PRODUCTIVITY MEASUREMENT OF THE SALES DEPARTMENT : A CASE STUDY OF COMPHILEBIZ CO., LTD.

by

Ms. Narumon Chomya

A Final Report of the Three-Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
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Project Title	Productivity Measurement of the Sales Department: A Case Study of ComphileBiz Co., Ltd.
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The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

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ABSTRACT

This project report is a case study of the sales department in ComphileBiz co., Ltd. The objectives are to study productivity measurement and performance evaluation. Benefits are the theory and idea, which will concern productivity measurement and performance evaluation.

The research methodology is Productivity Measurement Technique (Brinkerhoff and Dressler 1990) and Multi-Criteria Performance (Sink 1985), and divided into 2 parts. The first part will focus on forming family of measures for productivity measurement, determining from major function, objectives of department and customer expectation by respective ranking. The second part is performance evaluation throughout 12 month starting from June'2002 to May'2003 using different unit of measures.

The results of the research will arrive at family of measure for productivity measurement, consisting of 5 measures. The performance evaluation from the result of productivity measurement can be summarized into 2 parts: the first part, performance is less than the exception phase, which was major problem. The productivity improvement is critical. The second part, performance is higher than the exception phase, which has not been emergence but should be improved for the long-term benefit of the department.

We recommend using the productivity measurement and the performance evaluation methodology, which would gain short term and long term benefit. Organization should set the benchmark comparing to other organizations of similarity for effectiveness of the performance evaluation.

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I am indebted to the following people and organizations. Without them, this project report would not have been possible.

I desire to express the most sincere appreciation and thanks to my advisor, Dr. Chamnong Jungthirapanich, who encourages and provides valuable comments. I would like to thank all instructors in Computer and Engineering Management (CEM) on their knowledge transferring.

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I. INTRODUCTION

1.1 Background

At present, characteristics, work method, target and objectives of every organization are different. Although, there are some related factors such as skill, knowledge, capability, expertise and experience in work life, including the management who will be responsible for planning and determining the policies of organization conforming their aims and objectives.

The measurement is the first and very vital step in productivity improvement. Organizations, which would like to increase quality, efficiency, effectiveness, productivity and result under the competitive situation, then measurement is indispensable.

Organizations conducting measurement of productivity, and serious improvement have found many benefits throughout short term and long term. The results of productivity measurement come from,

Firstly, it is to modify coaching work method of employees, which will increase quality, efficiency and effectiveness of work.

Secondly, it is to improve strategic planning of organization in the future.

Thirdly, it is to improve the consuming resources for maximum efficiency.

Fourthly, it is to motivate job of employees and the rest.

1.2 Company Overview

ComphileBiz Co., Ltd. was established in 1999 supplying the product under the brand name like Compaq and Hewlett Packard. It was found that there was a demand for personal service, and easier upgrade-ability products. In many cases some brand names did not provide; where ComphileBiz Co., Ltd. could. It manufactured computers

to match the customer's requirement, providing consultation and a high degree of both pre and after sales service, which would be under our control. The success has come from the concept of customer service, development of skills to meet the market's requirements, workflow and IT development for our customers. There staffs still enabled them to understand and took advantage of the ever-changing opportunities of advancement and a practical judgement when considering IT investment. They're the organizations which customers need now and in the future.

1.3 Research Objectives

Research objectives are formulating family of measures used for productivity measurement and performance evaluation, which can be concluded as follows.

(1) To study the factors influencing productivity.

(2) To study the indicators for productivity measurement.

(3) To study the performance evaluation.

1.4 Scope and Limitations

(1) Focus on analyzing the results of sales department.

(2) Focus on analyzing measurement of major activity components, which are involved in the outputs of sales department.

II. LITERATURE REVIEW

2.1 Basic Definition of Productivity

Productivity indicates how resources are managed. A general definition is that productivity is the relationship between the output generated by a production or service system and the input provides to create this output. Therefore, productivity is defined as, the efficient use of resources such as labor, capital, land, materials, energy, and information in the production of various goods and services. Higher productivity means accomplishing more with same amount of resources or achieving higher output in terms of volume and quality for the same input (Prokopenko 1987). This is usually stated as:

$$\frac{\text{Output}}{\text{Input}} \quad \text{Productivity}$$

Or

$$\frac{\text{Product + quality + service + image}}{\text{People + Tangible assets + Money + Information + Technology}} = \text{Productivity}$$

The basic concept of productivity is also increasingly linked with quality of output, input and the process itself, which refers to the effective and efficient utilization of all resources, capital, lands, materials, information and time, in addition to labor. In promoting such views, one must cope with some common misunderstandings on productivity.

First, productivity is not only labor efficiency or labor productivity, but it is currently much more than just labor productivity and needs to take into account the

increase in cost of energy and raw materials along with a growing concern for unemployment and the quality of working life.

The second problem is confusion between productivity and profitability. In real life, profit can be obtained through price recovery even though productivity may regress. Conversely, high productivity does not always relevant to high profit since goods, which are produced efficiently, are not necessarily in demand.

The third is confusion between productivity with efficiency. Efficient production would reflect achieving desired outputs with a minimum of inputs. Efficient production does not guarantee the best productivity, if outputs are bad quality.

The fourth is confusion between productivity and effectiveness. Effective production is the process that produces the desired results. Effective production has increased, while the overall productivity of the organization has decreased, simply because the inputs needed to produce the outputs have risen more quickly than the effective production that causes the organization to be less productive.

The fifth productivity is differed from production because it concerns not how much is produced but rather how efficiently production is carried on. Efficiency is measured by counting how much output is achieved for each unit of input.

2.2 Productivity Measurement

Productivity measurement specialists sometimes prescribe very detailed and painstaking programs to develop the exactly appropriate measurement system in an organization, which must be completed before a productivity improvement program is allowed to begin. This is also an error. Measurement is not the goal, but improvement is the goal. A measurement system is a tool to direct scarce resources to the targets where the most benefit can be obtained from those scarce resources.

Figure 2.1 illustrates the relationship of measurement to other key stages in an improvement cycle. First is the awareness of productivity. The next step is to understand productivity measurement in conjunction with the other measurement and analysis systems, which are already present within the organization. With measured results in hand; there is an appraisal step needed. This can be ranged from a formal and structured diagnosis to a very information, and rapid checklist approach. The appraisal must take into account the basic needs and policies of the organization. Having gone through a process of appraisal, located problems, opportunities in certain areas, and analyzed resources available to make change; the manager must then investigate and employ the appropriate improvement techniques.

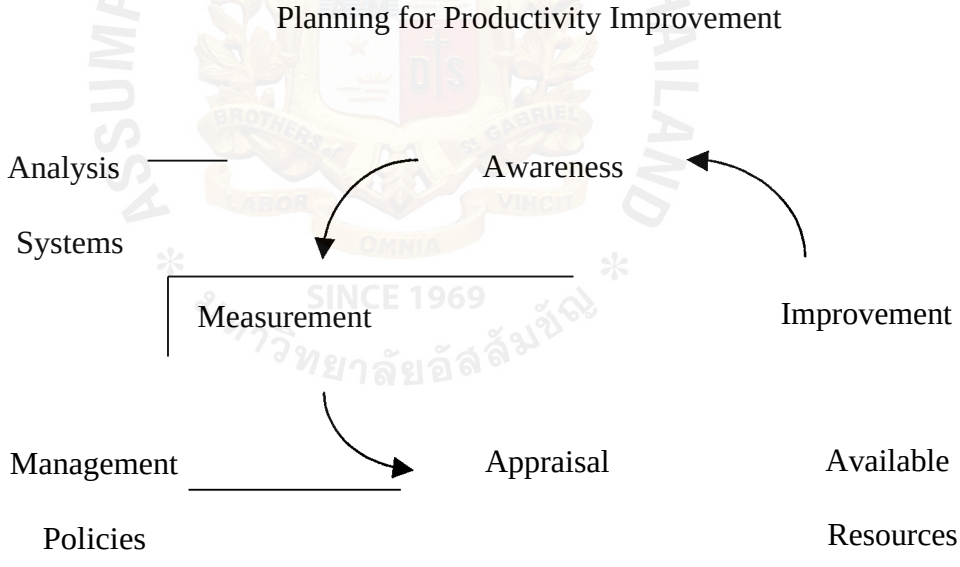


Figure 2.1. Measurement Is an Integral Part of the Improvement Cycle.

