AUTOMATING SALES SPREADSHEET PROGRAM USABILITY TEST

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ABSTRACT

Nowadays, most data are multi-dimensional data which are complex, unconnected and undesired format. Employees take hours or even day in cleaning and transforming data into a desired format before generating a report. The automatic program enables reduce time consumption in completing tasks. Hence, the purpose of this research is to initiate and test usability of the automating sales spreadsheet program that helps employees to automatically turn data into a desired format. Research scope is comparing time taken in completing the assigned task between using the program and manual process. It has been proven that Microsoft Excel is an important tool in extracting data in order to get insight, especially add-in function which is called VBA. Moreover, a good program should pass through SDLC framework. Also usability test has to be conducted to assess quality of the program with real time user testing.

The quantitative in term of experimentation design is used in this research. By developing the program and conduct usability test with 60 employees in a consumer goods company in order to do Paired T-test based on the two assumptions. As a result, the automatic program enables employees to significantly reduce time spent in completing tasks along with simplified work process. Whether employees are programmer or non-programmer, they can take the same amount of time just a few minutes in completing the same task.

KEY WORDS: Automatic program/ Program/ Usability Test/ Usability

44 pages

CONTENTS

CONTENTS (cont.)

LIST OF TABLES

LIST OF FIGURES

CHAPTER I
INTRODUCTION

1.1 Background and Problem Statements

Every second, the world has been changed. Businesses need to prepare themselves to cope with an ever-changing business environment. Technology plays an important role toward the change in the business world. Particularly, Information Technology (IT) is the engine that enables enterprises to succeed in highly competitive environments. Consequently, it is not strange why IT has stepped into a part of all businesses both domestic and overseas.

One of IT's backbone is data. Most people understand that the terms of "data" and "information" are the same meaning, and can be used interchangeably. In fact, there is a distinct difference between these two words. In general, data is the facts of things which can be either text or numbers, but it results in ambiguity; difficult to understand. Data is information that has been consolidated and translated for some purpose, especially in analysis. Approximately 80 percent of data in any enterprises is unstructured (Chakraborty, 2014). If unstructured data[1] is not put into context that gives a meaning or relevance, it is meaningless towards a human or computer. While information is an output data or outcome after data processing. It is valuable and usually formatted in a manner that a human can understand and find patterns.

Many enterprises recognize that data has critical potential towards more intelligent decisions as well as optimizing operations to survive and prosper, and increase competitive advantage, efficiency and productivity. Data and impactful information are the key factors in analyzing to improve business operations and performance in any functional area whether business development, marketing, sales, finance, supply chain and production, or even R&D. Since storing data is cheap and can be retrieved (Joe, 2008), enterprises have collected data like sales data, customer

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[1] Unstructured Data is Text Files, Word documents, PDF files, E-mail body, Twitter messages, books, and non-language based data such as Pictures, slides, Audio, and Videos.

information, purchasing information, and raw material specifications and so on, and kept in systems or servers to be the evidence of what happened in reality from their operations so that everyone understands in the same direction. This makes the volume of data in most enterprises move too fast (Jeff, 2009). Vast amounts of data that are becoming available across a wide range of application domains across industries. This event is known as multi-dimensional data phenomenon (IBM, 2015). Multi-dimensional means the volume of data that are very huge and complex. The growth of this phenomenon hints that enterprises must not only understanding that data in order to decode the useful information, but also understanding the possibilities of the data analytics. The quicker in getting meaningful insights out of the information under the data, the faster can create value for enterprise whether in increasing revenues or new revenue opportunities, improved customer service either get new customers or retain customers, or more effective marketing strategy (Oracle and FSN, 2012). Generating meaningful insights out of multi-dimensional data is driving further innovation, launching new services and businesses, or making a kind of impact that can change the world. Hence, it is not surprising that data has become a key thing to boost up enterprises' profits according to *McKinsey Global Survey* 2012. As a result, data analysis is critical required.

Unfortunately, it is insufficient to deal with multi-dimensional data by manual processing because the amount of datasets is extremely large, which exceeds an enterprise's current processing capacity (Oracle and FSN, 2012). Most employees often encounter with a problem that they need to clean and manipulate large sets of data before being used because of its sophistication. To solve the problem, enterprises have turned to different software solutions designed to help their employees better manage such data and extract meaningful value as well as enabling them to make the most efficient use of their available resources (IBM, 2015). A computer can turn data into information so that a human can understand through using software applications, formulas, or programming scripts, so numerous innovations have been developed to manage the data.

1.2 Research Objective

The purpose of automating sales spreadsheet program usability test is to initiate and test usability of the program that helps employees in a consumer goods company are able to automatically turn multi-dimensional data into knowledge in a short time in order to get opportunities or competitive advantages quicker.

1.3 Research Scope

This research focuses on employees in a consumer goods company. 60 employees inside the company were randomly selected to attend a usability test in both manual and automatic approach based on identical sales data which has been gathered from the company's distribution centers. As part of evaluation, time taken in the two processes in completing the given tasks represents a standard time of individual. The standard time was used to study a distribution of the samples. If it was a normal distribution[2], it can be assumed that they are the representative sample; the average of all interested population. Then, conducting hypothesis test at 95% confidence interval[3] by using a Paired t-Test to compare the two sample means in observations.

1.4 Expected Results

The automating sales spreadsheet program reduces time spent in analyzing sales data along with simplified work process of the given tasks that need to be performed. The program enables employees to accomplish their desired tasks quicker and easier in order to come up a potential outcome in the end.

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[2] Normal distribution is a probability of distribution that has a continuous cumulative distribution. It is frequently used to represent the real value of random variables whose the distributions are unknown.
[3] A confidence interval is the range of values which is calculated from the interested parameter

1.5 Expected Benefits

This automated program generation is relatively small, but it is a useful solution to problems. It enables end users in automating such their repetitive tasks without programming skills. End users are able to use the program to synthesize information and derive meaningful value from a massive amount of data with such a short time so that they make decisions timely and efficiently to drive the business ahead of competitors in highly competitive environment. The company gets an opportunity of being first at something to capture benefits or competitive advantages before competitors. If the company can be the first who launches a new product in the market, the benefits might result in long-lasting market dominance and the profits are higher than the average over time (Lieberman, el.at, 1998) (Mittal, et.al, 2004). Furthermore, people can use this program as a model, and then apply to build a specific program to facilitate their routine work or repetitious work easily and quickly by themselves.
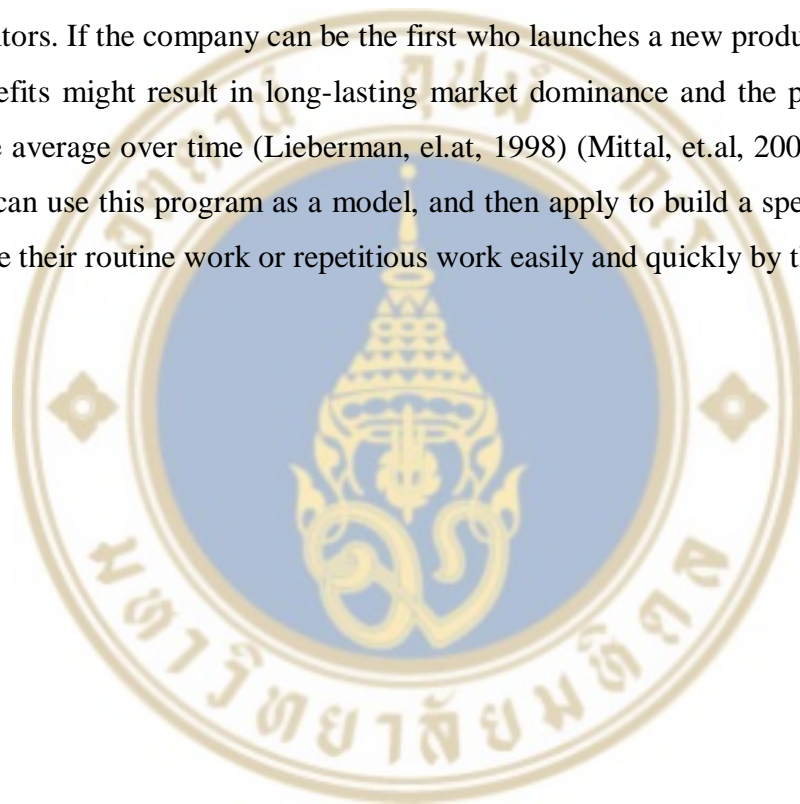
CHAPTER II
LITERATURE REVIEW

This chapter describes an overview as well as theories and researches on topics that are associated with this research. The main topic emphasizes on automating sales spreadsheet program in consumer goods company usability test.

This research was inspired by observing employees' ways of working in a consumer goods company in Thailand. Each week, employees need to perform their given tasks over large spreadsheet data, particularly in the areas where they deal with a lot of numbers such as marketing, business development, finance, sales, and customer development. They usually extract data from back-end systems of the company like SAP, Oracle, or Peoplesoft, and push it through Excel spreadsheet in order to do data analysis. Optimal processing analytic skills are essential to process that much data in order to figure out potential insights. Despite Excel providing the functionality and flexibility that allows users to complete most of their desired tasks easier and faster, they frequently struggle to find features that are required because they lack the knowledge of programming, time, or passion to develop specific software against their tasks. A lack of programming experience, skill, or knowledge, it is too difficult to do such tasks automatically due to the complexity of Excel. This is the reason why many employees still rely on manual approach even they know that manual processing multi-dimensional database often wastes their time for a day or more in order to get information includes the possibility of the errors are relatively high; however they do not have choices, especially people who do not have the advanced skill in Excel. Definitely, a few errors in handling data bring about inaccurate data or data distortion, which make a middle and senior management or top-level executives who require using such data in analysis get misinformation. It would increase risks in forecasting and problem-solving, and making decision for business. Hence, any complex task that has been done by human is necessary and vital, which should not overlook this key element. This gap leads to a new technical challenge in automated data manipulation, since enterprises depend on

information inside the data. The emerging of automated spreadsheet program emphasizes on handling massive amount of data through integration of manual manipulation by means of human and computer programming in the data manipulation process. Automatic manipulation aims to bridging the gap by employing more intelligent method into the manipulation process. The basic idea of automatic manipulation is to automatically transform data to gain insights and to make better decisions in the end.

