

DEVELOPMENT OF THE USER FRIENDLY SPREADSHEET BASED SPC
(STATISTICAL PROCESS CONTROL) ON SME COMPANY

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ABSTRACT

This Final Year Project is about the development of the user friendly spreadsheet based on SME company. Spreadsheet is a database that used to store or managed large data in order to have a good management in data collection. Besides that, spreadsheet itself is very useful in viewing the performance of the production process on certain company. This is because the spreadsheet that need to develop will applied SPC (statistical process control) which provide graphical tools and method on how to analyze a set of data. The objective of this project is to perform a set of graph base on the data collection that has been collected from the product produce by SME company. This project also has an alternative method on analyzing the set of data that have been collected. First one is about hypothesis testing which is a decision making analysis on the production performance on that day. With this hypothesis testing, the claim will be determined whether it will be rejected or acceptable by referring to the distribution graph provided. Second one is about confidence interval. It will guide the user to know the estimation of weight of cake produced on that day. So, by developing this project, it will make sure the SME company can have a good management besides having a good performance on production process.

ABSTRAK

Projek akhir tahun ini adalah berkaitan dengan pembentukan *spreadsheet* untuk industri kecil dan sederhana. *Spreadsheet* adalah satu set data yang boleh digunakan untuk menyimpan dan menyusun maklumat supaya sistem pengurusan maklumat sesebuah syarikat akan lebih strategik dan teratur. Selain daripada itu, *spreadsheet* juga boleh digunakan untuk memaparkan prestasi pengeluaran produk sesebuah syarikat. kerana *spreadsheet* yang hendak dibangunkan menggunakan teknologi SPC (*statistical process control*). SPC ini akan menyediakan pelbagai kemudahan graf yang boleh memaparkan dan menunjukkan prestasi pengeluaran sesebuah syarikat samada pengeluaran pada hari itu dalam keadaan terkawal atau tidak terkawal. Objektif utama projek ini adalah untuk memaparkan graf yang dibuat dengan menggunakan kemudahan SPC itu sendiri. Projek ini juga menyediakan alternatif lain dalam menilai prestasi sesebuah syarikat iaitu dengan menggunakan *Hypothesis Testing* dan *Confidence Interval*. *Hypothesis testing* adalah satu kaedah penyelesaian masalah dimana seseorang boleh mengagak jumlah produk yang dihasilkan pada sesuatu masa. Dengan ini langkah awal bagi mengatasi masalah akan terjadi akan dapat diatasi seawal mungkin. Alternatif lain pula adalah dengan menggunakan kaedah mengagak kadar berat sesuatu produk yang dihasilkan pada sesuatu masa. Oleh itu, dengan adanya *spreadsheet*, prestasi sesebuah syarikat kecil dan sederhana boleh ditingkatkan disamping mempunyai sistem pengumpulan maklumat yang baik.

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LIST OF SYMBOLS

$\sqrt{\quad}$	Square Root
\geq	Greater Than or Equal To
\leq	Less Than or Equal To
$>$	Greater Than
$<$	Less Than
σ	Population Standard Deviation
μ	Hypothesized Population Mean
\neq	Not Equal To
H_0	Null Hypothesis
H_1	Alternative Hypothesis

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LIST OF ABBREVIATION

SPC	Statistical Process Control
SME	Small and Medium Enterprise
CL	Control Limit
LCL	Lower Control Limit
Kg	Kilogram
SMIDEC	Small and Medium Industries Development
ICT	Information and Communication Technology

CHAPTER 1

INTRODUCTION OF THE STUDY

1.1 Introduction

The development and role of SME company had given a good effect to the Malaysian economy. The societies also make a good step by involving themselves in the SME company especially in the processing field.

There is no standard definition for the SMEs company because different organization that support SME have their own different definition. However in practice, the definition found in Malaysia are based on fixed quantitative criteria such as a number of employees, amount of capital, amount of amount assets and more recently are turnover. From the various definitions of SMEs found in Malaysia, the more widely accepted definition is the one used by the Small and Medium Industries Development Corporation (SMIDEC). Generally, SMEs are defined into two broad categories which is Manufacturing, Manufacturing-Related Services and Agro-based industries and Services, Primary Agriculture and Information & Communication Technology (ICT) [5].