2.3 Types of Productivity Measures

There are some general types of productivity measures with which the practical practitioner and researcher should be familiar, and there are four (4) basic types of

productivity measurement that are all commonly encountered, but each has special uses, and each has special limitations.

(1) Partial Measures

A partial measure reflects productivity at some level lower than the entire organization (Brinkerhoff and Dressler 1990). Partial Productivity is the ratio of output to one class of input (Sumanth 1984), such as:

$$\frac{\text{Number of satisfied customers}}{\text{Labor expenses}}$$

Or

$$\frac{\text{Total number of satisfactory hamburgers cooked}}{\text{Amount of grill electrical power used}}$$

(2) Total Measures

A total measure reflects productivity at the whole organization level (Brinkerhoff and Dressler 1990). Total productivity measure is the ratio of output to the sum of the sum of all input factors. Therefore, a total productivity measure reflects the joint impact of all the inputs in producing the output (Sumanth 1984), such as:

$$\frac{\text{Number of satisfied customers}}{\text{Annual expenses}}$$

Or

$$\frac{\text{Total sales}}{\text{Total costs}}$$

(3) Single Measures

Single measure is one for each of his major interests, such as:

$$\frac{\text{Number of hamburgers sold}}{\text{Resources expenses}}$$

(4) Family Measures

Using several measures of each major interest, and group of measures, which are called a "family" of measures. In that they are separate entities, but related to one another, such as:

$$\frac{\text{Number of meaningful training opportunities}}{\text{Percentage of gross sales spent on training}}$$

$$\frac{\text{Number of hamburgers sold}}{\text{Total expenses}}$$

$$\frac{\text{Number of hours of use of birthday party room}}{\text{Percentage of budget dedicated to birthday room}}$$

$$\frac{\text{Annual increase in net worth of property}}{\text{Annual costs of capital improvements}}$$

Partial versus Total Measures

It is important to understand the concept of total and partial measures. Partial measures are often much more useful than total measures, because they isolate one, or a few, inputs or output.

Single versus Family Measures

A single measure might show an overall increase. But this overall increase could be resulted from a great increase in sales, overriding a decrease in the number of birthday parties.

A family of measures clearly provides more and more discrete information about total unit performance than a single measure. We believe it reflects the true state of things, as there are always multiple interests, goals, and values. For these reasons, a family of measures typically provides more utility.

In this project, we will focus on group of the partial productivity to measure the productivity.

2.4 Productivity Ratios Reflect Productivity Improvement

There are five (5) basic ways in productivity improvement reflecting changes in productivity. In discussing each of these five ways, it refers to the same example: the number of secretarial hours of effort consumed in producing reports for clients, such as in a consulting firm that has a costly and elaborated production process. We would express this measure in a ratio by: (Brinkerhoff and Dressler 1990)

$$\frac{\text{Number of acceptable reports produced}}{\text{Secretarial hours expended for reports}}$$

(1) Producing the same output, while consuming fewer resources, represents a productivity gain.

1---110.

(2) When both input and output increase, but output increases faster than input, but use only 10% more effort.

$$\frac{it}{t}$$

(3) When output and input both decrease, but outputs decrease less than inputs.

$$\frac{\downarrow}{\downarrow\downarrow}$$

(4) When more output is produced, but less input is used.

$$\frac{t}{}$$

(5) When more output is produced, but the same input is used.

For five (5) relationship, the forth relationship is the best for productivity improvement.

Quality of measurement requires attention to a number of generic measurements concerned, as measurement of any type would in any social setting.

Quality of measurement consist of:

(1) Validity

Validity refers to the relationship between what is measured and what the person wants to know in the measurement.

(2) Reliability

Reliability describes the accuracy of a measure.

(3) Bias

(4) Reactivity

The tendency of a measuring process to influence what it measures is known as reactivity.

Ignoring validity, reliability, bias, and reactivity will result in misleading measures.

2.5 Measurement Effectiveness

These criteria should be considered by anyone whose goal is to help organizations to produce higher quality goods and services more productively. The four criteria for measurement effectiveness are as follows:

(1) Quality

The measure must define and reflect quality of production or services as well as quantity. A measure that assesses only quantity of output can lead to reduction of productivity.

(2) Mission and Goals

The measure must define and assess only outputs and services those are integrated with organization mission and strategic goals. Measures directed to products and services those are not consistent with mission and goals threaten productivity.

(3) Rewards and Incentives

Measures must be integrated with performance incentives, reward systems and practices. Measures of no important contingencies will not improve productivity.

(4) Employee Involvement

There must be involvement of organization employees and other direct stakeholders in the definition and construction of productivity measures. When lack of involvement has not resulted in commitment and buy-in, results from the measures are unlikely to be favorably received or to have any impact on future productivity.

2.6 Nominal Group Technique (NGT)

It is a method for structuring small group (5 to 9 members) meetings allowing individual judgments to be effectively pooled and used in situations in which uncertainty or disagreement exists about the nature of a problem and possible solutions

(Moore 1987). The technique is helpful in identifying problems, exploring solutions, and establishing priorities.

NGT typically includes four steps:

(1) Silent generation of ideas in writing

Working silently and independently, participants jot down their responses to a stimulus question.

(2) Round-robin recording of ideas

When called upon, each participant contributes a single idea that is recorded on a large flip chart. Discussion of the ideas is not permitted. Completed sheets are taped to the wall so that the group can see them. The group facilitator continues to call upon the participants unit all ideas have been recorded or the groups determine that they have produced a sufficient number of ideas.

(3) Serial discussion of the list of ideas

The participants discuss each idea on the list so that they are clear about the meaning of the ideas.

(4) Voting

The participants identify what each of them believes are the most important ideas, they rank-order their preferences, the votes are recorded on the flip chart, and the voting pattern is discussed.

There are three NGT essentials.

(a) A carefully prepared question that evokes responses at the desired level of specificity.

(b) A group of task-oriented individuals with expertise in the topic.

(c) A group leader who has mastered the process and is willing to act as a process facilitator, not a substantive expert.

2.7 Productivity Measurement Techniques

Three techniques for measuring productivity (Sink 1985).

(1) Normative productivity measurement methodology (NPMM).

A methodology, which incorporate involvement as a major component in the approach.

(2) Multi-factor productivity measurement model (MFPMM).

This model does not incorporate involvement in any major form in the collection of data. It is a more macroscopic measurement approach.

(3) Multi-criteria performance/productivity measurement technique (MCP/PMT).

This technique allows for measurement and evaluation of performance or productivity and, most importantly, it provides a mechanism for developing an aggregate performance or productivity index.

Each of techniques is differed in terms of unit analysis, what data are collected and how the data are collected, and now they're used and their ability to behaviorally link measurement activities to improve actions.

2.8 Definition of Terms

(1) Productivity: It is defined as the relationship between the output generated by a production or service system and the input provided to create this output (Prokopenko 1987).

(2) Efficiency: It is expressed as a pressed and a percentage of the effective capacity. Efficiency is a measure of actual output over effective capacity

(Heizer 1996), or the production would reflect achieving desired outputs with a minimum of inputs (Prokopenko 1987).

(3) Effectiveness: It is the process that produces the desired results (Brinkerhoff and Dressler 1990).

(4) Inputs: It is the term we use to define the resources consumed in the production of output. Therefore, inputs include all the tangible resources consumed, the services, which support production, and the effort or labor of people who use these resources to actually produce the output (Brinkerhoff and Dressler 1990).

(5) Outputs: Outputs, in their simplest from, gained from an individual, unit, or organization (Brinkerhoff and Dressler 1990) produce the goods and services.

III. PROJECT METHODOLOGY

Data Analysis

In this project, the methodology of Multi-Criteria Performance (Sink 1985) and Productivity Measurement Techniques (Brinkerhoff and Dressler 1990) are used because they are appropriate with the analysis of sales department. The case study in this project report is still the analysis methodology of performance against a variety of criteria for showing the monthly performance.

