the following questions, please answer according to the following scale:

1=Strongly disagree, 2=Disagree, 3=Neither agree / disagree, 4=Agree, 5=Strongly agree.

i. The external supports from the SuccMail company.

 The SuccMail manual is helpful to use.

 Online consultation is helpful to solve your problems of using SuccMail.

 An external SuccMail expert consultant helps use SuccMail.

ii. The internal supports of your company.

 Your company fully depends on using SuccMail to manage and communicate.

 Your company offers sufficient resources for using SuccMail.

 Your company had hired a full-time consultant for implementing SuccMail.

 The internal conflicts of the enterprise have been reduced by using SuccMail.

III. Task Performance

The questions below are about the effect of SuccMail on your task performance

For the following questions, please answer according to the following scale:

1=Strongly disagree, 2=Disagree, 3=Neither agree / disagree, 4=Agree, 5=Strongly agree.

- Using SuccMail is easier to perform tasks.
- SuccMail is helpful to improve communication.
- SuccMail is helpful to reduce the cost of Human Resources.
- SuccMail is helpful to reduce customer complaints.
- Using SuccMail can enhance working efficiency.
- Using SuccMail can increase production efficiency.

Appendix C: Questionnaire to measure the performance of linking ERP to ECS

I. General Information

For each question below, please tick or put a mark on one of the options to indicate your answer.

- Your gender:
  - Male
  - Female
- Your age:
  - 20 – 29 years
  - 30 – 39 years
  - 40 – 49 years
  - 50 – 59 years
  - Above 60 years
- Your position:
  - CEO
  - General Manager
  - Manager
  - Section Chief (Team Leader)
  - Other
- Your overall work experience:
  - Below 5 years
  - 5 – 9 years
  - 10 – 14 years

- 15 – 19 years
- Above 20 years

- Your highest level of education:
  - High school graduate
  - Bachelor Degree
  - Master
  - Ph.D.

The questions below are about the supports that make you get easier on using SuccMail.

For the following questions, please answer according to the following scale:

1=Strongly disagree, 2=Disagree, 3=Neither agree / disagree, 4=Agree, 5=Strongly agree

I. Top Management Supports

- Top management understands the importance of SuccMail.
- Top management supports the SuccMail function.
- Top management provides enough resources to use SuccMail.
- Top management recruits Personnel in charge of SuccMail.

II. Absorption Capacity

- I can use SuccMail very well if someone helps me get started.
- I am qualified enough to perform tasks using SuccMail.
- I have the capability to achieve the objectives of tasks by using SuccMail.
- I can apply the knowledge derived from SuccMail to my tasks.

III. User Satisfaction

- Is the output of SuccMail easy to understand?
- Is SuccMail easy to use?
- Are you satisfied with SuccMail?

IV. Performance

- Use of SuccMail has led to better management of organizational activities.
- The SuccMail has resulted in improved business processes.
- It is faster to perform tasks using SuccMail than before.
- It is easier to perform tasks by using SuccMail than before.
- I am more satisfied with my performance in conducting my tasks due to SuccMail than before.