

Initial Recommendation Model for Managing Sales Growth and Gross
Margin with Product Life Cycle (PCL) Concept

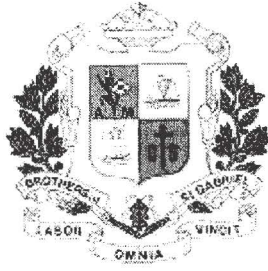
by

Panya Pusawasratana

MT6500 Technology Management Project

Submitted in Partial Fulfillment of
The Requirements for the Degree of
Master of Science
in Technology Management
Assumption University

February, 2002



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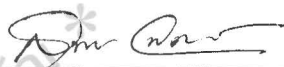
Project Approval

Project Title Simulation Model for Managing Sales and Gross Profit
Through Product Life Cycle (PLC) Concept



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ABSTRACT

Managing total sales and gross profit (in order to meet a firm's target) is a crucial task for senior management. Most companies have more than one products/services group to be managed and each group is often in different product life cycle (PLC). In order to manage total sales growth or gross margin target, senior management must set the target of sales growth and gross margin for each group.

The initial recommendation model is constructed to serve the objective by applying the product life cycle concept. The model is preset of the possible ranges of sales growth and gross margin of each stage of the product group based on the PLC concept. The program is running on the simple excel spreadsheet by simulating sales growth and gross margin from possible range of each product group based on its life cycle in order to meet the total sales growth and gross margin of the firm.

The model requires thoughtful attention from senior management on the input of each product group and select the possible sets of output to be the initial guideline. Therefore, careful use of the model is essential. For instance, if the target (sales growth and gross margin) is set inappropriately (too low/high), the model may not reach the any set of the outcome or even the target is set appropriate, the model may reach too many sets of outcome. These will require management attention to reconsider on setting the target or looking carefully on the contribution of each product group or carefully selecting one set of outcome before committing resources on the next stage.

The selected set of outcome will be the predetermined benchmark for performance evaluation of (middle) managers who manage each product group.

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CHAPTER 1

INTRODUCTION

1.1 Background of the project

Senior management tasks are to manage a company or groups of companies. The linkage of total sales and gross profit to each product group is not only setting pragmatic objectives to middle management but also communicating predetermined performance evaluation.

Senior management manages sales growth and gross profit while middle management drives the product in different stages of product life cycle. As a result, senior management is unable to perceive the healthy products in each stage of product life cycle, which may led to several problems. One problem would be addressed when senior management approves the budget, requested from middle management, for the next budgetary period. Senior management has no supporting information to make the right decision regarding budgetary. When senior management of target growth sets up the target company growth, senior management has very often no clue on how many percent for each product group.

In addition, due to the different characteristics of product life cycle, managing products in different cycles is important to a company. Companies normally reformulate their marketing strategy several times during a product's life cycle. Economic conditions change, competitors launch new assaults, and the product passes through new stages of buyer interest and requirements. Consequently, a company must plan strategies appropriate to each stage in the product's life cycle. Most companies hope to extend the product's life cycle and profitability but the product will not last forever.

Linkage of total sales/gross profit through product life cycle (PLC) concept is also considered. The PLC concept is a generalized concept depicting the unit sales trend of

some narrowly defined product or service from the time of market entry until withdrawal by the firm. It can be approximated by a bell-shaped curve, which is divided into several segments. Most writers reference a four-stage PLC curve that does not include a pioneering stage. The major characteristics of each stage of product life cycle are summarized, as follows.

Table 1-1: Table of Major Characteristics of Each Stage of PLC

Stage of PLC	Characteristics
Introduction	▪ Low sales as products introduced
	▪ Few competitors
	▪ Customers are innovators
	▪ High marginal cost per customer
	▪ Negative profit
Growth	▪ Rapidly rising sales
	▪ Growing number of competitors
	▪ Customers are early adopters
	▪ Average cost per customer
	▪ Rising profits
Maturity	▪ Peak of sales
	▪ Number of competitors either stabilize or decline
	▪ Customers are middle majority
	▪ Lowest cost per customer
	▪ Profits either stabilize or decline due to competition
Decline	▪ Sales fall
	▪ Number of competitors decline
	▪ Customers are laggards
	▪ Costs remain the same or increase due to less volume
	▪ Profits decline

Source: Marketing Management, Philip Kotler

1.2 Problem Statement

To effectively manage and maintain products through the product life cycle becomes a serious discussion in the company. Due to the fact that nowadays many companies are confronted with intensifying global competition, rapidly evolving technology, rising costs, and volatile customer preferences, one of the key questions under concern is:

How to set target sales/gross margin of each product group in different PLC in order to meet total sales/gross margin target of the company?

The result of the target sales/gross margin of each product group will help performance evaluation of managers (who manage each group of products) with the application of the PLC concept, the target sales of each product group should be aligned with its life cycle stage. Therefore, the total sales target will be able to achieve through the appropriate setting target of each product group.

1.3 The Objectives of the Project

The main objective of the project is to develop an initial recommendation model for managing sales target and gross margin target of each product group through the product life cycle and the result of them will help to evaluate performance of managers. The model will be a guideline for senior management in order to manage sales and gross profit through PLC concept.

The key objective of this study is:

- To be a guideline for senior management on managing sales and gross profit of each product group by using the initial recommendation model with the PLC concept application.

Limitation of model

- Products/services not all follow PLC concept require management judgment, such as duration of each stage of product life cycle.
- The range of sales growth, sales proportion, gross margin, and period in the model are quantified based on characteristics of PLC concept. It may not be suitable for some companies, which do not have more than one group of products/services – start up companies.
- Product Life Cycles vary in length. How long a whole product life cycle takes, and the length of each stage, varies across products. The cycle may vary from as little as 90 days to as long as 100 or more years, as for gasoline-powered automobiles. HENCE, MANAGEMENT JUDGMENT ON THE INPUTS IS CRUCIAL.

1.4 Scope of the Project

The scopes of this project are outlined as follows:

- 1) To apply PLC concept from the literature review for understanding and quantifying the characteristic for each stage of product life cycle through a total sales and gross profit of a company/group of companies.
- 2) To build an initial recommendation sets of outcome for managing sales and gross profit through PLC concept.
- 3) The selected sets of outcome from senior management will be applied as the preset benchmarks on evaluating performance of (middle) managers.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Many researches discussed about managing products through the product life cycle. This chapter focuses on some of the main issues related to the PLC concept and how to apply them to other areas in the company. The available literature has been reviewed under following headings:

2.2 The Product Life Cycle Concept

David R. Ring et al. (1999) stated that the product life cycle is a generalized model depicting the unit sales trend of some narrowly defined product from the time it is first placed on the market until it is later removed by the firm. It can be approximated by a bell- or S-shaped curve, which is divided into several stages or phases. The time length of any stage and the shape of the overall PLC may vary for different products and industries. But excluding commodities, such as wheat, or premature intervention by the firm, most products follow some type of PLC curve. Figure 1 depicts typical unit sales and profit curves for a four-stage PLC.

Strategic Planning and the PLC Concept

The PLC concept is especially appropriate for companies in which particular products dominant managerial thinking or actual volume. But its importance varies by stage. The early phases are more volatile and more consequential in their impact on functional operations than later ones. Seasonal patterns may override the PLC in a protracted, stable maturity period. During the decline stage, management's attention passes to successor products. The PLC concept does not apply to organizations whose output has

a steady long-term trend (such as unbranded hardware), or has balanced diversity such that no one product line's sales pattern justifies special attention.