Small and medium enterprises in the manufacturing, manufacturing related services and agro-based industries are enterprises with full-time employees not exceeding 150 or with annual sales turnover not exceeding RM25 million. On the other hand, Small and medium enterprises in the services, primary agriculture and Information & Communication Technology (ICT) sectors are enterprises with full-time employees not exceeding 50 or with annual sales turnover not exceeding RM5 million assets and more recently ales turnover. [5]

The SME sectors in Malaysia play a vital role in developing the Malaysian economy. One of them is maintaining the competitive market between the other company. The competitive between them will make a positive development in the Malaysian economy because every aspect must be considered in order to have product with good quality in the business world. The other role for the SME company are creating dynamic, market oriented economic growth, employing growing work force in developing country and promote democratization [10].

As a SME company that tried to survive among other companies including large company, SME's facing challenging situations such as policy and environment that will change according the change of market and technology, access to finance, counseling, information skills, technology and market. Therefore, some effort must be taken to ensure that the company able to compete with the others. One of the efforts that should be done by SME company is to take the large scale company as their role model in the field of technology and process control management system. A lot of them used the spreadsheet as their tools in having a proper data collection.

Spreadsheet is something like a paper that will analyze any data according to the desirous of the user who managed it. So, to improve the spreadsheet, the Statistical Process Control (SPC) tools must be used in order to strengthen up all the aspect including the potential to determine whether the process is in control or out of control. In other words, the use of spreadsheet will improve processing performance and a good impact when being use in SME company.

SPC is not refer to any particular technique and procedure [1]. It will make the user a freedom to choose any tools in SPC. When applying the SPC, it will concern with continuous process improvement using collection of tool like data and process analysis, making inference about process behavior and decision making which decide whether or not the production process is operating as expected. The key component while using the SPC is Total Quality initiatives that will seeks for improve product quality, improve productivity, streamlining process, reducing wastage, reducing emission and improve customer service.

As conclusion, applying spreadsheet based SPC will give the advantages in the processing field for the SME company because all consequences that can cause problem can be detected.

1.2 Project Background

Spreadsheet is one of the technologies that had being developed in order to have a good management in process control. Not all SME companies really know the existence and impact of the spreadsheet. Some of them do not really concerned on the technology that had being develop because it will requires them to learn new things and they tend to assume that new things means more work to be handled.

Besides that, they prefer using manual calculation than nowadays technology like the spreadsheet. Spreadsheet is the nowadays technology that can applied by whom who interested in process control management. By this spreadsheet, all the data will be arrange in a nice way and easy for the user to know the value of data that needed for their processing field. With the existence of this technology, large amount of data can be handled easily without having any difficulty.

1.3 Objectives

The main objective of this project is to develop a user friendly spreadsheet based on SPC (Statistical Process Control) for an SME company

1.4 Scope of Work

This project will focus only for one SME company in processing field. The development of the spreadsheet is specific for that SME company and only concern for one particular process of production.

After done all the procedure needed by the company, lastly Bakeria Enterprise which situated in Merlimau Melaka has been chosen to be one of the SME company that needed in order to take the data from their processing field. This company launched their processing by producing many types of cakes and biscuits. After a few discussion with that company entrepreneur, one process have been decided which is the weight of the cakes. So, each cake that needs to produce before baked must be weigh first in order to know all the weight for each product that will produce. All the data will be record for the calculation purpose to know whether the processing on that day is in control or out of control.

Quantity characteristic measurement is determined first in order to apply SPC methods. Next, a few sets of data will be collected for the characteristic measurement from the company. The control chart tools offered by SPC will be used to construct the visualization tool for the data sets.

1.5 Problem Statement

Usually, the SME company do not really interested to know about the technology system for instance by using the spreadsheet. They have lack of information and technology skills. Some of them do not really confident on the technology that have been developed in nowadays world. They tried to manage and done something in their own style because they know their ability well. But, this is not the best solution to manage a company in order to compete with other sectors. They should realize that the competition in the field of business is a continuous competition. Therefore, they must alert with the needs and changes of surrounding.

For the SME company which having their own spreadsheet as process control tools, it just can be used by the person who managed it. Therefore, to ensure a suitable number of employees able to utilized and feel comfortable by using a spreadsheet, a user friendly spreadsheet should be introduced. This will allows them to used the spreadsheet as a tools that can improve the processing field of their company without having any difficulty when used it.

So, by implement the user friendly spreadsheet using SPC tools, it will optimize the product that they produced regarding to the specification that offered by SPC graph.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Not all SME companies really know about the spreadsheet. They don't really understand about the effect of this technology which able to give benefits to them if it is being utilized. There are not really understood about the effect of this technology which can give a benefit to them if used in a correct way. Spreadsheet is one of the technologies that should be implement by the SME company because it can give a good effect to them. By implement the spreadsheet, SME company will able to determine whether the process that they done are in control or out of control. So, all the assignable causes that can effects the production process can be eliminate in an effective way.