2.1 Software/System Development Life Cycle

Numerous types of information systems are used by enterprises to deal with many processes that require in carrying out their business functions. Each system has its particular purpose and life. This basic concept is called the System Development Life Cycle (SDLC) which comprises the processes of establishing a good software including planning, building, deploying, updating and maintaining the software (Satzinger, et.al, 2007). All stages of the lifecycle are important in itself. Each stage provides quality and correctness of the good software. A mistake in one step can create a big obstacle in developing software. SDLC describes stages of information system development since the beginning until the end portion of the development lifecycle. A new information system development involves several differences but activities still relate together. The activities usually include planning, analysis, design, implementation, and maintenance respectively. In other words, SDLC is considered as a conceptual model that instructs project management about the development of the information system (Satzinger, et.al, 2010). Every time a system is required to be establish, it has to pass through the number of stages in SDLC that needs to be aware.

SDLC methodology consists of following stages:

- **Planning** – to understand problems of the existing system or tool and to study an initial feasibility of new system. Feasibility in terms of technical, operational, economic, or probability of investment values such as time, strategy as well as related staffs. It is considering that the system should be changed or not (Satzinger, et.al, 2010).

- **Analysis** – to consider a result from the feasibility study. Once a new system is required, the stakeholders' information should be gathered to understand what

the need of users are and study about problems that impact the existing system in order to improve designing a more efficient system. Then, discuss among end users and developers in order to agree on what are (Satzinger, et.al, 2010).

   • **Design** – related to physical construction of the system which consists of network configuration such as hardware, operating system, programming and so on. User interface design whether forms, reports and so on, system interface design to interact with other systems, and security issues. The proposed system design is essential to be tested in all aspects of performance to assure that the outlined requirements during the analysis phase are met. Deficiency adjustments must be made at this stage (Satzinger, et.al, 2010).

   • **Implementation** – initializing process: assumptions and constraints should be made as a physical document. Users must be tested and trained its use once the new system is developed. The old system is then gradually replaced (Satzinger, et.al, 2010).

   • **Maintenance** – deals with all activities that are required once the system is deployed and run for a while. The amount of required support is determined based on the size of system (Satzinger, et.al, 2010). A Larger system involves many departments, and maintenance and support requires a longer time.

Maintainace   **Planning**

SDLC
Software/System Development Life Cycle

Implementation   **Analysis**

Design
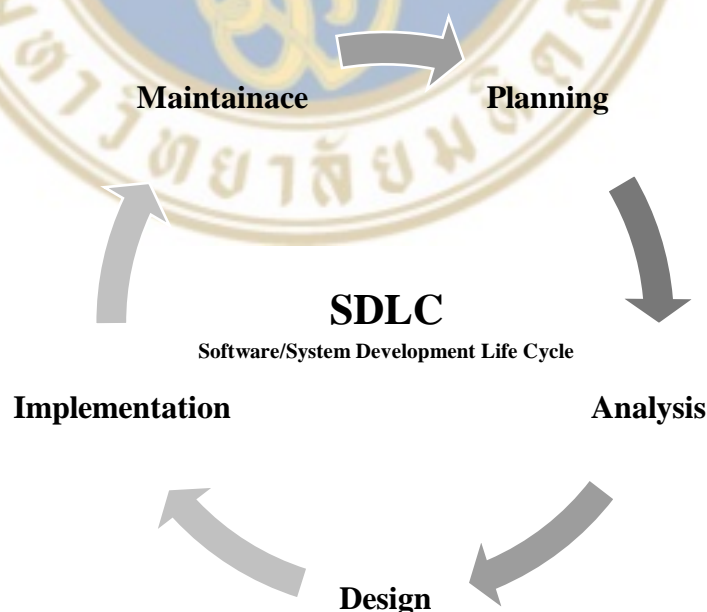
Figure 2.1 System Development Life Cycle Framework

Many SDLC models have been established by software development experts, standards organizations and universities. SDLC Models are used to provide a basis for project planning, estimating and scheduling, framework for standard set of terminologies, activities and deliverables, mechanism for project tracking and control, and to increase visibility of a project progression to all stakeholders.

Advantages of SDLC consist of increased development speed and product quality, improved tracking and control and client relations, and decreased project risk and project management overhead.

2.2 Microsoft Excel (Excel Spreadsheet)

One of the most powerful and important software applications is Microsoft Excel (MS Excel). Excel spreadsheet facilitates tremendous ability for quantitative analysis. It allows people to do anything from statistical analyses of databases with more than thousands of records easier and faster. Excel also provides user-friendly functions and an intuitive interface that allows people to see what happens to the data according to their manipulation (Chris and Scaffidi, 2010). Its utilities make Excel become a mandatory tool of almost all companies, universities, and government facilities around the world for storing and manipulating data to extract useful information and gather insights. Furthermore, the two key factors that make Excel popular are convenience and cost (Susan, et.al, 2015). Unlike investment in a system, which requires huge investments in terms of time and cost. This is why Microsoft Excel is the most-used spreadsheet program in the world.

It has been proven that Microsoft Excel is very useful for performing numeric computations along with organizing, manipulating, exploring, and visualizing data with complex analytical techniques. MS Excel is more intuitive for many non-technical database users compared to traditional alternatives (Chris and Scaffidi, 2010) and able to perform formula-based calculations and other mathematical functions. In addition to its spreadsheet functions, Excel also serves as a programming platform of Visual Basic for Applications. The tool is as an add-on to extend Excel's ability by providing analysis and visualization features. It is able to extract data from several files into a single document [1]. Excel Spreadsheet is a powerful analytical tool that helps

people improve decision making, forecasting and planning, and managing business processes to be smoother and more defined. As a result, Excel has become the most commonly used application in the business world for decades. However, previous studies about usage of spreadsheet have mainly emphasized on formulas, especially the correctness of formula. The studies have shown that spreadsheets are often built in an unofficial that overpasses quality control (Cragg and King, 1993). Spreadsheets typically contain one error of formula up to 94% at least (Panko, 1998). Formula errors come up with many different factors (Powell, et.al, 2009) (Rajalingham, et.al, 2001) which finally can bring about huge losses in budgetary (Caulkins, et.al, 2009).

2.3 Visual Basic for Applications (VBA)

One of the key advantages of Excel is it allows users to create a great output data with very tiny work through an add-in function which is called VBA (Chandan, 2004). VBA (Visual Basic for Applications) is the programming language incorporates in Microsoft Office whether Access, Word, Power Point, Excel, or Outlook to command the program automatically run.

VBA enables non-programmers to automate repetitive tasks in order to reduce complexity. VBA processing results in velocity and accuracy to accomplish desired tasks better than manual processing by human.

There are three principal reasons to consider VBA programming.

Automate Repetition

VBA is effective and efficient when it involves repetitive solutions in formatting or problem corrections. For example, users never changing a format of data or information and steps in analyzing data. They have to reformat multiple tables from Excel into a Word document or an Outlook e-mail and to perform the same change in multiple Outlook contacts.

In case of a user performing a change more than ten or twenty times, it is worth automating in VBA. It is certainly worth considering, if it is complex a change that you have to perform hundreds of times. Almost formatting or editing change that a user performs by hand can be done in VBA by clicking.

User Interaction Extensions

There are many times to encourage or force users to interact with the Office application or document in a particular way that is not part of the standard application. For instance, you might want to stimulate users to perform some particular action when they open, print, or save a document.

Interaction between Microsoft Office Applications

Sometimes a simple action like copy and paste does not meet what users want or it is too slow. Users can use VBA programming to interact with data of two or more Office applications at the same time, and then modify information in one application based on information in another. For example, moving data from Excel to a set of PowerPoint slides or copying all contacts from Outlook to Word and then re-format them in some particular way.

VBA can be used to automatically support business processes such as importing and exporting, customizing, and analyzing data. It facilitates users to import data or text files from other systems. VBA helps users to quickly customize border, format, font and color and to analyze data that is derived from other sources like SAP or ERP before being used. Moreover, VBA enables users to export data from excel to other systems easily.

The specific advantage of VBA is the amount of time that users take in performing tasks is reduced. Users are also able to accomplish the complicated tasks easily even they are not expert in Excel through VBA programing. Anyone is able to write VBA code even with the lack of programming knowledge because it does not complicate. It requires just basic excel formula. VBA is one of powerful solutions that can be facilitated users efficiently complete their tasks.

This is an example script of real world problem.

Delete all empty rows in Excel Spreadsheet with VBA code

```
Sub DeleteBlankRows()
'Update 20131107
Dim Rng As Range
Dim WorkRng As Range
On Error Resume Next
xTitleId = "KutoolsforExcel"
Set WorkRng = Application.Selection
Set WorkRng = Application.InputBox("Range", xTitleId, WorkRng.Address, Type:=8)
xRows = WorkRng.Rows.Count
Application.ScreenUpdating = False
For i = xRows To 1 Step -1
    If Application.WorksheetFunction.CountA(WorkRng.Rows(i)) = 0 Then
        WorkRng.Rows(i).EntireRow.Delete XlDeleteShiftDirection.xlShiftUp
    End If
Next
Application.ScreenUpdating = True
End Sub
```

Figure 2.2 Example of VBA coding

Even VBA programming is a powerful solution that enables non-programmers to automate repetitive tasks, however; it is not always the optimal approach. It is suitable to use other methods to achieve goals in some cases. Users should consider the built-in tools and standard functionalities before starting a VBA project. For examples, if users have a time in editing layout tasks, they should consider use of styles or shortcut keys to solve the problem. They can perform the tasks only one time and then use CTRL+Y to repeat it. Users can create a new document with the correct format or template, and then use CTRL+C and CTRL+V to copy and to paste the information into the new document. These examples perform that Office applications are powerful; the needed solution might already been there. Before jumping into programming, users should take some time to learn more about applications.

Therefore, users have to ensure that they have the time to work with VBA before beginning a project because programming requires focus and is unpredictable. Especially, beginners should not turn to programming unless they have time to work on it carefully. Writing a quick script to solve a problem when a deadline comes can result in a very stressful situation. Hence, whenever users are in a rush, they might want to use other conventional methods even if tasks are monotonous and repetitive.

2.4 Usability Test

Usability **i**s a technique to assess a software or system quality on how pleasant and easy the user interface and features are (Nielsen, 1994). So, usability test is testing a functionality and usage on users, which might be either working software or interactive prototype to measure its quality whether experience or impression when they interact with such software or system (Nielsen, 1994). It is observing about software efficiency and overall users' satisfaction. The purpose of usability test is to measure whether the software application meets expectations of users or not for improving ease of use.

Hence, after developing a software application, a usability test is requires in order to watch users attempt to accomplish tasks. This is the most effective and efficient way to reveal usability problems. There are five quality elements to determine usability (Nielsen, et.al, 1993):

- Ease of learning – easy to grasp and use at the first time they confront with the design

- Efficiency – user-friendly and desired tasks can be accomplished quickly.

- Memorability – easily recognize the use of the program when they return to the design after time away.