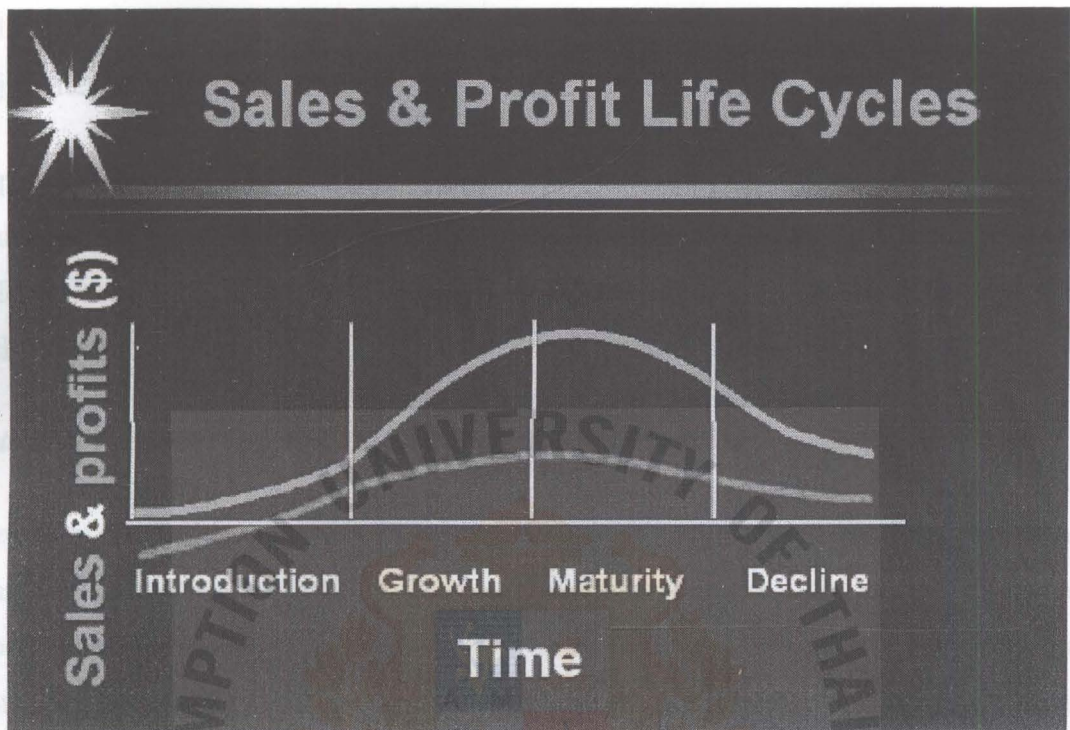


Figure 2-1: A Generalized Product Life Cycle Curve

It is important to note that the PLC does not just happen with the passage of time. Rather, it is the result of the interaction of a number of variables. It is shaped by both market demand factors and other external conditions – usually beyond the firm's control – as well as by the firm's marketing efforts. Even when a product's sales level off or start to decrease, the firm has several alternative strategies it can implement to prolong or revive the sales cycle, if it desires to do so. It can add extra features, target a new market, redesign the product, or develop a new promotional campaign. (Of course, this assumes that market demand factors and external conditions remain favorable.)

Business scholars and practitioners generally agree that the PLC concept is a crucial factor in the successful management of a firm's marketing effort as well as in determining appropriate market strategies. By portraying the "evolution of product attributes and market characteristics through time," says Polli (1968), it can be "used

prescriptively in the selection of...[strategic and tactical] actions and in planning.” Kotler (1997) notes that by “identifying the stage that a product is in, or may be headed toward, companies can formulate better marketing plans” – and more effective strategies and tactics. Hence, as a planning tool, says Kotler, the PLC is useful in “indicating the major alternative marketing strategies available to the firm in each stage.”

Gup and Agrawal (1996) suggest that the PLC concept provides unique insights for evaluating corporate growth and performance. According to Kotler, products “require different marketing, financial, manufacturing, purchasing, and personnel strategies in each stage of their life cycle.”

Rationale for Using the PLC Concept in Financial Planning

The use of the PLC concept as a framework to formulate and implement timely financial strategies can be readily justified. Product development teams often include a finance expert whose main objective is to ensure overall company profitability and maximize shareholders' wealth. Optimal financial decisions may result from using different approaches at various PLC stages. Investing in a new product with a negative net present value in the pioneering phase may allow the firm to enter a market that will be profitable in the growth and maturity phases. Thus, in the pioneering phase, strategic value originating from options that allow follow-up investments and growth opportunities may dominate traditional discounted cash flow analysis. Whereas the decision to produce at commercial scale may be viewed as a standard capital budgeting problem, the decision to proceed with pilot production and test marketing is similar to purchasing an option. Strategic value may also become important in the decline stage, when the option to abandon should be considered. Option pricing theory can be used to evaluate these strategic opportunities in order to either amplify good fortune or mitigate loss.

Products in different stages may be combined to form a diversified product portfolio, which can reduce risk. Mature products with strong steady cash flows can help balance the cash flow deficit of products in the pioneering stage, which will lower the risk of bankruptcy. A balanced product portfolio will also help smooth production and personnel needs. Low unit sales in the introduction and decline stages can be offset by

higher sales during the growth and maturity phases. This will facilitate scheduling as well as increase the stability and efficiency of operations.

If the company desires to be a healthy, ongoing concern, it cannot rely on only one product that will eventually reach maturity and decline. Instead, it should maintain a portfolio of several products – ideally, at least one product in each PLC stage. The cash flows generated by mature and declining products can feed the cash flow needs of new, developing products, creating a continuous cycle of evolution. One generation of products can help give birth to the next. Cash resources need not come from the capital market, but rather from those units that generate cash flows. In this way, the firm can perpetuate itself as a continually evolving, viable system.

2.3 Marketing and Financial Strategies Throughout the PLC

The dependence of financial activities on a product's sales trend was originally recognized by Fox (1973). Using the PLC as a gauge of changing market conditions, Fox formulated a set of prescriptive financial strategies (FSs) that he recommended for each stage of the product's sales cycle. Later, on the basis of subsequent research and discussions with several financial managers, Fox and Rink (1978) expanded the initial PLC-FS model to include 91 normative FSs. In order to assist managers in formulating and implementing even more timely and effective FSs, Devid R. Ring et al. (1999) synthesize, expand, and update previous PLC-FS models.

Pioneering Stage

New products are developed and test marketed during the pioneering stage. A high degree of uncertainty and risk is characteristic. The major challenge is juggling a strained cash flow in an uncertain environment while trying to maintain flexibility and allow for future growth options.

The first step in the pioneering stage is to cooperate with marketing to develop a sales forecast for the prospective product. Incremental cash flows can then be estimated. These should include all cash flows that result as a direct consequence of accepting the

new project. Sunk costs should be excluded, but side effects, such as the erosion of sales of existing products, should be counted. The financial manager should also look for embedded options, such as additional future growth opportunities. New products will always involve a degree of uncertainty, and the estimated cash flows can be adjusted for risk by using certainty equivalents or a higher discount rate.

Several techniques can help evaluate a proposed new product. Besides the traditional discounted cash flow techniques, such as net present value (NPV) and internal rate of return (IRR), strategic elements should also be considered. Investing in a new product with a negative NPV in the pioneering phase may allow the firm to enter a market that will be profitable in the growth and maturity phases. Thus, strategic value originating from options that allow follow-up investments and growth opportunities may dominate traditional discounted cash flow analysis.

The financial manager needs to evaluate several financial options. Internal sources of funds should be used whenever possible, but external capital markets may also be needed. Debt should be compared to equity, and short-term versus long-term borrowing should be compared based on market conditions, the need for flexibility, and the overall goal of maximizing shareholders' wealth. The manager should consider venture capitalists for possible funding of new technology, and establish relationships with bankers and creditors for future needs.

An important challenge involves managing working capital to accommodate tight cash flows. This may include stretching payables and doing some juggling for progressively higher cash outlays, such as R&D advances.

Routine operating decisions are also necessary, such as whether to budget new personnel needs, lease or purchase manufacturing equipment, and develop estimated standards for manufacturing costs and quality. Often these decisions will involve interfacing with several other departments, such as personnel, production, engineering, purchasing, and marketing. The financial manager may also work with the legal department in analyzing the benefits and costs of patent protection versus first-mover advantages.

Introductions Stage

The introduction stage begins with full-scale marketing of the new product. Usually there are a limited number of competing firms, profitability is low, prices are high, and liquidity and leverage positions are strained. Financial managers seek to balance the likelihood of new product failure with the urgency of adequate facilities and materials if the new product succeeds. The major challenge is to maintain flexibility by keeping options open, because a new product launch always carries a certain level of risk. During this introduction stage, variable costs should be used instead of fixed costs, such as leasing equipment instead of buying. Subcontractors should be used as much as possible. Production should be labor-intensive in order to minimize fixed investments in plant and equipment, thereby maintaining flexibility. Cash flow estimates should be revised and updated as the product is continually monitored for changes.

Strained liquidity means careful management of working capital. Payables may need to be stretched, while credit and collections may need to be streamlined. Special deals and sales inducements used to encourage potential customers to buy the new product must be carefully managed.

The financial manager meets with marketing to establish pricing, develop cost-effective selling tools and sales commissions, and determine plant location. Engineering can assist in determining the ultimate scale of the plant and “debugging” production, as well as designing a reporting system to monitor quality, costs, and scrap. The financial manager also participates in planning total quality management (TQM) and just-in-time (JIT) manufacturing programs.

