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THE IMPROVEMENT OF THAI TOY INDUSTRY'S COMPETITIVENESS: A BENCHMARKING APPROACH

Mr. Suthiket Thatpitak-kul

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By Mr.Suthiket Thatpitak-kul

Field of Study Engineering Management

Thesis Advisor Assistant Professor Suthas Ratanakuakangwan

Thesis Co-advisor Mr.Chanin Khaochan

Accepted by the Faculty of Engineering, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master’s Degree

.... Dean of the Faculty of Engineering

(Professor Direk Lavansiri, Ph.D.)

THESIS COMMITTEE

.... Chairman

(Professor Sirichan Thongprasert, Ph.D.)

.... Thesis Advisor

(Assistant Professor Suthas Ratanakuakangwan)

.... Thesis Co-advisor

(Mr.Chanin Khaochan)

.... Member

(Associate Professor Chuvej Chansa-ngavej, Ph.D.)

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วิทยานิพนธ์นี้เป็นการนำเทคนิค Benchmarking หรือการเทียบเคียงเข้ามาประยุกต์ใช้ในการวิเคราะห์ประสิทธิภาพเพื่อปรับปรุงความสามารถในการแข่งขันของผู้ผลิตไทยในอุตสาหกรรมผลิตของเล่น โดยวิธีการการเทียบเคียงประกอบด้วย 4 ขั้นตอนคือ ขั้นตอนแรกเป็นการเลือกกระบวนการปฏิบัติงานที่จะนำไปเทียบเคียง โดยพิจารณาจากกระบวนการต่างๆ ที่ส่งผลกระทบต่อระดับประสิทธิภาพของดัชนีวัดประสิทธิภาพ ทางด้านความสามารถในการแข่งขัน ของบริษัทผู้ผลิตของเล่นของไทย ขั้นตอนที่สองเป็นการสรรหาคู่เทียบเคียงที่เหมาะสม 2 รายซึ่งได้แก่ ผู้ผลิตของเล่นต่างชาติที่มีโรงงานในประเทศไทย (Factory B)และผู้ผลิตของเล่นจากต่างชาติที่นำเข้ามาจำหน่ายในไทย (Factory D)ขั้นตอนที่สามเป็นการเก็บรวบรวมข้อมูลดัชนีวัดประสิทธิภาพของคู่เทียบเคียงทั้ง 2 ราย และขั้นตอนสุดท้ายเป็นการวิเคราะห์ความแตกต่างของดัชนีวัดประสิทธิภาพของแต่ละคู่เทียบเคียงที่เลือกและสรุปผลที่ได้จากการเทียบเคียง

การเทียบเคียงในงานวิจัยนี้ได้กำหนดดัชนีวัดประสิทธิภาพทางด้านความสามารถในการแข่งขันของอุตสาหกรรมผลิตของเล่นไว้ 4 ประเภท คือ ด้านคุณภาพ (Quality) ต้นทุน (Cost) การส่งมอบ (Delivery)และสุดท้ายคือ ด้านทักษะการออกแบบของเล่น (Skill) โดยหลังจากการเทียบเคียงระดับประสิทธิภาพของดัชนีที่กำหนดไว้ของผู้ผลิตไทยกับคู่เทียบเคียงทั้ง 2 รายแล้ว พบว่าด้านคุณภาพและทักษะการออกแบบของเล่น ได้แก่ % Defect % Claim และ %Toy Design Performance สำหรับผู้ผลิตของเล่นไทยมีค่าดัชนีวัดประสิทธิภาพที่มีระดับประสิทธิภาพต่ำ โดยที่ % Defect มีความสัมพันธ์กับต้นทุนการผลิต จึงเป็นประเด็นที่จะนำไปเทียบเคียง เพื่อให้ได้มาซึ่งแนวทางในการปรับปรุงความสามารถในการแข่งขันของผู้ผลิตของเล่นไทย โดยผู้ผลิตไทยมี % Claim ที่ 8.53 % % Toy Design Performance ที่ 18.7 % และ% Defectที่ 3.8% ส่งผลให้มีต้นทุนการผลิตที่ 78.3% เมื่อเทียบกับราคาขาย โดยผู้วิจัยได้นำค่า % Claim % Defect %Toy Design Performance และต้นทุนการผลิตไปเทียบเคียง กับคู่แข่งขันทั้ง 2 ราย

จากการวิเคราะห์พบว่าผู้ผลิตของเล่นไทยควรมีการปรับปรุงการดำเนินงานผลิตโดยเน้นที่การควบคุมคุณภาพ กระบวนการผลิตและการออกแบบให้มากขึ้น ทั้งนี้ผู้วิจัยได้นำเสนอแผนการปรับปรุงประสิทธิภาพของโรงงานโดยมีเป้าหมายที่จะลด %Defect ให้เหลือ 1.7 % ซึ่งจะทำให้ต้นทุนการผลิตลดลงเหลือ 76.6% ลด % Claim ให้เหลือ 5.0 % อีกทั้งเพิ่มความสามารถในการออกแบบของเล่นให้เพิ่มสูงขึ้นเป็นร้อยละ40 ซึ่งทั้งหมดนี้เป็นการนำเทคนิค Benchmarking มาใช้เทียบเคียงเพื่อศึกษาหาแนวทางปรับปรุงและเพิ่มความสามารถในการแข่งขันของโรงงาน

ภาควิชา ศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต ลายมือชื่อนิสิต
สาขาวิชา การจัดการทางวิศวกรรม ลายมือชื่ออาจารย์ที่ปรึกษา
ปีการศึกษา 2546 ลายมือชื่ออาจารย์ที่ปรึกษาร่วม

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MR. SUTHIKET THATPITAK-KUL: THE IMPROVEMENT OF THAI TOY INDUSTRY'S COMPETITIVENESS:A BENCHMARKING APPROACH. THESIS ADVISOR: ASSIST. PROF. SUTHAS RATANAKUAKANGWAN. THESIS CO-ADVISOR: MR. CHANIN KHAOCHAN, 153 pp.
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This research has objective to benchmark and improve the competitiveness of Thai toy industry by using benchmarking technique. The phases of benchmarking process in this research composed of 4 steps. The first step is to select the process, the benchmarking study will focus on, by considering the process impact on Thai toy's manufactures performance indicator (PI) which is highly important while the performance is low. The second step is to search for and identify suitable benchmarking partner as the foreign factory. The third step is to collect data in benchmark partners. And the last step is to analyze and summarize the difference in methods performed between case study manufacture and the benchmarked partner. Types of critical success factor (CSF) was identified in this thesis emphasized on quality, cost, delivery and skill.

After comparing the indicator performance level of the sample factory against benchmarking partners, The author concluded that defect percentage, claim percentage and toy design performance level of the sample factory were the less value. For % defect, it is related with cost of product. The sample factory has the value of % claim at 8.53% defect at 3.58%, % toy design performance at 18.7 % and cost of product at 78.3% when compare with price. This research selected both 3 PIs of the sample factory to compare with the benchmarking partners for finding the improvement plan.

Finally, the author presented the improvement plan for the sample factory by set the target of claim at 5.0 %, % defect at 1.7% that relate with cost of product at 76.6% and design performance to 40%. So, this research has a scope to study and using benchmarking technique to improve toy manufactures competitiveness.

Department The Regional Centre for Manufacturing Systems Engineering Student's signature
Field of study Engineering Management Advisor's signature
Academic year 2003 Co-advisor's

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CHAPTER 1

Introduction

1.1 BACKGROUND

1.1.1 History of Toy Industry in Thailand

Toy manufacturing in Thailand has developed from a low-quality, low price industry producing goods for primarily the domestic market, to one that turns out quality products and plays an important role in the country's export sector. The industry emerged in the late 1980's and early 1990's when foreign investment from large Asian toy manufacturers began to enter Thailand, allowing the sector to register significant growth export volumes. The industry has leveled off since the growth spurt unable to live up to lofty government expectations, with export figures contracting since the financial crisis in 1997 when measured in U.S. dollars.

Toy industry in Thailand has been dominated by foreign investments, which poured into the country during the 1980's. Board of Investment (BOI) promotional incentives persuaded toy-makers, amongst many other manufacturers, to relocate or expand their production facilities to the Kingdom to capitalize on reduced corporate taxes and import duties. Asian toy-makers quickly set up production facilities, benefiting from low labour costs in Thailand and GSP privileges available for Thai based toy exporters to the leading markets in the U.S. and Europe. Exports volumes grew quickly, tripling between 1988 and 1991.

Thailand's toy industry is still dominated by foreign investment with the bulk of factories operating as joint ventures between Thais and investors from Hong Kong, Taiwan, South Korea and Japan. Over 450 factories are currently operating in Thailand with a combined total production capacity exceeding 1,000 million pieces per year. The bulk of toy factories in the Kingdom employ the practice of original equipment manufacturing (OEM), finding them producing toys for customers who control the goods design, name and trademark.

1.1.2 The Production Status of Thai Toy Industry.

Thai toy industry was established two decades ago as a cottage industry. At present, there are about 400 toy manufacturers, mainly small-scale operations. Toys produced in Thailand are divided into three main categories namely:

1. Plastic and Metallic toys, accounting for 60 percent of total toy production and 85 percent of total toy export
2. Wooden toys, comprising 10 percent of toy production and 5 percent of total toy export.
3. Cloth toys, which accounts for 30 percent of toy production and 10 percent of total toy exports.

1.1.3 The Structure of Production

The structure of production cost of toys consists mainly of raw materials (35-55 percent) and labour cost (15-30 percent). Most raw materials used for production of wooden toys and cloth toys are sources locally, while those for plastic and metallic toys are mainly imported.

The cost structure of toy production in Thailand also suffers from disadvantages related to raw materials, as producers pay higher than world prices for plastic pellets, due to the government protection of the local petrochemical industry. High-end toy producers in

Thailand must typically import costly plastic pellets, paint, springs, motors, woolen cloth and plastic moulds as local raw materials are not of the highest world standards.

1.1.4 Trade Performance.

Toy exports totaled US$ 229 million in 1999, registering slight growth over 1998, but down 36% over export shipments in 1995. Sales over the first eight months of 2000 remain steady with the volume achieved in the 1999. Approximately 80% of the toys produced in Thailand are made from plastic and metallic materials. The five largest export markets for Thai toys are the United States, Japan, the United Kingdom, Germany and France.

The performance of the toy industry in Thailand of the past decade has been sluggish at best. The export figures had leveled off in the years leading up to the economic crisis, and have declined significantly since 1997 when measured in U.S. dollars. Fierce competition from regional rivals have contributed largely to this situation, with China establishing itself as the center of the global toy production exporting over US$ 18 billion per year and cornering over 60% of the global market. Rising labor expenses in Thailand during the 1990's raised production costs resulting in the relocation of manufacturing facilities to lower cost countries including Vietnam, China, Pakistan, Sri Lanka and Indonesia.

1.1.5 Status of Major Inputs in Thai Toy Manufacturing.

Production cost of the selected Thai Toy industry consists mainly of raw materials and labors cost. The major inputs in light industry manufacturing are the followings: plastic pellets, hides and leather, and rolled steel sheets.

Due to inadequate supplies and low quality of locally produced inputs, the selected light industries rely heavily on imported inputs. LDPE, HDPE, PP, PS and PVC are types of plastic pellets used in production of toys. About 70-80 percent of plastic pellets used in production of the mentioned products are imported.

1.1.6 Markets for Thai Toy Industry Products.

Toy industry products distributed in local markets consist of:
Locally produced products which are mainly low-to-medium quality, low-priced light industrial products using their own brand names. The target group of buyers is low to medium-income earners. Imported products are more expensive and of better quality for serving the high-income earners.

1.2 Statement of the Problem

The Problems that exist in Thailand's toy industry today can be illustrated as follows:

- **Lack of international standards**: In order to suitable for exports contracts and meet new local requirements. Ensuring that practices meet ISO-14000 so that foreign buyers satisfied components and finished toy used will meet international standards imposed on their products at the point entry. Many toy manufactures in Thailand have no international standards.
- **Labour Skill and Training:** Lack of skilled workers in this sector and have effect to defect in manufacturing.

- **Design:** Thai toy industry has less design skills and cannot design new model by themselves. Mostly, Thai toy manufactures made product by foreign design

Other issues of concern were raised as indicated in table 1.1 that were essentially requiring negotiation between industry interests and raw materials suppliers or adoption of improved commercial practices.

Table 1.1: To summarize in Thai toy industry problem.

Item	Issue
Domestic Trade Practices	None identified
Environmental & Recycling	ISO 14000
Export Advice/ Expertise	Dependence upon foreign buyers & brand owners
Finance Access & Cost	Adverse domestic economy (slow pay, bad debts and bankruptcy)
Investment Orientation	None identified
Labour Skill & Training	Lack of skill workers
Management Culture	None identified
Production Economics	High labour cost compared to others
Quality & Standards	Dependence upon buyer
Relativity with other Materials	None identified
Technology Access & Innovation	Dependence upon buyer & brand owner for final order.
Linkage with polymer & Machinery Suppliers	None identified

In order to achieve the key issues as discussed above, the comparison of the company performance with the world leader in toy's manufacturing must be conducted. This is the alternative way to accomplish the manufacturing performance improvement needed. The Benchmarking is the effective approach to these problems.

1.3 Objective of the Study

To improve the competitiveness of Thai toy Industry by using benchmarking as the methodology for seeking the best practices, in terms of manufacturing enhancement for the Thai company in toy industry.

1.4 Scope of the Study

This research has the scope of the study as follows:

1. Aims at improving Thailand's competitiveness on Toy Industry.
2. Focus on Thai manufactures and the benchmarked foreign manufactures of toy industry.
3. Conduct an essential benchmarking research, as an information required for benchmarking.
4. Select the best in class in toy manufactures to be used as the benchmark.

1.5 Study Procedures

There are 8 steps for study procedures as follows:

1. Study the benchmarking process and literature search.
2. Plan benchmarking study.
3. Select the factors to benchmark and the benchmarked company.
4. Collect the data.
5. Analyze the data.
6. Determine benchmarking findings.
7. Develop improvement plans.
8. Write a report.

1.6 Expected Benefits of the Study

The study will be conducted with the purposes of achieving the benchmarking results and bringing the competitive performance improvement needed. The benefits can be illustrated as follows:

- To plan, control and increase competitiveness of the Thai toy Industry.
- To measure Thai performance against competitors.
- To take advantage of new opportunities.
- To improve and encourage Thai toy manufactures.

CHAPTER 2

Literature Review

This chapter is about the theory which using for this research. The theory is composed by the definition of the Benchmarking and the Benchmarking Process. Moreover, this chapter talked about the literature review that concerns with the case study of benchmarking.

2.1 The Definition of the Benchmarking

The American Productivity and Quality Centre (APQC,1993) addresses the key definition of the benchmarking in the Benchmarking Management Guide (1993) as follows:

Benchmark: " A best in class achievement"

Benchmarking Process: The Process of continuously comparing and measuring our organisation with business leaders anywhere in the world to gain information that will help the organisation take action to improve its performance

Critical Success Factors: Those characteristucs, conditions or variable that have a direct influence a customer's satisfaction with specific business process and therefore on the successive entire business.

Best Practices: Leadership, management, or operational methods or approaches that lead to exceptional performance.

Enablers: Those processes, practices or methods that make possible the best in class performance

So, the Benchmarking Methdology is the process of comparing performance with other organisations, identifying comparatively high performance organisations, and learning what it is they do that allows them to achieve that high level of performance or improvement available to the organisations. Benchmarking can be used in conjunction with other improvement tools. They all identify good practices and opportunities that can help improve performance.

However, there are many organisations or person that define the definition of the Benchmarking Methodology.

2.1.1 The American Productivity and Quality Centre (APQC,1993)

Define the benchmarking as " the practice of being humble enough to admit that someone else is better at something, and being wise enough to learn how to match and even surpass them at it".

2.1.2 Gallwey et al (1995)

Presented a technical research paper that described the important role of benchmarking as a part of total quality improvement that gained benefits for the company.

2.1.3 Camp (1989)

Presented that benchmarking is the search for and implementation of best practices. The continuous process of measuring products, services, and practices against toughest competitors or those companies known as leaders.

2.1.4 Crom and Napier (1995)

Presented a technical research paper that described the important role of benchmarking for creating customer value and delivering its value to a marketplace.

2.1.5 Pettersen (1995)

Presented a technical research paper that explained and gave the example of how benchmarking can be used as a tool for problem solving in addition to being a tool for comparison or evaluation. This paper explained that benchmarking could be used as a tool for identifying and analyzing different ways for implementing the chosen product strategy by learning from other organisation in the same situation.

2.1.6 Spendolini (1992)

Defines the benchmarking as "a continuous systematic process for evaluating the products, services, and work processes of organisation that are recognized as representing best practices for the purpose of organisational improvement"

2.2 Types of Benchmarking

2.2.1 The American Productivity and Quality Centre

The American Productivity and Quality Centre (APQC, 1993) defines the types of benchmarking as follows:

1) Internal Studies

   To compare similar operations within different units of an organisation, an example of internal studies is the comparison of production planning approaches, which uses management information systems at various manufacturing sites within a multi-unit business.

2) Competitiveness Studies

   Target specific product, processes or method used by an organisation's direct competitors. This type of study differs from internal studies in terms of the depth of the study. Competitive benchmarking seeks to establish measures or benchmarks rather than specific information about what enabled the degree of performance of the targeted competitor. An example of competitor studies is the comparison of product distribution method used to services a common distribution channel.

3) Functional or Industry Studies

To compare similar functions within the same broad industry or compare organisational performance with that of industry leader. An example of functional studies is the evaluation of supplier management systems from a sample of companies across industry boundaries.

4) Generic Benchmarking

To compare work processes or practices that are independent of industry. This method is the most innovative and can result in changed paradigms for reengineering specific operations. An example of generic benchmarking is the study of bar-coding applications from wide variety of industries (checkout stands at grocery stores) as a PC based inventory control and recording system.

2.2.2 The Types of Benchmarking by Watson

Watson (1992) states that the types of benchmarking as mentioned earlier can be classified, in terms of the goal as follows:

1) Performance Benchmarking: This type of benchmarking measures the performance of one company's products and processes against those of another companies as the competitors or industry leader. Example of the performance benchmarking are the measurement of products, services quality, product features etc.
2) Processes Benchmarking: This type of benchmarking seeks the best practices for conducting a particular business process to improve the key business process.

3) Strategic Benchmarking: This benchmarking focuses on the core competencies that will help sustain competitive advantage; targeting a specific shift in strategy such as developing new products, entering new markets.

2.3 Tools of Benchmarking Methodology.

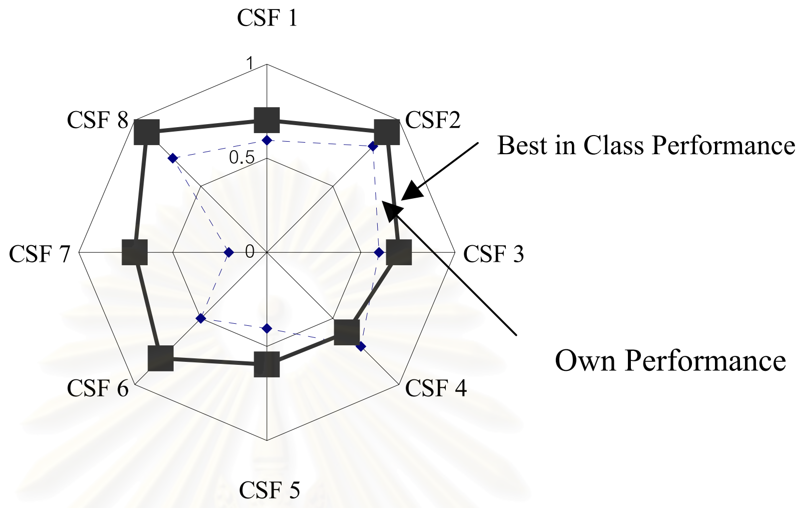
2.3.1 Spider Chart

A Spider is a tool for illustrating one's own performance compared to that of the competitors. It is mainly used for comparing the performance of CFS to the competitors. Additionally, a spider chart is also a useful tool for convincing management about the need for improvement.

Each spoke in the net represents a CSF. The performance level of the CFS is indicated by marking a point on the spoke. The performance level increases with increasing radius. The performance level can be indicated by using a numerical grading system, for instance 1 to 5(where 1 = needs improvement, 5 = world class).

By plotting both sample and competitor's performance profiles, a high illustrative picture of the situation is formed. Based on where the gap to the competitors is largest, the CSF most in need of improvement through benchmarking can be determined. Input for constructing the chart will typically be market surveys or industry statistics.

Figure 2.1: A spider chart



2.3.2 Performance Matrix

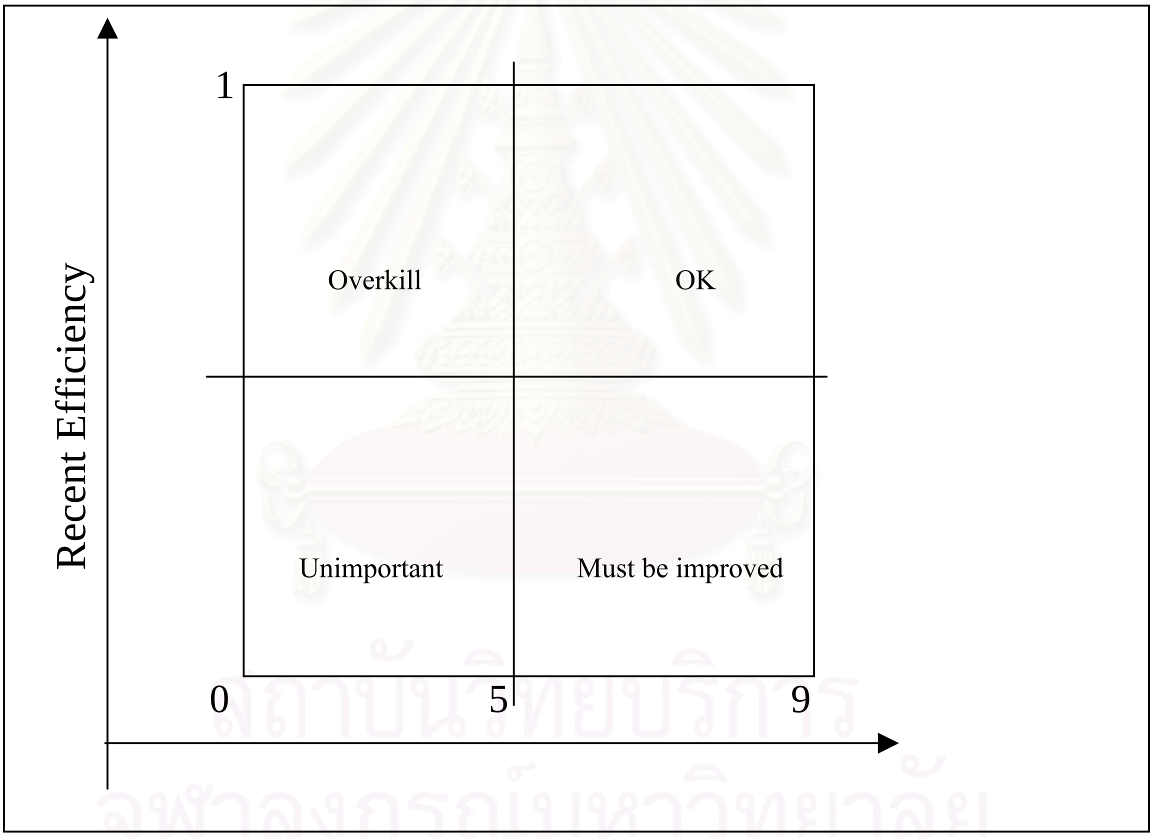
The performance matrix is used to analyse the identified critical success factors according to how important they are considered to be and according to how good the current performance is.