- Stability – few or no errors occur

- Subjective satisfactions – feedback of users either likes or dislikes, includes comment or recommendation

Usability test emphasizes on measuring capacity of the program that how well users are able to learn and use it to achieve their intended purpose.

Usability testing process consists of following steps:

1. Designing the test by using   5W + H
2. Preparing data and information and a place for testing
3. Testing which can be divided in to 3 steps:
    - Pre-test: sign agreement for using specific information
    - Test: observe issues or defects that happened during the test for improvement

- Post-test: recording the desired data and user feedback from the test

4. Analyzing data and results

Benefits of usability test consists of real time users are tested to observe issues or defects that occurred. Quantitative and qualitative data are recorded for further improvement or development. Inquiries decrease when a software application has been deployed together with reliability of the software increases. However, a usability test has drawbacks. Usability test have limitations including time, budget, people, equipment, and consent of testers. In addition, a usability test might incomplete when it was conducted with a small group of people and it might have obstacles happened during the test, so the application must be well-designed.
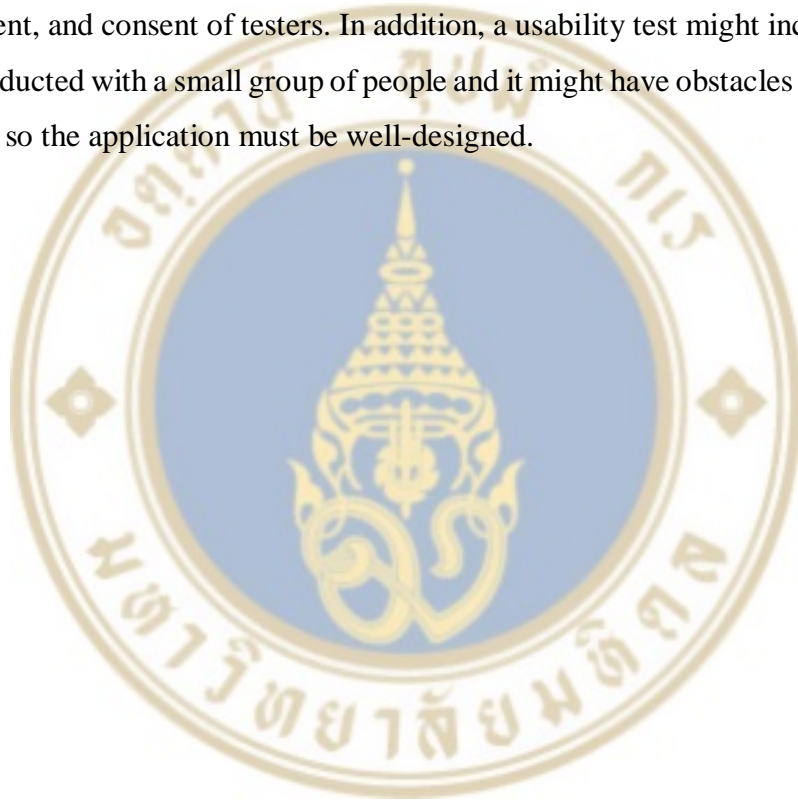
CHAPTER III
RESEARCH METHODOLOGY

This chapter emphasizes on the experimental design and particular methods that are applied to achieve the purpose of the research. This research requires a sample of 60 employees in a consumer goods company in order to participate in a usability test to see whether the automated process could reduce time or not. The effectiveness of the program has been assessed by using a quantitative method in term of time that each end users spent in both manual processing and automated processing.

3.1 Population and sample size

In completing the given tasks, time spent in both processes is assumed as the standard time of each individual to study standard distribution. In the case of normal distribution, we are able to assume that they are the representative sample, and then use the number of this sample to do the hypothesis test based on 95% confidence interval.

In this research, probability sampling is 60 randomly selected employees in a consumer goods company are selected to participate in the test as below.
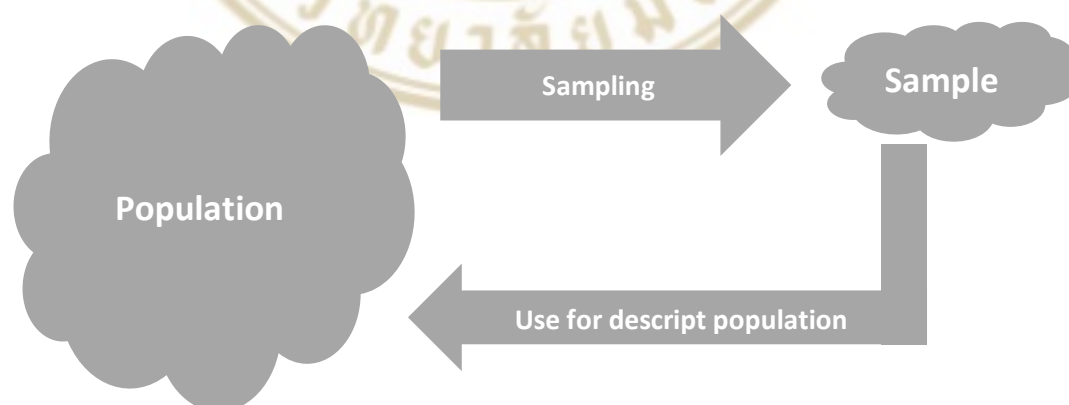
Figure 3.1 Fining Sample Size Framework

The picture shows the target population are relative large, which is difficult to study. Therefore, a sample is randomly selected to be the representative of the entire

population in the study. Finally, the conclusions of target population will be inferred by using Inference Statistics[4] in analysis.

3.2 Experiment/Instrument

Referring to the SDLC model, the stages of planning till implement were grouped into three major phases which are problem definition, problem solving, and summary as follows:

1) Problem Definition – finding the root causes of problems by analyzing all aspects and feasibility study solutions. Problem definition will cover user requirements analysis and decision analysis to looking for optimal tools or techniques to solve the problems.

a.   Problem Analysis - is understanding the current way of working and problems or complexity of tasks through the existing system

b.   Feasibility Study – looking for all of tools or methods that enable to perform tasks easily and smoothly.

c.   User Requirements Analysis - the results of studying possibilities of the way to solve the problems will be used to consider requirements of the users what their needs are to select the proper tools that align with their requirements the most.

d.   Decision Analysis – conditions that occurred from users and possibilities which have been passed screening are used to construct model in order to see the overview of changing system from old to new, to assess the progress of the change that is analyzed previously.

2) Problem Solving is reducing the number of issues of the work process, which consists of 2 major stages are designing a solution method and creating a system or tool to solve the problems.

a.   Designing – drawing physical details of a tool for solving problems in the next step. This stage is critical since it is like a virtual drawing of the

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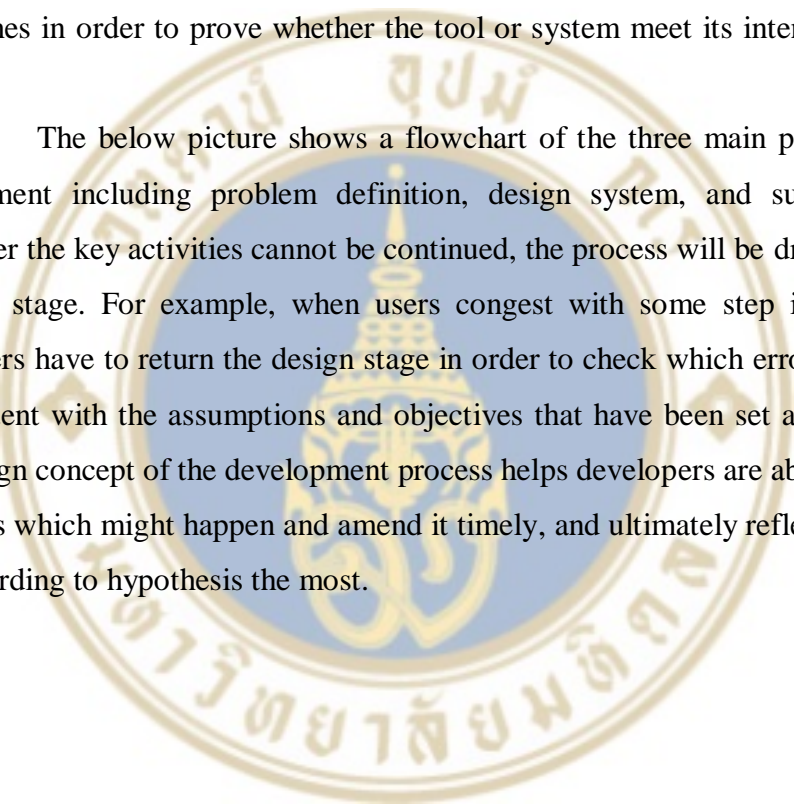
[4] Inference Statistics is the way to draw the conclusions of the population information from the study a piece of information of the representative sample.

solution. This stage mentions how the program works. If there are errors, we can see an overview of the errors.

b. Establishing – developing a model of the tool or system that has been designed. This stage needs to strictly follow the designed model in order to get the most appropriate tool for solving such problems.

3) Summary – Implementing the tool or system for testing usability in order to prove that it can solve such problems. This stage requires real users to participate in the test, data collection for doing hypothesis test, and data analysis based on statistical approaches in order to prove whether the tool or system meet its intended purpose or not.