Market conditions should be continually evaluated in order to consider financing alternatives. The financial manager may also establish a relationship with an underwriter for future issues of securities. The most important consideration is to maintain flexibility and manage risk, continually monitoring the environment for changes in the economic climate, changes in the original assumptions, and competitive reactions.

Growth Stage

Growth begins when unit sales start rising at a faster rate. Typically, there are substantial profits, a rapid expansion in demand, increasing competition, an improved cash flow position, improved liquidity, and high leverage. A big challenge is to maintain quality standards despite pressure for speedy deliveries.

During the growth phase, variable costs may be converted into fixed costs as the quantity produced rapidly rises. This increase in operating leverage will mean greater profits. Production should be switched from labor-intensive to capital-intensive. As much of the product as possible should be produced in the firm's own facilities. To ensure long-term distribution or supply, consideration should be given to buying an ownership interest in key distributors or suppliers. Manufacturing will likely incur a heavy amount of overtime to accommodate the rapid expansion in demand. Inventories need to be carefully managed to avoid stockouts at minimum cost.

Although the cash flow position is greatly improved, working capital must be carefully handled to accommodate an increased outflow of cash. Rapidly rising receivables will need to be managed to ensure timely collection. Favorable credit terms should be negotiated with suppliers.

The substantial profits generated during this stage may be used to fuel additional growth. Expansion alternatives to handle the increasing product demand should be carefully evaluated. Money should be committed to R&D for product extensions or successor products. At the same time, optimistic executives should be cautioned against overbuilding specialized facilities. Entering foreign markets should be considered.

Although growth may be financed internally by reinvesting profits, access to external capital may also be needed. Choices must be made between debt and equity, and the financial manager should work with an underwriter to select the best price and time to sell securities. Financial ratios should be monitored in order to appear favorable to creditors. The environment should be continually scrutinized for changes, and product cash flow estimates need to be revised.

Maturity Stage

During a product's maturity, sales volume continues to increase, but at a lower rate; eventually it levels off or drops slightly. This stage is also characterized by declining profits, many aggressive competitors, improved liquidity, decreased leverage, and excess cash flow. One of the biggest challenges is to maintain quality standards despite pressure for lower costs. Financial managers should continually search for ways to both reduce costs and improve quality throughout the organization.

In the maturity stages, production should be capital-intensive in order to gain the advantages of operating leverage. The financial manager should evaluate whether to establish decentralized manufacturing facilities. Standards for manufacturing costs and quality should be monitored, and a cost reduction analysis performed. Incentives should be developed for production efficiency. Tight control is needed for the extensive and complex inventories. Many clerical and other routine jobs may be computerized. Capital budgeting decisions at stage may rely more heavily on traditional discounted cash flow approaches, such as NPV and IRR.

Mature products with strong, steady cash flows can help balance the cash flow deficit of products in the pioneering stage. The firm should look for new products in the development stage to balance its product portfolio. The cash flows generated by mature products can feed the cash needs of new products. A balance of products can reduce risk as well as smooth production and personnel needs, facilitate scheduling, and increase the stability and efficiency of operations.

An effort should also be made to optimize interactions and synergies of the existing product with other products in different PLC stages. New markets and uses for the product should be evaluated, including international markets and product extensions.

As demand levels off, marketing should be consulted about sales forecasts to develop revised cash flow estimates. The financial manager should also work with marketing to determine the most cost-effective distribution system, authorize price reductions and sales inducements, and evaluate compensation packages for salespeople.

The improved liquidity and high cash flow during this stage may represent excessive slack and present agency problems as managers become complacent and indulge in many extra perks. These perks must be minimized, and incentives should be implemented to make the organization more efficient and competitive. The excess cash flow can be used to pay down debt, thereby improving the firm's credit rating. Management should also consider paying out profits as dividends.

Through benchmarking, the financial manager should monitor trends in the firm's financial ratios relative to those of its major competitors. Financial strengths and weaknesses as well as plans of major competitors should be evaluated to help the company determine appropriate strategic and tactical actions. Diversification, mergers, and forward or backward vertical integration may also be considered.

Decline Stage

During a product's decline, unit sales drop at a rapid rate. Typically, there are falling prices, extremely low profit, good liquidity, and low leverage. A major focus is on administering a systematic retrenchment.

As sales of the existing product decrease, capital should be reinvested in new products to maintain a balanced product portfolio. One generation of products can help give birth to the next, thereby increasing the overall stability and efficiency of operations and ensuring that the company remains a healthy, ongoing concern.

The product line should be simplified in this stage, if some models have low revenues. Product abandonment is an option. Even if the product's net present value is positive, it may be beneficial to abandon it in order to pursue more profitable alternatives. Marketing resources may be shifted to more favorable product prospects.

The financial manager should focus on true cost eliminations – selling manufacturing equipment, withdrawing promotional support, reducing or canceling the R&D budget – rather than cost reassignments. When possible, manufacturing facilities may be converted to more promising products. Specialized equipment and facilities may need to be disposed of, which could mean a return to subcontracting for the existing product.

Equipment and facility disposal should be performed in a manner that minimizes tax liability. Unstable inventory and equipment should be written off to take advantage of tax breaks.

Tight controls should be maintained to keep inventories low. High net cash inflows should be used intelligently. Agency costs that waste cash, such as excessive managerial perks, should still be avoided. Excess cash can be used to pay off remaining debt. The firm may also consider paying dividends to shareholders.



CHAPTER 3

METHODOLOGY

3.1 Project Concept

The goal of the project is to develop an initial recommendation model for managing sales and gross profit with the application of the PLC concept. The model would support senior management as a guideline to manage products through the product life cycle concept. The result of these will help to evaluate performance manager based on product group.

To achieve the goal in building the initial recommendation model, the key criteria (i.e., sales growth, sales proportion of the first period, gross margin and period - length of each stage) are required to define for each product group. PLC concept, which depicts the characteristics of each stage of product life cycle, can be used to determine sales proportion of the first period, sales growth, gross margin and period - length of each stage. Table 3-1 shows the relationship between the characteristics of each stage of product life cycle and sales growth, sales proportion, gross margin and period.

Table 3-1: Table of Relationship of PLC Characteristics and Model Criteria

Stage of PLC	Characteristics	Effects On
Introduction	▪ Low sales as products introduced	▪ Sales proportion
	▪ Few competitors	▪ Gross margin, Period, Sales growth
	▪ Customers are innovators	▪ Gross margin, Sales growth
	▪ High marginal cost per customer	▪ N/A
	▪ Negative profit	▪ N/A
Growth	▪ Rapidly rising sales	▪ Sales proportion, Sales growth
	▪ Growing number of competitors	▪ Sales growth, Period
	▪ Customers are early adopters	▪ Gross margin, Sales growth
	▪ Average cost per customer	▪ N/A
	▪ Rising profits	▪ N/A
Maturity	▪ Peak of sales	▪ Sales proportion, Sales growth
	▪ Number of competitors either stabilize or decline	▪ Sales growth, Period
	▪ Customers are middle majority	▪ Gross margin, Sales growth
	▪ Lowest cost per customer	▪ N/A
	▪ Profits either stabilize or decline due to competition	▪ N/A
Decline	▪ Sales fall	▪ Sales proportion, Sales growth
	▪ Number of competitors decline	▪ Sales growth, Period
	▪ Customers are laggards	▪ Gross margin, Sales growth
	▪ Costs remain the same or increase due to less volume	▪ N/A
	▪ Profits decline	▪ N/A

N/A: It means that the characteristic could not determine the key criteria (i.e., sales proportion, sales growth, gross margin, and period). The detail will be described in the next section.

3.2 Project Description

3.2.1 Description of Assumption for PLC Characteristics

In this section the characteristics of each stage of product life cycle is interpreted and analyzed in order to determine sales proportion of the first period, the range of sales growth, the range of gross margin, and period (length of each stage). These key criteria are summarized at the end.