The matrix is divided into 4 quadrants, with importance on the horizontal axis and current performance on the vertical. Each quadrant having the following meaning:

1. Unimportant (low importance, low performance): The current performance is inadequate, but the low importance of the CSF rules out the need for improvements.
2. Overskill (low importance, high performance): The performance is high, but due to the low importance. This is no candidate for benchmarking.

3. Must be improved (high importance, low performance): This is the obvious area to start the benchmarking efforts. The CSF covered by this quadrant are highly important while the performance is less than satisfactory.
4. OK (high importance, high performance): A sound rule of thumb is that also areas where one excels should be made subject to improvements. The CSF in this quadrant might be candidate for benchmarking.

Figure 2.2: Example of a performance matrix



2.3.3 Brainstorming

After identifying and ranking the critical success factors according to importance, the next step is to identify which process influence these CSFs. By using the below chart shown in table 2.1.

Table 2.1: Shown chart for brainstorming

Critical success factors (CSF)	Process that impact the critical success factors
1 Delivery precision	1.1 Inventory control 1.2 Production planning 1.3 Distribution 1.4 Order reception
2.	
3.	

2.3.4 Criteria testing

The identified CSFs are placed in the upper field of the matrix. Each of these is assigned a weight indicating their relative importance. The weights are placed directly below each corresponding CSF. The weight can for example be selected on a 1-3 scale, where 1 = low importance, 2 = medium and 3 = high importance.

Table 2.2: The determine which process has the highest impact on the CSF.

Processes	**CSF**	1	2	3	4	5	Total score
	Weight	3	1	1	3	2	
Process 1		3	1	2	9	4	19
Process 2		9	3	1	3	2	18
Process n		6	2	3	6	6	**26**

The processes identified as having an impact on these CSFs are placed on the left-hand side of the matrix. For each process, that process impact on each of the CSFs is determined. Accordingly, this can be done by using a 1-3 scale, 1= low influence, 2 = medium and 3 = high influence. This factor is multiplied with the weight of the CSF and the product is placed in the matrix cells. The score indicates the impact of each of the processes on the selected set of critical success factor. The higher score a process has achieved the more reason to benchmark this process.

Selecting the process based on the company's main functions. By main factors, we think of marketing, purchasing, R&D, finances, manufacturing. Two question to answer:

1. What functions are considered important to improve?
2. What processes influence these functions?

2.3.5 Matrix for analysis of processes and functions

In the matrix, the functions are placed horizontally and the processes vertically as shown in table 2.3. The analysis is performed by indicating each process' influence on each of the functions, using a symbol that is placed at the intersecting point. Afterwards, the matrix is examined to identify the process with highest overall impact on the set of functions.

Table 2.3: Shown the matrix for analysis of process and functions.

Business processes	**Main functions**					
	Sale	R&D	Purchase			Manu.
Process 1						
Process 2						
Process n						

2.4 Literature Review Related to Benchmarking

2.4.1 Xerox Corporation

The Xerox Corporation is recognized as the leader in the development of benchmarking. Xerox first started to conduct benchmarking in 1979 due to high competitive pressure from Japanese's companies. Xerox focuses on competitive benchmarking. Xerox benchmarked with Japanese companies such as Cannon, and Minolta. This benchmarking focuses on the unit manufacturing costs. In 1982, Xerox benchmarked the logistic and distribution process with L.L. Bean. In1990, Robert C. Camp and his colleagues at Xerox the benchmarking process into a ten-step process.

The Xerox's Ten-Step Process:

<u>Planning Phase</u>

Step 1 Identify benchmark output

Step 2 Identify best competitors

Step 3 Determine data collection method.

<u>Analyzing Phase</u>

Step 4 Determine current competitive gap

Step 5 Project future competitive performance level

<u>Integration Phase</u>

Step 6 Communication of data, acceptance of analysis

Step 7 Develop new goals and functional action plans

<u>Action Phase</u>

Step 8 Implement specific actions

Step 9 Monitor results and report progress

Step 10 Re-calibrate benchmarks

2.4.2 AT&T

In 1987, AT&T started to conduct benchmarking the software development process capability for twenty-five products against the standard industry. AT&T used benchmarking to learn best practices from many companies in order to motivate the performance improvement across diverse organisation (Finnigan, 1996).

The AT&T Bell Laboratories conducted benchmarking to search for the best practices in R&D process by focusing on process innovation and improvement. AT&T established R&D process team to define the benchmarking area of focus as 1) R&D performance 2) R&D technology and process capabilities and 3) R&D management system.

The AT&T's R&D process team focuses on process benchmarking. The R&D process team lists the activities of process benchmarking as follows:

1) Facilitate discussions to establish the scope of effort and develop a project plan.
2) Perform preliminary research to identify important area of focus and potential organisation to benchmark.
3) Assist team members to develop a baseline view of AT&T's R&D process characteristics and performance regarding the focus area.
4) Establish criteria for and assisting team member in the final selection of organisation to benchmark.
5) Perform additional research and arrange direct benchmarking exchanges with the organisation selected.

2.4.3 Shell Oil Company

In 1989 – 1990, The SRI international conducted the benchmarking, for shell Oil Company's operation, for searching the best practices in term of the effective of technical support delivery.

- The SRI 's benchmarking focuses on internal benchmarking for Sell Oil's internal operation and benchmarked with other companies both in the same industry and other industries in term of technical support delivery.
- The benchmarking selected 17 companies in technical support delivery and developed eight factors for success and set them as the baseline for comparison and measurement.
- The benchmarking developed the measurement for each key factor for success. The companies were related for each measurement and ranked on composite scores for each key factor for success.
- Rating was based on SRT interviews at each participating company. The Score rating for each key factor for success.
- Deviations from the norm, strengths and improvement opportunities were identified

2.4.4 Motorola

In 1980, the Motorola started to conduct benchmarking at the Motorola's Bandit plant, fort Baynton Beach, Florida. The benchmarking team at Motorola's Badit benchmarked with other companies such as Honda's just in time manufacturing process and Seiko's robotics techniques, including other Motorola operations computer integrated Manufacturing (CIM) techniques. The result of benchmarking best practices in terms of competitive techniques such as design for manufacture ability, design for assembles. The Motorola is recognized for quality improvement effort because its benchmarking was a powerful tools its improvement process.

2.4.5 General Electric (GE)

GE first conducted benchmarking at GE's appliance plant in Louisville, Kentucky. The study focused on benchmarking input and the plant's own process mapping. The benchmarking results can assist GE's appliance plant at Louisville speed up its manufacturing rate and cut cost.

2.4.6 Kodak

Kodak uses a benchmarking process based on the Rank Xerox methodology. Kodak approaches benchmarking in two ways as follows:

1. To uses the concept of "Kodak Class" representing best practices anywhere within Kodak.
2. To seek best practice and learning from leading companies both within Kodak's industry and also from outside.

Kodak indulges in a wide variety of benchmarking studies to establish benchmarks in key areas, which are critical to Kodak business operations.

2.4.7 IBM

IBM conducted internal benchmarking in 1960. Because of a great of variation in performance among location had occurred.

IBM developed the key measurement indicator for such functions as development engineering, product engineering, quality assurance and personnel. The key measurement indicators are such as new product cycle time, R&D cost per patent etc.

The results of benchmarking assisted IBM in determining the best production processes and adopting the processes as the corporate standard and gained IBM an internal competitive advantage.

2.5 Various Types of Benchmarking Process

Process model for benchmarking varies from company to company. For example, AT&T have a nine-step model, Xerox has ten-step model, Motorola has a five-step model and Florida Power & Light has a seven-step model.

APQC (1993) states that " the number of steps is not as important as the use of integrated, systematic, measured approach to benchmarking.

2.5.1 Xerox's Model

Xerox's Model set up 4 phase and10 steps. For each phase, it has the detail as follows:

<u>Phase 1: Planning Phase composed by</u>

1. Identify benchmarking subject

2. Identify benchmarking partners

3. Determine collection method and collect data.

<u>Phase 2: Analyzing Phase composed by</u>

4. Determine current competitive gap

5' Protected future performance

<u>Phase 3: Integration Phase composed by</u>

6. Communicate findings and gain acceptance.

7. Establish function goals

Phase 4: Action Phase composed by

8. Develop action plans.

9. Implement plans and monitor progress.

10. Recalibrate the benchmark.

2.5.2 Aloca's Model

The Aloca's Model called that the Aloca's Six Step Benchmarking Process Model. This Model has 6 steps as follows:

1. Decide what to benchmark.
2. Plan the benchmark project.
3. Understand your own performance.
4. Study others.
5. Learn from the data.
6. Use the findings.

2.5.3 AT&T's Model

AT&T has 12 steps for Benchmarking Process Model as follows:

1. Determine who clients are.
2. Advance the clients from the literacy stage to the champion stage.
3. Test the environment.
4. Determine urgency.
5. Determine the scope and type of benchmarking needed.
6. Select and prepare the team.
7. Overlay the benchmarking process onto business planing process.
8. Develop the benchmarking plan.
9. Analyze the data.

10. Integrate the recommended actions.
11. Take action.
12. Continue improvement.

2.5.4 Spendolini's Model

Spendolini (1992) states that the benchmarking process consists of five stages as follows:

1. Determining what to benchmark.
2. Form a benchmarking team.
3. Indentify benchmarking partners.
4. Collect and analyze benchmarking information.
5. Take action.

2.5.5 Model of Harrington.

Harrington H.J. and Harrington J.S. (1996) specify the process of benchmarking that consists of 5 phases and 20 steps as follows:

Phase 1 Planning the benchmarking process and characteristics

1. Identify what to benchmark
2. Obtain top management support.
3. Development measurement support.
4. Development data collection plan.
5. Review the plans with location experts.
6. Characterize the benchmark item.

Phase 2 Internal data collection and analysis

7. Collect and analyze internal published information
8. Select potential internal benchmarking site.
9. Collect internal original research information.

10. Conduct interviews and surveys.

11. Form an internal benchmarking committee.

12. Conduct internal site visit.

Phase 3 External data collection and analysis

13. Collect external published information.

14 Collect external original research information.

Phase 4 Improvement of the item's performance

15. Indentify corrective action.

16. Develop an implementation Plan.

17. Gain top management approval of the future

18. Implement the future-state solution and measure its impact.

Phase 5 Continuous improvement

19. Maintain the benchmarking data phase.

20. Implement continuous performance improvement.

2.5.6 APQC's Model

The American Productivity and Quality Centre (APQC,1993) defines the four phases of the benchmarking process models and the five company models as shown below and in Table 2.4.

The Four phases of APQC's Model composed by:

Phase 1 planning a benchmarking project

- Select the process to benchmark.
- Gain participation of the process owner.
- Select the leader for the benchmarking team and identify the team members.
- Identify the process flow and process customers' profiles and set of expectations.
- Analyze process flow and process performance measures.

- Clearly define the process input and output.
- Document and flow diagram the process.
- Select the critical success factors to benchmark.
- Establish data collection method.
- Develop the preliminary questionnaires.

Phase 2 Collection Data

- Collect internal process data.
- Research similar process through secondary sources.
- Identify best in class and potential benchmarking partners.
- Plan data collection.
- Develop survey and interview guide.
- Contact benchmarking partners and gain participation.
- Collect preliminary data.
- Mark on site observation.

Phase 3 Analyzing data for performance gap and enablers

- Organize and reformat the data to permit identification or performance gaps.
- Normalize performance to a common base.
- Compare current performance against the benchmark.
- Identify performance gaps and their root causes.
- Project performance three to five years into the future.
- Develop case studies.
- Isolate process enablers that correlate to process improvement.
- Evaluate the nature of the process enablers and best practices to determine their adaptability to your culture.

Phase 4 Improving by adapting process enablers and best practices

- Set goal to reduce, meet, and then exceed the performance gap.
- Modify process enablers and best practices to meet the company culture and organisation structure.
- Gain acceptance, support, commitment and ownership for changes required.

- Develop action plan.
- Communicate the plan to management for endorsement.
- Commit the resources required for implementation.
- Celebrate the results of the benchmarking project.
- Implement the action plan.
- Monitor and report progress toward the goal.
- Identify opportunities for future benchmarking.
- Recalibrate the measure regularly.

Table 2.4: The Five Company Models (APQC, 1993)

Four-Step Process Model	Plan	Collect	Analyze	Improve
1. Prepare to benchmark 2. Research process 3. Document best practices				
Six-Step Process Model	Plan	Collect	Analyze	Improve
1. Plan 2. Research 3. Observe 4. Analyze 5. Adapt 6. Improve				
Seven- Step Process Model	Plan	Collect	Analyze	Improve
1. Determine functional or process to benchmark 2. Identify key performance variable 3. Identify best in class company 4. Measure performance 5. Compare performance and				

compare group 6. Specify improvement 7. Implement and monitor result				
Eight Step Process Model	Plan	Collect	Analyze	Improve
1. Determine business issue. 2. Define what to benchmark 3. Define benchmark measure 4. Determine who to benchmark 5. Acquire data 6. Compare performance 7. Identify action to close the gap 8. Implement improvement and monitor results				
Ten Step Process Model				
1. Identify process 2. Identify partner 3. Collect data 4. Determine gap 5. Project future performance 6. Gain support 7. Set Goals 8. Develop Plans 9. Implement Plans 10. Recalibrate benchmarks				

2.6 Step of the Benchmarking Process.

Watson (1993) describes the Benchmarking Process as " a pattern that can be used as a guide for defining a business process". The template establishes a general context for developing a process model that indicates the specific sequence of actions required completing the benchmarking process.

2.6.1 Step 1 Determine What to Benchmark

The research study starts with the first step " What to benchmark ". Some experts in benchmarking give the suggestions for the key considerations as " What to benchmark "

Watson (1992) gives the suggestion for selecting " What to benchmark " as to plan the benchmarking study, you need to understand your company's business environment. This helps you identify your key business and where you have problems today. It also helps you develop the parameters that define your choice of what processes to benchmark .

Spendolini (1992) suggests that " developing a benchmarking plan and deciding what to benchmark is the identification of the customer for benchmarking information "

Leibfried et al.(1992) suggest that " benchmarking can be done to establish the function or mission of an organization and how that is reflected in its operations and service and benchmarking can also be used to examine existing practices as it look across the organization to identify the practices that support major processes or critical objectives".

The benchmarking process begins with a clear understanding of the environment, the competitors and the current structures, process and the strategies used by the organization ”

This research study develops the issues for consideration in selecting the factors to benchmark as follows:

1. Understand a view of toy business, missions and objectives.
2. Understand of toy manufacturing.
3. Determine the critical success factors of Toys Business.

2.6.2 Step 2 Determine Whom to Benchmark

In this step, the current research study considers the lists of potential companies used as the benchmark that must be defined. The selection criteria for a company to be used as the benchmark must be first established.

Ransley (1994) suggests the key considerations for selecting the company to used as the benchmark as follows:

1. Start with literature search to help identify partners.
2. Identify other people in the company who have knowledge about best practices company.
3. Ask customers, suppliers, consultants, professionals and associations for information about the Best Practices Company.
4. Limit the numbers of companies to four and eight.

The research study determines the potential companies required to be used as the benchmark in order to search for the one that is superior in both performance and practices and set as the baseline for measuring and improving.

The research study starts with the process of selecting the company to be used as the benchmark as depicted below and shown in figure 2.3 as follows:

1. List potential companies to be used as the benchmark.
2. Develop selection criteria for companies to be used as the benchmark.
3. Conduct future research in addition to preliminary research and on hand information.
4. Rank the potential companies in each of the selection criteria and identify the one with the highest point.
5. Prepare benchmarking questionnaires.

- Identify a list of potential companies to be used as the benchmark.

  The fist step is defined " Where are the company to be used as the benchmark? "and " What companies are possible the best in class in toy manufacturing " The research study will search the potential organizations that can be used as the candidate lists.

- Develop selection criteria for the company to be used as the benchmark. The potential candidate companies to be used as the benchmark are listed. The selection criteria will be established to identify companies with the most potential. The criteria are concerned with the most critical issues and will play an important role in making the suitable selection.

In order to create the criteria to meet the benchmarked company requirements, the carefully established set of selection criteria must be Considered and addressed. The available and useful research support and additional information must be acquired.

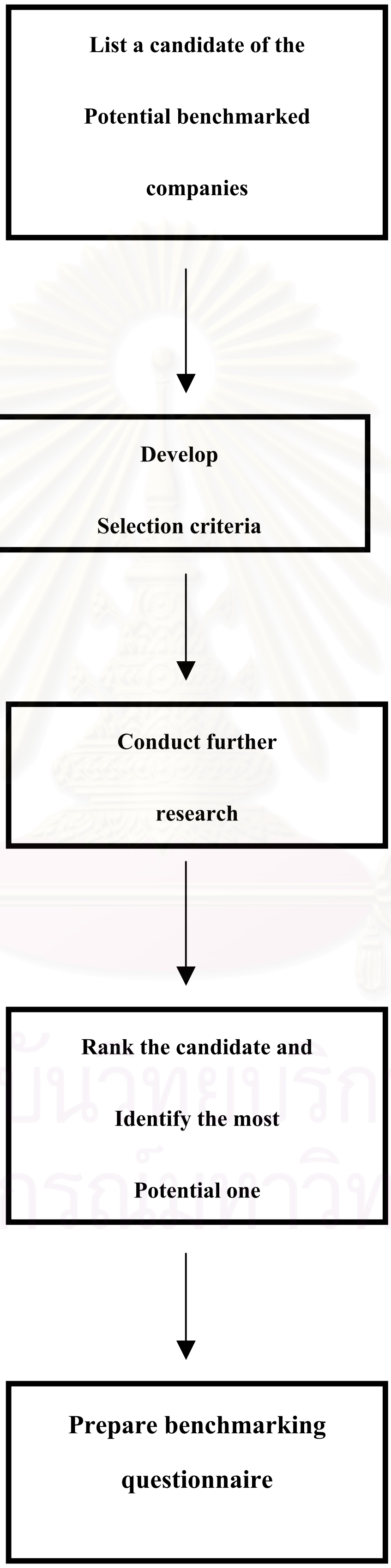
- Conduct further research in addition to preliminary research and on hand information. To ensure that all available information about each company to be used as the benchmark is included and satisfy selection criteria, the additional relational related information must be searched in addition to on hand information.
- Rank the potential companies under each selection criteria an identify the one with the most potential.

The selection criteria matrix was used as a tool for ranking the potential companies and identifying the company with the most potential to be the benchmark. The appropriate company will be selected to conform to the results of ranking performed by selection criteria matrix.

- Prepare benchmarking questionnaire

Once the appropriate company to be used as the benchmark is identified and accepted, the information sharing with the benchmarked company will be needed. The benchmarking questionnaires will then be developed.

Fig 2.3: The Process of Benchmarked Company Selection



- **Develop Selection Criteria**

The research study develops the selection criteria for selecting the company to be used as the benchmark. The research study develops selection criteria matrix in order to rate the candidate companies and find the one with the best score by consulting with the experts in Toy Business both inside and outside of the companies.

The research study conducts literature searches from secondary sources and consult with the toy experts both inside and outside of the company in order to evaluate carefully the potential benchmarked company in order to meet the selection criteria.

The research study assigns the scores for each potential benchmarked company in each selection criterion by evaluating the potential benchmarked company's information and consulting with the experts in toy business both inside and outside of the company.

The selection criteria matrix, the selection criteria, the weighting factors and selecting the benchmarked company are done by the research not the experts. The research carefully select the benchmarked company by consulting with the industrial experts both inside and outside of the companies and evaluating the benchmarked company's information from extensive sources of information.

2.6.3 Step 3 Develop Data Collection Methods

The benchmarking study relies heavily on information required in all phases of the benchmarking process. The research study develops various methods for gathering and obtaining various. Sources of information required. The date collection methods can be facilitated at planning and collecting phase of benchmarking process. The sources of information needed are both primary and secondary sources.

The data collection methods can be classified into the phases of the study and illustrated as follows:

- **Planning Phase**

This phase is concerned with defining and selecting the factors to benchmark including selecting the company to be used as the benchmark.

The data collection methods concerned with planning phase are Primary Sources and Secondary Sources. The research study develops company and customer surveys for use as an effective tool for improvement toy industry competitveness. To define the toy manufactures and toy's customer needs and their expectations from toy manufactures. The critical success factors of toy industry competitiveness will be addressed and defined by the toy manufactures in this stage of surveys through the benefit of planning as " What to benchmark "

- **Collecting Phase**

This phase, the research study will gather and obtain performance data from the benchmarked company in order to compare performance levels. In addition to performance data, collecting such information as internal operations of both companies must be acquired in this phase. The data collection methods concerned with collecting phase are internal source and external source. The research study develops the customer satisfaction surveys in indicating and rating the benchmarked company's performance levels and product level, in terms of satisfaction levels ranked by the customers

In addition to collecting performance data, the research study develops the benchmarking questionnaire that are sent directly to the benchmarked company in order to explore the key current practices performed by the best-in-class company.

2.6.4 Step 4 Develop Benchmarking Plan

The benchmarking plan is developed and set as a guideline document for conducting the benchmarking study. The benchmarking plan contains:

- All phases, steps and activities involved in the benchmarking process
- Demonstrate the allocating schedules requirements for completion of all steps and activities in project milestones dates.

CHAPTER 3

General Profile of the Sample Factory

3.1 Factory Background

At the beginning, this firm was a family enterprise sold plastic products. After that, owner foresaw to plastic product demand especially plastic toy then investor to manufacture toy product type medium grade for sale. Firm was extreme prosperous until its manufacturing capacity was not sufficient to serve marketing demand. Consequently, owners decided to expand their business by increasing capital to buy more new machine. In 1997, there are about 650 employees. Annual sale of 2003 was approximately US $ 12.5 millions. (or 500 million Baht) and has market share in Thailand around 20 % of toy medium grade product.

3.2 Working procedure

The sample factory is the integrated plastic toy production with both domestic and export markets. It was growth from a family enterprise. In the factory procedure study, we can classify main work related to product manufacture into 2 parts, which are:

- Administration part separated into 5 departments, such that:
    - Purchasing department is in charge of buying raw material or some part which not self-production, receive order by phone, and collect many expense and income figures.
    - Distribution department is in charge of delivering product to customers in domestic and to port for exporting aboard.

- Personnel department is in charge of recruiting employees throughout welfare.
- Marketing department is in charge of seeking both domestic and international market.
- Inventory department is in charge of receiving and paying the parts and equipment's according to each department's request, including inventory quantity check. When it is the time to purchase, store will request to purchasing department for next purchase.

- Production department. The sample factory has manager for responding on production and many chiefs' follows his order. This department can be divided into 6 departments:
  - Plastic injection department. This department produces each plastic piece for assembling toy by injection molding according to work order.
  - Assembly Department. Mainly assemble each various pieces together into a set of product. This department can be classified by manufacturing method as the following:

    I. Assembling division. Recent working feature is totally 7 sets of conveyer system in assembly line, which can be divided into 4 main assembly lines and 3 medium assembly lines. Routine manpower will be in charge in each main assembly line, once which medium assembly line is in need then such manpower will be moved from main assembly line automatically. Assembly chief's work is to request various pieces for assembly from stock division to distribute in accordance with flow chart created by engineering department.

    II. Color spray division. This division is in charge of spraying on some piece of product. Ventilation tube is available under and along to their counter for sucking color spray incurred during process. Generally, worker will sit along the assembly line and pick work to spray whereas chief and assistant are preparing material. Sprayed product will be delivered to store for request from assembling division.

III. Color mixing and defect eliminating division. This division is in charge of mixing plastic color before molding work for next assembly step and includes slice the defect, which damaged from injection and assembly.

IV. Quality inspection division. This division is in charge of inspecting product quality in manufacturing process and instant product including raw material or procuring work.

V. Design department. This department is in charge of designing toy throughout determining standard time for assembling product.