The process of analysis was consisted of 2 phases, which are:

(1) Productivity measurement phase

(2) Performance evaluation phase by multi-criteria performance

Data Collection

We would like to know monthly performance for using to analyst productivity of sales department. So the data were collected monthly started from June 2002 to May 2003. The data are productivity measurement of sale department in CompileBiz Co., Ltd. It is the relationship between the output generated by production or a service system and the input provided, which creates this output such as total number orders processed/total number quotations.

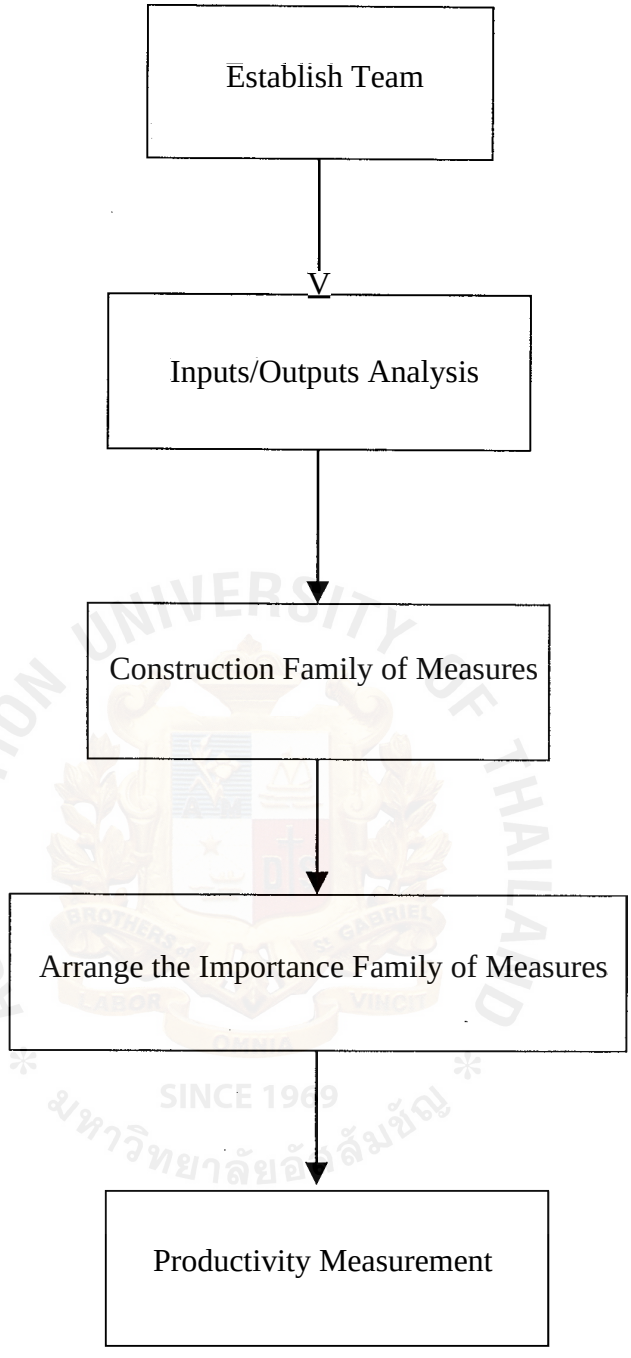


Figure 3.1. Productivity Measurement Conclusion.

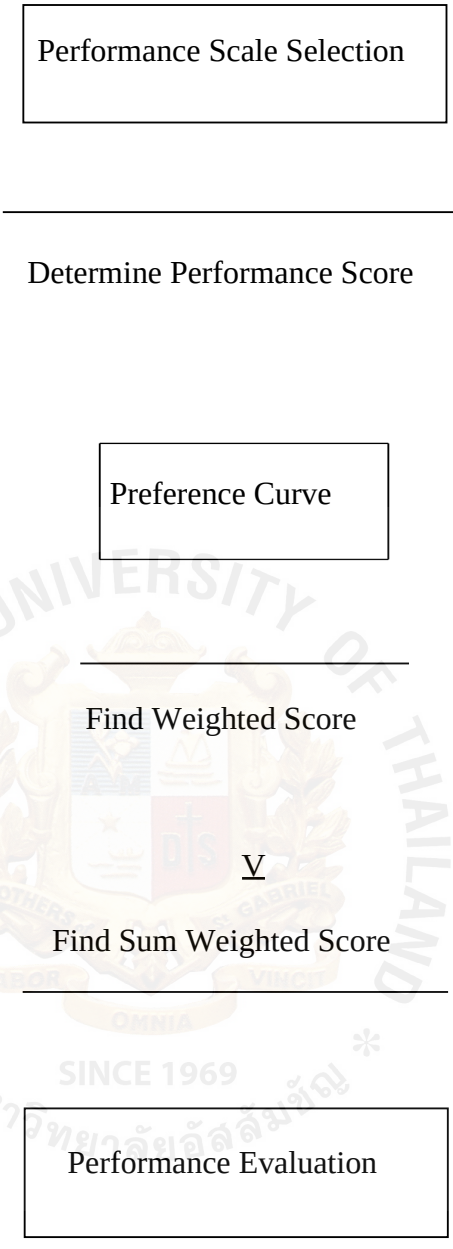


Figure 3.2. Performance Evaluation Conclusion.

3.1 Productivity Measurement Phase

Figure 3.1 depicts the methodology of productivity measurement, which have 5 steps as follows.

3.1.1 Establish Team

At first, a team must be formed for the implementation consisting members in sale department and researcher who have knowledge and understanding in objective of works and productivity measurement system. The team has responsibility in inputs and outputs analysis, design family of measure, and ranking the important family of measure for validity and reliability of the productivity measurement's result.

3.1.2 Inputs and Outputs Analysis

Input and output analysis help to understand problems and goals of sale department. It will help us in designing family of measures for productivity measurement, resulting in accuracy and effectiveness.

The processes of sales department analysis have steps as follows.

(1) Mission Statement Analysis.

Write a mission statement for the unit that identifies the major goals and customers of the unit. It should be emphasized on results, not the activities. Mission statement should answer the following questions.

(a) What are my organization's goals and how does my job help the company to achieve them?

(b) How does my job help my boss achieve his goals?

(c) What result am I responsible for achieving?

(2) Maj or Objective

Write a major objective of sale department. It must agree with the mission of organization.

(3) Expectations Analysis.

Identify each customer unit's products and services of each customer. Expectations must be clearly identified and explain quality needed and expectation, which will be held by each major customer group for the unit's products and services. The diversified problem of customer by observer and interviewer is necessary to find customer expectation.

(4) Major Functions.

Identify and describe the major functions of the unit. These must clearly represent unit operations and inputs as well as explain how key outputs are produced.

(5) Outputs Analysis.

Identify outputs those are important to the unit's mission, responsive to customer needs and expectation, and account for the majority of the expenditures of the unit's resources. It will produce the most practical, useful quality and productivity information.

(6) Inputs analysis.

Selection inputs those are critical to the production of the outputs by selected in Step (4); outputs analysis.

3.1.3 Design Family of Measures

The next is the family of measure construction that it must agree with major objectives, because it will help productivity measurement to have validity and effectiveness.

3.1.4 Arrange the Important Family of Measures

When having the family of measures, the important family of measures must be arranged by using nominal group technique (NGT), because members of assessor have

5 people suitable to NGT which is helpful in identifying problems, exploring solutions, and establishing priorities, which result the reliability of family of measure. Finally, we can evaluate performance and suggest productivity improvement.

3.1.5 Productivity Measurement

The productivity measurement throughout 12 months starting from June 2002 to May 2003 by using family of measure could be constructed in step 3.1.3.

3.2 Performance Evaluation Phase

When we get the results of productivity in each measure, we could not evaluate the performance due to family of measure are different in weighting and unit, therefore we have to use multi-criteria performance in performance evaluation.

Figure 3.2 depicts the methodology of performance evaluation phase; we use multi-criteria performance technique to evaluate the data that have 6 steps, which are as follows.