3.2.1.1 Introduction Stage

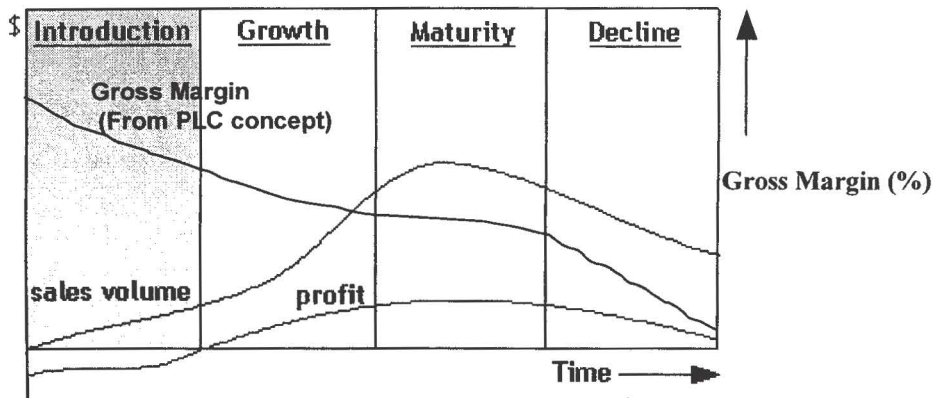


Figure 3-1: Introduction Stage of the Product Life Cycle

Characteristics Used for the Model

- **Low sales as products introduced:** Proportion of sales in the product life cycle is relatively low, therefore the range of total sales is between 0-20%.
- **Few competitors:** Few competitors resulting in high gross margin and period (length of each stage), therefore the range of gross margin is between 50-90%, and period will be 15%. Sales growth should be relatively lower than growth stage but higher than maturity stage, and should not be negative. Therefore, the range of sales growth is between 5-20%.
- **Customers are innovators:** Leading fashion, less price sensitive, reflects high gross margin. Therefore, the range of gross margin is between 50-90%. Sales growth should be relatively lower than growth stage but higher than maturity stage, and should not be negative. Therefore, the range of sales growth is between 5-20%.

Characteristics Unused for the Model

- **High marginal cost per customer:** Resulting in negative profit. It will not be included in this model.

- **Negative profit:** Due to the fact that the net profit includes SG&A, financial cost, investment expense, and etc., but the gross margin/profit (used in the model) does not include, therefore, it will not be reflected in this model.

3.2.1.2 Growth Stage

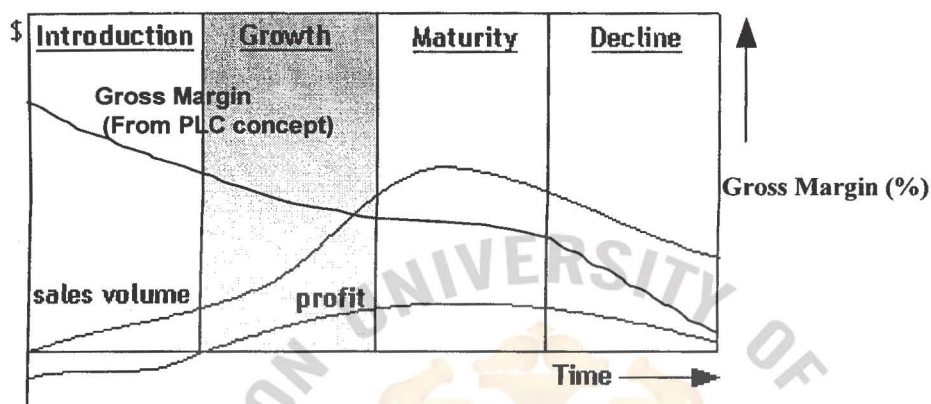


Figure 3-2: Growth Stage of the Product Life Cycle

Characteristics Used for the Model

- **Rapidly rising sales:** Resulting in high proportion of sales but lower than maturity stage, and also leading to highest sales growth comparing to other stages in the product life cycle. Therefore, the range of total sales is between 10-40% and the range of sales growth is between 20-150%.
- **Growing number of competitors:** Competitors see the opportunity and enter the market. Some just copy the most successful product, or try to improve it to compete better. Resulting in high sales growth, the range of sales growth is between 20-150%. Also the period of this stage is effected on the increasing number of competitors, the period will be 35%.
- **Customers are early adopters:** Product already recognized by customer and more competitors come in, so the product could be compared with the others. Resulting in low gross margin but higher than maturity and decline stage.

Therefore, the range of gross margin is between 30-70%. Also, resulting in high sales growth, the range of sales growth is between 20-150%.

Characteristics Unused for the Model

- **Average cost per customer:** It will not be included in this model.
- **Rising profits:** This is the stage where the company profits are largest. The innovator begins to make big profits as more and more customers buy because customers already recognize the product. The net profit includes SG&A, financial cost, investment expense, and etc., but the gross margin/profit (used in the model) does not include, therefore, it will not be reflected in this model.

3.2.1.3 Maturity Stage

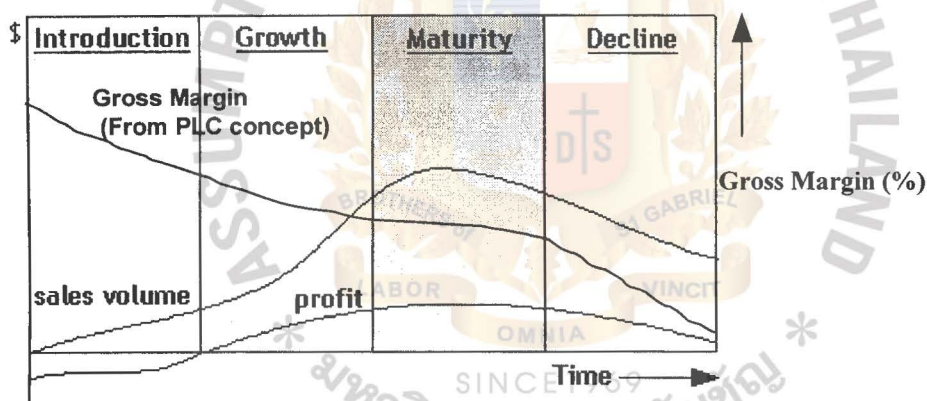


Figure 3-3: Maturity Stage of the Product Life Cycle

Characteristics Used for the Model

- **Peak of sales:** The product has now been on the market for some time. Sales volume and profit both reach their peak. Towards the end of this stage sales volumes begin to fall along with the profit generated by this product. Resulting in high proportion of sales – the range between 25-60%, relatively low sales growth – the range between 0-20%.

- **Number of competitors either stabilize or decline:** Reflects in relatively low sales growth, the range between 0-20%. Also, resulting in longer period than other stages, therefore the period will be 45%.
- **Customers are middle majority:** Resulting in low gross margin, the range is between 20-40%. Also, reflects in relatively low sales growth, the range is between 0-20%.

Characteristics Unused for the Model

- **Lowest cost per customer:** It will not include in this model.
- **Profits either stabilize or decline due to competition:** Producers who are operating on very low margins may find that the level of competition is too high and results in prices being lowered. Due to the fact that the net profit includes SG&A, financial cost, investment expense, and etc., but the gross margin/profit (used in the model) does not include, therefore, it will not be reflected in this model.

3.2.1.4 Decline Stage

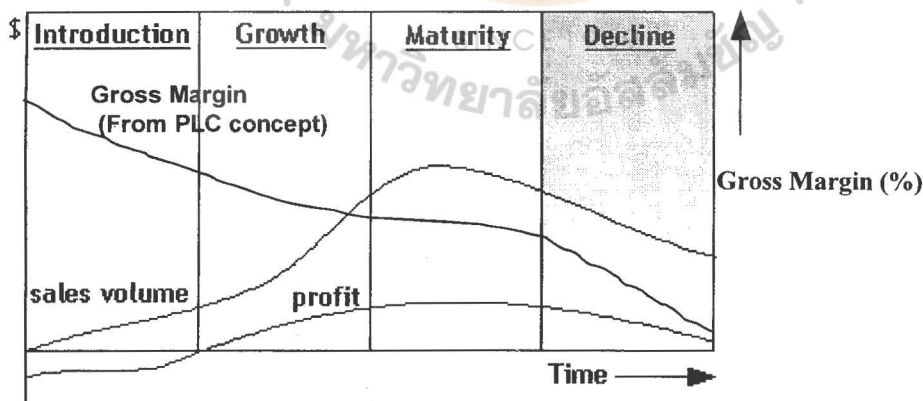


Figure 3-4: Decline Stage of the Product Life Cycle

Characteristics Used for the Model

- **Sales fall:** Proportion of sales in this stage is quite low, the range of total sales is between 0-10%. Also, resulting in lowest sales growth comparing with the other stages, the range of sale growth is between (-50) - 0%.
- **Number of competitors decline:** Resulting in lowest period comparing with the other stages, the period will be 5%. Also, resulting in lowest sales growth comparing with the other stages, the range of sale growth is between (-50) - 0%.
- **Customers are laggards:** price becomes more sensitive, reflects low gross margin, the range of gross margin between 0-15%. Also, resulting in lowest sales growth comparing with the other stages, the range of sale growth is between (-50) - 0%.