3.3 Manufacturing process

In general, plastic toy manufacturing industry operate almost the same process, only some part differ from other, such as, material type, molding size, work pattern. The process of this sample factory includes 7 steps, such that:

- Step 1:Specify product pattern or study product sample from client by separating into both plastic and metal small pieces so that we can plan for ordering raw material such that plastic resin, color powder, metal piece and packaging’
- Step 2: Mix color powder into plastic piece according to formula which be qualified for molding and standard specification.
- Step 3: Inject molding
- Step 4: Inspect the quality of all plastic work
- Step 5: Decorate work
- Step 6:Assemble work
- Step 7: Packaging

3.4 Product type of sample factory

In this study, product of manufacturing factory can be divided into 2 main type such that: car toy type and other toy type

1. Car toy type
    a) Two wheel type
       Motorbike
    b) Four wheel type
       Big grading truck, police car,
       firework truck, dump truck, ambulance car,
       racing car, Grading truck
       Benz car, telephone truck, jeep car
    c) more than four wheel type
       Truck, 10 wheels truck, 18 wheels truck,
       oil truck, gas truck, Coca-Cola truck,
       dump truck, 6 wheels firework truck
2. Other toy type
       Cute duck, guitar, gun,
       pan, pot, slide game,
       windmillll, plane, binoculars,
       tub boat, piano

All these type of toy, we call that Interaction Toy, Educational Toy and Model Toys and to be medium grade toy.

3.5 Present problem of sample factory

Because toy are a consumed goods and the market condition varied to the user demand and fashion. This is caused to continuous change of goods form. Nowadays, producer is turning to emphasis on quality control system management because of internal factory problems and market competition. They are separated according to the problem as the following:

1. Product quality problem

In the assembly process of sample factory has only assembly goods improvement, here, it is found that many products are under quality. Moreover, problems from import ordered parts have wrong specification because it is from historic receive procedure without sampling technique applied. On important cause, it is the part procedure before the assembly line; ex. Plastic string must stripe size process passed by quality of size. It has no smoothness.

This is caused to unable to assembled or assembled but into under quality product.

2. Management problem

In the part, the factory's high administrator seldom accept and ignore an important of quality control system and innovative product, they often emphasized on production quantity, but now they start realizing this system more and more because of increased waste and market competition.

3. Employee problem

There are many employees in this sample factory and often faced employee turnover problem which cause staff lack of skill especially staff in design department. Moreover, they are shortage of conscious mind in quality. From data collected from interviewing staff reveal that most of them do not know what product quality is. Many of them think that defect product is not waste but can be dismantled or adjust for reuse. Consequently, they ignore the quality in the process, which they are being in charge.

4. Marketing Problem

A major problem to the sample factory is competition from lower-cost countries in terms of raw materials and wage rates such as China, Indonesia and India. And, the competitions come from high-tech countries in term of design and technology such as Japan and USA. The sample factory has less price and design competitiveness with these rivals. China, in particular, has abundant labor force, which gives it a competitive edge in labor-intensive products such as plastic toys. China’s lower production cost has prompted several producers to move production base from Thailand to China.

According to problem occurred in sample factory, the main problem is the lack of suit quality control system and design, useless of industry engineering technique, and unstable system of documentary record and any specification. So, the author will use the benchmarking methodology to find the main factor that to impact the competitiveness of this factory and improve the competitiveness by new strategy.

CHAPTER 4

The Competitiveness of Sample Factory

This chapter will discuss the first step of benchmarking project running in the sample factory. This process was chosen to comparison for purpose data to adapt the factory procedure for increasing competitiveness. This research has chosen operation process for comparison by considering to process that impact on performance indicator (PI) competitiveness high importance level and low performance level. Accordingly, it must be able to indicate in priority that which competitiveness PI in factory is high importance level but low performance level. After that, we will be able to consider on which procedure in operation process impact on efficiency level of that PI.

PI is able to class by a critical success factor (CSF) of company. This CSF means the variable that indicates about efficiency in performance and result to the competitiveness level in their organisation.

CSF is able to class in 3 aspects; there are customer, employee and society.

1. <u>Customer aspect</u> is consisted of 3 kinds CSFs, which are Q, C, and D:
   - Q: Quality means something which customer needs or satisfy without harm to society and environment. In manufacturing process should be done in right at first so not need to correct or has defect. This will reduce the manufacturing cost and deliver on time as schedule.
   - C: Cost means expense, which paid to process goods or service. This cost will incur from first step of product design, manufacture, test, until getting the goods and delivery to customer. Cost is consisted of raw material cost, machine cost (overhead cost), and labor cost or wage. For good productivity, we need to reduce cost by emphasising on quality simultaneously. Otherwise, the manufacturing process problem will take

place, for instance, use low quality and price raw material may cause the defect incurred higher cost.

- D: Deliver means to send goods or service to customer according to assigned time which enable them to gain core competency. In order to meet such objectives, company or factory must have their good internal delivery in priority. One possible method is to reduce waste time for delivery, the purchasing department must attempt to supply raw material to manufacturing department on time, however they should not over stock because of inventory cost.

2. Employee aspect consists of 2 kinds of CSF, S and S.
   - S: Safety means the situation without any accident, injury, pain or lost condition, etc. Safety in working situation is the most important thing in manufacturing process running because good working environment will bring good relationship between employer and employee. Employee will have good responsibility and self-conscious throughout reducing manufacturing cost. Company can save the medical fee and compensation, which will increase profit. Safety comes from good environment, standard tool and no careless in working, for instance, no play while working, no drink before or while working.
   - S: Skill means proficiency or expertness of worker, which influence from working environment and will be reflect action to the company successful.

3. Social aspect consist of 2 kinds of CSF, E and E;
   - E: Environment, now is an important because of each countries aim to develop own industry to world market competition. This growth is high impact on environment. Accordingly, in production activity, it must be responding to environment and without damage. When the problem is take place, it will impact on public living quality, ex. Waste water, smog

and garbage. Undamaged production is to increasing more cleanly process and good environmental management. Therefore, cleaning goods and service are lead to increasing product.

- E: Ethic in business by not taking advantage of other:
  1. Not take advantage of customer, such as goods hoarded when it is laciness, low price product but now is quality.
  2. Not take advantage of distributor, such as, price pressed, wrong time paid.
  3. Not take advantage of employee, such as, salary pressed, child labor, working in harm condition.
  4. Not take advantage of stockholder, such as, suppress a real information unpaid share money.
  5. Not take advantage of competitor, such as, bad news released or grafting for customer.
  6. Not take advantage of government, such as, tax evades.
  7. Not take advantage of society, such as, fake advertisement
  8. Not take advantage of environment, such as, make a waste water, toxic air.

Accordingly, QCDSSEE is an important indicator in efficient measurement of organization enterprising. QCD is called quality of product & service (QPS) SSEE called quality of work life (QWL). The next part will discuss on the first step to research.

4.1 Planning and Collected Data Step

When the company headquarters have an idea to apply benchmarking (BM) technique for organization, it has an objective to know real production efficiency level of companies in own network and to keep practical guide way to lift it up. The BM project was established as demonstrate project for experience added to firm staff and a future's way. The administrator decides to start it on the plastic toy manufacture factory as sampled, because in the present day, the industry has more competition. Administrator wants to know own toy factory efficient when compared with other. Performance benchmarking will be a device to tell a real production efficiency level and process benchmarking help to compare for the practice way to lift it up. After that the project started by the first step of BM project in this research was chosen the practice process of sample factory for compared with other. There are recipient and considerate steps.

4.1.1 Choose the practice process to benchmark by PI's efficiency level Consideration.

This research is chosen by considerate on working process that impact to PI's efficient as high importance but low performance. First, we must define that what factory's PI have a high level importance but low performance than other, (consideration device is performance benchmarking) the detail in PI's efficiency level at competitiveness of sample factor are:

4.1.1.1 Assigned a competitiveness performance indicator of sample factory

After the benchmarking project was started in the plastic toy manufacture factory, the administrator set the meeting for explains the project's detail to related person. In the meeting, group's administrator was explained to assign the CSF kind that to be study in project, too. CSF was assigned in 2 kinds, CSF related with customer consists of quality (Q) cost (C) and delivery (D) and employee CSF consist of safety (S) and skill (S). In the reason that CSF related with customer, it has an extremely important to competitiveness level of organization. It was associated with company's vision emphasis on customer and officer satisfied. CSF related with social have an important but it hard to study this data from other. If study this, maybe not have a comparison data. This research is assigning production PI follows CSF kind that customer and employee related.

First step, the author was consisted of sample factory's staff and author co-assigning production PI, classed by CSF kind as follows:

<u>Customer Aspect on Toy Industry</u>

Quality type of CSF, primary specifications of PI for competitiveness are as follows:

- Overall Equipment Efficiency (OEE)
- Defect Percentage
- Claim Percentage

Cost type of CSF, primary specification of PI for competitiveness is as follows:

- Material Yield
- Toy Cost Structure
- Inventory Turnover

Delivery type of CSF, primary specifications of PI for competitiveness are as follows:

- On-time Delivery Percentage
- Production Lead-Time

<u>Employee Aspect on Toy Industry</u>

Safety type of CSF, primary specifications of PI for competitiveness are as follows:

- Accident Frequency Rate
- Accident Violent Rate

Skill type of CSF, primary specifications of PI for competitiveness are as follows:

- Labour Performance
- Toy Design Performance
- Training Rate

After studying toy manufacturing performance of sample factory, the author and factory's staff joint to consider and choose the significant PI of each CSF in order to collect all data and concern with factory's competitiveness. Those PI are as follows:

Customer Aspect on Toy Industry:

Quality type of CSF, PI is as follows:

- Defect Percentage
- Claim Percentage

Cost type of CSF, PI is as follows:

- Toy Cost Structure

Delivery type of CSF, PI is as follows:

- On-Time Delivery Percentage

Employee Aspect on Toy Industry:

Safety type of CSF, PI is as follows:

- Accident Frequency Rate

Skill type of CSF, PI is as follows:

- Toy Design Performance

Team can determine competitiveness performance indicator, then submit all detail to superior of such group for consideration. After approval from superior of group, start collecting data to determine such indicator.

The Detail for calculating each competitiveness performance indicator is as follows:

- % Defect of plastic manufacturing.

is the proportion of defected work weight unqualified from quality manufacturing inspection (waste from manufacturing) and is the proportion in weight of molding work which is rejected from customer to factory because of quality reason divided by total work weight which are manufactured and inspected in quality, derived from

$$\% \text{ Defect} = \frac{\text{No. of Defect}}{\text{Total of Production}}$$

- <u>% Claim or rejected work from customer.</u>

is the proportion in weight of molding work which is rejected from customer to factory because of quality reason, derived from

$$\%\text{Claim} = \frac{\text{Rejected product from customer}}{\text{Total delivery product to customer}}$$

- <u>%On-Time Delivery.</u>

is the proportion of on-time delivery lot which is deliveryed to customer on time as scheduled plan devided by total delivery lot which has to deliveryed to customer as scheduled plan, derived from

$$\%\text{On-Time delivery} = \frac{\text{On-Time Delivery Lot as Scheduled Plan}}{\text{Total Delivery Lot as Scheduled Plan}}$$

- <u>Cost structure</u>

is the structure of of molding manufacturing cost classified into 3 catagories : direct material cost (DM Cost), direct labor cost (DL Cost), and factory overhead cost (FOH Cost) where

Direct material cost includes steel scrap, return scrap, SIMO, sand. It can be represented in term of production cost percentage derived from:

$$\% \text{ DM Cost} = \frac{\text{Direct Raw Material Cost}}{\text{Production Cost}}$$

Direct labour is labour who operate in production line. Direct labour cost is wage and over time spent for such labour. It can be represented in term of production cost percentage derived from:

$$\% \text{ DL Cost} = \frac{\text{Direct Labour Cost}}{\text{Production Cost}}$$

Factory overhead cost is all expense incurred from molding manufacture excluding direct material cost and direct labour cost which equal to production cost deducted by direct material cost and direct labour cost. It can be represented in term of production cost percentage derived from:

$$\% \text{ FOH Cost} = \frac{\text{Factory Overhead Cost}}{\text{Production Cost}}$$

- Accident Frequency Rate

is number of accident and number of injures (frequency) to face accident per 1,000,000 working hour, derived from

$$\text{Accident Frequency Rate} = \frac{\text{Accident Frequency x 1,000,000}}{\text{Working Hour of Direct Labour}}$$

where; working hour of worker means total working hour of direct labour only, and accident frequency means accident caused to stop working only.

- <u>% Toy Design Performance.</u>

is the commercial efficiency and to be the proportion of the revenue from product that design by factory's designer divided by total revenue of company, derived from

$$\text{Toy Designer Performance} = \frac{\text{Revenue from Product that Design by Factory's Designer}}{\text{Total Revenue}}$$

All specified manufacturing type and detail of PI are shown in Table 4.1. Data source for calculating PI are shown in Table 4.2.

Table 4.1: Shown the detail of Performance Indicator (PI) for the toy's manufacturing.

CSF	PI	Level	Unit	Frequently
Quality	% Defect	Low	%	Yearly
	% Claim	Low	%	Yearly
Cost	Cost Structure	Normative	%	Yearly
Delivery	% On-Time Delivery	High	%	Yearly
Safety	Accident Frequency Rate	Low	%	Yearly
Skill	Toy Designer Performance	High	%	Yearly

Note: 1) High level means highest value is best data.

2) Low level means lowest value is best data.

Table 4.2: Shown the source of data for calculates PI

PI	Detail of formulation	Source of data (Department)
% Defect	No. of Defect	QC
	No. of Production	Production
% Claim	No. of Product Return (Claim).	QA
	No. of Finish Goods	Inventories Store

Table 4.2: Shown the source of data for calculates PI. (Continued)

PI	Detail of formulation	Source of data (Department)
% On-Time Delivery	No. of lot as scheduled plan	Inventories Store
	No. of Lot as scheduled on time	Planning
Cost Structure	Direct Material Cost	Accounting
	Direct Labour Cost	Accounting
	Over Head Cost	Accounting
Accident Frequency Rate	No. of Accident	Planning
	Working hour of direct labour	Personnel
Designer Performance	Revenue from product that design by factory's designer	Accounting
	Total Revenue	Accounting

After each PI and data source specification, next procedure is to collect data for determining such these PI value.

<u>Information system for determining the manufacturing PI of sample factory</u>

After PI specification for collecting data, next procedure is to determine such PI value. To derive PI value needs to collect data for calculating and concluding PI represented recent manufacturing efficiency level in sample factory. It includes that to analyze and conclude the monthly operation report for manager and others in order to enhance their working management appropriately.

To analyze data conviniencely, accurately, and checkability causes to design the document and information system for collecting data to determine PI of sample factory as the follwing :

1) Internal Documentary for recording daily manufacture and other related data.
2) Yearly report of manufacturing efficiency.

The detail of information system has been shown as the following:

1) Internal Documentary

Various documents to collect data for specified efficiency indicator analysis includes document sheet as the following:

- Manufacturing report sheet
- Plastic injection division
- Assembly division
- Color mixed and waste sliced division
- Quality inspection report sheet
- Raw material consumption sheet
- Return scrap summary sheet
- Work in process summary sheet
- Inventory stock report sheet
- Design report sheet

The detail of each division concerned to such document sheet is in Table 4.3 as the following:

Table 4.3: The Document Sheet for PI Calculation.

Document	Document issued division	Document submitted division
1. Raw material request sheet	- Manufacturing Division	- Manufacturing Division - Planning and Inventory division
2. Manufacturing report sheet	- Manufacturing Division	- Manufacturing Division - Planning and Inventory Division
3. Raw material report sheet	- Manufacturing Division - Planning and Inventory Division	- Manufacturing division - Planning and Inventory Division - Accounting Division
4. Scrap report sheet	- Manufacturing division	- Manufacturing Division

Table 4.3: The Document Sheet for PI Calculation. (Continued)

Document	Document issued division	Document submitted division
5. WIP report sheet	- Manufacturing division - Panning and Inventory Division	- Manufacturing Division - Planning and Inventory Division - Accounting and financial division
6. Inventory weight report sheet	- Manufacturing Division	- Manufacturing Division - Planning and Inventory Division - Accounting Division
7. Design report sheet	- Manufacturing division - Panning and Inventory Division	- Manufacturing Division - Planning and Inventory Division - Accounting Division

2) Yearly report of manufacturing efficiency

In each day, staff who is in charge of checking the accurate data recorded in each sheet will check data accuracy and correct it immediately in case of mistake available before transferring to person who is in charge of inputting into database in order to record all data from record sheet into database system. At the end of month and year, these data will access all performance activities to represent the efficiency level of each division in monthly and yearly report. There are many related information as follows:

- Raw material request sheet.
- Manufacturing report sheet.
- Raw material consumption sheet.
- Return scrap summary sheet.
- Design summary sheet.

There are 3 sources of return scrap for recycle purpose:

- From injection and assembly line division.
- From defect which is waste work in the process.
- From customer claim.

Manufacturing division will record these return scrap data for accounting and financial division to input to database.

- Work in process summary sheet.

At the end period of account, staffs have to check and summary total inventory in production line for accounting and financial division.

- Inventory stock report sheet.
- Yearly Revenue.

Once work part gets done from entire production line, they will be shift to keep in store and recorded the weight by staff.

After recording all required data into database by staff at the beginning of month, PI value of each part will be concluded and shown in monthly report for manager and related person as the follow details:

4.1.1.2 Efficiency level of manufacturing efficiency indicator of sample factory

All 6 PI indicator are available in this research which all indicator represent competitiveness performance of sample factory as follows:

- %Defect
- % Claim
- %On-Time Delivery
- Cost Structure
- Accident Frequency Rate
- % Toy Design Performance

At the ending period (the end of year), information division will collect and conclude manufacturing information of each division in database to write the manufacturing operation report of factory.

This research collects data and detail of efficiency indicator in each division for many continouse month to calculate the average figure. Such figures are representative in efficiency level PI of sample factory. The purpose to collect data for many months is to study the deviation and accurancy of data calculated such PI figure. It can be concluded as follows:

- % Defect

The 5 years data and detail related to analysis is shown in table 4.4.

Table 4.4: Shown the calculation of % defect

(Unit : pcs)

Year		**2002**	**2001**	**2000**	**1999**	**1998**
Production	Local	896,000	845,700	995,850	1,046,300	1,195,300
	Export	2,788,000	2,739,650	2,488,250	2,340,125	2,760,750
	Total	3,684,000	3,585,350	3,484,100	3,386,425	3,956,050
Defect	Local	17,915	21,238	28,745	25,297	18,040
	Export	101,515	84,490	101,909	115,239	132,290
	Total	119,430	106,187	130,654	140,536	150,330
% Defect	Local	2.0 %	2.51 %	2.89 %	2.42 %	1.51 %
	Export	3.64 %	3.08 %	4.10 %	4.92 %	4.80 %
	Total	3.24 %	2.96 %	3.75 %	4.15 %	3.80 %

The percentage of defect for each year can calculate as follows:

The first year:

$$\% \text{ Defect} = \frac{17915}{3684000} = 3.24\ \%$$

The second year:

$$\% \text{ Defect} = \frac{106187}{3585350} = 2.96\ \%$$

The third year:

$$\% \text{ Defect} = \frac{130654}{3484100} = 3.75\ \%$$

The fourth year

$$\% \text{ Defect} = \frac{140536}{3386425} = 4.15\ \%$$

The fifth year:

$$\% \text{ Defect} = \frac{150330}{3956050} = 3.80\ \%$$

From table 4.4 we can take the above data to plot % Defect's chart as shown the below figure:

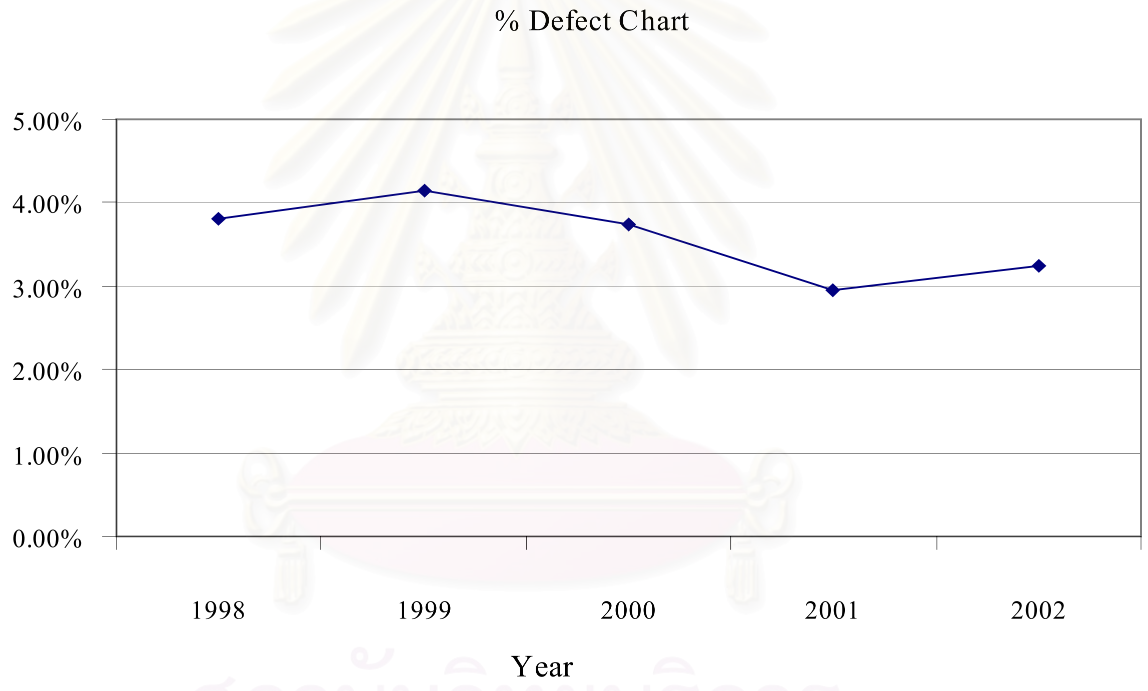


Figure 4.1: Shown % Defect Chart

From table 4.4 we can find the average of % Defect's sample factory. So, We can conclude that the average of % Defect in the 5 years is 3.58 % .

- % Claim

The 5 years data and detail related to analysis is shown in table 4.5

Table 4.5: Shown the calculation of % Claim

(Unit: pcs)

Year		2002	2001	2000	1999	1998
No. of Finish Goods	Local	1,044,000	507,510	820,775	577,060	711,410
	Export	2,436,000	2,477,840	2,462,325	2,308,245	2,845,640
	Total	3,480,000	2,985,350	3,283,100	2,885,305	3,557,050
	Total	9.00 %	8.47 %	9.33 %	10.50 %	5.35 %
No. of Product Return (Claim).	Local	37585	35400	61265	51503	13320
	Export	275615	217460	245050	251457	176982
	Total	313200	252860	306315	302960	190302
% Claim	Local	3.6 %	6.97 %	7.46 %	8.93 %	1.87 %
	Export	11.31 %	8.78 %	9.95 %	10.90 %	6.21 %
	Total	9.00 %	8.47 %	9.33 %	10.50 %	5.35 %

The detail of % Claim's Calculation as follows:

The first year:

$$\% \text{ Claim} = \frac{313200}{3480000} = 9.00\ \%$$

The second year:

$$\% \text{ Claim} = \frac{252860}{2985350} = 8.47\ \%$$

The third year:

$$\% \text{ Claim} = \frac{306315}{3283100} = 9.33\ \%$$

The fourth year:

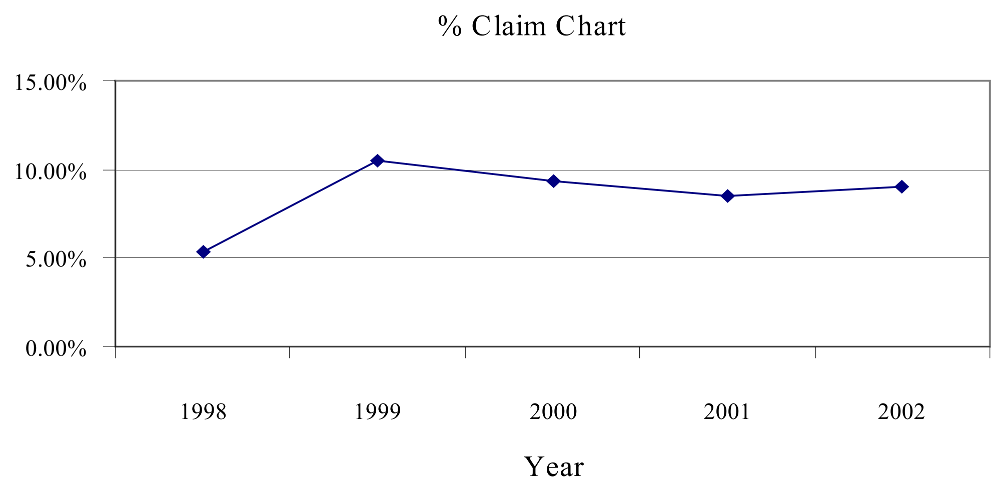
$$\% \text{ Claim} = \frac{302960}{2885305} = 10.50\ \%$$

The fifth year:

$$\% \text{ Claim} = \frac{190302}{3557050} = 5.35\ \%$$

From the table 4.5, we can take the above data to plot %Claim's chart as shown the below figure:

Figure 4.2: Shown % Claim Chart



From the table 4.5, we can calculate the average of % Claim's sample factory. So, We can conclude that the average of % Claim in the 5 years is 8.53 % .