2.2 Definition of SME Company

SME stand for small to medium enterprise. Operational definition of term small to medium enterprise (SMEs) are generally based on the number of person employed or the amount of fixed capital and vary from country to country. For the purpose, SMEs play pivotal role in producing the work marketing among new entrepreneur which still fresh in the marketing world. At this rate, new entrepreneur tent to learn and developed a good management in order to succeed in the processing field that they entered.

Actually, there is no exact definition for the SME company. From the various definitions of SMEs found in Malaysia, the more widely accepted definition is the one used by the Small and Medium Industries Development Corporation (SMIDEC) which have been discuss in Chapter 1.

2.3 Spread sheet Description

A spreadsheet is a rectangular table (or grid) of information. The spread sheet also known as a database that used to have a proper data collection from certain characteristic of product they produced. From these spreadsheet, the user will easily know the value or data that need to know in order to determine whether the process that they done is in control or out of control. It will make the spreadsheet look nicely if attached with graph which will make it user friendly with the user who used it. Figure 2.3.1 below show an example of the spreadsheet that used by Mitutoyo Corporation which display variable chart using SPC software.

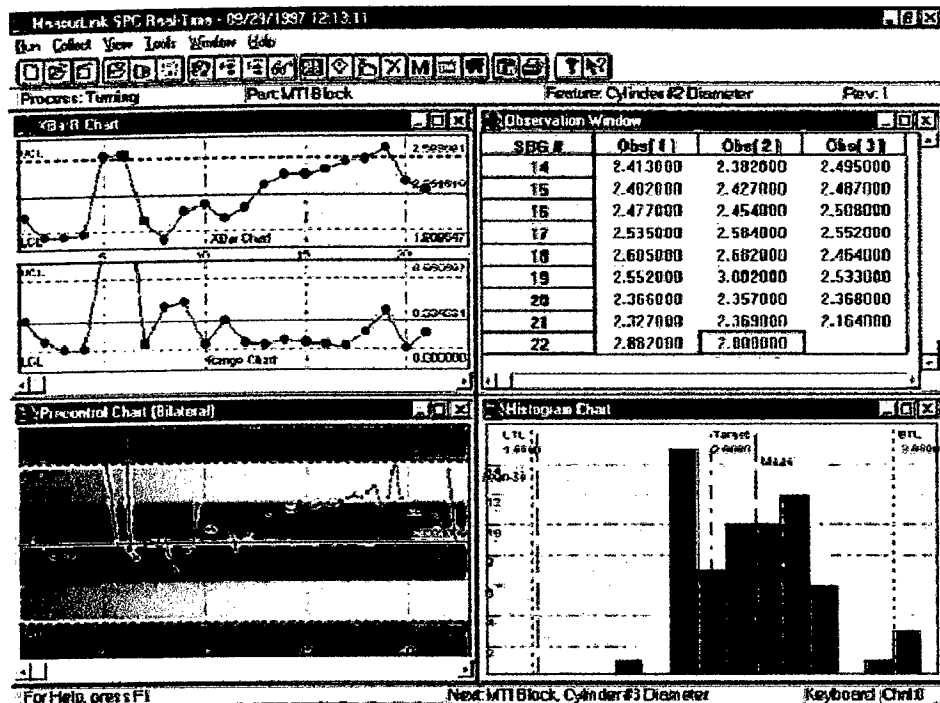


Figure 2.1 A quality control chart that used to control attributes

Spreadsheet interface from the simulation can be used in an effective way because it can analyze the data that had been collected from the processing field. From the simulation, it will make the spreadsheet become very useful in order to recalculate a large amount of data in order to have one decision of their processing field. It shows that the spreadsheet itself can be guidelines for someone to know the processing performance of their product.

Spreadsheet had brought a new hope for the company whose implement it because of their advantages in management of processing data. Spreadsheet itself can be used to optimize the product quality of their processing field. At the same time, the defective criteria can be eliminated because of the SPC tools which used together with the spreadsheet. It will cause some revolution in the SME company who used the spreadsheet. Spreadsheet can be used easily and widely because nowadays each computer used Microsoft Office which include Microsoft Excel in that program. The owner of the

computer will know how to use the Excel program because it was very useful and can calculate a large amount of data.

So, the proper database and arrangement from the data collection will make the easiest way for the user to analyze the performance of their company. As mentioned before, the spread sheet can be used with the SPC (statistical process control).