Characteristics Unused for the Model

- **Costs remain the same of increase due to less volume:** It will not be included in this model.
- **Profits decline:** Due to the fact that the net profit includes SG&A, financial cost, investment expense, and etc., but the gross margin/profit (used in the model) does not include, therefore, it will not be reflected in this model.

After analyzing and interpreting the major characteristics of each stage of product life cycle, the range of sales proportion, sales growth, gross margin, and period in each stage of product life cycle can be approximated as follows.

Table 3-2: Table of the key criteria in each stage of PLC

Stage of PLC	Sales Proportion Range		Sales Growth Range		Gross Margin Range		Period
Introduction	0%	20%	5%	20%	50%	90%	15%
Growth	10%	40%	20%	150%	30%	70%	35%
Maturity	25%	60%	0%	20%	20%	40%	45%
Decline	0%	20%	-50%	0%	0%	15%	5%

3.3 Project Construction

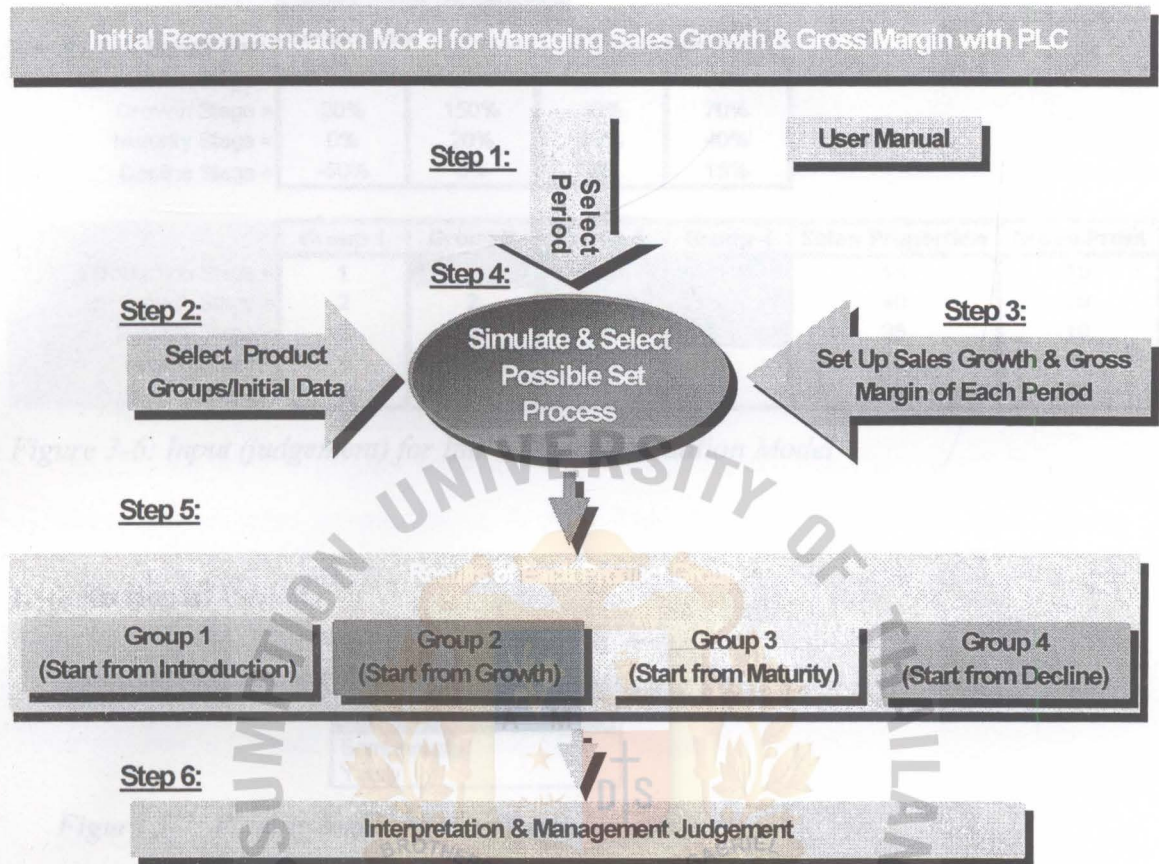


Figure 3-5: Initial Recommendation Model Processes and Components

In this project the key criteria (i.e., sales proportion, sales growth, gross margin, and period) and the PLC concept from literature review will be used for the main source of construction of the initial recommendation model. The process of construction is divided into 4 parts that are (1) inputs (judgement) (2) simulation process, (3) possible set and selection, and (4) interpretation and judgement.

3.3.1 Input (judgement)

Selected Period =	Yearly				Select drop-down list	
Specify PLC Range For:	Quarterly Semiannually Yearly					
					Gross Margin	
	Introduction Stage =	5%	20%	50%	90%	
	Growth Stage =	20%	150%	30%	70%	
Maturity Stage =	0%	20%	20%	40%		
Decline Stage =	-50%	0%	0%	15%		

	Group 1	Group 2	Group 3	Group 4	Sales Proportion	Gross Profit
Introduction Stage =	1				15	10
Growth Stage =	2	2			40	20
Maturity Stage =	2	2	3		35	10
Decline Stage =	1	1	1	1	10	2
Total =	6	5	4	1	100	42

Figure 3-6: Input (judgement) for Initial Recommendation Model

1. Selection of Period

Selected Period =	Yearly	Select drop-down list
	Quarterly Semiannually Yearly	

Figure 3-7: Planing and Targeting Period

In this model, three types of period are applied (i.e., quarterly, semiannually, and yearly) because when company and management set up a plan for each product, they always set up the plan as quarterly, semiannually, or yearly. The period can be selected depending on the requirement of users who need to foresee total sales target and gross profit as quarterly, semiannually, or yearly. The limitation of the period is that each product group could not be assigned to different period. Once any period is selected, all product groups will be forced to use the same period.

2. Selection of Product Groups and Initial Data

	Group 1	Group 2	Group 3	Group 4	Sales Proportion	Gross Profit
Introduction Stage =	1				15	10
Growth Stage =	2	2			40	20
Maturity Stage =	2	2	3		35	10
Decline Stage =	1	1	1	1	10	2
Total =	6	5	4	1	100	42

Figure 3-8: Product Groups and Initial Data

Product groups: Based on PLC concept and study, product group in this model is categorized into 4 groups consisting of Group1 (start from introduction stage), Group2 (start from growth stage), Group3 (start from maturity stage), and Group4 (start from decline stage). Each group has to specify duration (length of each stage) except the stage already passed. Any product in Group2, for instance, is not required to specify duration (length of each stage) in introduction stage because the life cycle of product in Group2 is already in the growth stage.

For example:

	Introduction	Growth	Maturity	Decline
Group1:	1 year	2 years	3 years	1 year
Group2:	N/A	2 years	4 years	1 year
Group3:	N/A	N/A	5 years	1 year
Group4:	N/A	N/A	N/A	1 year

Besides the experience of management there is an idea from PLC concept, which management can use as a guideline for selecting product groups. The idea for selecting product groups is based on sales proportion of each product. Interpretation

from PLC concept, resulting in 0%-20% for Group1, 10%-40% for Group2, 25%-60% for Group3, and 0%-20% for Group4 as shown in Table 3-2.

Initial data of each group: The initial data need to supply by users consist of: -

- Total sales of company – The default of total sales of company is set to 100 for ease of understanding and judgement.
- Sales proportion of the first period – Sales proportion will be set only for the first year. The range of sales proportion in Table 3-2 will be used as a guideline in order to set for each product group. Sales proportion is the initial sales for each group and the sum amount of sales proportion must be equivalent to total sales of company (100).
- Gross profit – Gross profit will be set depending on historical data of company.

3. Setting Up Sales Growth and Gross Margin of Each Period

	Period (Yearly) for 6 Years						
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Sales	100	110	121	133	146	161	177
Sales Growth	N/A	10%	10%	10%	10%	10%	10%
Gross margin	42%	43%	43%	43%	43%	43%	43%
Gross profit	42	47	52	57	63	69	76

Figure 3-9: Total Sales Growth and Gross Margin Target of Each Period

This is setting up sales growth and gross margin at company level (not in each product group) for each period. The period could be quarterly, semiannually, or yearly depending on selecting period, and how long the period used in this model depends on the maximum duration of product groups (as shown in Figure 3-9, the period is yearly and the long of period is 6 years). Setting up sales growth and gross margin target should be set properly. If the target of sales growth and gross margin is

set inappropriately (too low/high), the model may not reach the any set of the outcome or the model may reach too many sets of outcome.

The purpose of setting up sales growth and gross margin is to help management to manage sales and gross profit of each product group effectively.