The below picture shows a flowchart of the three main phases of system development including problem definition, design system, and summary results. Whenever the key activities cannot be continued, the process will be drawn back to the previous stage. For example, when users congest with some step in testing stage, developers have to return the design stage in order to check which error and factor are inconsistent with the assumptions and objectives that have been set at the beginning. The design concept of the development process helps developers are able to investigate problems which might happen and amend it timely, and ultimately reflect results of the test according to hypothesis the most.
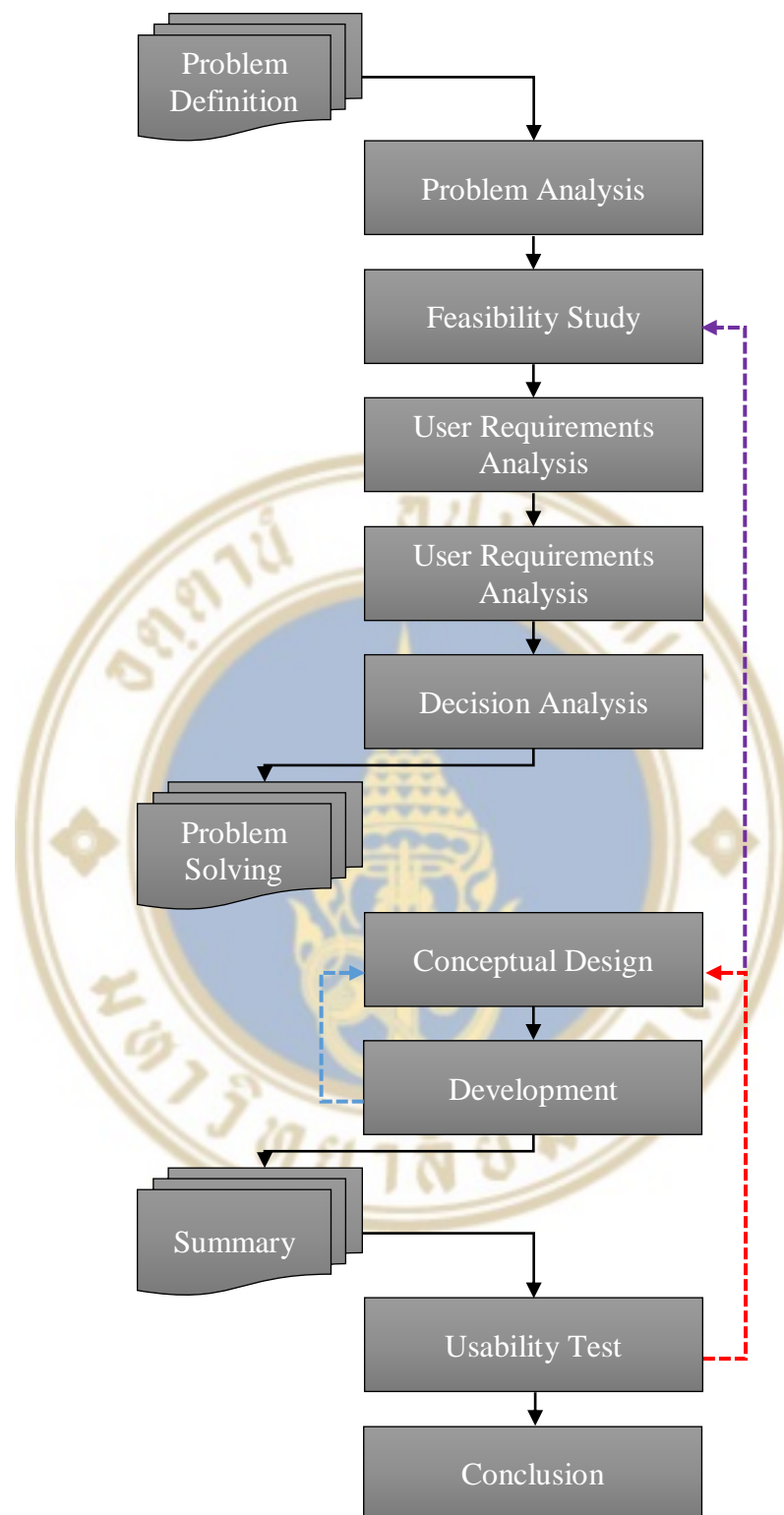
Figure 3.2 Program Development Flow Chart

The automated sales spreadsheet is developed in Excel by using VBA programming to automatically turn multi-dimensional sales data of customer services department into information according to the requirements of end users. The critical

requirement is time consuming in completing repetitive complex task. After development, performance of the automated program will be tested with 60 employees inside a consumer goods company to ensure its capability in solving the problem that they are facing. Whereas, manual process, users are allowed to complete the given task as they ever done.

3.3 Data Collection

Usability test focuses on 60 employees in a consumer goods company who are randomly selected to participate the test. Each user has to interact with both manual approach and automation based on identical sales data that has been gathered from the distribution centers of the company. Time taken of individuals in the two processes are recorded for analyzing results. The manual processing will be tested without test scripts because the individual user has their own way to accomplish the assigned task. While testing the usability of the automated sales spreadsheet program, a session to communicate information about the program together with providing test script will be set up to the testers. The program will be executed as following steps.

1.) Open the automating sales spreadsheet program as well as the required sources of data
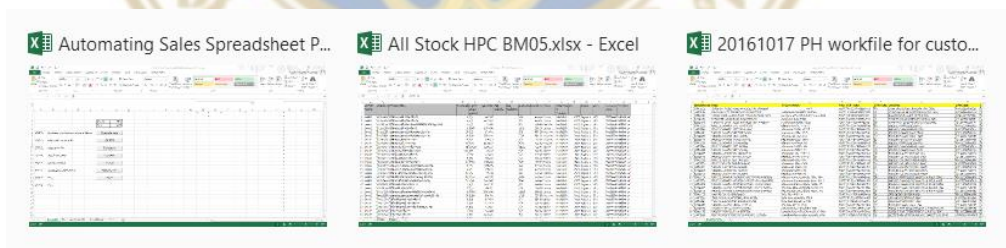
2.) Open Marco program on the program sheet, and then perform as the identified guideline.

	A	B	C	D	E	F	G	H
1								
2								
3						Month		SEP
4						Year		2016
5								
6	STEP 1:	Duplicate data from another workbook				Duplicate data		
7								
8	STEP 2:	Filter and remove data				Cut data		
9								
10	STEP 3:	Update PH file				PH Update		
11								
12	SETP 4:	Calculation data				Calculate		
13								
14	STEP 5:	Formatting data				Format		
15								
16	STEP 6:	Mapping Cat/Market/BU				Mapping PH		
17								
18	STEP 6:	Pivot				Pivot		
19								
20	STEP 7:	Save						
21								
22								
23								
24								
25								
26								
27								
28								

◄ ► **Program** | PH | Sheet2 | Sheet1 | StockByCAT | Pivot | ⊕

3.) Duplicate data and choose data sources

3.1 Click on Duplicate data button

STEP 1:	Duplicate data from another workbook	Duplicate data

3.2 Small window which contains the list of sources for duplication will be populated, and then select the required source.

Select what workbook you want to copy data

All Stock HPC BM05.xlsx
20161017 PH workfile for customer.xlsb
Automating Sales Spreadsheet Program.xlsb

4.) Click on Cut data

STEP 2:	Filter and remove data		Cut data

5.) Update PH and choose data source

5.1 Click on PH update

STEP 3:	Update PH file		PH Update

5.2 Small window pops up for selection the required source

Select what workbook you want to copy data

| All Stock HPC BM05.xlsx |
| 20161017 PH workfile for customer.xlsb |
| Automating Sales Spreadsheet Program.xlsb |

6.) Click on Calculate

| SETP 4: | Calculation data | | | Calculate |

7.) Click on Format

| STEP 5: | Formatting data | | | Format |

8.) Click on Mapping PH

| STEP 6: | Mapping Cat/Market/BU | | | Mapping PH |

9.) Click on Pivot

| STEP 7: | Pivot | | | Pivot |

10.) The result in each page should be showed as following formats.

10.1 Page of Analysis

สถานที่	รหัสสินค้า	คำอธิบายวัสดุ	Market	Cat	BU	มูลค่าร	Site	Area	Custom	DT Name	Stock C	Region	Month	Year
SALE	21141517	บริษเพาเวอร์ 4500 กรัม P4	431332	Fabric Wash	Home Care	3910.94	2003	CE1	50000598	ศุภมิตร LV	4.75	1	OCT	2016
SALE	21141513	บริษเพาเวอร์ 3000 กรัม P6	431332	Fabric Wash	Home Care	121430.8	2003	CE1	50000598	ศุภมิตร LV	177.5	1	OCT	2016
SALE	21141515	บริษเพาเวอร์ 900 กรัม P8	431332	Fabric Wash	Home Care	170768.1	2003	CE1	50000598	ศุภมิตร LV	594.25	1	OCT	2016
SALE	21150779	บริษเพาเวอร์ 400กรัม พิเศษ25บ P 24	431332	Fabric Wash	Home Care	257559.2	2003	CE1	50000598	ศุภมิตร LV	602.75	1	OCT	2016
SALE	21141772	บริษเพาเวอร์ 270ก P6x6	431332	Fabric Wash	Home Care	13.02	2003	CE1	50000598	ศุภมิตร LV	0.027778	1	OCT	2016
SALE	21141514	บริษเพาเวอร์ 120 กรัม P6x12	431332	Fabric Wash	Home Care	579326.2	2003	CE1	50000598	ศุภมิตร LV	1235.931	1	OCT	2016
SALE	21141516	บริษเพาเวอร์ 60 กรัม P12x12	431332	Fabric Wash	Home Care	77017.62	2003	CE1	50000598	ศุภมิตร LV	153.9306	1	OCT	2016
SALE	21142378	บริษคัลเลอร์ 3000 กรัม P6	431332	Fabric Wash	Home Care	224141	2003	CE1	50000598	ศุภมิตร LV	332.8333	1	OCT	2016
SALE	21142377	บริษคัลเลอร์ 900 กรัม P8	431332	Fabric Wash	Home Care	89899.3	2003	CE1	50000598	ศุภมิตร LV	308.25	1	OCT	2016
SALE	21142290	บริษคัลเลอร์ 120กรัม P6x12	431332	Fabric Wash	Home Care	284775.9	2003	CE1	50000598	ศุภมิตร LV	607.4306	1	OCT	2016
SALE	20247830	บริษคัลเลอร์ 120กรัม P6x12	431332	Fabric Wash	Home Care	166.08	2003	CE1	50000598	ศุภมิตร LV	0.333333	1	OCT	2016
SALE	21143619	บริษ เพาเวอร์ สวิท ฟลาวาเวอร์ P6x3000g	431332	Fabric Wash	Home Care	215233.4	2003	CE1	50000598	ศุภมิตร LV	319.6667	1	OCT	2016
SALE	21143618	บริษ เพาเวอร์ สวิท ฟลาวาเวอร์ P8x900g	431332	Fabric Wash	Home Care	64096.87	2003	CE1	50000598	ศุภมิตร LV	208.375	1	OCT	2016
SALE	21150778	บริษ สวิท ฟลาวาเวอร์ P24x400g 25 บาท	431332	Fabric Wash	Home Care	276428.9	2003	CE1	50000598	ศุภมิตร LV	646.4167	1	OCT	2016
SALE	21143620	บริษ พว สวิท ฟลาวาเวอร์ P6x12x120g.	431332	Fabric Wash	Home Care	198547	2003	CE1	50000598	ศุภมิตร LV	423.4583	1	OCT	2016
SALE	20104511	บริษเมดิก 9000กรัม P2 -N	431332	Fabric Wash	Home Care	26774.26	2003	CE1	50000598	ศุภมิตร LV	45.5	1	OCT	2016
SALE	21074783	บริษเมดิก 8000กรัม P1	431332	Fabric Wash	Home Care	2178.99	2003	CE1	50000598	ศุภมิตร LV	6	1	OCT	2016
SALE	21037199	บริษเพาเวอร์บอกทากคืนอับ 3000 กรัม P6	431332	Fabric Wash	Home Care	887.76	2003	CE1	50000598	ศุภมิตร LV	1.333333	1	OCT	2016
SALE	67022736	โอโม ชันซายน์ 3000 กรัม P6	431332	Fabric Wash	Home Care	284080.1	2003	CE1	50000598	ศุภมิตร LV	456.1667	1	OCT	2016
SALE	67022734	โอโม ชันซายน์ 900 กรัม P8	431332	Fabric Wash	Home Care	59327.41	2003	CE1	50000598	ศุภมิตร LV	225.625	1	OCT	2016
SALE	67022732	โอโม ชันซายน์ 300 กรัม พิเศษ20บ. P24	431332	Fabric Wash	Home Care	745517.9	2003	CE1	50000598	ศุภมิตร LV	2357.708	1	OCT	2016
SALE	21141569	โอโม 4500กรัม P.4	431332	Fabric Wash	Home Care	3338.57	2003	CE1	50000598	ศุภมิตร LV	4.75	1	OCT	2016
SALE	21141568	โอโม 3000 กรัม P6	431332	Fabric Wash	Home Care	127897.1	2003	CE1	50000598	ศุภมิตร LV	236.1667	1	OCT	2016
SALE	21141567	โอโม 900 กรัม P8	431332	Fabric Wash	Home Care	74286.27	2003	CE1	50000598	ศุภมิตร LV	240.125	1	OCT	2016
SALE	21141656	โอโม 450 กรัม พิเศษ25บ. P24	431332	Fabric Wash	Home Care	189372.2	2003	CE1	50000598	ศุภมิตร LV	450.5	1	OCT	2016
SALE	21131508	โอโม 125กรัม P6x12	431332	Fabric Wash	Home Care	342113.7	2003	CE1	50000598	ศุภมิตร LV	747.8611	1	OCT	2016
SALE	21141566	โอโม 60กรัม P12x12	431332	Fabric Wash	Home Care	9227.95	2003	CE1	50000598	ศุภมิตร LV	19.6875	1	OCT	2016
SALE	67002101	โอโม พลัส 5000กรัม P3	431332	Fabric Wash	Home Care	4941.27	2003	CE1	50000598	ศุภมิตร LV	6	1	OCT	2016
SALE	67002094	โอโม พลัส 3000กรัม P6	431332	Fabric Wash	Home Care	13700.48	2003	CE1	50000598	ศุภมิตร LV	13	1	OCT	2016