2.4 Statistical Process Control

2.4.1 Mean and Range Charts

The normal distribution is defined by two parameters, the mean and standard deviation. The \bar{x} (mean) chart and R chart mimic with these two parameters. The \bar{x} chart is sensitive to shift in the process mean. Which mean that the \bar{x} chart can detect the changes of the processing by referring to the process mean. In the other hand, R chart is sensitive to shift in the process standard deviation whereas it can detect the changes of the processing by referring to the process standard deviation. Consequently, by using both charts we can track changes in the process distribution.

For instance, the samples and resulting \bar{x} chart in Figure 2.2 show below the shift in the process mean, but because the dispersion is constant, no change is detected by the R chart. As stated before, the process can only be detected in the process mean. From figure 2.2, the sampling distribution is shifting upward but the range is consistent.

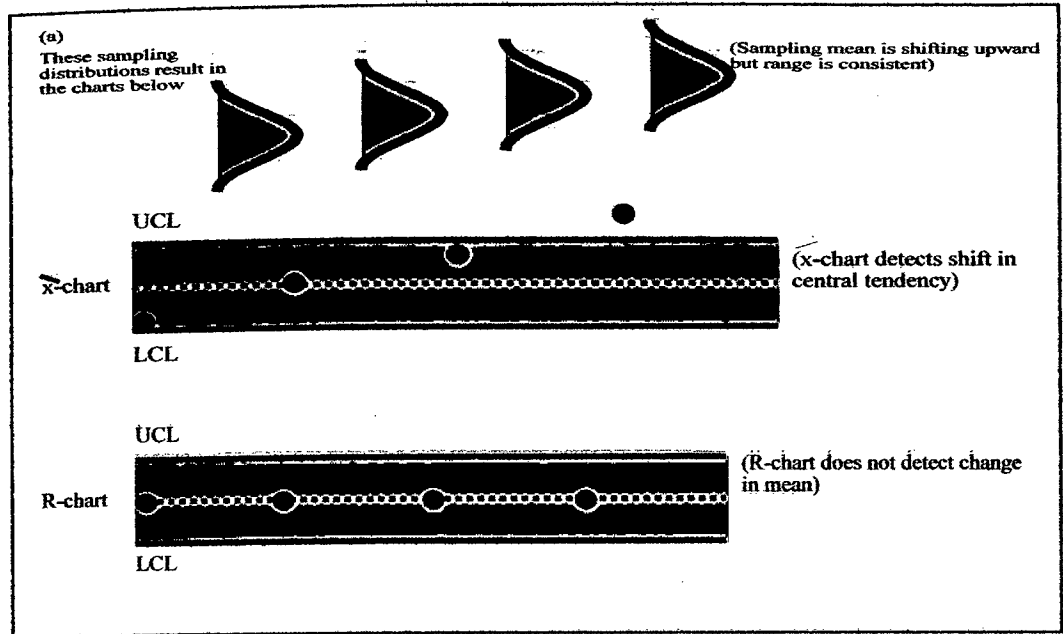


Figure 2.2 Shift in process mean but constant dispersion

Conversely, the samples and chart in Figure 2.3 detect no shift but the R chart does detect the shift in dispersion. Both charts are required to track the process accurately.