4. Possible Ranges of Sales Growth and Gross Margin

Specify PLC Range For:	Sales Growth		Gross Margin	
Introduction Stage =	5%	20%	50%	90%
Growth Stage =	20%	150%	30%	70%
Maturity Stage =	0%	20%	20%	40%
Decline Stage =	-50%	0%	0%	15%

Figure 3-10: Possible Ranges of Sales Growth and Gross Margin

These are the ranges of sales growth and gross margin from interpreting and analyzing the characteristics of each stage of product life cycle.

When the model finds out a possible set of sales growth and gross margin of each product group, these ranges will be used for getting the appropriate outcome and each possible sales growth and gross margin of each product group could not be out of these ranges.

3.3.2 Simulation Process

How the Model Works

Before the model could start simulation, the required inputs must be entered properly such as period (quarterly, semiannually, and yearly), product group and duration, initial data (sales proportion of the first year, gross profit), possible ranges of sales growth and sales margin, and sales growth and gross margin target (at company level) of each period.

There are two major processes of simulation in this model; those are simulating for sales growth and simulating for gross margin. The conditions and details are described as follows:

The process of simulation for sales growth – the model must first start simulating for the first period of sales growth in order to find out possible sets of sales growth. If not found the possible sets, the model will not allow processing to the next period. If found the possible sets, the model allows simulating for the next period of sales growth after selecting one set of the possible sets.

The process of simulation for gross margin – it is important to remember that before the model could simulate for gross margin, the simulating and selecting process for sales growth (at the same period) must be done. Also, the model must start simulating period by period in sequence, by starting at the first period.

Simulating period by period in sequence (if not found the results, the process could not continue for the next period) is necessary because the model uses the values (sales and gross profit) from the previous period as inputs. It is possible that the model may/may not find the possible sets.

1. Simulate Possible Sets of Sales Growth

The model starts by simulating sales growth from possible ranges of each product group based on its life cycle in order to meet the total sales growth of the company. The model will find out possible sets of sales growth according to the selected targeting period, from which the targeting period should be selected in sequence (for example, Year 1, Year 2, etc.) as shown in Figure 3-11.

Select Period:

Year 1
Year 2
Year 3
Year 4
Year 5
Year 6

Figure 3-11: Targeting Period of Sales Growth

During processing, the model uses the required inputs in order to find out possible sets of sales growth of each period. As a result, the model may/may not find out the possible sets as shown in Figure 3-12 and Figure 3-13.

In case the model could not find out possible sets, the required inputs may be set inappropriately. This requires management attention to reconsider on setting the required inputs (for instance, the total sales growth target may be set too low/high).

Sales Growth

Select Period: Year 1

Select Possible Sets:

5%	20%	10%	-20%
5%	30%	0%	-30%
15%	20%	0%	0%
15%	20%	10%	-40%

Figure 3-12: In Case of Possible Sets of Sales Growth Found

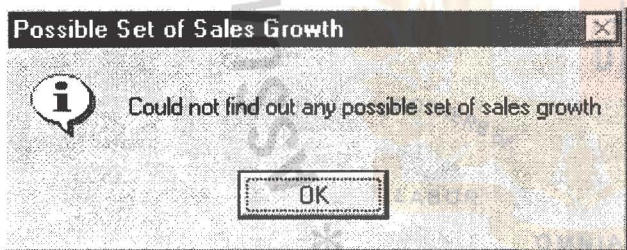


Figure 3-13: In Case of Possible Sets of Sales Growth Not Found

2. Simulate Possible Sets of Gross Margin

The model starts by simulating gross margin from possible ranges of each product group based on its life cycle in order to meet the total gross margin of the company. The model will find out possible sets of gross margin according to the selected targeting period, from which the targeting period should be selected in sequence (for example, Year 1, Year 2, etc.) as shown in Figure 3-14.

Gross Margin

Select Period:

Year 1
Year 2
Year 3
Year 4
Year 5
Year 6

Figure 3-14: Targeting Period of Gross Margin

During processing, the model uses the required inputs in order to find out possible sets of gross margin of each period. As a result, the model may/may not find out the possible sets as shown in Figure 3-15 and Figure 3-16.

In case the model could not find out possible sets, the required inputs may be set inappropriately. This requires management attention to reconsider on setting the required inputs (for instance, the total gross margin target may be set too low/high).

Gross Margin

Select Period:

Year 1

Select Possible Sets:

50%	40%	30%	0%
50%	40%	30%	10%
60%	30%	40%	0%
70%	40%	20%	10%

Figure 3-15: In Case of Possible Sets of Gross Margin Found

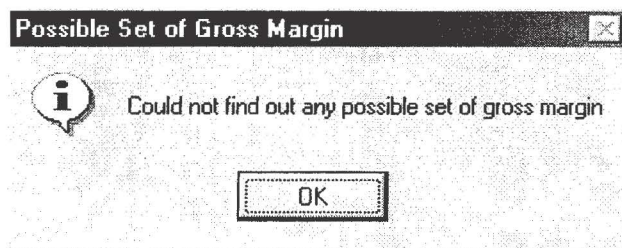


Figure 3-16: In Case of Possible Sets Gross Margin Not Found

3.3.3 Possible Sets and Selection

Due to the fact that the model may not reach any possible set or reach many possible sets, the model requires thoughtful attention from senior management on the input of each product group and selecting one set of the possible sets to be the initial guideline.

If the model could not find out any possible set, senior management would be looking back on setting target of sales growth and gross margin (at company level). It may be set too low or high. Therefore, management judgement must be required on setting the appropriate target.

In case many possible sets are found, the model will show the possible sets for selecting (as shown in Figure 3-12 and Figure 3-15). In order to achieve selecting one set of the possible sets, the model provides a guideline for senior management on selecting one set, that is a percent of contribution of each product groups. The percent of contribution could help management to carefully select one set of outcome (possible sets).

How to select one set of the possible sets

- First, senior management has to consider the possible sets for the interested period in order to see which set is suitable or possible in term of management/operation. By choosing the interested set, the model will show a percent of contribution of the interested period in comparison with the previous period (as shown in Figure 3-17, Figure 3-18).

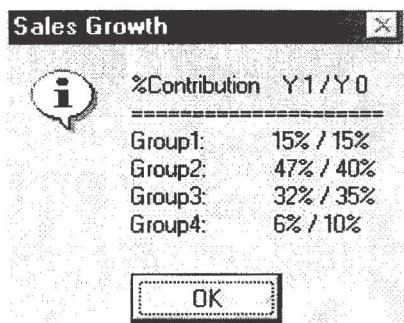


Figure 3-17: Percent of Contribution of Sales Growth for Period 0 and 1

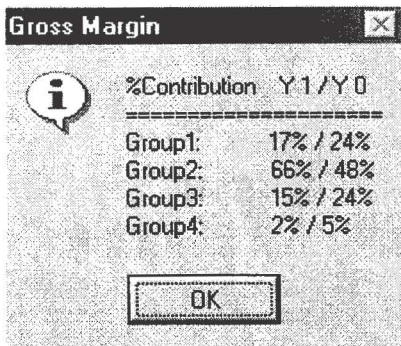


Figure 3-18: Percent of Contribution of Gross Margin for Period 0 and 1

- After that senior management has to carefully select one set of the possible sets by looking on the contribution of each product group. If the percent of contribution of the interested period has significantly increased from the previous period, the management would consider whether or not to commit resource in order to achieve the target. If the percent of contribution of the interested period has significantly decreased from the previous period, the management would be looking back on the input of each product group.
- Also, for the next period, senior management has to consider the contribution of each group (as shown in Figure 3-19, Figure 3-20, Figure 3-21, and Figure 3-22) and make decision to select one set of the possible sets for that period.