- Cost Structure

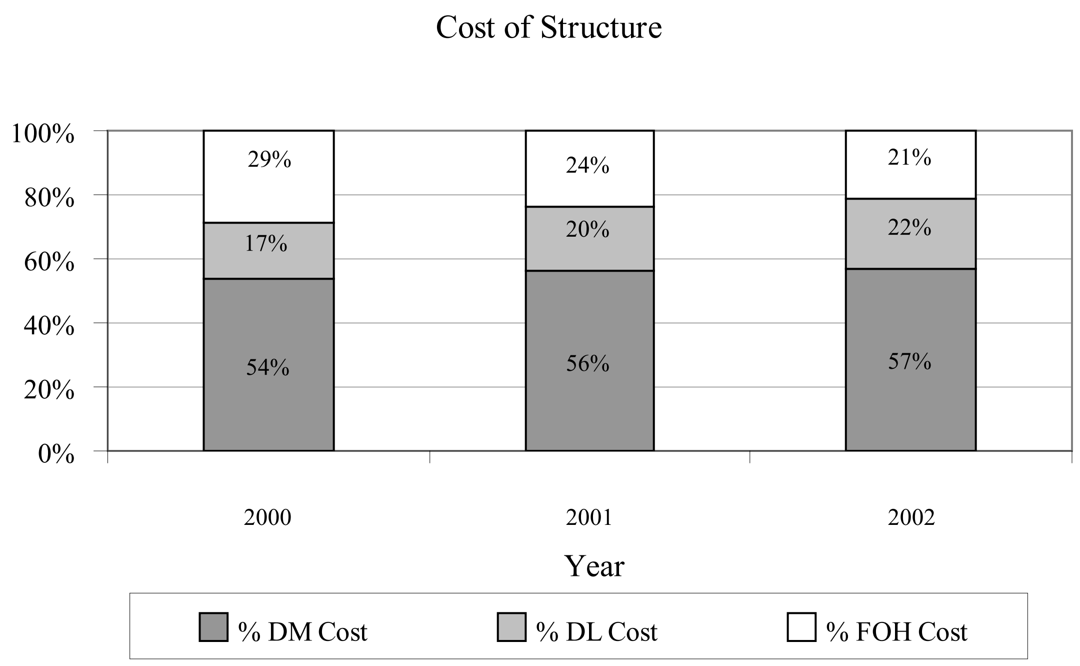
Because of data of cost structure is the confidential data. The Sample Company cannot give the expense of cost structure's data. The Sample Company just gave the percentage of cost structure for 3 years only. The 3 year's data and detail related to analysis is shown in table 4.6.

Table 4.6: Shown the cost structure data

Year	2002	2001	2000
% DM Cost	57 %	56 %	54 %
% DL Cost	22 %	20 %	17 %
% FOH Cost	21 %	24 %	29 %
Total	100 %	100 %	100 %

From table 4.6, we can take the above data to draw the cost structure as shown the below figure

Figure 4.3: Shown the Cost Structure



From table 4.6, we can conclude that the cost structure of the sample company in the past 3 years as follows:

DM Cost = 55.67 %

DL Cost = 19.67 %

FOH Cost = 24.66 %

- % On-Time Delivery

The 5 years data and detail related to analysis is shown in table 4.6.

Table 4.7: Shown the calculation of % On-Time Delivery

(Unit:Times)

Year		2002	2001	2000	1999	1998
No. of Lot as scheduled plan	Local	970	950	930	1150	1200
	Export	138	143	139	114	120
	Total	1108	1093	1069	1264	1320

Table 4.7: Shown the calculation of % On-Time Delivery. (Continued)

(Unit:Times)

Year		2002	2001	2000	1999	1998
No. of Lot as scheduled on- time.	Local	965	937	930	1145	1193
	Export	120	131	130	102	102
	Total	1085	1068	1060	1247	1295
% On-Time Delivery	Local	99.45 %	98.63 %	100.00 %	99.56 %	99.42 %
	Export	86.96 %	91.61 %	93.53 %	89.47 %	85.00 %
	Total	97.92 %	97.71 %	99.16 %	98.65 %	98.11 %

For each year, the percentage of the On-Time Delivery can calculate as follows:

The first year:

$$\% \text{ On-Time Delivery} = \frac{1085}{1108} = 97.92\ \%$$

The second year:

$$\% \text{ On-Time Delivery} = \frac{1068}{1093} = 97.71\ \%$$

The third year:

$$\% \text{ On-Time Delivery} = \frac{1060}{1069} = 99.16\ \%$$

The fourth year:

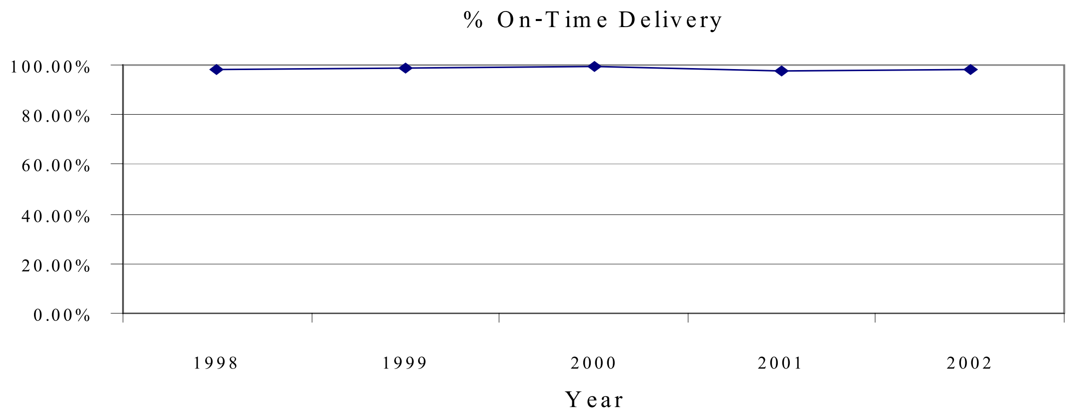
$$\% \text{ On -Time Delivery} = \frac{1247}{1264} = 98.65\ \%$$

The fifth year:

$$\% \text{ On-Time Delivery} = \frac{1295}{1320} = 98.11\ \%$$

From table 4.7, we can take the above data to plot % Defect's chart as shown the below figure:

Figure 4.4: Shown % On-Time Delivery



From table 4.7, we can calculate the average of % Locally On-Time Delivery's sample factory. So, we can conclude that the average of % On-Time Delivery in the 5 years are 93.31 %

- The Accident Frequency Rate.

The 5 years data and detail related to analysis is shown in table 4.8

Table 4.8: The calculation of the Accident Frequency Rate.

Year	2002	2001	2000	1999	1998
No. of employee in the production line	650	500	527	510	670
Working Hour (hrs)	41440.4	25550.2	39957.8	34437.6	42235.7
No. of Accident (times)	0	1	0	0	1
Accident Frequency Rate. (times per 1 million working hrs)	0	39	0	0	24

The detail of the Accident Frequency Rate's Calculation as follows:

The first year:

$$\text{The Accident Frequency Rate} = \frac{0 * 1000000}{41440.4} = 0 \text{ times}$$

The second year:

$$\text{The Accident Frequency Rate} = \frac{1 * 1000000}{25550.2} = 39 \text{ times}$$

The third year:

$$\text{The Accident Frequency Rate} = \frac{0 * 1000000}{39957.8} = 0 \text{ times}$$

The fourth year:

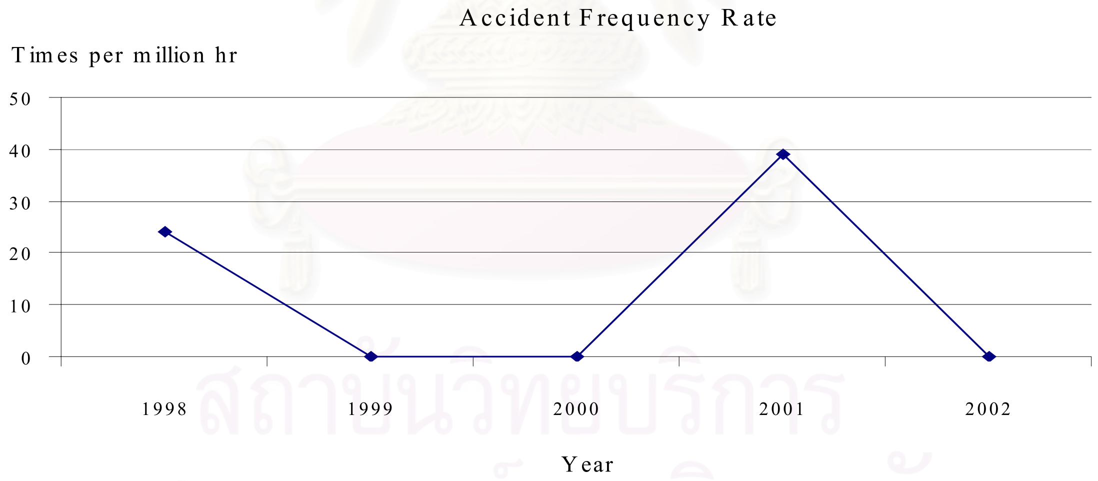
$$\text{The Accident Frequency Rate} = \frac{0 * 1000000}{34437.6} = 0 \text{ times}$$

The fifth year:

$$\text{The Accident Frequency Rate} = \frac{1 * 1000000}{42235.7}$$

We can take the above data to plot the Accident Frequency Rate's chart as shown the below figure:

Figure 4.5: The Accident Frequency Rate's chart.



From table 4.8, we can conclude that the average of Accident Frequency Rate of the sample factory is 13 times per 1 million working hours within 5 years.

- Toy Design Performance

Because the sample factory has never recorded the related data for toy design performance indicator before, data collection therefore needs to start collecting at the beginning step and enable to collect only 3 years as the following:

Table 4.9: The calculation of % Designer Performance.

Year		2002	2001	2000
Revenue from product that design by factory's designer ('000 US$)	Local	810	720	1,200
	Export	1,200	1,655	2,225
	Total	2,010	2,375	3,425

Table 4.9: Shown the calculation of % Designer Performance. (Continued)

Year		2002	2001	2000
Total Revenue **('000 US$)**	Local	3,600	3,700	4,075
	Export	8,800	9,000	12,225
	Total	12,400	12,700	16,300
% Toy Design Performance	Local	22.5 %	19.4 %	29.4 %
	Export	13.6 %	18.4 %	18.2 %
	Total	16.2 %	18.7 %	21.0 %

The detail of % Designer's Calculation as follows:

The first year:

$$\text{\% Toy Designer Performance} = \frac{2010}{12400} = 16.20\ \%$$

The second year:

$$\text{\% Toy Designer Performance} = \frac{2375}{12700} = 18.7\ \%$$

The third year:

$$\text{\% Toy Designer Performance} = \frac{3425}{16300} = 21.0\ \%$$

From table 4.9, we can take the above data to plot % Designer Performance's chart as shown figure in the next page.

Figure4.6: Shown the toy design performance.

From table 4.9, we can conclude that the average of toy design performance percentage is 18.67 % within 3 years.

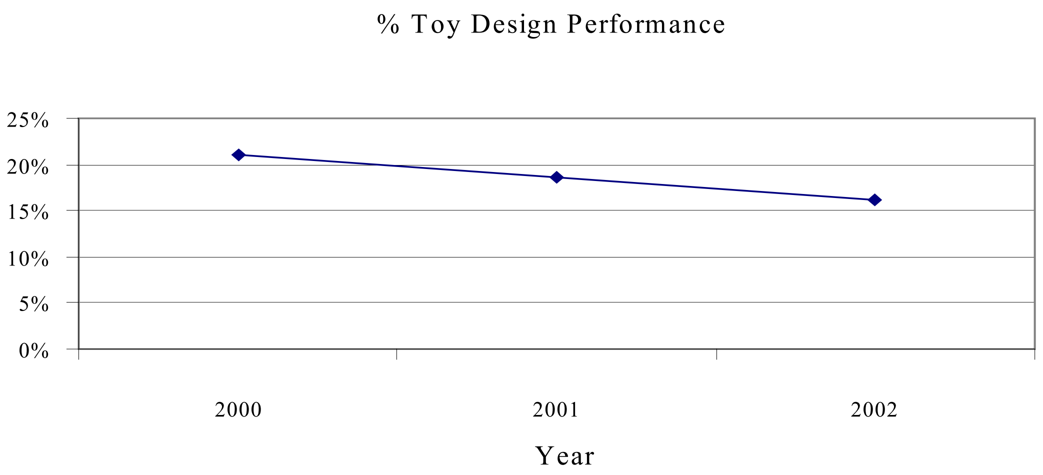


Table 4.10: The results of the Performance Indicator's the sample manufactures.

Performance Indicator (PI)		**Results**		
		Local	**Export**	**Average**
% Defect		2.27 %	4.11 %	3.58 %
% Claim		5.77 %	9.43 %	8.53 %
Cost Structure	DM Cost	55.67 %		
	DL Cost	19.67 %		
	FOH Cost	24.66 %		
% On- Time Delivery		99.42 %	89.31 %	93.31 %
Accident Frequency Rate		13 times per 1 million working hours.		
% Toy Design Performance		23.76 %	16.70 %	18.67 %

When derived competitiveness PI figure of sample factory, next procedure is to indicate each PI efficiency level of sample factory compared to other factory in the same industry.

At the recent, there is no any institute in Thailand to collect the competitiveness level in this industry therefore standard index is not available for benchmark. Consequently, this research creates questionnaire to interview 40 factories where operate in the same plastic toy manufacturing industry. The objectives are to ask for PI figure of each specified aspects including to survey opinion about the significant level of each PI which effect to management in their organization and to compare resulting PI with sample factory. This enables to indicate the significant and efficiency level of PI in sample factory which efficiency level the firm is, compare to other organization in this field. Moreover it enables to indicate that which manufacturing PI is high importance but low performance level. Such PI figure will be used to select operation process which will be for benchmark accordingly.

This questionnaire conprise of 3 parts as follows: (See sample in Appendix A)

1) General data of factory, such as:
   - Employee number
   - Type of Plastic Molding.
   - Average manufacturing capacity per year
   - Toy Product
   - Raw material type
2) Description about:
   - Meaning of each PI and formular
   - Meaning of the significant level of specified PI
3) Question about all specified PI in each part that each PI is comprised of 3 questions aimed to

- Ask for opinion about the significant of such PI which effect to their firm.

There are 9 significant level as the following:

Level 1 means insignificant at all
Level 2 means significant between level 1 and 3
Level 3 means not really significant
Level 4 means significant between level 3 and 5
Level 5 means significant
Level 6 means significant between level 5 and 7
Level 7 means very significant
Level 8 means significant between level 7 and 9
Level 9 means extremely significant

- Ask for each PI figure in that factory
- Ask for opinion that which level the best and practical PI figure in plastic toy manufacturing industry generally should be.

In part 3 of questionnaire ask for the significant level of each PI including each PI figure of each factory and opinion about the best and practical efficiency level of each PI which can be concluded as the following:

From questionnaire distributed to each factory reveal that all 6 competitiveness performance indicators, most factory replied questionnaire did not fill in the data of toy cost structure and accident frequency rate. They gave the reason that they have never kept such records therefore we are not able to benchmark the efficiency level of manufacturing PI in sample factory and other factory with this 3 aspects. So this research will benchmark the efficiency level of only 4 competitiveness PI which most factory response. It comprises of the following:

- Defect
- Claim
- On-time delivery
- Toy Design Performance

Detail of 4 competitiveness PIs in questionnaire are as the following:

- The significant level of 4 competitiveness PI

Surveying result from questionnaire, which distributed to related person and have the authority in manufacture in each factory, and bring to conclude with opinion from related person of sample factory. It can derive the significant level of each PI which received from

- Distributed questionnaire to other 40 factories which they response back all 32 factories.
- Staff in sample factory includes of manufacturing manager, accounting financial and information manager, manufacturing planning and inventory chief and assistant, quality assurance chief and assistant, engineering chief and assistant.
- Researcher

Data and result have in detail as the following:

Table 4.11: The Significant Level of Defect.

Significant Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	1	1	4	**4**	**19**	2	0

From table 11, we will select the significant level, which is the mode of all resulting data. We conclude that defect is significant to competitiveness of toy industry is level 6.

Table 4.12: The Significant Level of Claim.

Significant Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	3	2	4	3	**15**	5

From table, we will select the significant level, which is the mode of all resulting data. We conclude that claim is significant to competitiveness of toy industry is level 8.

Table 4.13: The Significant Level of On-Time Delivery.

Significant Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	0	0	3	3	**14**	12

From table 4.13, we will select the significant level, which is the mode of all resulting data. We conclude that On-Time Delivery is significant to competitiveness of toy industry is level 8.

Table 4.14: The Significant Level of Toy Design Performance

Significant Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	0	0	0	3	7	22

From table 4.14, we will select the significant level, which is the mode of all resulting data. We conclude that toy design performance, which is significant to competitiveness of toy industry, is level 9.

The result can be concluded in table as the following:

Table 4.15: The significant level effected all 5 competitiveness PI for toy business.

Manufacturing Performance Indicator	Significant Level
Defect	7
Claim	8
On-Time Delivery Percentage	8
Toy Design Performance	9

- 4 competitiveness PI figures of other toy factory.

4 competitiveness PI figures which most of factory reply can be concluded in comparative table as the following:

Table 4.16: Comparison matrix between sample factory and other factory

Factory / PI	Sampling Factory	A	B	C	D	E
Defect (%)	3.58	2.0	3.0	1.5	5.0	4.0
Claim (%)	8.53	5.5	6.0	5.2	2.3	7.5
On-Time Delivery Percentage (%)	93.31	94.2	97.5	88.7	95.2	97.4
Toy Designer Performance (%)	18.67	42.0	32.3	43.5	51.0	25.7

The result from table can be determined each average PI figure for this average industrial index which may be used to compare roughly with sample factory's figure as shown in table 4.17

Table 4.17: The average of competitiveness PI index.

PI	Sample factory	Average Competitiveness PI
Defect (%)	3.58	3.1
Claim (%)	8.53	5.30
On-Time Delivery (%)	93.31	94.6
Toy Designer Performance (%)	18.67	38.9

- The Best Significant Level of each PI

Questionnaire in last part of each PI is to interview opinion about the best and practical significant level of each PI, which is to test the understanding of interviewee upon each PI. The result will not be adopted in this research. The best and practical significant level of each PI is shown in table 4.18.

Table 4.18: The Best Significant Level of each PI from Questionnaire.

Factory / PI	Sample Factory	A	B	C	D	E
Defect (%)	< 2.5	1.0	2.0	1.0	3.0	<4
Claim (%)	< 7.0	5.0	4.0	< 5.0	1.5	5.0
On-Time Delivery (%)	100	100	99.0	90	100	>90
Toy Designer Performance (%)	> 20	50.0	> 30	-	>50	-

It can be rearranged the figure into interval of significant level of each PI as shown in table 4.19.

Table 4.19: The Best Significant Interval level of each PI from Questionnaire.

Manufacturing Performance Indicator	The Best Significant Interval Level
Defect (%)	1.5-4
Claim (%)	1.5-10
On-Time Delivery Percentage (%)	90.0 – 100
Toy Designer Performance (%)	15-55

After analyzing all data from questionnaire, next procedure is to indicate the significant level of each PI in sample factory compared with average industrial index by Measure-Matrix-Diagram (M^2-Diagram) which derive the figure from Comparison Matrix for assessment. The resulting figure range between 0 and 1. To construct M^2-Diagram has detail as the following:

- Classify all 3 PIs as
  1. The lowest is the best as %Defect and % Claim
  2. The highest is the best as %On-time delivery and %Toy Design Performance.
- Interpolate each PI figure into 0.0-1.0 range by
  - The lowest is the best type that can be calculated by Benchmark / Indicator
  - The highest is the best type that can be calculated by Indicator / Benchmark

The resulting figure are shown in the follow table:

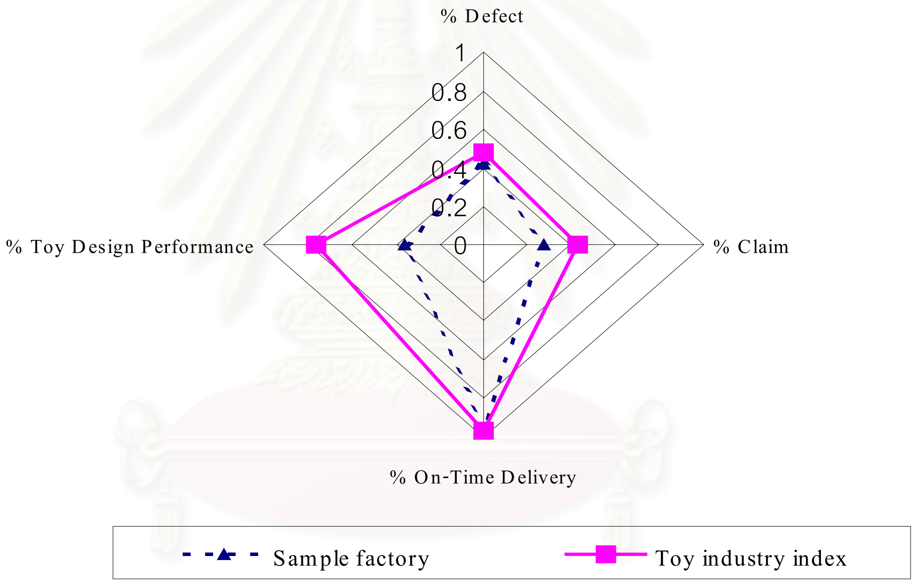
Table 4.20: The M^2-Diagram (Measure-Matrix Diagram).

PI	Type	Benchmark Value	Sample factory	Average Industrial Index
Defect (%)	Low	1.5	1.5/3.58 = 0.42	1.5/ 3.1= 0.48
Claim (%)	Low	2.3	2.3/8.53 = 0.27	2.3/5.30 = 0.43
On-Time Delivery (%)	High	97.5	93.3/97.5 = 0.96	94.6/97.5 = 0.97
Toy Design Performance (%)	High	51.0	18.7/51.0 = 0.36	38.9/51.0 = 0.76

Remark: Benchmark Value comes from the best PI value each factory.

After deriving data in the above table, next procedure is to apply such information in spider chart, which compare the efficiency level of each PI in sample factory with average industrial index. Coordinate represents each PI figure on chart axis; the fairer from centre the better efficiency level of such PI. The resulting chart is shown in figure 4.7

Figure 4.7: The Measure-Matrix Diagram of sample factory compare with average toy industrial index.