3.2.1 Performance Scale Selection

The performance scale is the criteria for productivity evaluation that could be ranged over any interval to follow suitable data such as 0.0 to 1.0, 0.0 to 10.0 or 0.0 to 100.0.

3.2.2 Determine Performance Score

Productivity score can be determined for transformation productivity as measured against the scales represented on the x-axis, which is into a performance score on the y-axis that transforms each unit of measures within the same unit. By performance score 0.00, 5.00, and 10.00 are determined from minimum, mean, and maximum of productivity. If productivity would like to stay the interval at 0.00 to 5.00 or 5.00 to 10.00, it has to use interpolate method for performance score calculation.

3.2.3 Preference Curve

Each measure will have preference curve to depict performance tendency of each measure.

Y-axis = Performance Scale (0 to 10) that determines form Step 3.2.1.

X-axis = Productivity

3.2.4 Find Weighted Score

The weighting score used to illustrate performance of each measure will come from performance score in Step 3.2.3 and multiply with weighted measure from Step 3.1.4.

3.2.5 Find Sum Weighted Score

In order to show performance of sale department throughout 12 month, it has to find sum-weighted scores from totals weighted scores of each measure.

3.2.6 Performance Evaluation

Performance evaluation of sales department, which come from the sum-weighted score compared with performance scale that has determined from Step 3.2.1, and the results of performance evaluation will cause productivity improvement.

IV. RESULTS AND DISCUSSIONS

4.1 Construction Productivity Measurement

The processes of productivity measurement have 4 steps, which are as follows.

4.1.1 Established Team

The first step, a team must be established, which would like to participate in designing family of measure implementation. The team contains five members; four members from sale department as who have knowledge and understanding in work and objectives of sales department and one researcher who has knowledge and understanding in productivity measurement system. The researcher has a duty to depict objective, importance, and system of productivity measurement to all members in team. The team is responsible for inputs and outputs analysis, design family of measure, and ranking the important family of measure.

4.1.2 Inputs and Outputs Analysis

Inputs and outputs analysis helps to understand work system and department's goals that influence department's achievement. The team should brainstorm to define clear details for understanding everybody in department as follows.

(1) Mission Statements

(a) To construct quality of work life and treat employees with respect and accredit.

(b) Products and services to worldwide customers with sufficient numbers.

(c) To construct customer satisfaction at all time.

(d) Profit is the important thing to achieve in the future.

(2) Major Objectives

Objectives at level of department and support to mission of company influence to department's achievement. Clear major objectives allow, the employees know to the responsibility.

(a) Increase the members of new entry customers by 30% in this year.

(b) Decrease customer petition to less than 3% of total number of processed orders.

(c) Increase continuous productivity that will increase outputs and decrease inputs.

(3) Customer Expectation

It will come from entail of interviews and observes which are as follows.

(a) Ability to suggest the methodology to revising the problems of hardware and software computers.

(4) Key Outputs

(a) Process Orders

Process orders from the customer after the offering of the quotation or the proposal.

(b) New Entry Customer

(c) Petition from Customers

Such as a defect of product, manners of sales employee, and convenient of communication.

(d) Total Profit

(5) Major Functions

It is major function of sale department, which have influence to increasing productivity.

(a) Close Sale

Deciding to buy of customer after the offering of the quotation or the proposal, which it is "close sale".

(b) Finding new customers

(c) Decrease customer's petition

(d) Maintain margin of company, which should not less than 10 %.

(6) Key Inputs

(a) Quotations

To offer the prices of goods when being requested by the customers in each month.

(b) Proposals

To offer suggestion in methodology for revising the problems of hardware and software computers including the expenses when being requested by the customers in each month.

(c) Total Costs in each month.

(d) Total Customers, who have processed orders in each month.

Input and output data details of sales department show in Table 4.4 to 4.8, including the results on consider and glean from each step, which will bring accurate and effective family of measures for productivity measurement.

4.1.3 Design Family of Measure

Family of measure will be constructed for productivity measurement in sale department, which is important to department's achievement. The most important thing is validity and effectiveness of each measure. Therefore, family of measure must be constructed according to major objectives, major function and customer expectation.

This family of measure consists of five (5) measures, which is the relationship of output/input derived from team's brainstorming.

Measure No. 1 $\frac{\text{Total Number Process Orders}}{\text{Total Number Quotations}}$

Measure No. 2 $\frac{\text{Total Process Orders}}{\text{Total Proposal}}$

Measure No. 3 $\frac{\text{Total New Entry Customer}}{\text{Total Customer}}$

Measure No. 4 $\frac{\text{Total Profit}}{\text{Total Costs}}$

Measure No. 5 $\frac{\text{[Total Number Process Orders-Total Number Petitions]}}{\text{Total Number Process Orders}}$

Table 4.1 shows the objective of measures which agree with each measure, major objectives and customer expectation. Note that objectives of measures are the demanded key outputs, which are:

Measure No.1 and 2 have the same objective, which effectiveness of close sale because they would like to get the same output "process order" with the difference input.

Measure No.3 is to investigate the ability of increasing new customers.

Measure No.4 is to investigate the ability of maintenance margin.

Measure No.5 is to investigate the ability of decreasing customer petition.

Table 4.1. Objectives of Measures.

Measure	Objectives of Measures
No.1	Effectiveness of close sale
No.2	Effectiveness of close sale
No.3	Ability of increasing new customers
No.4	Ability of maintenance margin
No.5	Ability of decreasing customer petition

4.1.4 Arrangement the Important Family of Measures

Arrangement of the important family of measures is important because it will bring the reliability family of measure, and the another thing, which the team must consider in relative to major objectives of department and customer expectation.

Table 4.2 is to illustrate methodology of ranking importance family of measures by assessor. Each people in the team will have 100 point (total point), and they could vote not more than 50 point and not less than 10 point in each measures. Note that assessor No.1 has 100 points and to vote to measure No.1 to 5 are 15, 35, 15, 15, and 20. Collections of score of each measure in column "Measure" are concluded into column "Total Score". Column "Average" is the result of the dividing the total score by the number of assessor (5 people). For example measure No.1 average is 17, which will come from total score (85) divided by the number of assessor (5).

Table 4.2. NGT-based Ranking Importance Families of Measures.

Assessor	Measure					Total Score of Each Measure	Average
	1	2	3	4	5		
No.1	15	35	15	15	20	85	17
No.2	15	30	15	10	30	140	28
No.3	20	25	15	15	25	80	16
No.4	15	30	15	15	25	75	15
No.5	20	20	20	20	20	120	24

The result on weighting measures will reflect the relative importance of family measure, which must manage first. It will be concerning in increasing reliability of the results. The weighting measures are computed from average in Table 4.2, and divided by 100 (which is the total point) and multiplied by 100 to convert into percentage as shown in Table 4.3.

Weighting measure will focus on measure No. 2, 5, 1, 3, and 4 in order of importance. Note that measure No. 1, and 2 has the same objective of measure, which is effective to close sale but weighting measure is different in order that the sale department will focus on suggesting method to revise the problem of hardware and software computer for the customers.

Table 4.3. Weighting Measures.

Measures	Weighted %
Measure No.1	17 %
Measure No.2	28 %
Measure No.3	16 %
Measure No.4	15 %
Measure No.5	24 %

4.1.5 Productivity Measurement

After family of measures have been constructed and arranged, we will measure the productivity throughout 12-month beginning from June 2002 till May 2003 and the results of productivity measurement show in Table 4.4 to 4.8. But the result of productivity could not be used to evaluate the performance due to family of measures has the difference of weighting importance and unit measures. Therefore, multi-criteria performance technique could help the performance evaluation in order to be mechanism by evaluating the productivity of sale department with one performance indicator.

Measure No.1. Total Number Process Order (document)

Total Number Quotations (document)

Table 4.4. Data of Measure No.1

Month		Output	Input	Productivity	Score
June	2002	10	100	0.1000	1.671
July	2002	20	100	0.2000	3.899
August	2002	20	100	0.2000	3.899
September	2002	30	100	0.3000	6.010
October	2002	30	100	0.3000	6.010
November	2002	2	80	**0.0250**	**0.000**
December	2002	25	100	0.2500	5.012
January	2003	20	100	0.2000	3.899
February	2003	50	100	**0.5000**	**10.000**
March	2003	30	100	0.3000	6.010
April	2003	25	120	0.2083	4.084
May	2003	45	110	0.4091	8.186
			Mean	**0.2494**	**5.000**

Min = 0.0250 Max = 0.5000

Mean= Sum Productivity from June 2002 to May 2003 / Data = 2.9924 / 12

= 0.2494

Measure No.2. Total Number Process Order (document)

Total Number Proposal (document)

Table 4.5. Data of Measure No.2.