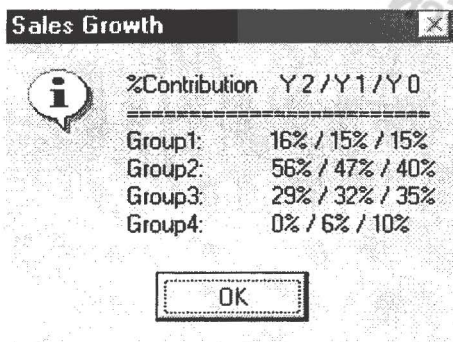


Figure 3-19: Percent of Contribution of Sales Growth for Period 0, 1, and 2

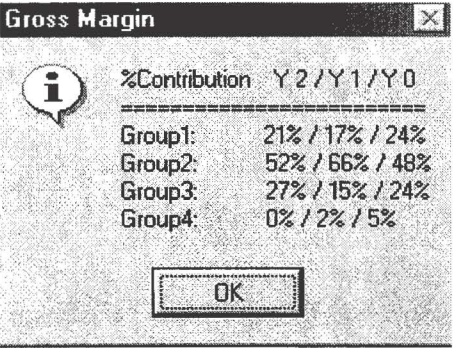


Figure 3 -20: Percent of Contribution of Gross Margin for Period 0, 1, and 2

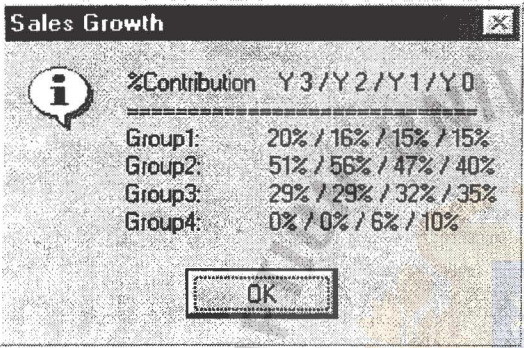


Figure 3-21: Percent of Contribution of Sales Growth for Period 0, 1, 2, and 3

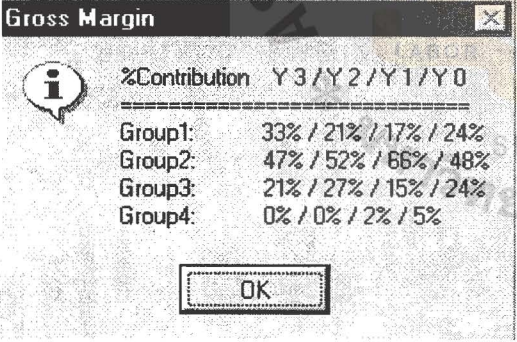


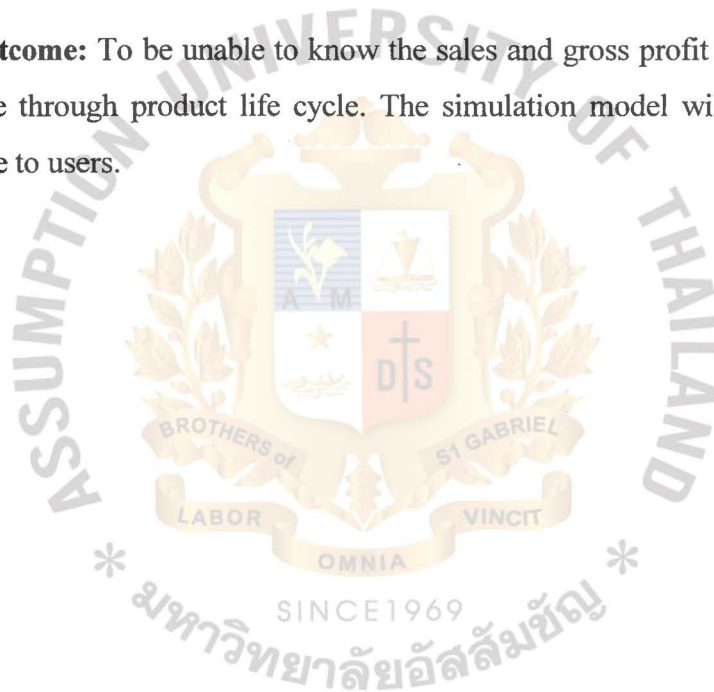
Figure 3-22: Percent of Contribution of Gross Margin for Period 0, 1, 2, and 3

3.3.4 Interpretation and Judgement

How to Interpret Results

The results of the initial recommendation model will be generated depending on the supplied inputs such as product group, period, and the range of sales growth, gross margin of each stage of product life cycle. Hence, the results of this model could be possible both as an easy interpreted outcome and difficult interpreted outcome.

1. **Easy Outcome:** To be able to know the sales and gross profit of each period of each stage through product life cycle.
2. **Difficult Outcome:** To be unable to know the sales and gross profit of each period of each stage through product life cycle. The simulation model will generate the error message to users.



CHAPTER 4

PROJECT IMPLEMENTATION AND EVALUATION

4.1 Project Implementation

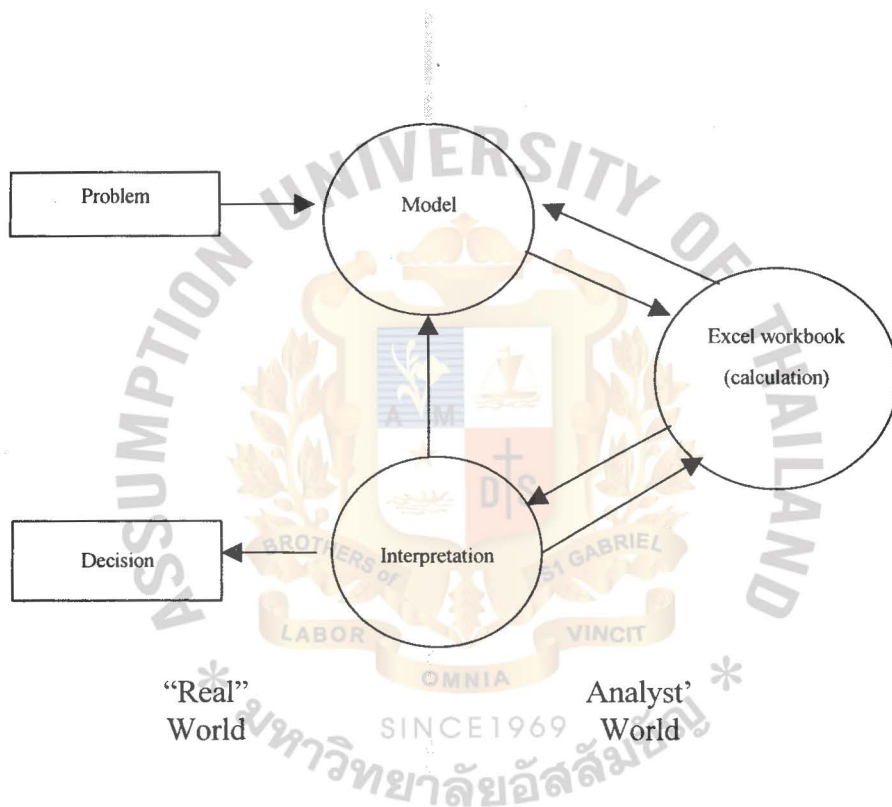


Figure 4-1: Building and implementing decision models

Source: Management Decision Making, George E.

Figure 4-1 depicts the relations among the various elements of the model. The left half of the figure relates to the “real world” in which the problem resides (inputs to the analyst) and where the implementation of the solution takes place (the output of the analyst’s activities). On the far right side of the figure is the ‘analyst’s world’ where tentative solutions to models are generated. Note that arrows circulate among the three

activities on the right side of the diagram, indicating that the development and analysis of a decision model is iterative in nature.

4.1.1 Who Are Users

- Senior management of a company
- Senior management of group of companies

4.1.2 How To Use Model

The initial recommendation model is an excel-based application, which uses the features and environment of excel program. Therefore, before the model can be used, the excel program must be started.

In the model there are many steps, which users have to follow the instruction in order to complete all processes. Online user manual is also provided as a clear guideline of how to use the model.

Initial Data

User Manual

Main Menu

Selected Period = Yearly

Select drop-down list

Specify PLC Range For:

	Sales Growth		Gross Margin	
Introduction Stage =	5%	20%	50%	90%
Growth Stage =	20%	150%	30%	70%
Maturity Stage =	0%	20%	20%	40%
Decline Stage =	-50%	0%	0%	15%

	Group 1	Group 2	Group 3	Group 4	Sales Proportion	Gross Profit
Introduction Stage =	1				15	10
Growth Stage =	2	2			40	20
Maturity Stage =	2	2	3		35	10
Decline Stage =	1	1	1	1	10	2
Total =	6	5	4	1	100	42

Note:

Change only the data in

boxes

Figure 4-2: Input (Select Period, Product Group, and Initial Data) Screen

Notice that in each screen the model provides two buttons labeled “User Manual” and “Main Menu.” The User Manual button will be used when user needs more information or needs help on how to use the model, and the Main Menu button will be used to return to the main menu.

Step 1: Select Period

By Selecting “Select Period” button on main menu (shown in Figure 3-5), the model will show the input screen for selecting period (shown in Figure 4-2). Select period (quarterly, semiannually, and yearly) from drop-down list. After finishing, select “Main Menu” button to return to the main menu.