Program | PH | **Analysis** | StockByCAT | Pivot

10.2 Page of Stock by Category

10.3 The last page shows the sales value and sales units of each distribution center

Distribution code	Sum of Value	Sum of Stock CS
15062636	4709508.05	7200
15066727	12535257.74	16106
15124035	16076436.25	19160
15128268	13264819.86	18410
15170027	2480331.39	3676
15178260	8789684.56	11743
15178261	13875564.17	19919
15178515	9015888.48	11919
15180126	4839488.19	6522
15180127	4095019.38	7164
15180354	7537993.53	9611
15192667	14396370.56	18431
15193223	5915088.05	7451
15195266	9024527.18	10645
15206479	6926998.24	9256
15207311	12507802.84	14496
15210790	4630351.35	6303
15228162	6210065.38	7255
15228255	3239666.32	3805
15228494	13471169.59	17287
15269245	6695232.72	7822
15269247	7998428.73	10185
50000243	3855848.24	3915
50000244	7191856.5	8817
50000327	5825233.43	7481
50000328	13298942.21	16932
50000332	7454855.89	10478
50000346	9284861.84	11959
50000350	13903936.21	17898
50000351	9037390.23	10862
50000406	20891934.7	28459
50000407	8104205.61	11136
50000409	14487822.4	17790
50000413	15496244.33	20479

Program | PH | Analysis | StockByCAT | **Pivot**

Then, time spent of each tester in both processes will be recorded into an example of table below for the use of analyzing data.

Table 3.1 Time Recording

Number	Time Consuming (Second)	
	Program	Manual
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
n		

After usability test, all testers were asked to complete post-test satisfaction questionnaire by providing satisfaction rate based on their experience and impressions toward the program that were developed according to their requirement of reducing the time in accomplishing the task. An interval scale of rating consist of *"Very Dissatisfied," "Dissatisfied," "OK" "Satisfied," "Very Satisfied,"* sorting from 1 to 5. The questionnaire also requires a short comment or recommendation towards the program for further improvement.

3.4 Data Analysis

Add-in excel functions were used to support the experiment in analyzing the recorded time. This add-in function is applied in the method of Paired t-Test approach.

Usually, Paired t-Test is used to demonstrate whether the two treatments that variables or interested results are significantly different or not. Therefore, this research applies Paired t-Test to prove the differences of time consuming between the two

processes; manual and automation. By the two group of data are independent or not related to each other. In analysis, the differences will be considered the average or mean of both data group. This topic related to the case of the two groups of data are independent in a one-to-one manner, which is called pair. Data in each pair will be kept under the same condition, but among pairs can be different conditions. It is provides more treat to the data in order to see the differences obviously.

The recorded time in both processes will be used to do statistical test by using Paired t-Test; comparing two means with paired sample t-Test (Rosie, 2004). This is the method that use to measure the time spent in each process are different or not.

By assumption; $H_0: \mu_0 <= \mu_1$

$H_1: \mu_0 > \mu_1$

This process is called Hypothesis Testing. H_0 is Null Hypothesis. It represents a key assumption which means what we are interested in finding the answers. If there is insufficient evidence or reason, the key assumption will be accepted. H_1 is Alternative Hypothesis which represent a possible alternative in case of the key assumption is rejected. The alternatives might be able to have more than one hypothesis, which based on the key assumption.

μ_0 represents time consuming in manual processing while μ_1 represents time spent in using the automated program at 95% confidence interval. The test result must be able to reject H_0 in order to accept H_1 at this confidence interval value, which is performing that each individual spent more time in manual processing than using the automated program.

Additionally, the satisfaction rate together with comments from users after usability test is important information that is critical in considering the quality of the program whether it worked or did not work and what improvements might be needed. The description for the levels of satisfaction which sort from 1 to 5 are as follows.

Table 3.2 Rate of Satisfaction

Rating	Description
5	Very satisfied
4	Somewhat Satisfied
3	Neither Satisfied Nor Dissatisfied
2	Somewhat Dissatisfied
1	Very dissatisfied

CHAPTER IV
RESEARCH FINDINGS

This chapter presents information that is gained and the duration of time which each tester spent on both processes. This includes satisfaction rate and feedback obtained from the testers after they finished the tests. The satisfaction survey was distributed to 60 users in the consumer goods company in order to provide the rate of satisfaction as well as feedback toward the usability of the program.

Automating sales spreadsheet program is developed through the stages of SDLC. First, starting with investigating and understanding problems that customer service's employees within a consumer goods company often encounter with their assigned tasks during operations. The problem is the assigned tasks are complex. This makes them spend a very long time in order to get desired information. Second, gathering what they want and analyzing feasibilities to solve such problems. Third, constructing the program based on their requirement. Users want a tool that can be helped them complete their tasks quickly and easily. Then, arranging a session for usability test and training them on how to use the program.

4.1 Automating sales spreadsheet program usability test

Usability test was arranged an hour inside the company in order to demonstrate the program that can solve their problems together with the process in operation. Real time program are tested with the actual task. The quality of the developed program needs to be assessed to see whether it works or needs to be improved. Also spending time of each tester in using the automate program will be recorded at the end of the session.

4.2 Time consuming

This table shows the recorded time that each tester spent in each process.

Table 4.1 Time Consuming between Using the Program and Manual Process

Number	Time Consuming (Second)	
	Program	Manual
1	88.81	1846.54
2	83.48	2412.63
3	83.19	4710.07
4	84.69	3336.89
5	87.46	3042.45
6	87.90	5298.08
7	80.15	3272.62
8	85.42	2361.56
9	82.09	2117.63
10	84.46	5725.95
11	80.41	5157.21
12	83.65	4071.01
13	89.34	2896.36
14	87.45	1860.31
15	87.91	5909.14
16	86.76	2211.87
17	88.65	4913.85
18	87.74	3187.90
19	85.55	5383.71
20	83.34	2411.65
21	82.01	6006.71
22	89.63	2675.09
23	87.31	5376.07
24	82.06	5379.13
25	86.80	5752.79
26	85.05	3513.65

Table 4.1 Time Consuming between Using the Program and Manual Process(cont.)

Number	Time Consuming (Second)	
	Program	Manual
27	84.62	3645.03
28	86.57	4852.92
29	86.65	2289.30
30	84.48	4354.83
31	82.01	4910.98
32	87.57	2310.61
33	83.21	5898.09
34	88.75	3008.37
35	82.59	6320.79
36	88.15	3168.31
37	83.09	2472.84
38	82.19	4450.09
39	83.79	5476.76
40	85.49	5939.45
41	84.04	5166.00
42	83.56	2070.38
43	86.90	2895.76
44	85.61	2949.68
45	87.54	5207.95
46	87.75	2941.23
47	88.65	3268.93
48	89.83	4176.20
49	87.65	3942.06
50	81.22	3956.92
51	83.09	3251.91
52	88.02	3373.27
53	85.75	2288.59
54	80.25	5537.54

Table 4.1 Time Consuming between Using the Program and Manual Process(cont.)

Number	Time Consuming (Second)	
	Program	Manual
55	86.74	1930.39
56	82.21	5146.75
57	80.27	3833.37
58	86.03	4311.17
59	80.87	3383.56
60	85.10	5304.85

4.3 Inferential statistics

After gathering data, time consumption of each user in the above table were used to analyze based on Inferential statistics including Average, Standard Deviation, Variance, Min, Max, and the rate of speed in each Quartile, at 95% confidence interval or 0.05 ($\alpha = 0.05$). The values have been shown as in below table.

Table 4.2 Statistics Values

	Program	Manual
Average	85.1924	3914.429
Standard Deviation	2.674672	1317.441
Variant	7.275123	1765068
Min	80.14515	1846.54
Q1	83.16581	2896.211
Med	85.45856	3739.198
Q3	87.54507	5176.485
Max	89.82912	6320.794

By comparison, the rate of speed in analyzing data both using the program and manual process, the difference of average values between the two processes is 3829.24 seconds, which is about 63 minutes. Obviously, the two processes are completely different. The average speed of using programming is 85.19 seconds or one and a half minutes. Standard deviation is equal to 2.67, and Variant is 7.2 only. This can

be indicated that the distribution of the speed in using the program is less. Moreover, the distribution can be implied that whether people have more or less programing skills, they can use the program in analyzing data at relatively the same average speed as people who are experts or are experienced in programing.