From figure 4.7, we can see that sample factory has somewhat low performance level of % Defect, % Claim and Toy Design Performance. Consequently, to select 3 indicators for benchmark should be focus to these PI in priority. However to select which PI figure as first priority for benchmark needs to consider the efficiency level of that PI together with the significant level of PI effected to company performance as well. The way is to construct the performance matrix from efficiency level and significant level of each PI. This performance matrix is tool for considering and selecting PI as benchmark.

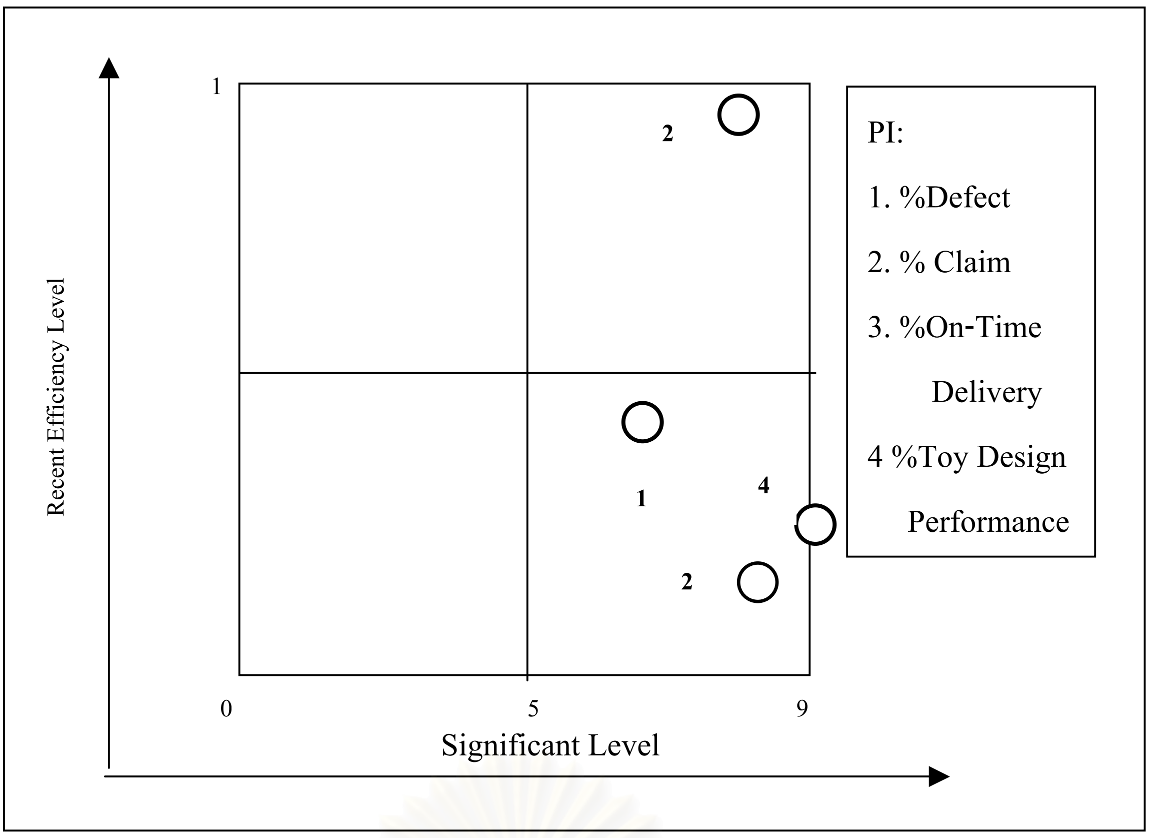
The efficiency level and significant level figure of 4 PIs in sample factory are shown in table 4.21.

Table 4.21: The Efficiency Level and Significant level of PI in sample factory.

PI	Significant Level	Efficiency level
Defect	7	0.42
Claim	8	0.27
On-Time Delivery	8	0.96
Toy Designer Performance	9	0.36

The figure in above table can be constructed Performance Matrix as Figure 4.8.

Figure 4.8: The Performance Matrix PI in sample factory



From chart in figure 4.8 show that point 1 (%Defect), point 2 (%Claim) and point 4 (%Toy Design Performance) fall in the fourth quadrant of graph means that they are PI which should be benchmark in priority. This research chooses % Toy Design Performance in first priority for benchmark because it is low performance level and the highest importance level. However, the author chooses % Claim and % Defect in second priority for benchmark because it is low performance and high importance and might impact to company's competitiveness also.

When we can to conclude that what PI of factory has high importance level while low performance level, next step is to considerate that what process have effect to efficiency level of defect, claim and toy design performance. This considerate will use brainstorming from many staff of factory, to considerate that what practice process will chosen to compared with benchmarking partner. These are for keep a purpose data to adapt and change working method for claim's efficient lift up. Details for consideration are as follows:

4.1.1.3 Comparison process chosen

From the efficiency level comparison of competitiveness performance indicator of factory, it is found that the defect, claim and toy design performance were PI which low performance level and should be adjusted. Next step of benchmarking project, it is running is to considering that what process impacts on defect, claim and toy design performance's level. Take this process to compare with benchmarking partner which how it is different. Therefore, keep a purpose data to adjust the process for lift those PI's efficiency level up. The process was considered by brainstorming method from factory's staff.

- Manufacturing Manager.
- Accounting, Financial and Information Manager.
- Personnel Manager.
- Engineering Chief.
- Toy Designer Chief.
- Quality Assurance Chief.

In the consideration will consider from many process which maybe claim impacted. The process was considerate as follows:

- Customer demand.
- Product quality inspection.
- Manufacturing Process.
- Quality Control.
- International Standard Adopted on Toys.
- Skill of Toy Designer.

After each process was considerate, this sample concludes that;

- Raw material quality approves and production procedure. Even though, it maybe causes to toy design procedure but the toy designer can choose the specification of raw material before designing by themselves. This process is not related with toy design performance level.
- QC process is a directly relate with crack detected. This process is the end of toy production. So, This process is not related with toy design performance level but **related with defect and claim percentage of the sample factory.**
- Manufacturing Process. This sample factory is a family company and has operated for 20 years ago. Some machinery in this factory has used more than 10 years. **Hence, manufacturing process is related with defect and claim of this factory.**
- International Standard Adopted on Toys is a directly relate with claim percentage. In the present, there are 4 mains international standard adopted on toy manufacturing. The American Society for Testing and Materials (ASTM) and the Consumer Product Safety Commission regulate the quality of imported toys and those sold in the US. EN-71 is the law concerning safety standards of toys imported to or sold in the EU. Safety Standard Mark (ST Mark) is the certification of toy safety standard adopted by Japan. Australia Toy Safety Standard is applied to toys in Australia such as inspection of paints or toxicity of the toys. So, the sample factory will export toy product to those countries. Toy product must produce toy product follow by that international standard. Otherwise, toy product export might send back to the factory and to be the claim case. **This process is related with claim level.**
- Skill of Toy Designer. All Educational Institutions in Thailand have no directly course that study concerns the toy design. So, mostly toy designer on this sample worked in the production line before work in toy design division. So, Thai nationally designer have a few experiences in toy design field. **This process is related with toy performance level.**

- Customer Demand. Because of this sample factory is the OEM factory. Mostly the production plans and designs drawing come from customer. However, the customer used to accept toy design by designer's factory when 7 years ago. But, the world economic has been slowdown since 1997 and impact to the customer. This reason is making customer to change the policy. The customer has to emphasize the top sale product and do not accept the new design from factory. Nowadays, the toy designers in this factory just have improved the toy drawing from customer only. However, the factory try to improve the design performance by designs the owns band and sale in domestic and some export. **This process is the main cause that related with toy performance level.**

Finally, the sample factory was concluded that the customer demand is the highest impact to designer performance and should be compare with other's toy manufactures. And QC process is the highest impact to a defect percentage and should be compare too.

4.1.2 Working Team for Benchmarking.

When the comparison process was chosen, the next will be staff assigned into teamwork. They were chosen from person who related with comparison process. They must spend time and mind for project participation. Importantly, they must have some knowledge about benchmarking.

- The author
- Quality assurance manager who is directly in charge of operation process
- Engineering chief who provide toy product specification
- Toy Designer Chief who provides toy product figure.
- Manufacturing manager who control overall operation in this factory
- General manager who is in charge of coordinating between workgroup and executive who support this project

4.2 Analysis the Trends of Toy Industry that Impact the Customer Demand.

The poor design performance of sample factory could be immediately attributable to feeble world demand, although the causality should not be exaggerated. Retail sales were indeed quite stable in all major markets for toys, which have been the main focus of sample factory suppliers. In the US, total sales of traditional toys grew by 2% in 2001, although sales increases of video game hardware, software and accessories were even higher at 42%. In Germany, sales turnover of traditional toys also improved slightly, while that of video games posted bigger gains, leading to an aggregate increase of 4% in toy sales (including both traditional toys and video games). Similar sales increases were reported in the UK, France and other markets. On the other hand, not only Hong Kong, the world's production centre - the Chinese mainland - also saw declines in toy exports in 2001, albeit moderately by 2%. Similarly, from the other side of the trade, import demand of major markets (except Japan) contracted in 2001. The puzzle might be reconciled as follows:

- While overall consumer demand for traditional toys was stable in almost all major markets in 2001, buyers and importers appeared to be worried about market prospects and tended not to increase stocks amid the economic slowdown, particularly after the terrorist attacks. Stable retail sales were therefore supported by running down inventories but not replenishing them with new orders or re-orders until recently. Further depressing the export value was increased competition from mainland suppliers and buyers' growing bargaining power as a result of retail and wholesale consolidation. The latter has cut into exporters' profit margins.
- In 2001, there were only a handful of chartbuster items such as Harry Porter, Disney and other licensing tie-ins, but their success was at the expense of other toys. Company performance was thus varied and polarised. As it turned

out, large, established toy makers, who typically were licensors or licensees of popular characters, outperformed the remaining players in the industry.

As a common trend in all markets, there was a comeback for licensing in 2001 led by Harry Porter, and to a lesser extent by Monster Inc., Star Wars and Jurassic Park, that was able to close the turnover gaps left by Pokemon and the aluminium scooters. The increasing popularity of video games has however been eating into the market for plastic toys.

While the world demand for toys tended to move in unison with the regained popularity of licensing, some specific features still remained for different markets. In the US, with more focus on family and community after the terrorist attacks, family games gained new popularity in 2001. Rescue and military heroes were also selling exceptionally well in memory of the incident. As for other markets, the impact of the terrorist attacks has been indirect and less noticeable in regard to toy demand.

4.3 Analysis Skill of Toy Designer.

Mostly Toy Designers of the sample factory are the young designer and less experience. The experience is the best thing for toy design performance. The average ages of toy designers for the sample factory are around 24 years old and 2 years experience only. While the other factory has the average ages of toy designers around 35 years old and 10 years experience.

Although, the sample factory has OEM and ODM production also but company's policy emphasizes the OEM production. OEM production does not have the good opportunity for increasing of toy design performance. The designer of the sample factory cannot design the new type of those products including the sample factory does not have the own popular products to competition.

Moreover, Thailand does not have the educational institution or the government agency to support toy industry in the term of design performance. Therefore, mostly Thai toy manufactures emphasize OEM production including the sample factory. While, the foreign companies have the Mother Company or the Government to support for increasing design performance. For example, the Chinese Government has been supported the toy factory for increasing the design performance such as invest to build toy design centre, permission foreign toy designer to work in factory. The Chinese Government is the main mechanism to driven Chinese toy industry to the rising star of the toy world.

4.4 Analysis Quality Control of the Sample Factory.

The study and process detail collected starting at to observe QA and QC work. The author used an interview methodology with factory B staffs for collect the data. The QC and QA of the sample factory has the detail as follows:

4.4.1 QC at Injection Division.

The main part of plastic toy is the plastic part that made by injection division and keep storage in warehouse inside the factory. It is used of internal quality audits for controlling injection's work. They use the quality system as document and continuous practical in efficiency. To assigned assessment issue and concluded the quality system assess.

4.4.2 Part Assembly QC.

This process is operated by QC staff likes as injection division. QC staffs will control raw material and finish goods. For the raw material and plastic assembly parts that it's not rectified are more 2 ways decision as rework and scrap.

However, the sample factory has a random process to check some finish goods before send product to customer. This process is operated by QA staffs and work under international standard. The QA staff will choose the sample finish goods to inspect. There are 3 points that improve as follows:

- Point 1: Check the dimension of plastic toys.
- Point 2: Check the physical of plastic toys.
- Point 3: Check the appearance of plastic toys.

4.5 Analysis Manufacturing Process of the Sample Factory.

The author collected data that concern with the manufacturing process of the sample factory. These data are shown in figure 4.9 and 4.10.

Figure 4.9: Source of main Manufacturing Process Problem Areas

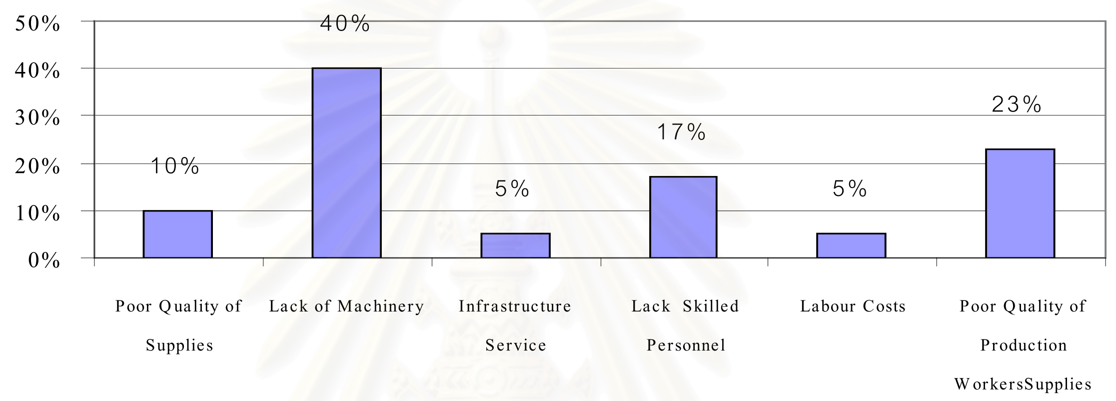
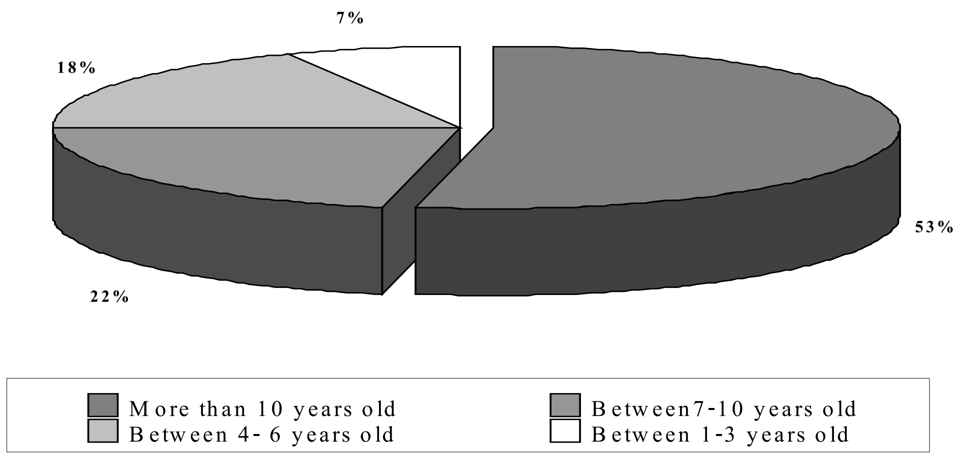


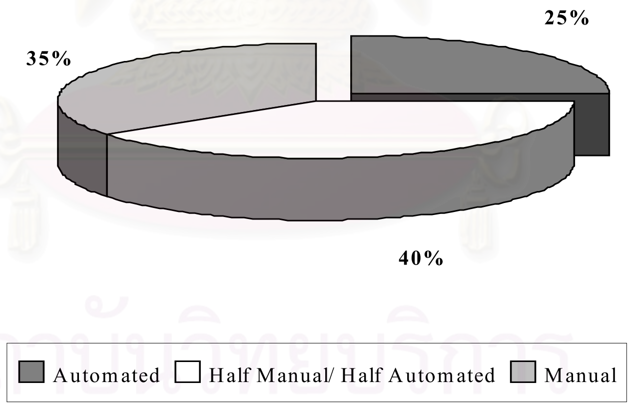
Figure 4.10: Age of Machinery and Equipment.



From figure 4.9 and 4.10, we found that Approximately 40% of the sample factory reported machinery related problems as a main issue. More of 50% of the machinery and equipment was more than 10 years old and therefore benefiting from many of the technological developments that took place in the last 5 years. Most toy factory has technologies that are between 5 to 10 years old.

From collected data, the sample factory has the level of automation is rather low as shown in figure 4.11

Figure 4.11: Level of Automation of the Sample Factory.



From figure 4.11, we found that only 25% of the manufacturing process are automated. The sample factory have semi-automated processes (40%) clearly relying on the labour force to meet quality and productivity targets. 35 % of the manufacturing process are manual systems. Hence, the sample factory stills stress the role that labour has in this factory.

Although, defect percentage of the sample factory has ratios at 3.6 % when compare with total production of the sample factory by volume. Generally, it is a satisfying level for the sample factory when compare with the average defect percentage of toy manufacturing (3.1%). However, the defect percentage of sample factory has some worse effective to company competitiveness. Table 4.22 will show the relationship between value of defect and cost of product in the past 3 years.

Table 4.22: An Effect for the Sample Company Cost in the case of Defect.

Year		2002	2001	2000
Defect	Value ('000 US$)	125	189.5	175.8
	Percentage	3.24 %	2.96 %	3.75 %
Cost of Product		9,200	9,150	11,390
Total revenue ('000US$)		12,400	12,700	16,300

From table 4.22, the author can conclude that defect problem may be a part of obstacle company's competitiveness. Although, the defect problem of the sample factory will has the low percentage when comparing with the production. However, we will see the effective of defect in the other factory and finding the solving plan in the future.

The next step of research is finding the suitable benchmarked partners and the improvement plan. So, the detail of finding is shown in the next chapter.

CHAPTER 5

Comparison with Benchmarking Partners and Improvement Plan.

This chapter will discuss the detail in searching for suit benchmarking partner factory including study on chosen partner's operation process. Finally, this chapter will study on toy industry competitiveness for finding the improvement plan. Details are as follows:

5.1 Benchmarking Partner Search

The next step of benchmark project is to search for suit benchmarking partner because no any organizations collect the Competitiveness data for toy industry. We can not know which factory has a high performance at % defect and % toy design performance. The factory's team primarily concluded to choose from 5 factories where turn questionnaires back. The consideration's details are:

5.1.1 Feature and Criteria Specification for Benchmarking Partner.

First part of this step is to specify required feature and criteria for benchmarking partner factory by brainstorming method from the team staff. The required feature and criteria for benchmarking partner factory are as follows:

- Most important key is that it must be excellence in % defect and % toy design performance. It means that % defect should not be over 5 % per year and should not be over 7 % for claim. For % toy design performance should be over 10 % per year.
- Main process must be plastic injection molding process only.
- Main raw material is plastic resins.
- Ages of customer target is 6-12 years old

- Product must be a medium grade toy.
- Export Market is a mainly market.

Most criteria and feature will cover the production technology and product. To ensure that chosen factory is a real competitor of sample factory will enable to benchmark with sample factory and really get useful from benchmark.

5.1.2 Benchmarking Partner Factory Assessment and Selection.

The first step in the benchmarking partner was chosen assessment from 5 factories. The data about their feature are;

Table 5.1: The Data of Selected Factories.

Factor / Criteria	A	B	C	D	E
% Defect	7.0	3.0	1.5	5.0	6.0
% Claim	2.0	1.5	5.5	6.8	3.7
% Toy Design Performance	10	32.3	43.5	14.0	25.7
Type of main process	Injection Molding	Injection Molding	Injection Molding	Injection Molding	Injection Molding
Main Raw material	Plastic resins	Plastic resins	Plastic resins	Plastic resins	Plastic resins
Target group (years)	3-10	6-12	6-10	6-12	3-10
Grade of product	Low	Medium	Low	Medium	Medium
% Export	30	70	60	80	20

From table 5.1, it is shown that

- Factory B and
- Factory D

The next step to connect to them and ask for admission permits to the data gathering. This step was done by letter with this project detail explained to both factories' management.

After this contact, factory B gave a respond and please to join the project. For factor D, it is a foreign factory (Chinese Mainland) and have no toy plant in Thailand but has a sale representative office at Bangkok. However, factory D has pleased to join this project too and gave some information by document. So, the author was decided to choosing B and D to be the benchmarking partner.

Next step is to make an assignment and agreement to study admission at factory B.

Study framework

- To gather the data that shows % defect, % claim and % toy design performance both factory B and D in 2 years latest. This is comparable data with its answer in the questionnaire.
- Study on the detail of quality control manufacturing process and design process of factory B.
- Study the product, market and strategy of factory B and D. It was done for finding how it different or same with the sample factory.
- To analysis the strategy of 3 factories that might concern the firms competitiveness.

After these agreements were done, the author studies every detail in the partner factories in the next step.

5.2 Study and comprehension of the partner's process

This step has an objective to understanding about the partner's quality and design process, compared with the sample factory. The objective is kept an information and method for own process development. There are details of every function;

5.2.1 Benchmarking partners

After studied and process comprehension, we found that it is plastic toy manufacture factory. Most of its products are closely the sample factory. Raw material of factory B and D are PVC, PE, PS and ABS plastic resins like as the sample factory. The author was concluded that these partners suit for comparison with the sample factory.

5.2.2 Defect and Toy Design Performance Percentage of the Benchmarking Partners.

The step after studied was to identify how many % defect, % claim and % toy design performance of the benchmark partners compared with the sample factory. The author was collected of 2 factories' % defect, % claim and % toy design performance for 2 years backward as shown in table 5.2,5.3 and 5.4

Table 5.2: The Percentage of Defects in Benchmarking.

Year	2002			2001		
	Sample	B	D	Sample	B	D
Toy Production (pcs)	3,6840,000	2,870,000	4,770,450	3,585,350	2,945,700	4,325,700
Defect (pcs)	119,430	80,360	207,520	106,187	85,425	231,425
% Defect	3.24 %	2.80 %	4.35 %	2.96 %	2.90 %	5.35 %

Table 5.3: The Percentage of Claim in Benchmarking.

Year	2002			2001		
	Sample	**B**	**D**	**Sample**	**B**	**D**
No. of Finish Goods	3,480,000	2,812,600	4531930	2,985,350	2,710,050	4,195,930
No. of Product Return (pcs).	313,200	47,250	294,575	252,860	65,854	307,561
% Claim	9.00 %	1.68 %	6.50 %	8.47 %	2.43 %	7.33 %

Table 5.4: The Percentage of Design Performance in Benchmarking.