Month		Output	Input	Productivity	Score
June	2002	5	5	**1.0000**	**10.000**
July	2002	2	2	**1.0000**	**10.000**
August	2002	5	5	**1.0000**	**10.000**
September	2002	8	8	**1.0000**	**10.000**
October	2002	6	7	0.8571	0.972
November	2002	8	8	**1.0000**	**10.000**
December	2002	5	6	**0.8333**	**0.000**
January	2003	9	9	**1.0000**	**10.000**
February	2003	8	8	**1.0000**	**10.000**
March	2003	8	9	0.8889	2.271
April	2003	7	7	**1.0000**	**10.000**
May	2003	8	9	0.8889	2.271
			Mean	**0.9557**	**5.000**

Min = 0.8333 Max = 1.0000

Mean= Sum Productivity from June 2002 to May 2003

Data

11.4682

12

0.9557

Measure No.3. $\frac{\text{Total Number New Customers}}{\text{Total Number Customers}}$ (man)

Table 4.6. Data of Measure No.3.

Month	Output	Input	Productivity	Score
June 2002	1	52	**0.01923**	**0.000**
July 2002	5	52	0.09615	5.454
August 2002		52	**0.01923**	**0.000**
September 2002	5	52	0.09615	5.454
October 2002	10	52	**0.19231**	**10.000**
November 2002	2	52	0.03846	1.428
December 2002	1	52	**0.01923**	**0.000**
January 2003	1	52	**0.01923**	**0.000**
February 2003	6	52	0.11538	6.363
March 2003	10	52	**0.19231**	**10.000**
April 2003	10	52	**0.19231**	**10.000**
May 2003	2	52	0.03846	1.428
		Mean	**0.08654**	**5.000**

Min = 0.01923 ; Max = 0.19231

Mean= $\frac{\text{Sum Productivity from June 2002 to May 2003}}{\text{Data}}$

$$= \frac{1.03845}{12}$$

$$= 0.08654$$

Measure No.4. Total Profit/Total Cost (baht/baht)

Table 4.7. Data of Measure No.4.

Month		Output	Input	Productivity	Score
June	2002	42,530	416,580	0.1021	0.332
July	2002	49,340	325,740	0.1515	6.679
August	2002	37,480	394,550	0.1203	3.514
September	2002	54,480	534,560	0.1019	0.297
October	2002	97,540	496,540	**0.1964**	**10.000**
November	2002	58,940	588,450	**0.1002**	**0.000**
December	2002	35,220	324,440	0.1086	1.469
January	2003	75,480	626,650	0.1205	3.549
February	2003	84,220	694,820	0.1212	3.671
March	2003	85,940	711,540	0.1208	3.601
April	2003	106,820	699,220	0.1528	6.775
May	2003	111,230	742,820	0.1497	6.546
			Mean	**0.1288**	**5.000**

Min = 0.1002

Max = 0.1964

$\bar{X}$ = Sum Productivity from June 2002 to May 2003 / Data

$$= \frac{1.546}{12}$$

$$= 0.08654$$

Measure No.5.

$$\frac{\text{[Total Number Process. Order (document) - Total Number Petition (time)]}}{\text{Total Number Process Order (document)}}$$

Table 4.8. Data of Measure No.5.

Month		Output	Input	Productivity	Score
June	2002	6	6	1.000	10.000
July	2002	6	7	0.857	0.618
August	2002	6	6	1.000	10.000
September	2002	11	13	**0.846**	**0.000**
October	2002	15	16	0.938	5.231
November	2002	10	10	1.000	10.000
December	2002	6	6	1.000	10.000
January	2002	10	10	1.000	10.000
February	2003	12	14	0.857	0.618
March	2003	17	18	0.944	5.692
April	2003	15	17	0.882	2.022
May	2003	9	10	0.900	3.034
			Mean	**0.935**	**5.000**

MM = 0.846 ; Max = 1.000

Mean= Sum Productivity from June 2002 to May 2003

Data

$$\frac{11.224}{12}$$

$$= 0.935$$

4.2 Performance Evaluation

The performance evaluation uses multi-criteria performance technique, which is the mechanism to evaluate the productivity of sale department with one performance indicator that has the following process.

4.2.1 Performance Scale Selection

Table 4.9 illustrates phase exception of measures that is the criteria of self-assessment for self-improvement. In performance scale selection considering on suitable data so that performance scale determined from 0.0 to 10.0, are determined from productivity in Tables 4.4 to 4.8 by:

(1) Bad performance scale (0.0) determined from minimum of productivity.

(2) Exception performance scale (5.0) determined from mean of productivity, and the calculation is shown in Tables 4.4 to 4.8.

(3) Best performance scale (10.0) determined from maximum of productivity.

Table 4.9. Phase Exceptions of Measures.

Measures	Scale		
	Min	Mean	Max
	0.0000	5.0000	10.0000
Measure No.1	0.0250	0.2494	0.5000
Measure No.2	0.8333	0.9557	1.0000
Measure No.3	0.0192	0.0865	0.1923
Measure No.4	0.1002	0.1288	0.1964
Measure No.5	0.8460	0.9350	1.0000

4.2.2 Determining Performance Score for Productivity

Determination of performance scores for each measure is to transform productivity (actual performance) by the scale represented on the x-axis that has different unit into a performance score (0 to 10) on the y-axis which is the same unit. The first, performance score determinations are 0.00, 5.00, and 10.00 which are determined from minimum, mean, and maximum productivity of each measure. The next, performances score calculation of productivity to stay in interval of 0.00 to 5.00 or 5.00 to 10.00 by Interpolate method. (See table 4.4 to 4.8 show productivity and performance score of each measure and appendix A shows example computing performance score by Interpolate method)

4.2.3 Preference Curve

Each measure will have preference curve to show performance tendency of each measure, which points to weak point and strong point in the performance. Preference curve constructed from y-axis, is performance score, determined in step 4.2.2 and x-axis, is the result of productivity of measurement.

Figure 4.1 to 4.5 are preference curve of measure. No. 1 to 5 show performance tendency by seeing slope of graph that stays the interval 0 to 5 or 5 to 10. Note that 5 are phase exception of measures by represented on y-axis. When graph has slope to stay within the interval performance scale between 0 to 5, it is the low performance, while staying between 5 to 10 is high performance.

The results on performance for measure from No. 1 to 5, allow to revise the problem. It can be summarize as three group the following.

(1) Firstly, the performance of measures No.3 and 4 has low tendency because it is a curve, which sloping stay in the interval performance between 0 to 5. It

is weakest point in the family of measure, which critically needs to find the cause for the productivity improvement.

(2) Secondly, the performance of measures No.1 stay in the average interval because the graph is almost linear. It should improve to curve, and stay within the interval performance between 5 to 10 scales.

(3) Thirdly, the performance of measures No.2 and 5 have high tendency because the graph is in curve, and staying within the interval performance between 5 to 10. It is the strongest point in family of measure and has high weighting score that requires continuous improvement.