On the other hand, means of manual process require skills and experiences of programming. Manual processing takes longer time than using the auto program. The average time consumed by manual processing is 3914.42 seconds, around 65 minutes. The time is much more than using the program about 60 times. The standard deviation is 1317.44 and the variance is equal to 1765068, which is quite high. In statistics, the high values represent a wide distribution. So, this can be indicated that some people completed the given tasks very quick and some too slow.

The difference between the two independent samples are considered in terms of one to one, which is called pair. The pair of information were kept under the same conditions. Research design can be Pretest-Posttest Design or Matching Design. Pretest-Posttest Design means before and after training measurement to assess the change in knowledge. Matching Design is comparing capability of different instruments based on the same samples.

Analyzing data have to figure the values as follows:

- d(Range): the difference of information between before and after
- SD: Standard Deviation of such difference

Pair t-Test was conducted based on following assumption:

$$H_0: \mu_0 - \mu_1 = 0 \quad \ldots (1)$$

$$H_1: \mu_0 - \mu_1 \neq 0 \quad \ldots (2)$$

Null hypothesis (H_0) refers to time spent in both processes has no different, while alternative hypothesis (H_1) is time spent in both processes are different. The experiment is trying to reject H_0 and accepting H_1.

Table 4.3 Hypothesis Testing

t-Test: Paired Two Sample for Means	*Variable 1*	*Variable 2*
Mean	85.19240151	3914.429425
Variance	7.275123496	1765068.325
Observations	60	60
Pearson Correlation	-0.252404553	
Hypothesized Mean Difference	0	
df	59	
t Stat	-22.31432669	
P(T<=t) one-tail	9.46576E-31	
t Critical one-tail	1.671093032	
P(T<=t) two-tail	1.89315E-30	
t Critical two-tail	2.000995378	

As a result, refer to the above table, t-stat (22.3143), standard value, is more than whether t-critical one tail (1.6710) or t-critical two tail (2.0009), so H_0 can be rejected. Also the same as P value, P(T<=t) one tail is 9.4657×10^{-31}, which less than 0.05 or $p<0.05$ at 95% confidence interval. This can reject H_0 as well. This indicates that at 95% confidence interval, the difference of average time spent of using auto program is less than manual processing.

4.4 Discussion

Recorded times that were received in the usability test were used to plot graph in order to see the distribution of time consuming of each method.
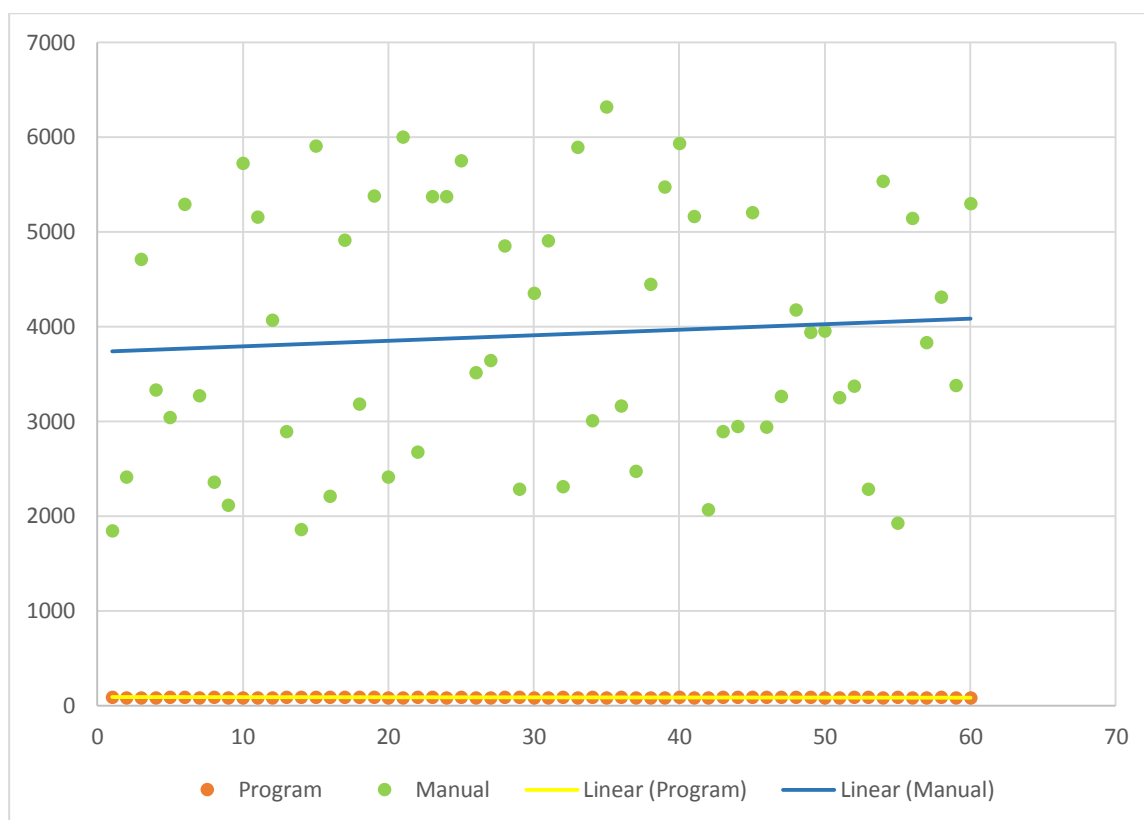
Figure 4.1 Experimental Results after Usability Test

From the graph, time spent in manual process is significantly scattered compared to using the program that anyone can complete the given tasks on time. This means time consumption of each person in manual process is much more different because of the difference of capabilities, skills and experiences of using MS Excel in analyzing data. People who have Excel formula skills are able to analyze multi-dimensional data quickly. While people who lack the skills and experiences regarding Excel cannot complete everything in a short time. However, each person takes a minimum of 2000 seconds or about 35 minutes at least. It is much time consuming. Those who spent the most were around 6000 seconds or 1 hour and 40 minutes. In contrast, the use of auto program, consumes approximately 80 to 90 seconds, or around 1.5 minutes. The difference of time consumption between manual and program is the return that people can take in other activities or something else at least 33 minutes or 1.5 hours at most.

In addition, according to comparing absolute value of the difference between the times spent in both processes, the graph shows time consumption in using the

program is quite stable as straight line. While the range is much more varying following time consumption in manual process. This can be stated that whether more or less capabilities in programming or Excel skills, the program enables everyone to spend the same amount of time in completing the same assigned task. According to the result of the usability test, it can be claimed that this program is work because it does not cause significant differences. The program can eliminate variables that cause differences due to decreasing in ability of individuals.

4.5 Satisfaction Feedback

(60 responses)
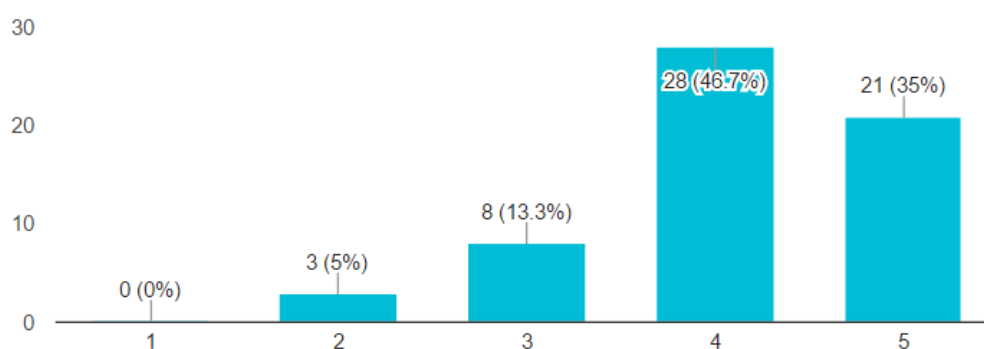
Figure 4.2 Satisfaction Rate after Usability Test

According to the satisfaction rate in the graph after usability test shows that the auto program works and meet users' expectation. Around 28 of the 60 people or about 46.7%, were impressed with the program. Moreover, comments of the users (refer to appendix A) can also support that they had a good experience toward the program. The program helps them to simplify the task and complete it faster as well as ease of use. They can save a lot of time for doing something else and joining the company's activities. From the graph, there are only 3 people, around 5%, that are dissatisfied because they are not assured in the accuracy of the program. They trust in their own ability more than using program even it takes longer time.

CHAPTER V
CONCLUSIONS AND RECOMMENDATION

This chapter is divided into two parts. The first part provides a summary of research findings according to the usability test in Chapter 4 together with discussion results. The second part provides recommendation for further developing the auto program to support other works.

5.1 Conclusions

This research was conducted to prove that technology enables employees in a consumer goods company to reduce wasting time in completing their works, especially repetitive tasks. They can make their working life easier by themselves, even though they are not experts in programing, by introducing a program developed from a plug-in function inside MS Excel called Visual Basic Analysis (VBA). VBA can facilitate people in developing the automatic program easily and smoothly in order to accomplish their repetitive tasks within a few minutes. It requires only basic Excel formula to write commands, and then CPU processes things through RAM of a computer automatically. There is no human involvement at all. Therefore, employees can assure that they will get the potential information.

Developing the program started from investigating the issue that often happens to employees in customer services department in a consumer goods company each day. Most problems arise from human errors in transforming multi-dimensional data into the desired format, which can lead to wrong information instead of potential information. Then, management uses such insufficient information in making decision. This can bring about negative impact to the company. Those problems come from skill and capability of users regarding MS Excel. Since analyzing multi-dimensional data requires complicated formulas, employees lack of systematic thinking prevent them from writing excel formulas correctly. Therefore, the program should be passed through

the SDLC cycle to study feasibilities in developing to support analyzing such data. According to the study, Microsoft Excel has a tool called Visual Basic Analysis (VBA) that can support complicated tasks and result outputs as people expected within a short time since it is an imitation of systematical human thinking. People sequence concepts and steps in getting outputs only one time through VBA, and then processing units (CPU and RAM) of computer will automatically generate results. Whenever the process remains the same, the results are always accurate. In addition to this, VBA allows people to edit code through developer mode whenever they want. Once the automate sales spreadsheet program is developed, its usability was tested with 60 users. In term of statistics, the 60 users are a sampling population which can be assumed that they are representative of the total population. The program was tested with raw sales data gained from the customer services department. The usability performs that the program can be completed the given task faster than manual processing by human and efficiently used without problems. The test starting with use of program, and then manual processing consequently.