Year		2002			2001		
		Sample	**B**	**D**	**Sample**	**B**	**D**
Revenue from product that design by factory's designer ('000 US$)	Thailand	810	1,442.5	1,910	720	1,240	1,550
	Export	1,200	4,327.5	2,865	1,655	7,025	2,631
	Total	2,010	5,770	4,775	2,375	8,265	4,181
Total Revenue ('000 US$)	Thailand	3,600	4,500	9,800	3,700	6,700	7,100
	Export	8,800	13,700	17,500	9,000	18,500	19,700
	Total	12,400	18,200	27,300	12,700	25,200	26,800
% Toy Design Performance		16.2 %	31.7 %	17.5 %	18.7 %	32.8 %	15.6 %

We can drawn the chart of % defect, % claim and % toy design performance as the figure 5.1, 5.2 and 5.3

Figure 5.1: Comparison Chart of Defect Percentage

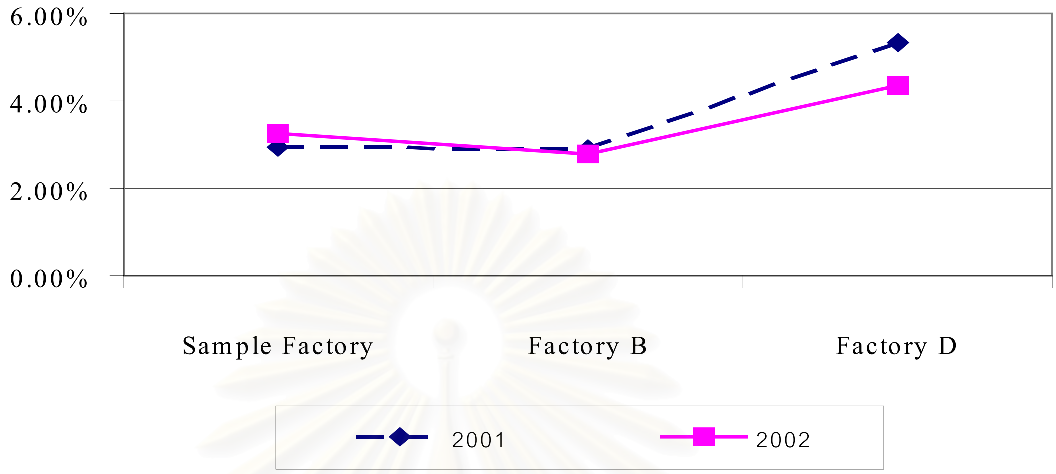


Figure 5.2: Comparison Chart of Claim Percentage

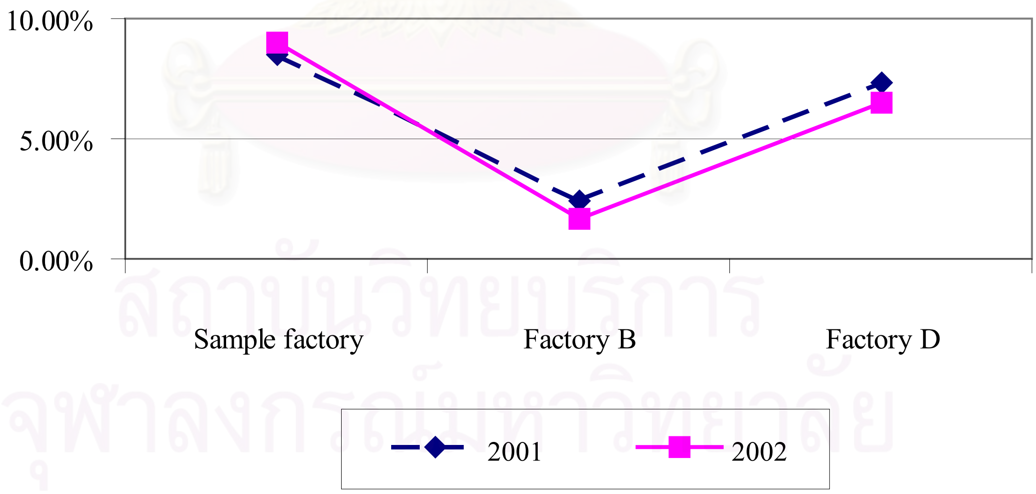
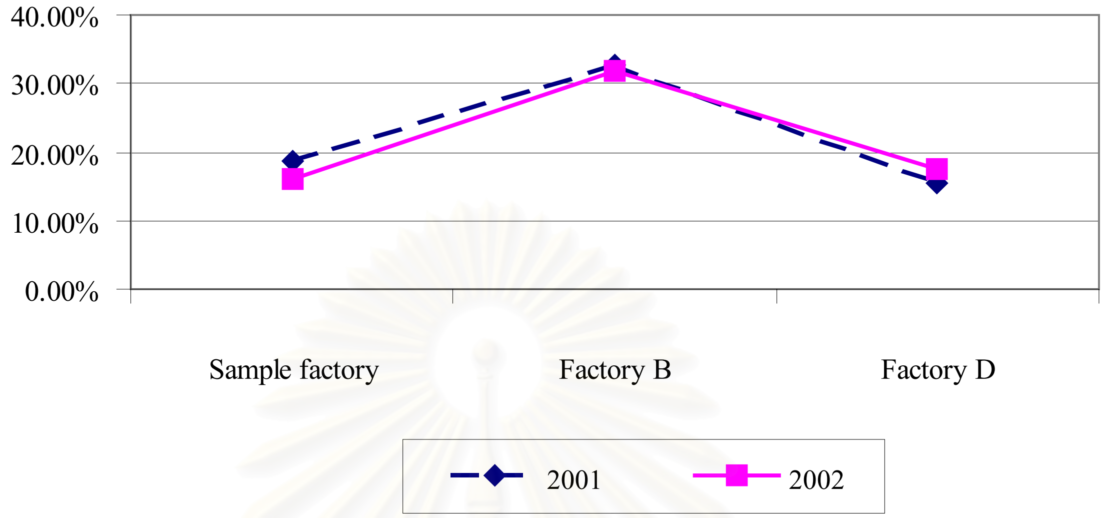


Figure 5.3: Comparison Chart of Toy Design Performance Percentage



From table 5.2, 5.3 and 5.4, the author found that the average defect percentage at factory B and D are 2.85 % and 4.85 %, the average claim percentage are at 2.06 % and 6.92 % while the average of toy design performance percentage are 32.25 % and 16.55 %. Both 2 factories, factory B and D, have the average of % Defect, % Claim and % Toy Design Performance close to its answered in table 5.1. So, this was trusted us in its real efficient.

The next step is studying about QC process and manufacturing process of the factory B as theirs % defect and % claim issue.

5.2.3 Quality Control Process of Benchmarking Partner.

From the author survey data, the QC staff of factory B ever answers about their process as the same way with the sample factory. Their answer was QC and QA processes have most effect to factory. Then, we will study and collecting information of QC and QA process in factory B.

The study and process detail collected starting at to observe QA and QC work. The author used an interview methodology with factory B staffs for collect the data. The QC and QA of factory B has the detail as follows:

5.2.3.1 Incoming Quality Control.

This process is an important step and has an effect for quality of factory B. If the worse part or material were received into the process, its resulting in a worse quality toys that called defect. For factory B, the incoming part are 2 types as plastic resins and assembly parts such as sticker, container, string, screw. The author was studied assembly part only because their were imported part of the factory B. This process, IQC, has 2 controlling as follows:

1. Part Assembly QC.

This QC is begun at making the part's standard assignment for ordered. Thereby, the classed to 2 level as the important level and lighten level for assigned the Agreement Quality Level (AQL)

For the supplier returned, this process will done by QC staff told to strange by reported about part insecticide. These are considered by QA and factory manager including give the additional suggestion for the next time.

For the raw material and plastic assembly parts that it's not rectified are more 2 ways decision as rework and scrap.

2. QC at injection factories

The main part of plastic toy is the plastic part that made by injection division of factory B and keep storage in warehouse inside the factory before it sent to assembly process. Thus, the injection division as the internal supplier and assembly division as internal customer. Thereby, it is used of internal quality audits for controlling injection's work. They use the quality system as document and continuous practical in efficiency. To assigned assessment issue and concluded the quality system assess.

5.2.3.2 In process Quality Control.

This control is starting at designed the daily report for data collected. The data is used for a real problem. Then, it use the 7 basics tools for data arranged to be the purpose data for problem understood and reach to practical step.

After that, the factory B has a random process to check some finish goods. This is a step of Quality Assurance. The QA staff will choose the sample finish goods to inspect. There are 4 points that improve as follows:

- Point 1: Check the microstructure of plastic toys.
- Point 2: Check the dimension of plastic toys.
- Point 3: Check the physical of plastic toys.
- Point4: Check the appearance of plastic toys. This point is most important point that done under the agreement of the product guarantees.

In the present, the factory B has around 3.0 % of claim by volume per year. Main cause of 80% claim was come from produce less than international standard adopted on toys and 20% was from physical, dimension, appearance and microstructure.

The author was asking about the process to make a low claim percentage. The factory B staff was gave an advice that;

- Personal interchange with customer, by sent own staff to co-working with customer' QC faction for data interchange. When the customer's QC found the factory's crack goods, then they claiming back. The factory will quickly know detail and information from sent staff. Including, maybe receive a suggestion and improvement method from the customer. These are make the factory have a pro-improving, that reducing a problem.

- Strict with every QC process as assigned standard. The benchmarking partner have their concept that more reduce in process crack, more reduced sent its to customer.
- Applied QC 7 tools into the process, for statistic method to finding fact. For example, we are applying the part to chart claimed cause clarified and pro-fixed.

Accordingly, this method will reduce claim goods. It should be emphasized to every worker about an important point and unavailable. It will make every worker concern to each process.

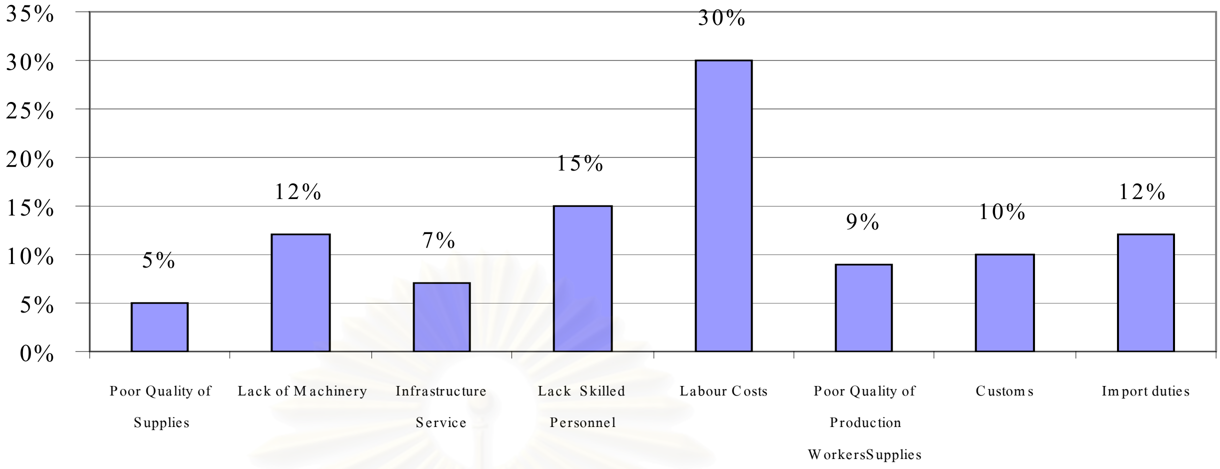
5.2.4 Manufacturing Process of Benchmarking Partners.

The author studied the manufacturing process of benchmarking partners. There are some details as follows:

5.2.4.1 Manufacturing Process of Factory B.

The author collected data that concern with the manufacturing process of the factory B. These data are shown in figure 5.4 as:

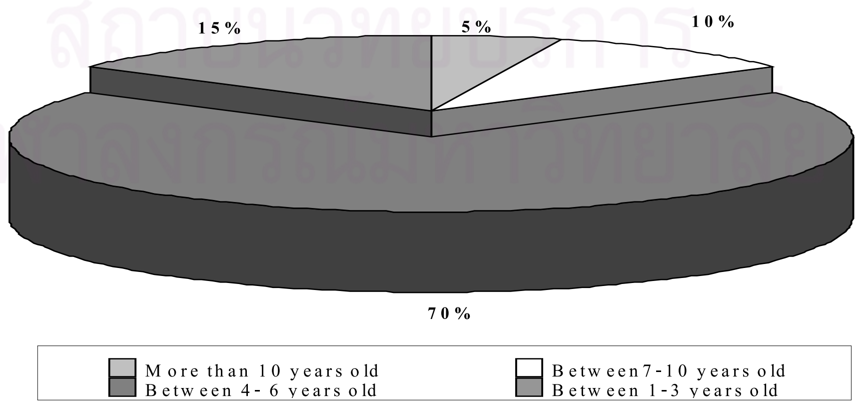
Figure 5.4: Source of main Manufacturing Process Problem Areas of factory B.



From figure 5.4, we found that approximately 30% of the factory B reported labour cost related problems as a main issue. Labour cost of factory B including welfare expense. It is different from the sample factory's problem area.

For machinery that use in factory B, more of 70% of the machinery and equipment was approximately 5 years. Moreover, factory B has the level of automation is rather high as shown in figure 5.5

Figure 5.5: Age of Machinery and Equipment of Factory B.



Approximately 60% of the manufacturing process in factory B is automated. Factory B have semi-automated processes (30%) clearly relying on the labour force to meet quality and productivity targets. 10 % of the manufacturing process are manual systems.

5.2.4.2 Manufacturing Process of Factory D.

The author collected data that concern with the manufacturing process of the factory D by the interview with executive staff. These data are shown in figure 5.6 and 5.7.

Figure 5.6: Source of main Manufacturing Process Problem Areas of factory D.

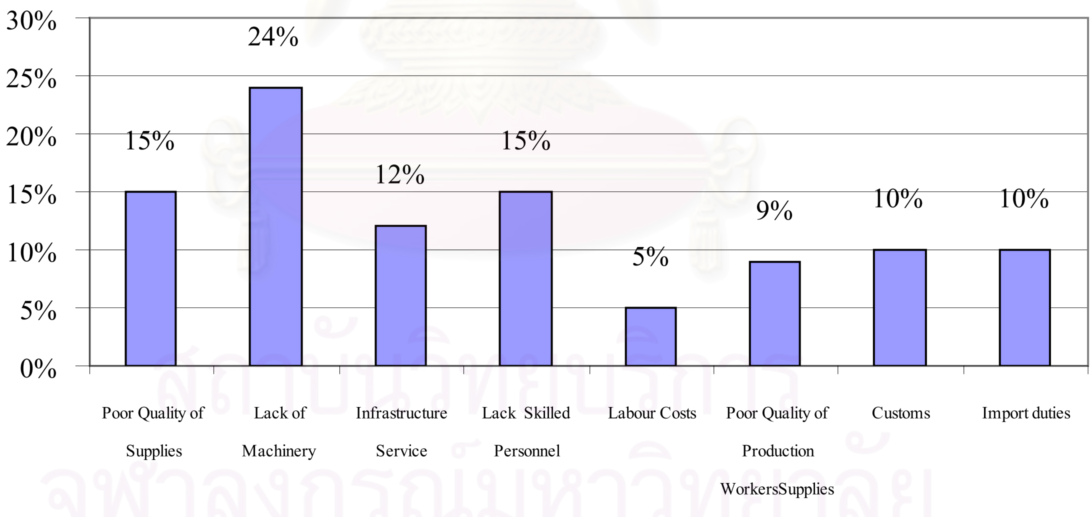
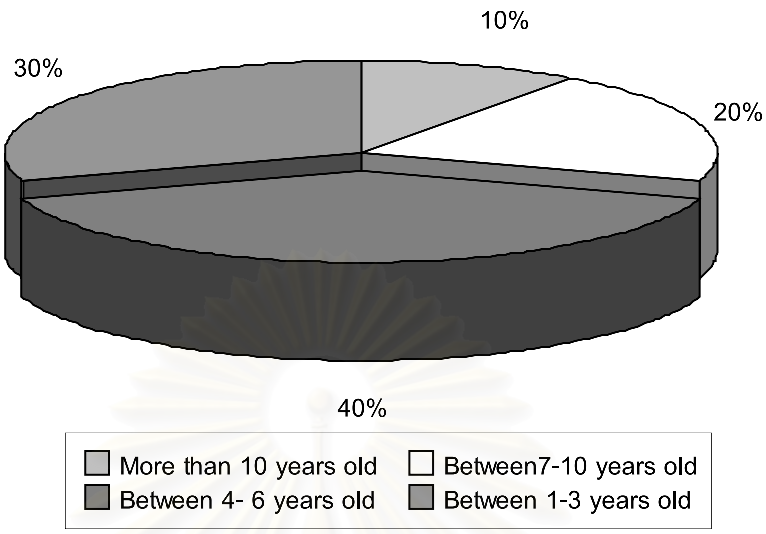


Figure 5.7: Age of Machinery and Equipment of Factory D.



From figure 5.6 and 5.7, we found that Approximately 25% of factory D reported machinery related problems as a main issue same the sample factory. And, machinery that use in factory D. Mostly of the machinery and equipment was approximately 5 years. Approximately 30% of the manufacturing process in factory D is automated. Factory D have semi-automated processes around 30% clearly relying on the labour force to meet quality and productivity targets. 40 % of the manufacturing process are manual systems.

5.2.5 Comparison QC and Manufacturing Process of the Sample Factory with Benchmarking Partners.

After the collected data process, the author has an observation that % claim may depends on QC process and % defect depends on manufacturing process of each factory. So, the author would like to compare QC and Manufacturing Process of the sample Factory with factory B and D as the below table.

Table 5.5: Compare with QC Process, Manufacturing Process of 3 factories

	Sample Factory	**Factory B**	**Factory D**
QC Process			
1. % Claim	8.53 %	2.06	6.92
2. Step of QA	3	4	-
3. QC Tool	-	QC 7 Tools	-
Manufacturing Process			
1. % Defect	3.58	2.85	4.85
2. Main Problem	Machinery	Labour cost	Machinery
3. Mostly Age of Machinery	More than 10 years	5 years	5 years
4. Mainly System	Semi –Automated	Automated	Manual

From table 5.5, Factory B has the average of defect percentage at 2.85 %, 3.6 % for the sample factory and 4.85 % for factory D. Meaning factory B has the least defect percentage for this case while factory D has the most defect percentage for this case. For the sample factory, it is a middle rage between factory B and D.

The defect percentage is not to be a PI that only impact to the quality process of factory but may impact to the cost and profit of factory too. The author would like to show some data in table 5.5.1 that show the yearly waste raw material cost (WRM) percentage compare with the defect percentage for each factory.

Table 5.5.1: Compare with defect percentage and WRM percentage.

	2001			2002		
	Sample	B	D	Sample	B	D
% Defect	2.96 %	2.90 %	5.35 %	3.24 %	2.80 %	4.35 %
% WRM	1.78 %	1.20 %	2.70 %	2. 05 %	1.30 %	2.2 %

Factory B has the least defect percentage and has the least waste of raw material cost percentage too. Contrary, factory D has the most defect percentage and has the most waste of raw materials cost too. For the sample factory, it has the defect percentage higher than factory B and has waste of raw materials cost percentage higher than too.

After compare manufacturing process, the author found that machinery of factory B has age of machinery less than the sample factory. This case is the main reason that to be factory B has the defect percentage lower than the sample factory. Consequently, factory B use the raw materials lower than the sample factory and impact to the direct material cost percentage of factory.

Although, factory D has age of machinery less than the sample factory like as factory B. But, factory D has the problem of poor quality of supplies and lack of skilled personnel also. So, the factory D has defect percentage higher than the sample factory and factory B.

For the relationship's detail of defect percentage and waste raw material cost percentage that may concern with company competitiveness, the author will discuss in section 5.3.8

So, the sample factory should improve QC process and manufacturing process for decrease claim percentage and defect percentage in order to increase company competitiveness. The author will present QC improvement plan and manufacturing process improvement plan in the last section of this chapter.

5.3 Industrial Competitiveness

Wherever possible we benchmark the sample factory against factory B and D that are the foreign toy manufactures. This gives an indication of the problem areas and its strength. This benchmarking has been grouped into the following:

- The Competitors' Current Strategies.
- The Competitors' Strength and Weakness.
- Survey analysis of perceived strength and weakness.
- Competitive Advantage.
- The Competitive Position
- The Competitors' Future Goals.

5.3.1 The Competitors' Current Strategies.

The author can concluded that the detail of each competitor's strategy as follows:

- Factory B: The strategy of B emphasizes the Royalty Band, Quality, Product Variety and Product Design.
- Factory D: The strategy of D emphasizes the price leadership and Product Variety.
- The Sample factory: The strategy emphasizes the Quality of product and Customer Satisfaction.

5.3.2 The Competitors' Strengths and Weaknesses?

Assessing a competitors' strengths and weaknesses involves assessing the core competencies and capabilities of the firm, its resources, ability to grow and achieve sustainable growth, and its ability to respond and adapt to change. These abilities to respond to changes in the competitive, technological and environment are reflected in the strengths and weaknesses that surround the company's products, services, and operations.

Each company has the strengths and weaknesses that summarised by table as follows:

- Factory B

Factory B has the strengths and weakness as shown in table 5.6.

Table 5.6: The strengths and weaknesses of factory B.

Strength	Weakness
- Band - Product Design - Product variety - Quality - Product Reliability	- Price

- Factory D

Factory D has the strengths and weakness as shown in table 5.7.

Table 5.7: The strengths and weaknesses of factory D

Strength	Weakness
- Price Leadership	- Product Reliability
- Product variety	- Band
- Cost Structure	- Product Design
	- Quality
	- Service

- The Sample Factory

The sample factory has the strengths and weakness as shown in table 5.8:

Table 5.8: The strengths and weaknesses of the sample factory.

Strength	Weakness
- Service	- Band
- Quality	- Product Design
- Product Reliability	- Product variety

5.3.3 Survey Analysis of Perceived Strength and Weakness.

After we knew strength and weakness for each factory. We can conclude that the factors of the strength and weakness are composed by the main 4 factor as follows:

- Price.
- Product Design & Product Variety.
- Quality & Reliability and
- Service.

So, the author creates questionnaire to interview 20 toy-trading firms that contact with these 3 factories. The objectives are to ask for the customer satisfaction level for each the above factor and factory including to survey opinion about the level of each factory's product. After that, the author will find the average of the customer's satisfaction for each factory and to shown the status of each factory by the view of customers.

This questionnaire set up 3 sections as follows: (See sample in Appendix B)

- Section 1: General data of toy trading firm as:
  - Name of company
  - Toy Product
- Section 2: Meaning about the satisfaction level by the view of customer indicator about Price, Product Design & Variety, Quality & Reliability and Service for each factory.

  There are 9 customer's satisfaction level as the following:

  Level 1 means unsatisfying at all.

  Level 2 means satisfying between level 1 and 3.

  Level 3 means not really satisfying.

  Level 4 means satisfying between level 3 and 5.

  Level 5 means satisfying.

  Level 6 means satisfying between level 5 and 7.

  Level 7 means very satisfying.

  Level 8 means satisfying between level 7 and 9.

  Level 9 means extremely satisfying.
- Section 3: Meaning about the product level by the view of customer.

  Figure 1 to 9 represent the product level by the view of customer. Each figure represents meaning as the following:

  Level 1 means medium grade toy at all.

  Level 2 means medium grade toy between level 1 and 3.

  Level 3 means not really medium grade toy.

Level 4 means hi medium grade toy between level 3 and 5

Level 5 means hi medium grade toy

Level 6 means hi medium grade toy between level 5 and 7

Level 7 means hi grade toy.

Level 8 means hi grade toy between level 7 and 9

Level 9 means extremely hi grade toy

Surveying result from questionnaire, which distributed to related person, and bring to conclude with opinion from that related person. It can derive the satisfying level of each factor, which received from distributed questionnaire to other 20 firms which they response back all 15 firms.

Data and result have in detail as the following:

Table 5.9: The Satisfying Level of factory B's Pricing.

- Factory B

Satisfying Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	1	2	2	2	**6**	2	0	0	0

Table 5.10: The Satisfying Level of factory D's Pricing.

- Factory D

Satisfying Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	0	2	1	3	2	**6**

Table 5.11: The Satisfying Level of the sample factory 's Pricing.

- Sample Factory

Satisfying Level	1	2	3	4	5	6	7	8	9
Frequency	0	0	0	0	2	**7**	3	3	0

From table 5.9 to 5.11: we can concludes that the rating of satisfying level of Price for factory B at level 5, factory D at level 9 and the sample factory at level 7.

Table 5.12: The satisfying level of factory B's Product Design & Product Variety.

- Factory B

Satisfying Level	1	2	3	4	5	6	7	8	9
Frequency	0	0	1	1	2	3	2	**6**	2

Table 5.13: The Satisfying Level of factory D's Product Design & Product Variety.