Measure No.1. Total Number Orders Processed/Total Number Quotations

Performance Scale

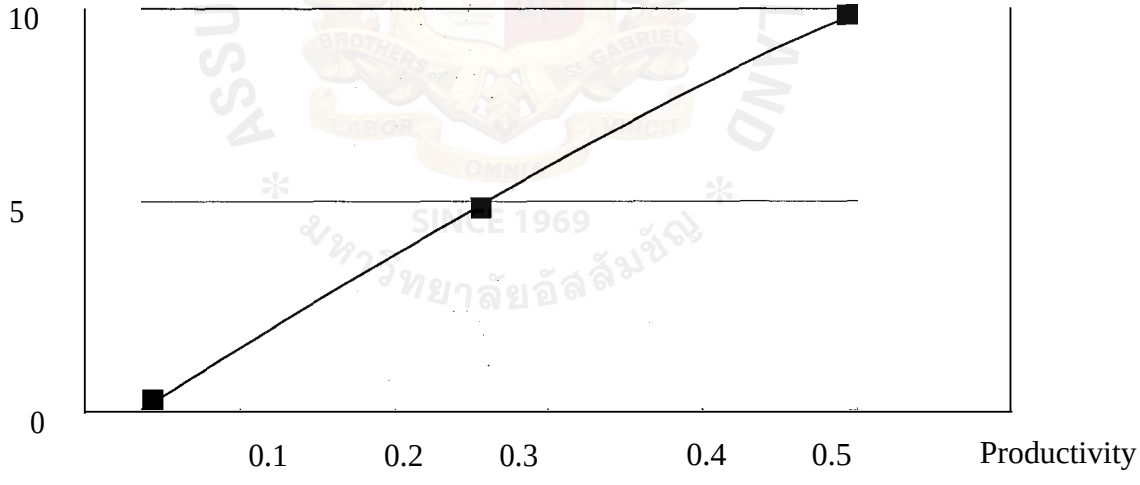


Figure 4.1. Preference Curve of Measure No.1.

Measure No.2. Total Number Orders Processed/Total Number Proposal

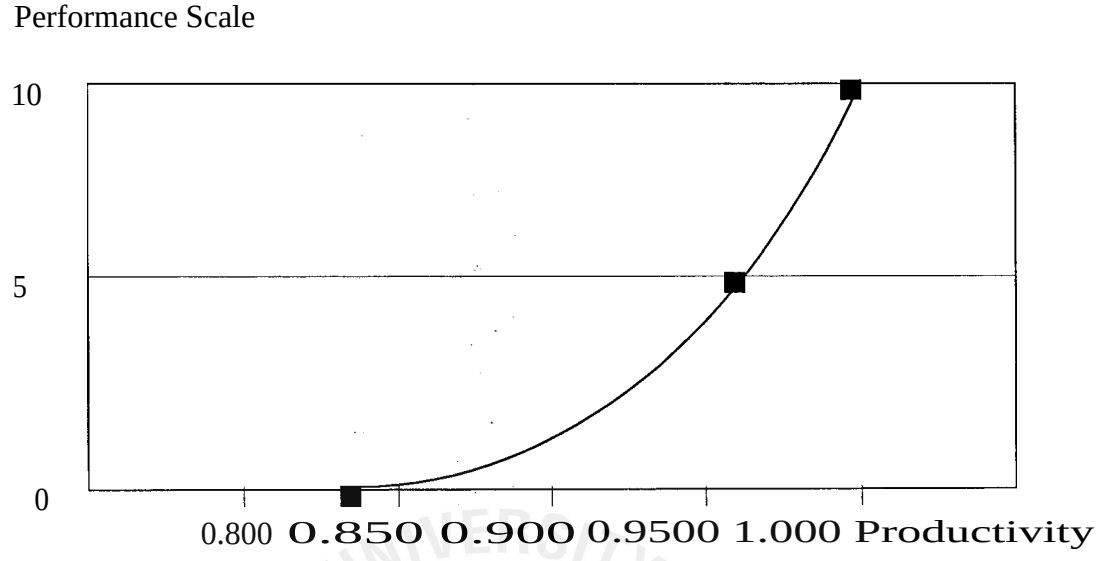


Figure 4.2. Preference Curve of Measure No.2.

Measure No.3. Total Number New Customers/Total Number Customers

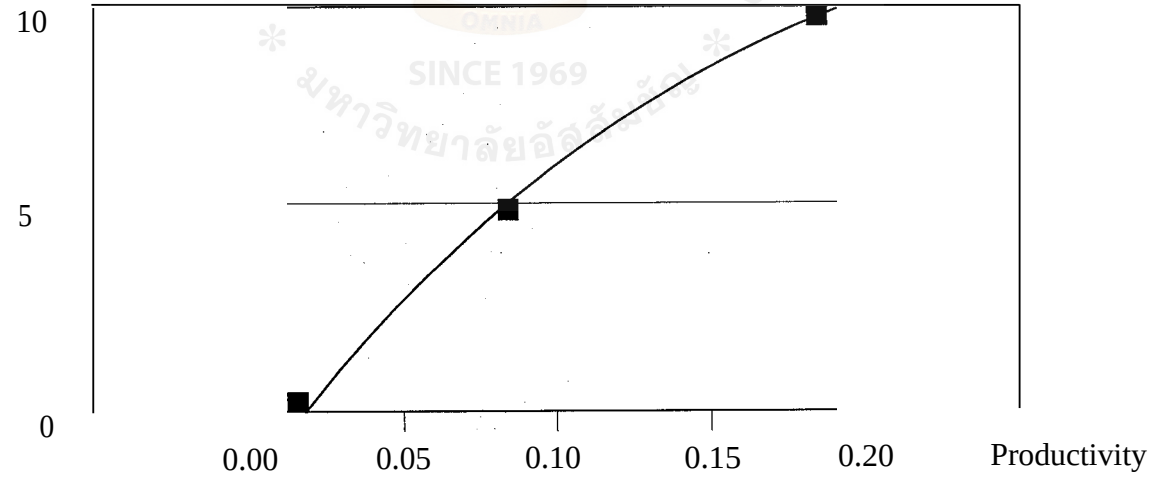


Figure 4.3. Preference Curve of Measure No.3.

Measure No.4. Total Profit/Total Cost

Performance Scale

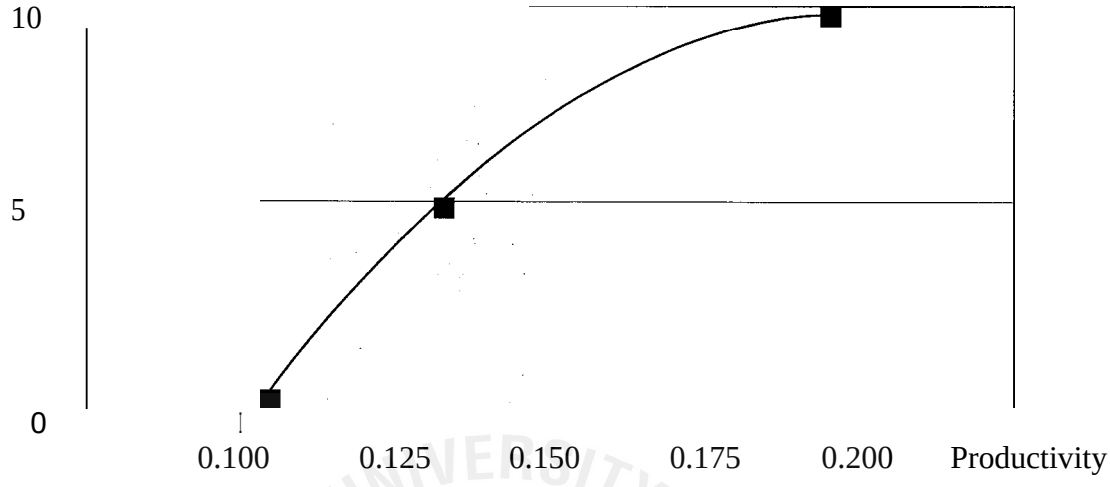


Figure 4.4. Preference Curve of Measure No.4.