In analysis, the average of consuming time in manual processing by a human is around one hour. However, analyzing the same data by using the program takes only a minute and twenty five seconds. This proves that the difference between manual doing by human and using the program is about one hour and twenty third seconds. When looking at standard deviation and variance of the two processes found that distribution of manual process is quite wide. It is because some people could finish the given tasks quickly while some people took much time. Variables causing such result come from different way of working of each person. On the other hand, usability test of the program used similar time because the program provides steps to accomplish the assigned tasks clearly. It does not require programing skills or systematic thinking to get the outputs. That is why users could finish the given tasks at relatively close time. Further, experience and knowhow to use Excel also affects the manual processing of each. People who have a better understanding or expert in Excel have shortcuts to complete tasks quicker either using add-in functions or complicated formulas. While people who have less experience require basic formula to support in analysis, which wastes a lot of time. However, people can be able to complete tasks at the same time whether they have

programing skills or not by using the program because it was developed to reduce problems that arise from such variables without any required skills.

In the view of range between using program and manual processing found that using the program has the range between the minimum and maximum values is quite less, about 9 seconds. Whereas the manual process has a larger range around 75 seconds or 1 hour and 15 seconds. This is clearly seen that the two processes have the difference of the range significantly. Such range in the unit of time perform employees' performance. If the range is high shown that the performance is low. Similar to machine performance, a good machine can produce each product in the same time. Whenever production time has a wide distribution, it performs that such machine has a problem. Therefore, the distribution was analyzed to measure the position of information in four of the statistics. In 4 Quartiles, the distribution of using program is quite less, about 3 seconds only. While the distribution of manual process is quite wide. The distribution in four Quartiles are different to 18 minutes. This performs that using program has more efficient than manual.

Then, analysis of inferential statistics was conducted to do hypothesis test at 95% confidence level whether the average time in analyzing data by using program equal to manual processing or not. The null hypothesis (H_0) is the average time in analyzing data of both processes are equal. The alternative hypothesis is the average time consuming in analyzing data of both processes are unequal. The experiment was analyzed both types, one tail test and two tail test, to check both positive and negative side whether it has significant correlation or not. As a result of T-Test: Paired Two sample means, t-stat (22.3143) is more than t-critical one tail (1.6710), so H_0 can be rejected. Similar to t-critical two tail (2.0009), t-stat is also more than. So, H_0 also can be rejected. When considering P-value, $P(T<=t)$ one tail is 9.4657×10^{-31} which is less than the defined confidential level 0.05 or $p<0.05$ (95% confidential level) also can reject H_0 as well. This indicates that the average time spent in using program is less than the average time spent in manual process significantly in term of inferential statistics at confidential level 0.05 or 95%.

In addition, satisfaction rate together with comments toward the program can be ensured that the program meets user's expectation. Because it reaches key quality parameters of usability test which are easy to learn, easy to use and able to complete

tasks very fast, easy to remember steps, and no error occurred. Most of them satisfies the expectations.

In conclusion, the result that gained from usability test of the automating sales spreadsheet program together with users' feedback can be assured that the program enables employees to significantly reduce time spent in analyzing data along with simplified work process of the given tasks that need to be performed. It makes them accomplish the desired task quicker and easier, and come up a potential values in the end. This research proves that completing complicated repetitive tasks are not difficult anymore if we know the root cause and seek for feasibilities to solve or prevent it. The research shows that manual processing makes employees accomplish the given task very slow compare to using the program because of variables including skill and experience about Excel or programming, systematic thinking, and computer specification. Hence, solving the problems about time and steps in completing complicated repetitive tasks, users has to develop the program or tool for support. The automatic program helps employees do not need to take hours or even days in completing the complicated tasks. However, usability test should be conducted before deployment of the program every time because it helps developer know about the quality and problems of the developed program. Developer needs to know that the program work or does not work and it requires further improvements or not from users' feedback after the usability test.

5.2 Recommendation

According to users' feedback (refer to Appendix A), efficiency of the program can be enhanced by reduced processing steps from eight to just one or two steps if users have time consuming, added function that can re-check the correctness of outputs, and reduced opening many files at the same time to prevent confusing and choosing a wrong file. In addition, the program can be further developed to generate output not only texts, but also graphs or can be used as a prototype to develop a program to automatically operate specific tasks.

Implementing the automating sales spreadsheet program benefits a company by enhancing employees' performance, reducing human error, decreasing time consumption in a training, and increasing work life balance. Moreover, it helps a

company to get insight faster than others. All of these advantages bring about opportunities and profits to a company. As a result, a company get competitive advantages before competitors in the market.

5.3 Limitations and Further Research

Usability test in this research only emphasizes on time consumption in completing work because of limitations of time used in experimentation. That is why the research cannot use accuracy as a variable. Since it does not have the accurate measurements and cannot identify percentage of the accuracy between the two processes. Besides, this research only tested with sales data of customer services function, so it cannot represent all sales data of all functions under sales department in consumer goods company in Thailand.

Further research could find other variables from other functions or departments that affect employees' performance in applying Excel VBA to develop a program that helps employees automatically work in order to increase efficiency and productivity of their tasks. Moreover, in usability test should add accuracy as an important parameter to perform that the program can help to complete tasks more accurate than human because it is imitated human thinking but automatically run by the program. Adding accuracy as a parameter in measuring quality of the program helps to increase reliability of the program. It can assure that the program has high efficiency. In addition, it would be interesting to know how the employee adjusts themselves to improve their skill and work performance.

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APPENDICES

APPENDIX A: Program coding

Module 1

```
Sub AllWindows()
    UserForm1.Show
End Sub
Sub CopyData()
    Sheets("Manipulation").Activate
        'Show All data
    If ActiveSheet.FilterMode = True Then
            ActiveSheet.ShowAllData
        End If
    'Clear Old Data
    Range("A1").Select
    Cells.Select
    Selection.delete Shift:=xlUp
    Call AllWindows
    Range("A1").Select
    Range(Selection, ActiveCell.SpecialCells(xlLastCell)).Select
    Selection.Copy
    ThisWorkbook.Activate
    Sheets("Manipulation").Activate
    Range("A1").Select
        Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
        :=False, Transpose:=False
    Sheets("Program").Activate
    Range("O1").Select
    ActiveCell.FormulaR1C1 = "=COUNTA(Manipulation!C[-14])"
    Range("A1").Select

End Sub
```

Module 2

```
Sub calfor()
' calfor Macro
    Sheets("Manipulation").Select
    Columns("O:O").Select
    Selection.Insert Shift:=xlToRight, CopyOrigin:=xlFormatFromLeftOrAbove
    Range("O2").Select
    ActiveCell.FormulaR1C1 = "=RIGHT(RC[-1],1)"
    Range("O2").Select
    Selection.AutoFill Destination:=Range("O2:O" & Sheets("Program").Cells(1, 15))
    Columns("O:O").Select
    Selection.Copy
    Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
        :=False, Transpose:=False
    Range("N1").Select
    Application.CutCopyMode = False
    Selection.Copy
    Range("O1").Select
    Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
        :=False, Transpose:=False
    Columns("F:F").Select
    Application.CutCopyMode = False
    Selection.Insert Shift:=xlToRight, CopyOrigin:=xlFormatFromLeftOrAbove
    Range("F1").Select
    ActiveCell.FormulaR1C1 = "Stock CS"
    Range("F2").Select
    Sheets("Manipulation").Select
    Range("F2").Select
    ActiveCell.FormulaR1C1 = _
        "=((LEFT(RC[-1],(FIND(""/"",RC[-1],1)-1))*RC[-2])+MID(RC[-
1],FIND(""/"",RC[-1])+1,LEN(RC[-1])-FIND(""/"",RC[-1])))/RC[-2]"
```

```
    Range("F2").Select
    Selection.AutoFill Destination:=Range("F2:F" & Sheets("Program").Cells(1, 15))
    Columns("F:F").Select
    Selection.Copy
    Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
        :=False, Transpose:=False
        Columns("O:O").Select
    Selection.Insert Shift:=xlToRight, CopyOrigin:=xlFormatFromLeftOrAbove
    Selection.Insert Shift:=xlToRight, CopyOrigin:=xlFormatFromLeftOrAbove
    Range("O1").Select
    ActiveCell.FormulaR1C1 = "Month"
    Range("O2").Select
    ActiveCell.FormulaR1C1 = "=Program!R3C7"
    Range("O2").Select
    Selection.AutoFill Destination:=Range("O2:O" & Sheets("Program").Cells(1, 15))
    Columns("O:O").Select
    Selection.Copy
    Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
        :=False, Transpose:=False
    Range("P1").Select
    Application.CutCopyMode = False
    ActiveCell.FormulaR1C1 = "Year"
    Range("P2").Select
    ActiveCell.FormulaR1C1 = "=Program!R4C7"
    Range("P2").Select
    Selection.AutoFill Destination:=Range("P2:P" & Sheets("Program").Cells(1, 15))
    Columns("P:P").Select
    Selection.Copy
    Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
        :=False, Transpose:=False
    Sheets("Program").Select
End Sub
```

Module 3

Sub format()

' format Macro

   Sheets("Manipulation").Select

   Columns("D:E").Select

   Application.CutCopyMode = False

   Selection.delete Shift:=xlToLeft

   Columns("D:F").Select

   Selection.Insert Shift:=xlToRight, CopyOrigin:=xlFormatFromLeftOrAbove

   Range("D1").Select

   ActiveCell.FormulaR1C1 = "Market"

   Range("E1").Select

   ActiveCell.FormulaR1C1 = "Cat"

   Range("F1").Select

   ActiveCell.FormulaR1C1 = "BU"

   Columns("H:H").Select

   Selection.cut

   Columns("G:G").Select

   Selection.Insert Shift:=xlToRight

   Columns("O:O").Select

   Selection.cut

   Columns("H:H").Select

   Selection.Insert Shift:=xlToRight

   Columns("T:V").Select

   Selection.cut

   Columns("I:I").Select

   Selection.Insert Shift:=xlToRight

   Columns("M:R").Select

   Selection.delete Shift:=xlToLeft

   Columns("P:P").Select

   Selection.cut

```
   Columns("M:M").Select
   Selection.Insert Shift:=xlToRight
   Columns("P:P").Select
   Selection.delete Shift:=xlToLeft
   Sheets("Program").Select
End Sub
```

Module 4

```
Sub cut()
' cut Macro
   Sheets("Manipulation").Select
   Rows("1:1").Select
   Application.CutCopyMode = False
   Selection.AutoFilter
   ActiveSheet.Range("$A$1").AutoFilter Field:=1, Criteria1:=Array( _
      "BLCK", "CVAN", "DAMG", "GIFT", "LOST", "POSM", "SCRP"),
Operator:=xlFilterValues
   Rows("2:2").Select
   Range(Selection, Selection.End(xlDown)).Select
   Selection.delete Shift:=xlUp
   ActiveSheet.ShowAllData
   Sheets("Program").Select
End Sub
```