- Factory D

Satisfying Level	1	2	3	4	5	6	7	8	9
Frequency	0	0	0	1	2	**6**	3	2	1

Table 5.14: The Satisfying Level of the sample factory Product Design & Product Variety.

- Sample Factory

Satisfying Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	1	3	**7**	3	1	0

From table 5.12 to 5.14: we can concludes that the rating of satisfying level of Price for factory B at level 8, factory D at level 6 and the sample factory at level 6.

Table 5.15: The Satisfying level of factory B Quality & Reliability.

- Factory B

Satisfying Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	0	2	2	2	**7**	2

Table 5.16: The Satisfying Level of factory D Quality & Reliability.

- Factory D

Satisfying Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	3	2	**6**	2	1	1	0	0

Table 5.17: The Quality & Reliability Satisfying Level of Sample factory.

- Sample Factory

Satisfying Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	0	3	2	**9**	1	0

From table 5.15 to 5.17: we can concludes that the rating of satisfying level of Price for factory B at level 8, factory D at level 4 and the sample factory at level 7.

Table 5.18: The Service Satisfying Level of factory B.

- Factory B

Satisfying Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	1	2	3	**7**	1	1

Table 5.19: The Service Satisfying Level of factory D.

- Factory D

Satisfying Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	1	**8**	3	1	2	0	0

Table 5.20: The Service Satisfying Level of sample factory.

- Sample Factory

Satisfying Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	0	0	3	3	**7**	2

From table 5.18 to 5.20: we can concludes that the rating of satisfying level of Price for factory B at level 7, factory D at level 4 and the sample factory at level 8.

Table 5.21: The Product Level of factory B.

- Factory B

Product Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	0	0	3	**9**	2	1	0

Table 5.22: The Product Level of factory D.

- Factory D

Product Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	2	3	**6**	2	2	0	0	0

Table 5.23: The Product Level of sample factory.

- Sample Factory

Product Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Frequency	0	0	1	1	**8**	2	3	0	0

From table 5.21 to 5.23: we can concludes that the rating of product level for factory B at level 6, factory D at level 4 and the sample factory at level 5.

From the result of table 5.9 to 5.23, we can find the average of customer satisfaction and product level both 3 factories in table 5.24 as follows:

Table 5.24: The Average of Customer Satisfaction and Product Level.

Factory / Factors	B	D	Sample
Price	5	9	6
Product Design & Variety	8	6	6
Quality & Reliability	8	4	7
Service	7	4	8
Total Average	**28/4 = 7**	**23/4 = 5.75**	**27/4 =6.75**
Product Level	**6**	**4**	**5**

The result can be concluded in table 5.25 as follows:

Table 5.25: The Customer Satisfaction and Product Level for each factory.

	Customer Satisfaction Level	Product Level
Factory B	7.0	6
Factory C	5.75	4
Sample Factory	6.75	5

5.3.4 The Competitive Advantage.

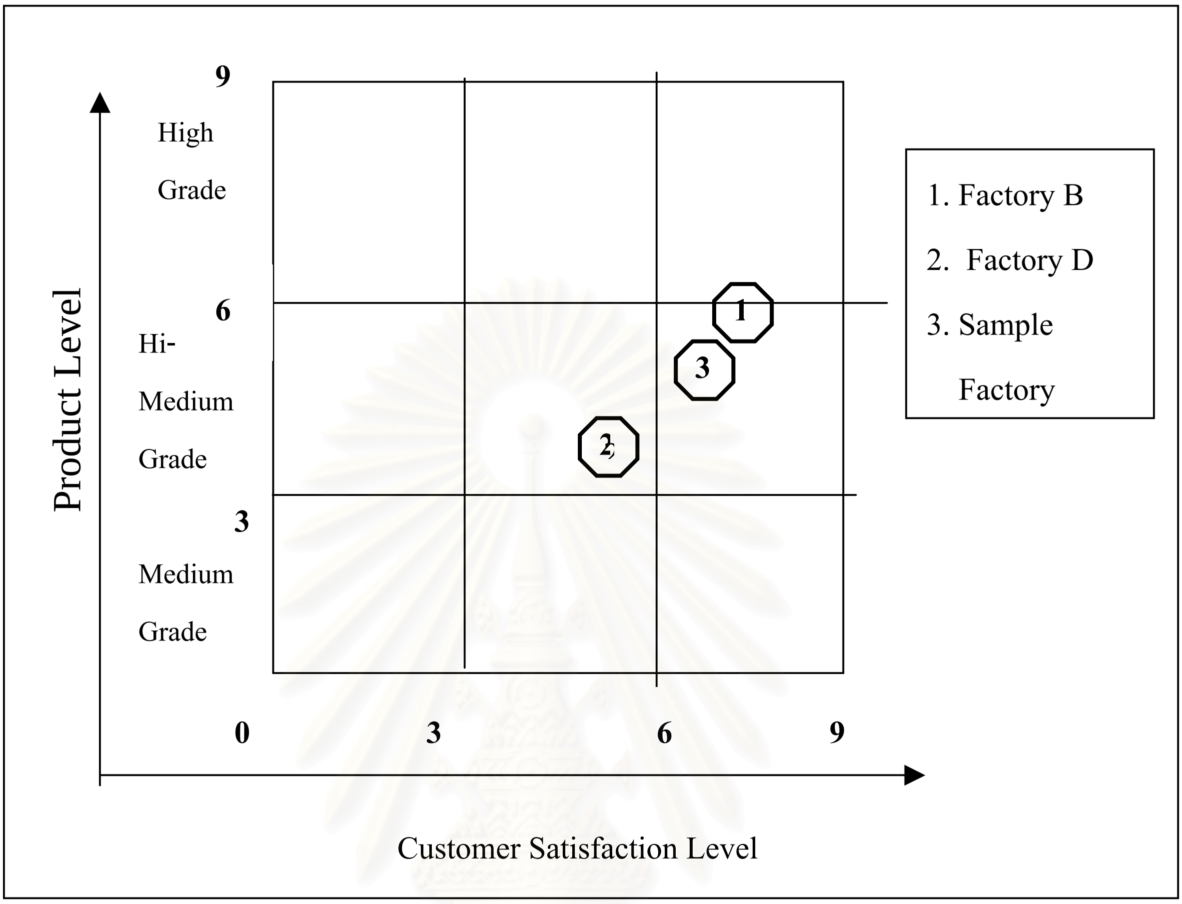
The competitive environment of the medium-grade toy industry has been analysed using matrix structure. This enables a view on industry market positioning and customer satisfaction where a factory has a comparative advantage in export and domestic markets.

<u>Methodology</u>

Data from table 5.25 has been used to compare the position of the sample factory with factory B and D in the present. Data on customer satisfaction and level of product has been obtained both 3 factories.

From table 5.25, we can be constructed the matrix structure as figure 5.8

Figure 5.8: The Matrix Structure in the Present.



From figure 5.8, we can conclude that the sample factory has the position at level 5 in product level and at level 6.75 in customer satisfaction. So, the sample factory is in the hi-medium grade toy business same factory B and has the higher position than factor D by the view of customer.

5.3.5 The Competitive Position.

In our competitive environment analysis, we have benchmarked the sample factory with factory B and D as follows:

- Factory B

  The factory B is very strong toy industry with the customer satisfaction and level of product. The factory B produce high quality and innovative toy product in the medium grade toys. However, the competitive situation in the medium grades toy that emphasizes the price competition strategy. The factory B might change the strategy or goals of business in the future. Because of the company's strategy in the present that emphasizes the high quality and innovative but can not complete in the medium grade toy business. The total revenue including local and export market has decrease in every year though the customer is satisfied toy product by the factory B.

- Factory D

  The factory D has a strong position in the medium-grade toy market. The market positioning of factory D depends largely competing on the basis of lower price rather than quality, service and design. So, the factory D has a strategy to increase the market share in the medium grade toy both Thailand and worldwide by the price leadership strategy. The factory D has estimation that will increase market share in Thailand from 20 % in the year of 2002 to around 40 % in the next 5 years and to increase export market share to 10% in the next 5 years too.

- The sample factory

  The sample factory has the higher position in the medium-grade toy market than factory D but lower than factory B. It is a very difficult to compete. However, the factory B will change the position of the product market in the nearest future. This is a good opportunity for the sample factory. Moreover, the sample factory has the best service by the view of customers. So, the sample factory should change the strategy for competition in the future because the stronger competitor will change the marketing strategy while the other competitor still emphasizes price leadership strategy and has a goal to increase market share both local and export market.

5.3.6 The Competitors' Future Goals.

Following the identification of the main competitors in the marketplace with their associated strength and weaknesses and after we analysis the data both 3 factories, we must identify the future goals of the competition. At the most general level it is assumed that competitive goals involve return on investment, profitability, and market share. However, goals often range from that of a traditional company that conducts day to day business with highly loyal customers to a high tech company on the edge of the tornado of demand that is trying to stretch enough to produce product and meet customer orders. The company might be in an aggressive fight for its virtual existence or perhaps for market domination. For each company, there is the future goal as follows:

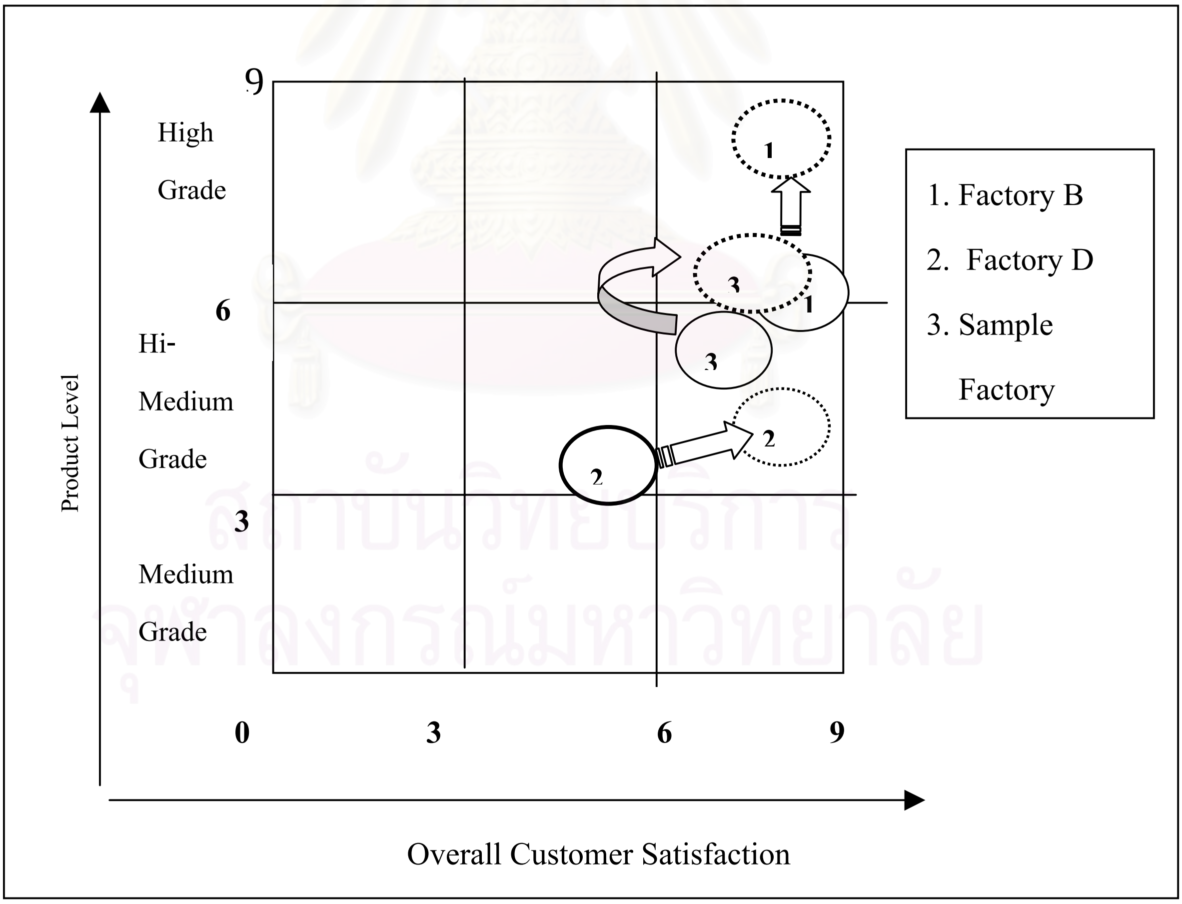
- **Factory B:**
  - Increasing toy market shares both locally and exports market in the High- grade toy.
  - Increasing the manufacturing of hi-tech toy and reducing low-tech toy.
  - Reduce product life cycle.
  - Move to the higher market within the year of 2008.

- **Factory D:**
  - Increasing toy market shares both Thailand and export market.
  - Maintain the strategy of price leadership.
  - Increasing the type of product. (Product Variety)
  - Reduce product life cycle.
  - Standing in the medium grade toy market.

- **The sample factory:**
  - Increasing the type of product. (Product Variety)
  - Reduce product life cycle.
  - Find the new market.
  - Emphasizes market and product focus.
  - Move to the hi-medium toy product replace the factory B

From those data, we can be constructed the future matrix structure of strategic position as figure 5.9

Figure 5.9: The New Matrix Structure for the Future Goals in next 5 years



From figure 5.9, there needs to be greater planning for increasing revenue sale of toy product including local and export markets and upping the pitch of marketing in key sectors.

5.3.7 Cause of Restructuring Product Position

From the interview, the author found that factory B has the future goal to Hi Grade toy product. The factory B can not stand in Medium Grade toy business or Hi-Medium Grade toy business like the present because it has a cost structure higher than the other company. Moreover, the factory B has had the total revenue decreasing including local and export market since the year of 2000-2002 as shown in table 5.26

Table 5.26: Total revenue of factory B

Unit: ’000 US$

Year / Market	2000	2001	2002
Local	8,400	6,700	4,500
Export	17,400	18,500	13,700
Total	25,800	25,200	18,200

One of the total revenue decreasing causes come from Chinese Mainland product as the factory D. However, factory B has R&D unit that supports toy design performance. Factory B needs to move to the higher market that do not competed by price strategy.

The sample factory has had same problem as factory B. Total revenue decreasing including local and export market since the year of 2000-2002 as shown in table 5.27. So, the moving position markets of factory B therefore to the good opportunity for the sample factory. The sample factory should replace position market of factory B in the Hi-medium grade toy product. The moving the position market of the sample factory has the objective to avoid the violent price competition strategy in the medium grade toy market. Because of the sample factory has the cost structure lower than factory B and has a few gap cost structure from factory D. However, the sample factory should build the differentiation from the product of the factory D that emphasises the price strategy. The sample factor should has to upgrade the technology input for currently favoured products or risk losing even more market share to Chinese lines, or conceivably to the lower-end producers in Vietnam and Bangladesh.

Table 5.27: Total revenue of the sample factory.

Unit: '000 US$

Year / Market	2000	2001	2002
Local	4,500	3,700	3,600
Export	11,800	9,000	8,800
Total	16,300	12,700	12,400

From the strategy of both 3 factories, factory B has strategy that emphasis quality, design and to be the hi-medium grade toy in the present while factory C has strategy that emphasis price and to be medium grade toy. The sample factory has service and quality strategy and to be medium grade toy in the present.

For the future, factory B has a strategy for moving into the high market to produce the Hi Grade Toy in the next 5 years. Factory D has a strategy to stand at the medium grade and cost leadership. Hence, this is a good opportunity for the sample factory will to replace the market of factory B and develop toy design performance.

The last step, the author will recommend the improvement plan for develop the competitiveness of the sample factory.

5.3.8 Defect and Claim is been a part of factory competitiveness

In this research, the author collected mostly data under the condition of toy manufacturing. Scope of data collecting is collected within the factory only. Some data is the secret data and cannot to disseminate to the public such as production cost data or the capital cost. So, the author cannot to evaluate for some case because lack of data.

For the sample factory, the author found that PI level is % Defect, % Claim and % Toy Design Performance is suitable for benchmarking. For Toy Design Performance, it is very clear that to be the important PI for toy manufactures competitiveness. But, Defect percentage and Claim percentage is not clearly that suitable to be a part of toy competitiveness or not.

The author would like to present that Defect percentage and Claim percentage are the part of company competitiveness and must have the plan to improve. The objective for improves defect and claim problem is to reduce company cost and increase the company competitiveness. For each case, there is the detail as follows:

5.3.8.1 Defect Problem

The sample factory has a satisfying level of defect percentage at 3.58 % and has a less different gap from toy industry index (3.1 %). However, the sample factory should reduce the defect percentage for the benefit of company in the future.

In this case, the author selected one type of toy product that produces both 3 factories to compare with cost of product, price and defect percentage of this product. For detail is shown as table 5.28

Table 5.28: The Detail of Sample Product Production.

	Sample factory	Factory B	Factory D
Cost of product (US$/ Unit)	9.0	8.90	8.87
Price (US$ / Unit)	11.5	11.7	11.4
% Cost of Product	78.3 %	76.0 %	77.8 %
% Defect of this product	3.8 %	1.7 %	2.0 %

From table 5.28, the author found that the sample factory has the highest cost of product. This cause may come from the highest defect percentage. So, the sample factory should find the procedure to reduce cost of product. One procedure for cost of product reducing is defect reducing. The author would like to trial the reducing of defect percentage of the sample factory from 3.8 % to 1.7 % and reduce % cost of product too. The reason for defect reducing to 1.7 % comes from the author's requirement. The author would like to know about cost and price of the sample factory when defect percentage is the lowest level like factory B. The detail as shown in table 5.29

Table 5.29: Estimation of defect Reducing

	Sample factory	Factory B	Factory D
Cost of product (US$/ Unit)	8.81	8.90	8.87
Price (US$ / Unit)	11.5	11.7	11.4
% Cost of Product	76.6 %	76.0 %	77.8 %
% Defect of this product	1.7 %	1.7 %	2.0 %

Remark: In this case, factory B and D is not changing the manufacturing process (Static Model)

The detail of calculation as follows:

Before defect reducing,

Cost of product = 9.0 US$

Margin of product = 11.5 − 9.0

= 2.5 US$/ Unit

From cost structure, %DM of the sample factory = 57 %

DM cost for this product = 0.57 * 9.0

= 5.13 US$ /Unit

% Defect of this product = 3.8 %

Defect value of this product = 0.038 * 5.13

= 0.19 US$/ Unit

DM cost exclude defect = 5.13 − 0.19

= 4.94 US$/ Unit

After defect reducing

% Defect target = 1.7 %

Decrease from % Defect in the past = 2.1 *100 / 3.8

= 55.26 %

So, the new defect value = 44.74 *.19 / 100

= 0.08 US$/Unit

DM cost include defect = 4.94 + 0.08

= 5.02

New Cost of product = 5.02 * 100 / 57

= 8.81

% cost of product = 8.81 /11.5

= 76.6 %

From calculation, the author found that the sample factory could compete with the other factory by price strategy when the sample factory reduces defect percentage. So, the sample factory should set up a plan to decrease defect percentage and cost of product under the time that factory needs. The sample factory can make more profit because the sample will have the decreasing ratio between cost of product and price.

The good point of this plan will make the sample factory to compete with the other factory especially factory D by price strategy. Because of the sample factory is been in the medium grade toy market. The price strategy still has an importance level for customer. This plan will make the sample factory to have a low cost of product in the future and will increase company's competitiveness too.

5.3.8.2 Claim Problem

From the collected data, claim percentage of the sample factory has the different level from the industrial index that shown in chapter 4. The sample factory has % claim at 8.53 % while the industrial index has % claim at 5.3%. Moreover, claim percentage of the sample factory has higher than factory B and D too. Meaning the sample factory cannot produce toy product under the condition of toy standard manufacturing. So, the sample factory should improve QC process and QA process of factory for reduces claim percentage in the future.

The author would like to show the value of claim product within 3 years as shown in table 5.30

Table 5.30: Value of Claim Product

Year	2000	2001	2002
Value of Claim ('000 US$)	3,260	1,905	2,232
Total Revenue ('000 US$)	16,300	12,700	12,400

From table 5.29, we found that the average value of claim product is around 17.7 % when compare with the total revenue. Hence, the sample factory should reduce claim percentage to closely the industrial index. The sample factory has many benefits for solving claim problem by improves QC and QA process as shown in the next section and is a part of company competitiveness.

5.4 The Improvement Plan for the Sample Factory's Competitiveness.

To bolster competitiveness, the sample factory must develop skills and production technique with a focus on product diversification, and use of modern and sophisticated production technology. More should also be done to create own unique designs, tap new markets to head off the ever-intensifying competition and upgrade the products to the high-medium markets replace factory B and move far from factory D.

After the sample factory knew the Competitors' Strengths and Weaknesses including the Competitors' Future Goals. The sample factory is likely to continue to face strong competitiveness pressures over the next decade. So, the sample factory can decide the new strategy for improve the company's competitiveness in the future.

The sample factory is competitive in both local and export markets. However there is a danger of it being between low cost but low quality toys and the mid-rage toy product. The sample factory needs to invest in quality and production development in order to make it more competitive against the quality segment of Japan industry such as factory B and differentiate itself from low cost producers such as factory D from Chinese Mainland.

The plan for improves the company competitiveness that the author to be present for the sample factory divided 3 parts. These are Quality Process, Manufacturing Process and Design Process Improvement Plans.

For each part has the detail as follows:

5.4.1 Quality Improvement Plan

Quality Improvement Plan has the objective to decrease claim percentage and improve company competitiveness. The sample factory should study about the quality management and done within the short time. The improvement plan in the term of quality can be done immediately for decrease defect goods. The target point of Quality Improvement plan to decrease claim percentage from 8.53 % to 5.0 % within 2 years. The author was gave an advice to make a low claim percentage in the improvement plan that;

- Strict with every QC process as assigned standard. The benchmarking partner have their concept that to reduce in process.
- Personal interchange with customer, by sent own staff to co-working with customer' QC faction for data interchange. When the customer's QC found the factories crack products, then they claiming back. The factory will quickly know detail and information from sent staff. Including, maybe receive a suggestion and improvement method from the

customer. These are making the factory have a pro-improving, that reducing a problem.

- The sample factory should applied QC tools such as QC 7 tools or TQM into the process, for statistic method to finding fact. For example, we are applying the part to chart claimed cause clarified and pro-fixed.

The Quality Improvement Plan has many benefits for factory such as follows:

- Reduce cost. Because of claim percentage is a part of production cost. So, the claim percentage reducing by the Quality Improvement Plan to make the sample factory has a lower cost of production and increase company competitiveness.
- Company Image. The sample factory adopting a improvement plan have achieved a remarkable change in factory or company image.
- Committed Customer. The company's customers are satisfied the more committed they will be to company. The quality focus can create a partnership based on mutual trust.

5.4.2 Manufacturing Process Improvement Plan.

Manufacturing Process Improvement Plan has the objective to decrease defect percentage and cost of production for increasing company competitiveness. The objective needs to decrease defect percentage from 3.58 % to 1.7% or reduce cost of product from 78.3 % to 76.6 % within 2 years. The author was gave an advice to make a low defect percentage or low cost of product in the improvement plans that;

- Changing to mostly automated manufacturing process. In the present, the sample factory has only 25% of the manufacturing process is automated while 40% is the semi-automated processes and 35 % is the manual systems. Moreover, mostly the age of machinery is more than 10 years. These are cause of the sample factory has % defect more than factory B and D. So, the sample factory should change to use the efficiency machinery and to be the automated system. The efficiency machinery has better than labour productivity for all processes.

- Training to develop managerial skills, particularly in:
    - Supply chain management and production planning, to improve lead times, production flexibility and the speed it takes to introduce new planning.
    - Cost management and process engineering, to ensure that investment are cost effective
- Specialist technical training for complicated processes. Thai Toy Association already offers specialized training programmers for Thai Toy Manufactures.
- The sample factory should be encouraged to adopt the international standard of toy product other than ISO 9000. Foreign consultants can be helping the sample factory. The consultant must adopt a pragmatic approach so that the systems work to improve the competitiveness of the company.