Measure No.5. [Total Number Orders Processed - Total Number Petition (time)]

Total Number Orders Processed (document)

Performance Scale

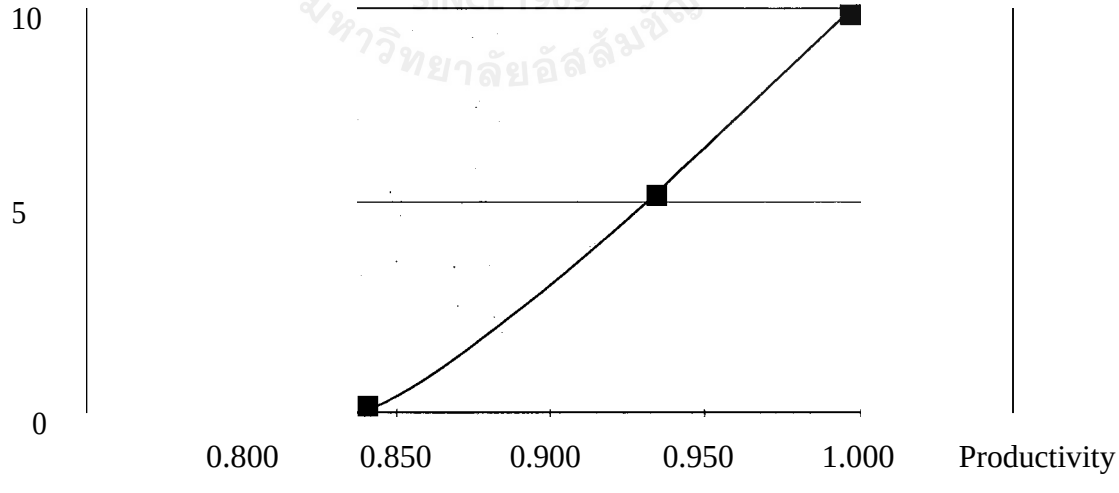


Figure 4.5. Preference Curve of Measure No.5.

4.2.4 Find Weighted Score

The weighted score depicts the performance of each measure and table 4.5 to 4.9 illustrates the weighted scores, which come from performance scores in Step 4.2.3 multiply by the weighted of measures from Step 4.1.4.

Table 4.10. Weighted Score of Measure No.1 .

Month		Score	Weight	Weighted Score
June	2002	1.671	0.17	0.284
July	2002	3.899	0.17	0.663
August	2002	3.899	0.17	0.663
September	2002	6.010	0.17	1.022
October	2002	6.010	0.17	1.022
November	2002	0.000	0.17	0.000
December	2002	5.012	0.17	0.852
January	2003	3.899	0.17	0.663
February	2003	10.00	0.17	**1.700**
March	2003	6.010	0.17	1.022
April	2003	4.084	0.17	0.694
May	2003	8.186	0.17	1.392

Min = 0.000

Max = 1.700

Mean = $\frac{9.977}{12}$ = 0.833

Table 4.11. Weighted Score of Measure No.2.

Month	Score	Weight	Weighted Score
June 2002	10.000	0.28	**2.800**
July 2002	10.000	0.28	**2.800**
August 2002	10.000	0.28	**2.800**
September 2002	10.00	0.28	**2.800**
October 2002	0.972	0.28	0.272
November 2002	10.000	0.28	**2.800**
December 2002	0.000	0.28	**0.000**
January 2003	10.000	0.28	**2.800**
February 2003	10.000	0.28	**2.800**
March 2003	2.271	0.28	0.636
April 2003	10.000	0.28	**2.800**
May 2002	2.271	0.28	0.636

Min = 0.000

Max = 2.800

Mean = $\frac{23.944}{12}$ = 1.995

Table 4.12. Weighted Score of Measure No.3.

Month		Score	Weight	Weighted score
June	2002	0.000	0.16	**0.000**
July	2002	5.454	0.16	0.873
August	2002	0.000	0.16	**0.000**
September	2002	5.454	0.16	0.873
October	2002	10.000	0.16	**1.600**
November	2002	1.428	0.16	0.228
December	2002	0.000	0.16	**0.000**
January	2003	0.000	0.16	**0.000**
February	2003	6.363	0.16	1.018
March	2003	10.000	0.16	**1.600**
April	2003	10.000	0.16	**1.600**
May	2002	1.428	0.16	0.228

Min = 0.000

Max = 1.600

Mean = 8.02 / 12 = 0.668

Table 4.13. Weighted Score of Measure No.4

Month	Score	Weight	Weighted Score
June 2002	0.332	0.15	0.050
July 2002	6.679	0.15	1.002
August 2002	3.514	0.15	0.527
September 2002	0.297	0.15	0.045
October 2002	10.000	0.15	**1.500**
November 2002	0.000	0.15	**0.000**
December 2002	1.469	0.15	0.220
January 2003	3.549	0.15	0.532
February 2003	3.671	0.15	0.551
March 2003	3.601	0.15	0.540
April 2003	6.775	0.15	1.016
May 2003	6.546	0.15	0.982

Min = 0.000

Max = 1.500

Mean = $\frac{6.965}{12}$ =0.580

Table 4.14. Weighted Score of Measure No.5

Month	Score	Weight	Weighted Score
June 2002	10.000	0.24	**2.400**
July 2002	0.618	0.24	0.148
August 2002	1.000	0.24	**2.400**
September 2002	0.000	0.24	**0.000**
October 2002	5.231	0.24	1.255
November 2002	10.000	0.24	**2.400**
December 2002	10.000	0.24	**2.400**
January 2002	10.000	0.24	**2.400**
February 2003	0.618	0.24	0.148
March 2003	5.692	0.24	1.366
April 2003	2.022	0.24	0.485
May 2003	3.034	0.24	0.728

MM = 0.000

Max = 2.400

Mean = $\frac{16.13}{12}$ = 1.344

4.2.5 Find Sum Weighted Score

Finding sum-weighted score is to integrate the weighted scores of each measure from step 4.2.4 into one performance indicator to depict performance of sale department throughout 12 month. Table 4.15 shows monthly sum weighted score to evaluate monthly performance of sale department for the next step.

Table 4.15. Sum Weighted Score.

Month	WS1	WS2	WS3	WS4	WS5	Sum Weighted Score
June 2002	0.284	2.800	0.000	0.050	2.400	5.534
July 2002	0.663	2.800	0.873	1.002	0.148	5.486
August 2002	0.663	2.800	0.000	0.527	2.400	6.390
September 2002	1.022	2.800	0.873	**0.045**	**0.000**	**4.740**
October 2002	1.022	0.272	1.600	1.500	1.255	5.649
November 2002	0.000	2.800	0.228	0.000	2.400	5.428
December 2002	0.852	**0.000**	**0.000**	**0.220**	2.400	**3.472**
January 2003	0.663	2.800	0.000	0.532	2.400	6.395
February 2003	1.700	2.800	1.018	0.551	0.148	6.217
March 2003	1.022	0.636	1.600	0.540	1.366	5.164
April 2003	0.694	2.800	1.600	1.016	0.485	6.595
May 2003	1.392	**0.636**	**0.228**	0.982	**0.728**	**3.966**

NOTE: WS = Weighted score; 1 = Measure No.1

4.2.6 Performance Evaluation

Figure 4.2 illustrates the performance evaluation throughout 12 months with sum weighted scores staying between the interval at 3.472 to 6.595 beginning from June 2002 to May 2003 by comparing with performance scale. Note that a maximum score would be 10.00, exception phase represented with 5.00 score and bad performance represented with 0.00 score. We can summarize the performance into 2 parts, which are:

The first part of performance are 4.740, 3.472, and 3.966 within September 2002, December 2002, and May 2003 pointed to productivity staying at the level which was

lower than exception phase. It is the major the problem therefore it critically needs to find the cause and effect of productivity improvement for benefits of organization in short term. Especially December 2002 gains the lowest performance, which the major causes, are measuring No. 2, 3, and 4 with the performance lower than exception phase (see Table 4.15).

The second part have performance interval at 5.164 to 6.595 for the whole 9 month exception of September 2002, December 2002, and May 2003. The productivity stays at the level of slightly better than the exception phase but likely lower than the best performance. Therefore, it needs to improve productivity after revising major the problem for benefits of organization in long term.