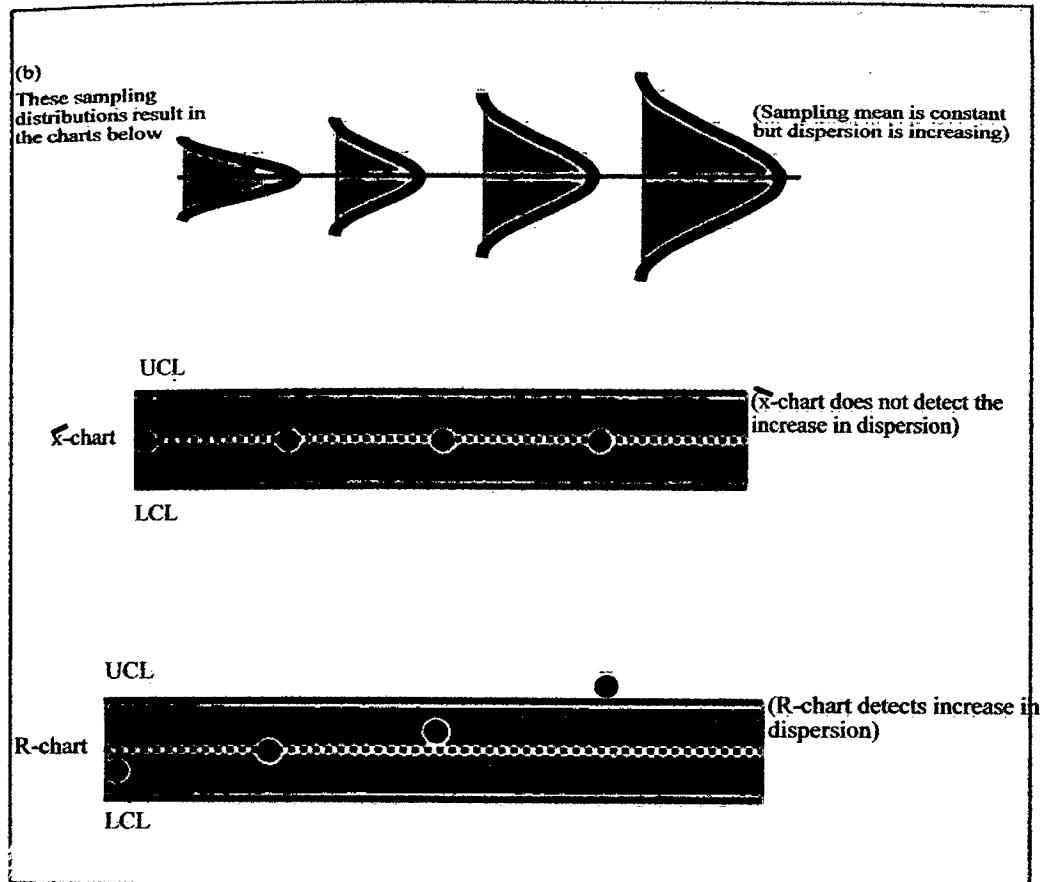


Figure 2.3 No shift in process mean but shift in dispersion

To measure the process, we take samples and analyze the sample statistics following these steps:

- a) Samples of the product, say five boxes of cereal (cornflakes) taken off the filling machine line, vary from each other in weight

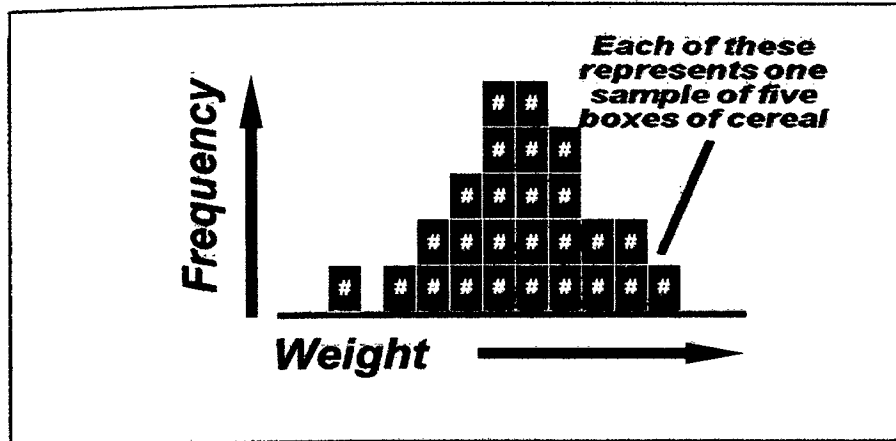


Figure 2.4 Sample of product

- b) After enough samples are taken from a stable process, they form a pattern called a distribution

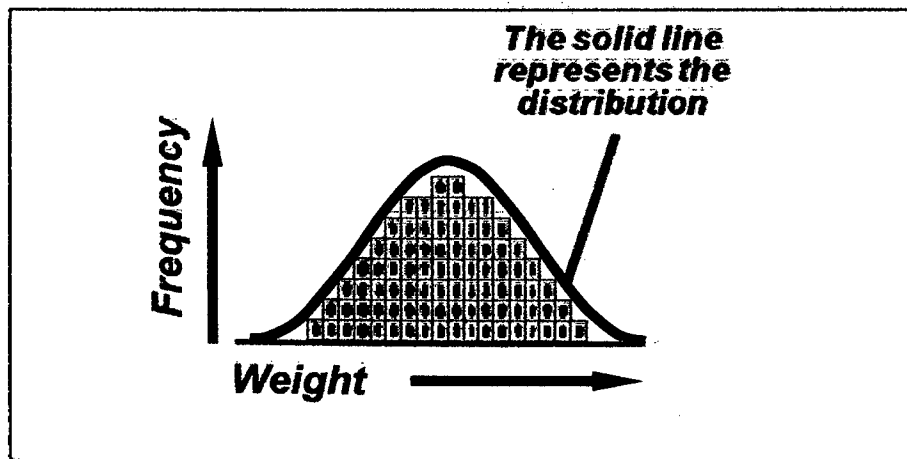


Figure 2.5 Distribution diagram