The Manufacturing Process Improvement Plan has many benefits for factory such as:

- Cost Reduction. The sample factory have adopted the Manufacturing Process Improvement Plan can report major savings in factory operational costs. A saving of the cost can be shown within a few years.
- Improved Productivity. Quality and productivity are inter-connected. Productivity is not about speeding up of the manufacturing process.
- Improved Operations. To bring some process under control requires the removal of all the conflicting within it. Make the process swifter and more flexible in adapting to changing requirements that opening opportunities to offer variety and obtain business.

5.4.3 Design and Technology Improvement Plan.

This is the most important point. The sample factory needs to continuously improve competitiveness in the world of toy business. The objective of this plan needs to increase toy design performance from 18.7 % to 40 % (Better than factory B)in the next 5 years. The author has some suggestions to the sample factory in the term of design, technology and production of the improvement plan as follows:

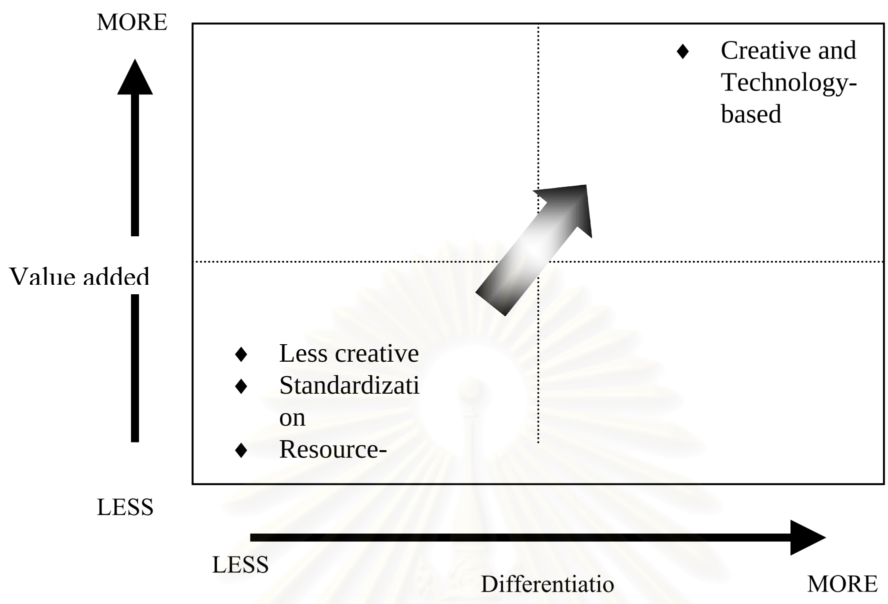
5.4.3.1 Creativity and technology keys to competitiveness of toys.

The sample factory should be done for the industry to stay even more competitive. Because of the toy product from the Chinese mainland has enhanced the price competitiveness, while the foreign manufactures' role like the factory B and D has shifted even more towards quality control, management, marketing, product design and product variety.

The sample factory should focuses on an increasingly creative and design product. Otherwise, safe and ethical working conditions have risen higher and higher on the agenda of overseas buyers. Meeting these standards has become a matter not only of social responsibility, but also of maintaining and growing the toy's business.

For the sample factory, the best option might be to use technology and creativity to make them configurable. So, they will adapt to different preferences and sizes. This is the better option for the sample factory.

Figure 5.10: The New Strategy to improve toy's competitiveness by design



5.4.3.2 New Production Process Strategy: Mass Customization.

In today's rapidly changing economy, manufactures must find new ways to add value. Competition is no longer based solely on aggressive pricing; commodity products have little chance to succeed. So, The sample factory has to focus on the customer experience, understanding what happens when customers acquire and use their goods. Producers understand that customization is the way to create a unique customer experience, but efficiency comes with mass production.

Ideally, the sample factory would like to have the best of toy business that called mass customization. When an organization collaborates, multi-specialty teams marketing, sales, design and manufacturing work together and directly with customers to determine what customers want and then produce it automatically. That is the secret to mass customization and the solution for differentiation against low-margin commodities. Designing, producing, and delivering customized products to customers for at or near the cost and convenience of mass-produced items and combines high production volume with high product variety compose Mass Customization.

If the sample factory will change to mass customization, there are two main advantages for them as follows:

1. Customers will tell what they want and need. Mass customization creates an environment where the customer will create the product or service that they are looking for. Instead of manufacture needing to guess what product will best meet their needs, the customer will do the work to define the product that they desire.
2. By getting the customer to invest time in Thai's product, they will be more loyal to the sample factory. It seems a little backwards, but it is true. If customers have spent time customizing a product by themselves from Thai toy manufactures and customer will remember their customization in the future, they will not want to work with anyone else. Thai toy manufactures customer's time is very valuable and they will not want to spend the time with another vendor to re-specify their needs.

Furthermore, the year 2001 to present has been fruitful for licensed products and brought about by the sales wizardry of Harry Porter, Monster Inc. Spider-Man and Star Wars. The sample factory will ride on the licensing bandwagon in the hope of success. So, the sample company should contact the owners of Thai licensing cartoons such as JA TING JA or HANUMA for produce to plastic toy or model. This is a special Thai toy product. Designers of the sample factory can design this toy model and to be once way for design performance increasing too.

5.4.3.3 Moving up the Value Chain

In the face of intensified competition in the world market, the sample factory should strive to move up the value chain in order to establish a sustained basis for long-term success. The sample factory have to build up the image of their products with respect to quality and delivery lead-time in an effort to cope with the trend of shorter product life cycles and a wider variety of novelty designs. While maintaining their OEM production, they should concentrate more on ODM business to render more value-added services to their overseas customers. Developing ODM business will naturally incur additional investment, but it is an important, worthwhile strategy for improving the company's competitiveness.

However, the sample factory should be to collaborate with the some Thai government agencies or the Thai Toy Manufactures' Association to build sustainable strengthens by

- Encouraging investment in sampling and laboratory equipment. To this extent, the Thai government agencies as BOI could offer additional tax incentives for companies that invest in new equipment including computer hardware and software.
- Establish centres of excellence in chosen universities, in conjunction with the Thai Toy Institute and the private sector trade associations, in toy design process. These centres will be responsible for raising the level of technology in the toy industry and promoting product design and development. Also there should be a forum where new products are developed bearing in mind the latest requirements of market needs.
- Develop a programme of scholarships or awards in design and product development to further encourage and offer incentives to companies carrying these activities.

- Further develop toy design and tool-making capabilities for both local and export markets. Basic infrastructure in product design and tool-making are necessary for toy product to be less dependent upon foreign control and direction whilst remaining internationally competitive. It is also relevant in reducing import reliance and potentially developing exports.
- Thai Ministries of Education and Industry should ensure adequate design and toolmarking courses are promoted user toy industry though toy industry associations and directly to toy factories. Coordination of such efforts could be through the Ministry of Education section responsible for vacational training.

CHAPTER 6

Research Conclusion, Problem and Recommendation

Toy manufacturing in Thailand has developed from a low-quality and low price industry. Thai Toy Manufactures are the integrated toy production with both domestic and export markets. Major threat to the Thai toy industry is competition from lower-cost countries and high technology countries. Thailand has less price and technology competitiveness with these rivals. Another problem of Thai Toy Manufactures is shortage of skilled labors and quality of product.

This research aims at improving Thai Toy industry especially Thai Nationally Manufactures and searching for the best practices in the same industry in toy manufacturing. Hence, the research selected Thai Nationally Company to study and use the competitive benchmarking.

This chapter describes the research conclusion including the problem of research and any suggestion related to this research.

6.1 Research Conclusion

This research is used of benchmarking technique to apply with analysis and production efficiency comparison for company's competitiveness improvement. The sample factory is the plastic toy manufacture. This research has 4 main steps as follows:

- **The First Step: Finding Benchmarking Process.**
  The first step is to finding benchmarking process. Thereby, choosing from resulting process on competitiveness performance indicator, this indicator is important to organization's competitiveness, but it is low

performance when compared with the competitor. It must be found a real efficiency level of every faction of the sample factory.

- **The Second Step: Finding Benchmarking Partners**

  The second is search for the benchmarking partner that must be a real competition and have a great efficient to comparison. This is ensuring that kept purpose data and able to applied for the sample factory.

- **The Third Step: Collecting Data and Analysis.**

  The third step is to learning and collecting data from the benchmarking partners. This step aims to study and analyse the working procedure to lead competitors into the best in class.

- **The Fourth Step: Finding the Improvement Plan.**

  The last step is to sum up the results from analysis and benchmark procedure between the sample factory and benchmarking partners. For finding the improvement plan for develop the sample factory's competitiveness.

For each step has a detail as follows:

6.1.1 The First Step: Finding Benchmarking Process.

After study and understand the production process of the sample factory, then assigned CSF to efficient measuring. These researches will assign CSF for cover the important issue, emphasis on CSF related with customer. It is consisted of quality (Q), cost (c) and delivery (D). The officer CSF is consisted of skill (S) and safety (S). Every part will consist of performance indicator (PI) as;

The percentage of Defect and Claim are PI in Q CSF. Cost structure is PI in Cost CSF. % On-Time Delivery is PI in Deliver CSF. Toy design performance is PI as Skill type CSF, The Accident Frequency Rate is PI in Safety type CSF.

After collect information and PI shown in every part of the sample factory, and then we are sending the questionnaire to other 40 small plastic toy manufactures. These were keep the benchmarking data, 32 factories answer at the number in % defect, % on-time delivery, % toy design performance but at cost structure and accident frequency rate have no answer at all factory. They gave reason that they not called these data. This research will benchmark by backward data.

After production benchmarking with other factory, it let know a real efficient level of sample factory;

- % On-Time Delivery has a very good level, which a level close to average value of industrial.
- % Defect has a low efficiency level, that lower than best level and average value of industrial, but in slightly lower.
- % Claim and % Toy Design Performance have to much lower than other.

Lastly, the consideration of efficiency with the important of PI of each side is concluded and selected % Defect, % Claim and % Toy Design Performance to be a point for benchmarking. QC Process, manufacturing process and the company's strategy are the procedure that impact to % Claim, % Defect and % Toy Design Performance. This procedure will benchmark with other factory for improvement competitiveness.

6.1.2 The Second Step: Finding Benchmarking Partners

For seeking of 5 factories that is answer from the questionnaire, it is found that 2 factories to be the suitable benchmarking partners. The author chooses 2 factory that placed and answer to let us study and talk to the executive staff. The objective is the guideline of improvement the competitiveness of the sample factory.

6.1.3 The Third Step: Collecting Data and Analysis.

After studying and collecting the information of benchmarking partners including the competitive strategy, the author was concluded the study result as;

- The sample factory had the average of defect and claim at 3.58 % and 8.53 % while toy design performance at 18.7 %.
- Benchmarking partners, factory B had the average of defect at 2.85 % and factory D was 4.85 %.
- Benchmarking partners, factory B had the average of claim at 2.06 % and factory D was 6.92 %.
- For % toy design performance, factory B was 32.25 % while factory D was 16.55 %.

From the analysis, the author found that QC and QA processes have most effect to claim percentage, the manufacturing process has effect to defect percentage and company's strategy has most effect to toy design performance percentage. Moreover, defect percentage is still reflected to cost Structure of company too.

6.1.4 The Fourth Step: Finding the Improvement Plan.

The results of benchmarking study will bring the opportunities for the sample factory competitiveness improvement. The key findings and best practices will modify and adapt into the sample factory's environment. The improvement plan will develop that would achieve the company competitiveness at five years

The improvement plan will develop and classified into two main plans as Quality and Design Improvement Plans.

6.1.4.1 Quality Improvement Plan.

The plan can be stated as follows:

- Strict with every QC process as assigned standard.
- Personal interchange with customer for reducing a problem.
- To applied QC 7 tools or TQM into the process.

6.1.4.2 Manufacturing Process Improvement Plan.

The manufacturing process improvement plan as:

- Changing to mostly automated manufacturing process.
- To use efficiency machinery
- Training to develop managerial skills, particularly in:
  - Supply chain management and production planning
  - Cost management and process engineering.
- Specialist technical training for complicated processes. Thai Toy Assosocation already offers specialised training programmes for Thai Toy Manufactures.
- The sample factory should be encouraged to adopt the international standard of toy product other than ISO 9000.

6.1.4.3 Design and Technology Improvement Plan.

This plan can be stated as follows:

- Creativity and technology keys to competitiveness of toys. To use technology and creativity to make them configurable.
- New Production Process Strategy to Mass Customization. For focus on the customer experience, understanding what happens when customers acquire and use their goods.
- Moving up the Value Chain. For Developing ODM business will naturally incur additional investment. To establish basis for long-term success.

6.2 Research Problem

In this research will face many problems that can conclude into;

- Lack of case study of benchmarking between competitors. Nowadays, many technicians try to write the article about the advantage of benchmarking technical for apply in business. The knowledge of benchmarking in Thailand is not much. The suggestion of case study will be more difficult for applying in Thailand because the experience of benchmarking aboard has different business culture.
- Personal in industrial part is lack of benchmarking knowledge. Benchmarking project in factory has one procedure in creating teamwork for contact and deal with concerning. Teamwork mostly lack in benchmarking understanding, so co-operate is not ready such as research process. First we must point to the efficiency of factory by collecting the data for CSF value in each side. Most data comes from operation officer in product line that lack of understanding in real objective. The data collecting is not correct because of the fear of in correcting data and the truth cannot be use.
- The data collecting about the efficiency in side of production in Thailand. Research has to make the questionnaire of factory efficiency of metal

melting factory for number collecting. So the PI value that compare with the sample factory is come from the questionnaire and cannot prove that is true to the real number. Whenever the organizations even the private business or government collect the data as the evidence for reference. It may be making the benchmarking easy and reliable.

- Many organizations are not co-operate with the research. We can notice from the questionnaire that sends for the result of production efficiency. Researcher sends them to 35 factories and the answer is only 7 factories. The benchmarking process ask for co-operate to 2 factories but only one glad to answer and join us. So the benchmarking is use only the joining factory. If there are many factories agree with us, so the benchmark has more choice of operation.

6.3 Recommendations for research

The research has faced the problem in many parts. The author collects and suggests for the interesting person. It is the advantage for the benchmarking project performance as follows:

1. CSF and Performance Indicator (PI) should identify by the vision on business performance. Consider that organisation must deal and agree with the future CSF and PI. It should have agreed with the vision too. It should realize how difficult it is to collect the data and advantage. CSF and PI may use the complicated information and get little advantage. If CSF and PI are not important, it will waste the time and expenses. Another point, CSF and PI should not involve with the secret information of any business such as price data of classified numbering in account.
2. Before the benchmarking project has begun, it should have been explored the real objective of project of any personal who concerned. If someone concerned in misunderstand, they will not spend co-operate and get the project failed.

3. Data collecting for showing PI value, it must be sure that is the real data and information and truly in operation. If the data is not correct, it make the result unclear and fake, for example, if PI is higher than reality, the efficiency that benchmark with other organization will fake and other will much more lower. It is not true from the real and it will be the waste of time, not get the real advantage. So the data collecting must have checked the corrective by the recording because the more correct in truth, the more advantage we get for comparison.
4. Thailand is still lack of information data of industrial for database to reference. It is hard to know which organisation is excellent. Government should create the organisation for collecting industrial data in production of each industry. Many industry organisations have creditable data for reference and compare it as advantage in improvement.
5. Some organisation should bring benchmarking technique to apply for their business in term of improvement and lift up efficiency of organisation. Benchmarking is the study of successful operation, so the data we get is very advantage if we bring the study and adapted for business. Benchmarking should have been use often for the development. It may be change and compare in many terms as CSF value changing or changing the procedure in operation.

The author would like to say that benchmarking could be used as a competitive and powerful tool for improvement company's competitiveness. Benchmarking needs the person in the organisation to be involved in the benchmarking process. Everyone have to be cooperated as a single unit in order to reach the success of the Benchmarking.

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APPENDIX A

Survey Sheet

The Competitiveness Level of Toy Industry

General data

Factory name:

Employee number_________person Manufacturing capacity per month____________Ton

Product type	1._______________________	2._______________________
	3._______________________	4._______________________
	5._______________________	6._______________________
Main raw material in	1._______________________	2._______________________
Production process	3._______________________	4._______________________
	5._______________________	6._______________________
Machine type	1._______________________	2._______________________
	3._______________________	4._______________________
Toy standard certificate	1._______________________	2._______________________
	3._______________________	4._______________________

Questionnaire

This questionnaire will survey about 6 competitiveness indicators of plastic toy manufacturing industry, such that:

1. %Defect is the proportion of defected or rejected work weight because of unqualified from factory inspection or quality defect (unit in %), derived from

$$\textbf{\% Defect} = \frac{\textbf{Defect Weight}}{\textbf{Inspected Work Weight}}$$

2. %Claim is the proportion of rejected work weight because of quality defect (unit in %), derived from

$$\textbf{\% Claim} = \frac{\textbf{Rejected product from customer}}{\textbf{Total delivery product to customer}}$$

3. % On-Time Delivery is the proportion of on-time delivery lot devided by total scheduled delivery lot (unit in %), derived from

$$\textbf{\% On-Time Delivery} = \frac{\textbf{On Time Delivery Lot}}{\textbf{Total scheduled delivery Lot}}$$

4. Cost structure is the structure of of molding manufacturing cost classified into 3 catagories : direct material cost (DM Cost), direct labor cost (DL Cost), and factory overhead cost (FOH Cost) where

Direct material cost means the cost of raw material for melting which is all metal including sand for molding. It can be represented in term of production cost percentage derived from:

$$\textbf{\% DM Cost} = \frac{\textbf{Direct raw material cost}}{\textbf{Production Cost}}$$

Direct labour is labour who operate in production line. Direct labour cost is wage and over time spent for such labour. It can be represented in term of production cost percentage derived from:

$$\textbf{\% DL Cost} = \frac{\textbf{Direct labour cost}}{\textbf{Production Cost}}$$

Factory overhead cost is all expense incurred from molding manufacture excluding direct material cost and direct labor cost which equal to production cost deducted by direct material cost and direct labor cost. It can be represented in term of production cost percentage derived from:

$$\textbf{\% FOH Cost} = \frac{\textbf{Factory overhead cost}}{\textbf{Production Cost}}$$

5. Accident Frequency Rate is number (frequency) of accident per 1,000,000 working hour that working hour of worker means total working hour of direct labor only, and accident frequency means accident caused to stop working only, derived from

$$\textbf{Accident Frequency Rate} = \frac{\textbf{Accident frequency x 1,000,000}}{\textbf{Working hour of direct labor}}$$

6. % Toy Design Performance is the commercial efficiency and to be the proportion of the revenue from product that design by factory's designer divided by total revenue of company, derived from

$$\textbf{\% Toy Designer Performance} = \frac{\textbf{Revenue from product that design by factory's designer}}{\textbf{Total Revenue}}$$

Meaning about the significant level of efficiency indicator

Figure 1 to 9 represent the significant level of indicator affecting company performance, for instance, it is significant upon company'scompetitiveness, it is significant or effect company's competitiveness or/and performance, etc. Each figure represents meaning as the following:

Level 1 means insignificant at all

Level 2 means significant between level 1 and 3

Level 3 means not really significant

Level 4 means significant between level 3 and 5

Level 5 means significant

Level 6 means significant between level 5 and 7

Level 7 means very significant

Level 8 means significant between level 7 and 9

Level 9 means extremely significant

Please mark √ in the block and fill in the space

%Defect Indicator

1. You think that %Defect indicator is significant to your company's competitiveness in which level

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

2. Your factory's average %Defect per year is ______%

3. You think that the best and practical %Defect indicator in toy industry generally should be __________%

% Claim Indicator

1. You think that % Claim indicator is significant to your company's competitiveness in which level

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

2. Your factory's average %Claim per year is ______%   3. You think that the best and practical %Claim indicator in toy industry generally should be __________%
%On-Time Delivery Indicator   1. You think that %On-time delivery indicator is significant to your company's competitiveness in which level   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9   2. Your factory's average %On-time delivery indicator per year is _________%   3. You think that the best and practical %On-time delivery indicator per year in toy industry generally should be__________%
Cost Structure Indicator   1. You think that cost structure is significant to your company's competitiveness in which level   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9   2. How much is your factory's average cost structure per year?   DM Cost is ____________%   DL Cost is ____________%   FOH Cost is ___________%   3. You think how much the best and practical cost structure per year in toy industry generally should be?   DM Cost is ____________%   DL Cost is ____________%   FOH Cost is ___________%
Accident Frequency Rate Indicator   1. You think that accident frequency rate indicator is significant to your company's competitiveness in which level   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9   2. Your factory's average accident frequency rate indicator per year is _________time per million working hour.   3. You think that the best and practical accident frequency rate indicator per year in toy industry generally should be__________time per million working hour.

Toy Design Performance Indicator

1. You think that toy design performance indicator is significant to your company's competitiveness in which level

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

2. You think how much the best and practical toy design efficiency per year in toy industry generally should be?

Toy Design Performance = ___________%

Name___________________________________

Interviewee's position_____________________

Date__________ / ___________ / __________

APPENDIX B

Survey Sheet

The Customer's Satisfaction Level

Section 1: General data

Company name:

Product type 1.________________ 2.________________

3.________________ 4.________________

5.________________ 6.________________

Questionnaire

This questionnaire will survey about the customer' satisfaction of plastic toy manufacturing industry, such that:

Section 2: Meaning about the satisfaction level by the view of customer indicator about Price, Product Design & Variety, Quality & Reliability and Service.

Figure 1 to 9 represent the satisfaction level of customer affecting for each company performance. It is significant upon company's competitiveness, it is significant or effect company's competitiveness or/and performance, etc. Each figure represents meaning as the following:

Level 1 means unsatisfying at all

Level 2 means satisfying between level 1 and 3

Level 3 means not really satisfying

Level 4 means satisfying between level 3 and 5

Level 5 means satisfying

Level 6 means satisfying between level 5 and 7

Level 7 means very satisfying

Level 8 means satisfying between level 7 and 9

Level 9 means extremely satisfying

Please mark √ in the block and fill in the space

1. Price

You think that Price for each toy manufacture is satisfying to your company in which level

- Factory B

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- Factory D

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- The Sample Factory

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

2. Product Design & Product Variety

You think that Product Design & Product Variety indicator for each toy manufacture is Satisfying to your company in which level

- Factory B

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- Factory D

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- The Sample Factory

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

3. Quality & Reliability

You think that Quality & Reliability for each toy manufacture is satisfying to your company in Which level

- Factory B

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- Factory D

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- The Sample Factory

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

4. Service

1. You think that service for each toy manufacture is ssatisfying to your company in which level

- Factory B

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- Factory D

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- The Sample Factory

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

Section 3: Meaning about the product level by the view of customer indicator.

Figure 1 to 9 represent the product level by the view of customer. Each figure represents meaning as the following:

Level 1 means medium grade toy at all.

Level 2 means medium grade toy between level 1 and 3.

Level 3 means not really medium grade toy.

Level 4 means hi medium grade toy between level 3 and 5

Level 5 means hi medium grade toy

Level 6 means hi medium grade toy between level 5 and 7

Level 7 means hi grade toy.

Level 8 means hi grade toy between level 7 and 9

Level 9 means extremely hi grade toy

Please mark √ in the block and fill in the space

You think that product level for each toy manufacture in which level

- Factory B

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- Factory D

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

- The Sample Factory

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

Name________________________________

Interviewee's position____________________

Date__________ / __________ / __________

BIOGRAPHY

Suthiket Thatpitak-kul was born on November 13th, 1970 in Bangkok, Thailand. He graduated from Chulalongkorn University in 1993 with a Bachelor degree in Chemical Engineering. After graduated, he started his work in the Office of the Board of Investment (BOI), government agency, at the position of investment promotion officer 3. In 2001, he studied for the Master degree in Engineering Management at the Regional Centre for Manufacturing Systems Engineering, Faculty of Engineering, Chulalongkorn University and University of Warwick.