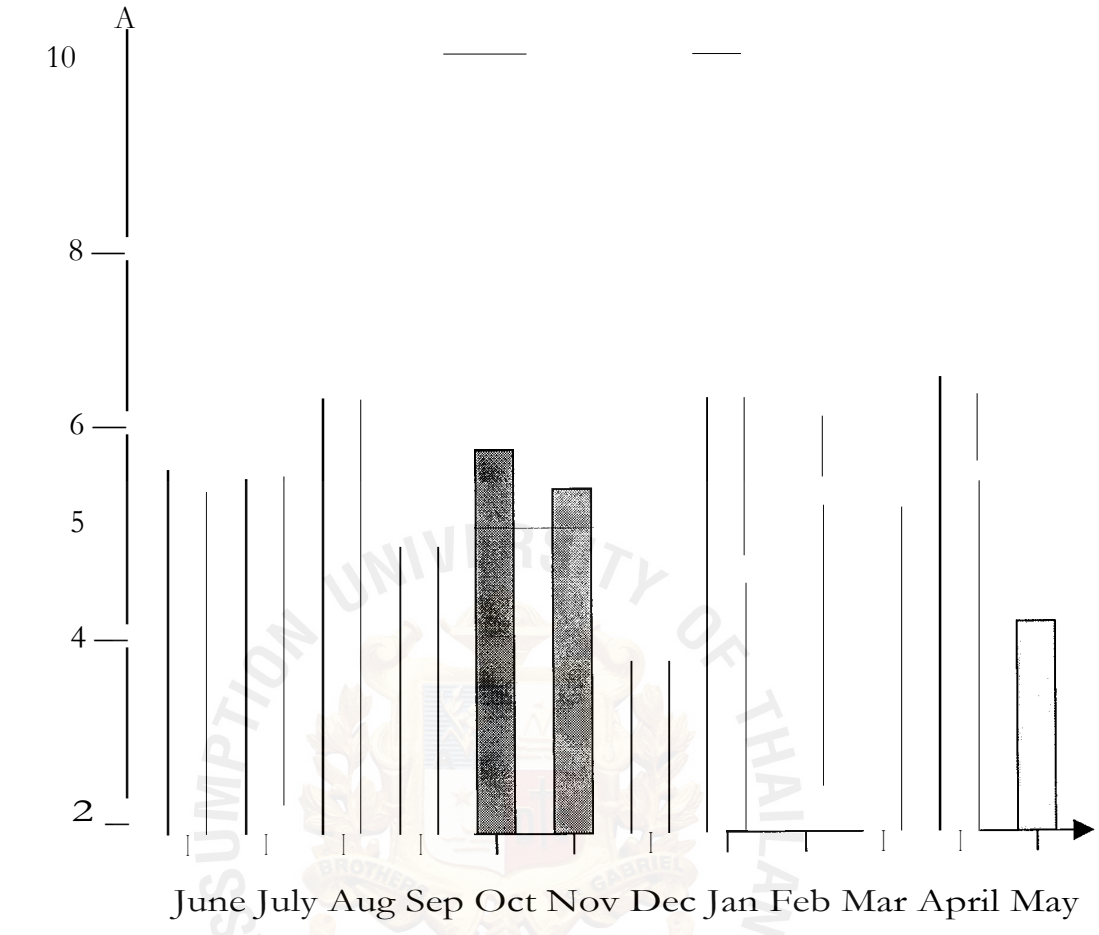


Figure 4.6. Monthly Performance of Sales Department.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The research productivity measurement in the case study of ComphileBiz Co., Ltd. is (1) to study the factors influencing to productivity, (2) to study the indicators of productivity measurement, and (3) to study the performance evaluation causing the productivity improvement. It focuses on the productivity measurement, and evaluation among major function of sale department involved in the output of sales department.

Literature reviews have been investigated on measurement productivity.

Moreover, it explains the measurement effectiveness, productivity measurement technique, productivity ratios reflect productivity improvement, and nominal group technique for understanding the productivity measurement.

In this project report, has been monthly collected beginning from June 2002 to May 2003 concerning productivity measurement. Research methodology is based on Productivity Measurement Technique (Brinkerhoff and Dressler 1990) and Multi-Criteria Performance (Sink 1985). The implementation is divided into 2 parts. The first part will focus on productivity measurement, which construct family of measure and ranking the importance family of measure for productivity measurement. The second part is performance evaluation of sale department from the result of productivity measurement throughout 12 months.

After application of productivity measurement methodology, it brings to family of measure, which is consisted of 5 measures; each measure has different weighting and importance. The performance evaluation from the result on monthly productivity measurement of sale department throughout 12 months, which we use multi-criteria performance because each measure are different.

The performance illustrated with sum weighted scores stay in the interval between 3.472 to 6.595, and could summarize the performance into 2 parts comparing with performance scale.

The first part of the performance is 4.740, 3.472, and 3.966 within September 2002, December 2002, and May 2003 that points to productivity to stay at the level which was lower than exception phase. Note that the exception phase represented 5 score. Especially December 2002 has the lowest performance. Therefore, it is critical to find the cause and effect to improve productivity.

The second part has summed interval weighted score at 5.164 to 6.595 for the whole 9 month to except in September 2002, December 2002, and May 2003. It points that productivity stays at the level of slightly better than exception phase but likely lower than the best performance. Note that the best performance represented by 10 score. It needs to improve productivity for benefits of organization in long term.

In this case, productivity improvement will be indicated through one of the five basic ratio changes depicted in Chapter 2.4. Before improving they must analyze all the possible causes and effects which are related to increasing and decreasing productivity by applying a cause-and-effect diagram.

When one knows and understands all the possible cause and effect relative to increasing productivity then follows the process of selecting productivity improvement techniques to match the size of unit, the controllable resource, and unit's needs.

Recommended techniques are as follows:

(1) Job design, redesign, and enrichment

(2) Job evaluation

(3) Strategic planning

(4) Management by objective

(5) Quality control

(6) Human factors engineering

(7) Decision support system design

Again the productivity measurement from the result on productivity improvement, is the long-term improvement cycle for benefits of organizations.

5.2 Recommendations

Recommendations as followed are for the next research methodology that can be considered to improve a part of productivity measurement and performance evaluation.

(1) The performance evaluation should benchmark with other organization with similar business type for the effectiveness of performance evaluation.

(2) The performance evaluation should benchmark with organization of the best practice. The benefits are to save time for continuous improvement into the best practice.

(3) The performance evaluation adds data collection for clearing such as increasing data from 1 year is 2 year.

(4) The productivity measurement, the designing family of measures should be balanced on perspective consisting of financial perspective, customer perspective, business-process perspective, learning and growth perspective, and so on for effective productivity measurement.

To person interested in productivity measurement and prefers to apply to the organization, is vital and indispensable a step-by-step for productivity measurement and performance evaluation methodology. To get the most effective result, one also should consider the following concerns.

(1) The productivity measurement should be focused on family of measure construction and weighting. If one would like to get the best family of measures, which

are validity and reliability for productivity measurement in your organization. Rationally in every organization, environment of organizations is different such as major objective, major function, strategic, and so on.

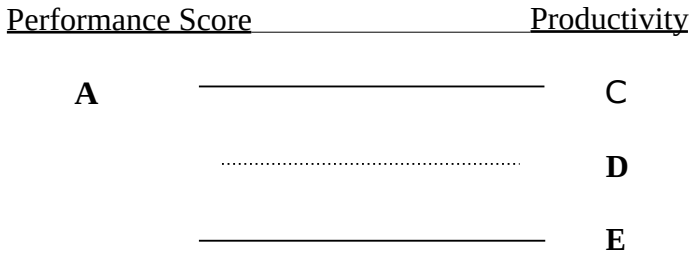
(2) New productivity measurement should help continuous improving according to environment of organizations, which changes overtime.

APPENDIX A

PERFORMANCE SCORE CALCULATION BY INTERPOLATION

Example of Calculation: Performance score calculation by Interpolate method.

Formula for performance score calculation.



$$I = A + \left| \frac{(D - C)}{(E - C)} \times (B-A) \right|$$

Note: I = performance score which we want to know when know A and B, and D must to stay interval C and **D.**

Refer to Table Appendix A.1

When you know performance score of June 2002 that has productivity = 0.1000 by stay between minimum and mean.

- November 2002 has productivity = 0.0250 that is minimum so that performance score determined is 0.
- Mean has productivity = 0.2494 and performance score = 5.

So that performance score of June 2002 can compute form formula to following.

$$I = 0 + \left| \frac{(0.1000 - 0.0250)}{(0.2494 - 0.0250)} \times (5 - 0) \right|$$

$$I = 1.6711225$$

Therefore, performance score of June 2002 equal 1.6711225 is answer.

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