Module 5

```
Sub Pivot()
' Pivot Macro
   Sheets("StockByCAT").Select
   'Show All data
   If ActiveSheet.FilterMode = True Then
        ActiveSheet.ShowAllData
     End If
```

```
Range("A2").Select
Range(Selection, ActiveCell.SpecialCells(xlLastCell)).Select
Selection.ClearContents


Sheets("Manipulation").Select
Range("A2:O2").Select
Range(Selection, Selection.End(xlDown)).Select
Selection.Copy
Sheets("StockByCAT").Select
Range("A2").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
    :=False, Transpose:=False
Sheets("Pivot").Select
Application.CutCopyMode = False
ActiveSheet.PivotTables("PivotTable1").PivotCache.Refresh
Sheets("Program").Select
Range("A1").Select
End Sub
```

Module 6

```
Sub AllWindows()
    UserForm1.Show
End Sub
```

Module 7

```
Sub PHCopy()
    Sheets("PH").Activate
    'Show All data
    If ActiveSheet.FilterMode = True Then
        ActiveSheet.ShowAllData
    End If
```

```
Range("A1").Select
Cells.Select
Selection.delete Shift:=xlUp
Call AllWindows
Range("A1").Select
Range(Selection, ActiveCell.SpecialCells(xlLastCell)).Select
Selection.Copy
ThisWorkbook.Activate
Sheets("PH").Activate
Range("A1").Select
    Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
   :=False, Transpose:=False
Sheets("Program").Activate
End Sub
```

Module 8

```
Sub PHcal()
' PHcal Macro
    Range("A1").Select
    Sheets("Manipulation").Select
    Range("D2").Select
    ActiveCell.FormulaR1C1 = "=VLOOKUP(RC[-2],PH!C[-3]:C[22],26,)"
    Range("D2").Select
    Selection.AutoFill Destination:=Range("D2:D" & Sheets("Program").Cells(1, 15))
    Range("E2").Select
    ActiveCell.FormulaR1C1 = "=VLOOKUP(RC[-1],PHMAP,2,1)"
    Range("E2").Select
    Selection.AutoFill Destination:=Range("E2:E" & Sheets("Program").Cells(1, 15))
    Range("F2").Select
    ActiveCell.FormulaR1C1 = "=VLOOKUP(RC[-2],PHMAP,3,1)"
    Range("F2").Select
    Selection.AutoFill Destination:=Range("F2:F" & Sheets("Program").Cells(1, 15))
```

```
Columns("D:F").Select
Selection.Copy
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
    :=False, Transpose:=False
Sheets("Program").Select
End Sub
```

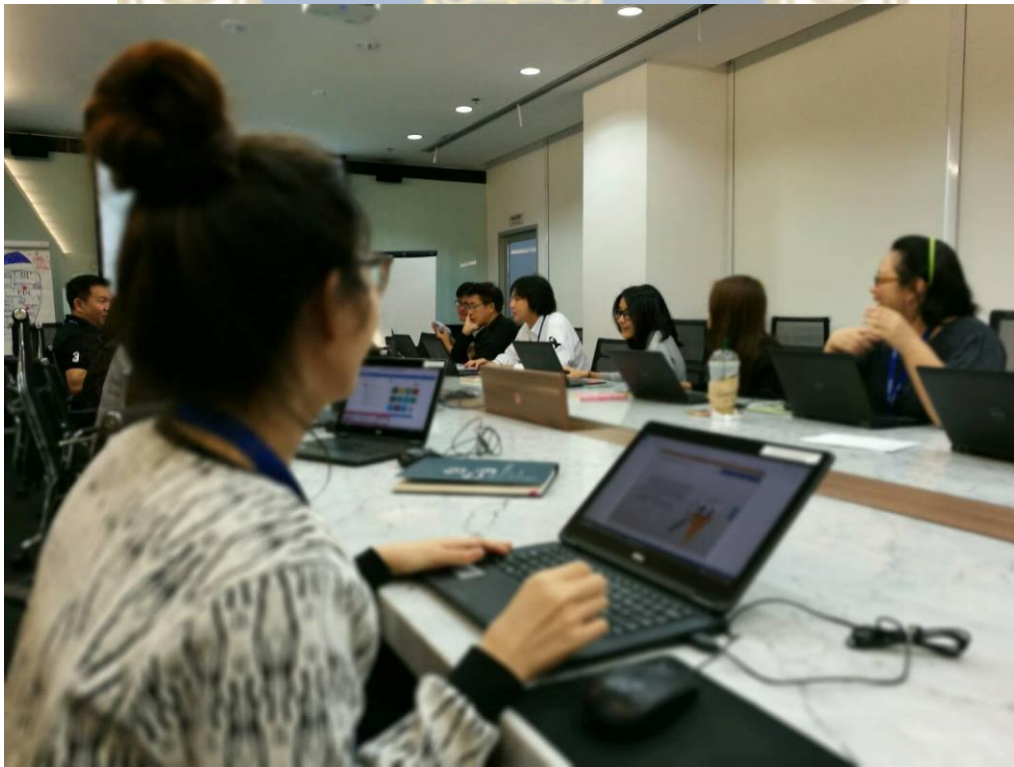
Module 9

```
Option Explicit
Private Sub Label1_Click()
End Sub
Private Sub ListBox1_Click()
    Windows(ListBox1.Value).Activate
    Unload Me
End Sub
Private Sub UserForm_Activate()
    Dim wkb As Workbook
    For Each wkb In Workbooks
        If Windows(wkb.Name).Visible Then _
            ListBox1.AddItem wkb.Name
    Next
End Sub
```

APPENDIX B: Sessions of Usability Test

APPENDIX C: Users' Feedback after Usability test

Timestamp	Q1: Please give the overall rate of satisfaction toward the automating sales spreadsheet program based on a period of time taken, ease of learning, use and recognize.	Q2: Please give a short comment toward the automating sales spreadsheet program. Why do you like or dislike it? What can be improved?
12/7/2016 10:59:07	5	It is a great program to make my life easier.
12/7/2016 16:12:43	5	Very useful, I can complete complex tasks easier and faster
12/10/2016 18:11:12	4	Can do more automatic
12/10/2016 18:12:03	4	Make it easy
12/10/2016 18:13:07	4	Sum of action step
12/10/2016 18:17:03	4	More step for click. Possible to sum of it.
12/10/2016 18:51:19	5	Can it analysis by graph
12/10/2016 18:51:53	5	It's easy to work with.
12/10/2016 18:52:49	5	Very friendly with user
12/10/2016 18:53:35	4	Should be reduce step on working
12/10/2016 18:54:28	3	It's difficult when must to open more workbooks
12/10/2016 19:35:06	5	Good
12/10/2016 19:35:52	4	Should be hightlight on problem sale store
12/10/2016 19:36:18	4	How to double check databases
12/10/2016 19:36:48	3	How we know a data was correct?
12/10/2016 19:37:11	4	Is it use with excel 64 bit
12/10/2016 19:37:43	4	How to fix if it has some change in future?

Timestamp	Q1: Please give the overall rate of satisfaction toward the automating sales spreadsheet program based on a period of time taken, ease of learning, use and recognize.	Q2: Please give a short comment toward the automating sales spreadsheet program. Why do you like or dislike it? What can be improved?
12/10/2016 19:38:04	4	How to make sure data is correct
12/10/2016 19:38:28	4	How to develop in future change
12/10/2016 20:10:13	4	How much of data can we use this analysis file?
12/10/2016 20:11:13	2	I'm not trush this program work.
12/10/2016 20:11:34	5	Very friendly with user.
12/10/2016 20:12:42	4	What's the cpu can use this vba?
12/10/2016 20:13:16	5	Is it have limits for analysis?
12/10/2016 20:13:37	5	Grate program.
12/10/2016 20:14:30	3	Easy to use but not sure it's easy to change?
12/10/2016 20:16:13	4	Good job.
12/10/2016 20:17:27	4	It's very friendly with user.
12/10/2016 20:18:49	4	Is it flexible to apply for another report?
12/10/2016 20:19:11	5	Very easy to use
12/10/2016 20:20:28	2	How you can reliably this analysis?
12/10/2016 20:20:46	5	It's fast.
12/10/2016 20:21:30	4	That the best.
12/10/2016 20:22:36	3	It's complex to choose more than 1 file when analysis.
12/10/2016 20:23:00	3	It's can be easier.

Timestamp	Q1: Please give the overall rate of satisfaction toward the automating sales spreadsheet program based on a period of time taken, ease of learning, use and recognize.	Q2: Please give a short comment toward the automating sales spreadsheet program. Why do you like or dislike it? What can be improved?
12/10/2016 20:23:40	4	It's fast but a bit difficult when select file.
12/10/2016 20:24:35	4	Is can move to calculate in ram not cpu?
12/10/2016 20:24:49	5	Perfect
12/10/2016 20:25:12	5	I'm wonder to ise it.
12/10/2016 20:26:21	5	I've more free time when I use it.
12/10/2016 20:28:27	5	Excellence program
12/10/2016 20:31:39	4	I think it's should be easy more than now.
12/10/2016 20:32:24	4	Please try to confirm a correct result.
12/10/2016 20:33:16	2	I'm trust myself. I 'm not trust a program.
12/10/2016 20:33:57	4	Some problems do my computer slow down when analysis.
12/10/2016 20:34:38	4	Good excel running.
12/10/2016 20:35:19	3	It's do my computer slow when excel work.
12/10/2016 20:35:49	4	Can program transform a data?
12/10/2016 20:36:40	4	Is program can work with anoter raw data formats?
12/10/2016 20:37:23	4	Can you test with anoter raw data formats?
12/10/2016 20:38:20	5	I'm not see this program before. It's can help me to work.
12/10/2016 20:40:27	3	I'm not sure a result is correct. You should do something to confirm a result again.
12/10/2016 20:41:11	5	I'm not believe it can help me to work

Timestamp	Q1: Please give the overall rate of satisfaction toward the automating sales spreadsheet program based on a period of time taken, ease of learning, use and recognize.	Q2: Please give a short comment toward the automating sales spreadsheet program. Why do you like or dislike it? What can be improved?
12/10/2016 20:41:43	5	Use it easy.
12/10/2016 20:42:16	5	It's can replace daily operations.
12/10/2016 20:42:48	4	It's very user friendly.
12/10/2016 20:43:11	5	I love this program.
12/10/2016 20:43:42	4	It's can make value.
12/10/2016 20:44:32	3	It's fast but I can't believe the result
12/10/2016 20:44:56	5	The best one.