Step 2: Select Product Groups/Initial Data

By selecting “Select Product Group/Initial Data” button on main menu (shown in Figure 3-5), the model will show the input screen (shown in Figure 4-2). Select product groups (Group1 – start from introduction, Group2 – start from growth, Group3 – start from maturity, and Group4 – start from decline) and enter duration of each product group, then enter the initial data (sales proportion, gross profit). After finishing, select “Main Menu” button to return to the main menu.

Step 3: Set Up Sales Growth and Gross Margin of Each Period

Selecting “Set Up Sales Growth & Gross Margin of Each Period” button on main menu (shown in Figure 3-5) launches the preset of sales growth and gross margin screen (shown in Figure 4-3). Enter sales growth and gross margin for all period, then the model will automatically calculate sales and gross profit for all period. After finishing, select “Main Menu” button to return to the main menu.

Preset of Sales Growth and Gross Margin

User Manual

Main Menu

	Year 0	Period (Yearly) for 6 Years					
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Sales	100	110	121	133	146	161	177
Sales Growth	N/A	10%	10%	10%	10%	10%	10%
Gross margin	42%	43%	43%	43%	43%	43%	43%
Gross profit	42	47	52	57	63	69	76

Note:

Change only the data in boxes

Figure 4-3: Preset of Sales Growth and Gross Margin Screen

Step 4: Simulate and Select Possible Set Process

By selecting “Simulate and Select Possible Set Process” button on main menu (shown in Figure 3-5), the model will show the simulation and possible sets screen (shown in Figure 4-4). To find out the possible sets of sales growth and gross margin of each period, users have to select targeting period in sequence (for example, Year 1, Year 2, etc.). If users do not select in sequence, the model will not allow, and display warning message.

When finishing simulation, the model will show all possible sets of sales growth and gross margin for selecting, then select 1 set from possible ranges. After that the model will automatically update sale growth and gross margin with the selected possible set and automatically calculate sales and gross profit for each group. After finishing, select “Main Menu” button to return to the main menu.

By selecting “Group1”, “Group2”, “Group3” or “Group4” button on the main menu (shown in Figure 3-5), the model will show the model of each product group. The model consist of the table of sales, sales growth, gross margin and gross profit for each product group, and the graph for each group. After finishing, select “Main Menu” button to return to the main menu.

Simulation and Possible Sets

Sales Growth

Gross Margin

User Manual

Main Menu

Select Period:

Year3

Select Period:

Year3

Select Possible Sets:

Select Possible Sets:

Figure 4-3: The Result of Group Screen

Summary of Product Group

	Period (Yearly) for 6 Years						
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Sales:							
Group1(start from Introduction)	15	16	20	29			
Group2(start from Growth)	40	48	62	62			
Group3(start from Maturity)	35	39	39	42			
Group4(start from Decline)	10	8	N/A	N/A			
Total Sales	100	110	121	133			
Sales growth:							
Group1(start from Introduction)	N/A	5%	30%	40%			
Group2(start from Growth)	N/A	20%	30%	0%			
Group3(start from Maturity)	N/A	10%	0%	10%			
Group4(start from Decline)	N/A	-20%	N/A	N/A			
Total Sales growth	N/A	10%	10%	10%			
GIM%:							
Group1(start from Introduction)	67%	60%	30%	70%			
Group2(start from Growth)	50%	50%	60%	40%			
Group3(start from Maturity)	29%	30%	20%	30%			
Group4(start from Decline)	20%	10%	N/A	N/A			
Total Gross Margin	42%	42%	42%	43%			
Gross profit:							
Group1(start from Introduction)	10	9	6	20			
Group2(start from Growth)	20	24	37	25			
Group3(start from Maturity)	10	12	8	13			
Group4(start from Decline)	2	1	N/A	N/A			
Total Gross profit	42	46	51	58			

Figure 4-4: Simulation and Possible Sets Screen

Step 5: See the Result of Each Product Group

By selecting “Group1”, “Group2”, “Group3”, or “Group4” button on the main menu (shown in Figure 3-5), the model will show the result of each product group. The results consist of the table of sales, sales growth, gross margin, and gross profit for each product group, and the graph for each group. After finishing, select “Main Menu” button to return to the main menu.

Group 1 (Start from Introduction Stage)

User Manual

Main Menu

	Year 0	Year 1	Period (Yearly) for 5 Years				Year 5	Year 6
Sales	15	16	20	29				
Sales Growth	N/A	5%	30%	40%				
Gross margin	67%	60%	30%	70%				
Gross profit	10	9	6	20				

Figure 4-5: The Result of Group1 Screen

Group 2 (Start from Growth Stage)

User Manual

Main Menu

	Year 0	Year 1	Period (Yearly) for 5 Years				Year 5
Sales	40	48	62	62			
Sales Growth	N/A	20%	30%	0%			
Gross margin	50%	50%	60%	40%			
Gross profit	20	24	37	25			

Figure 4-6: The Result of Group2 Screen

Group 3 (Start from Maturity Stage)

User Manual

Main Menu

	Year 0	Year 1	Period (Yearly) for 4 Years			Year 4
Sales	35	39	39	42		
Sales Growth	N/A	10%	0%	10%		
Gross margin	29%	30%	20%	30%		
Gross profit	10	12	8	13		

Figure 4-7: The Result of Group3 Screen

Period (Yearly) for 1 Years		
	Year 0	Year 1
Sales	10	8
Sales Growth	N/A	-20%
Gross margin	20%	10%
Gross profit	2	1

Figure 4-8: The Result of Group4 Screen

Step 6: Interpretation & Management Judgment

After selecting “Interpretation & Management Judgement” button on the main menu (shown in Figure 3-4), the total graph will show for interpretation and management judgement. After finishing, select “Main Menu” button to return to the main menu.

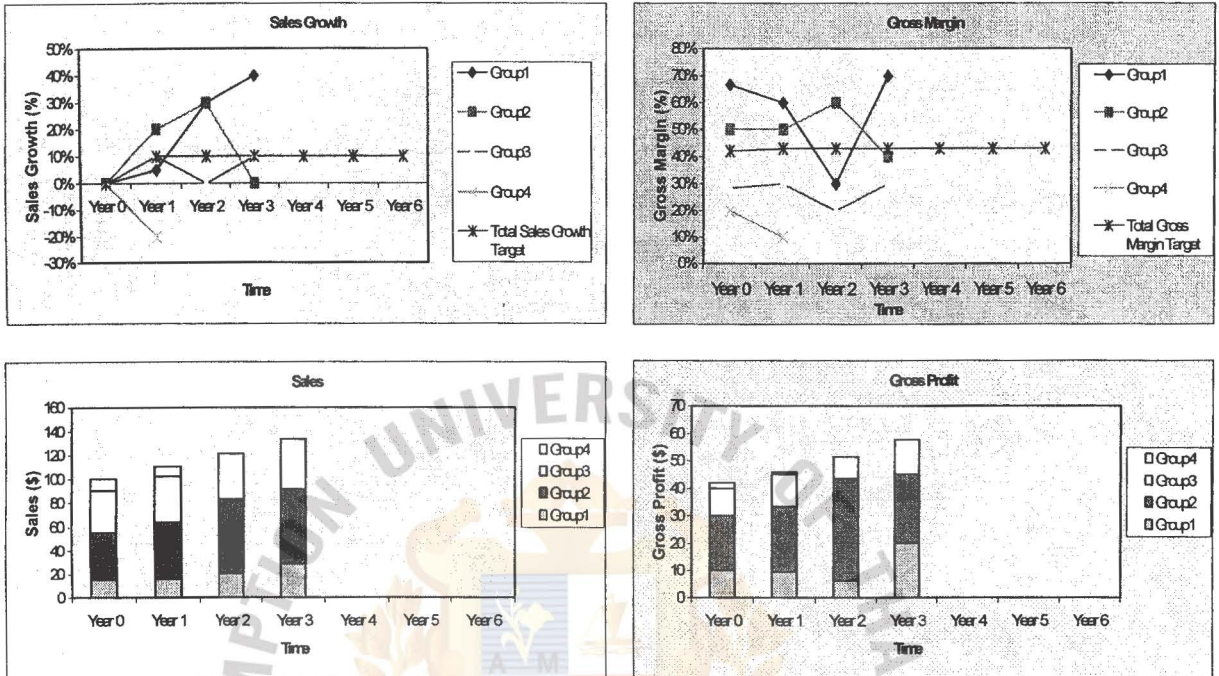


Figure 4-9: Total Graph (Sales Growth, Gross Margin, Sales, and Gross Profit)

4.2 Project Evaluation

In order to perform the evaluation of project, the testing plan is established to examine the accuracy and functionality of the initial recommendation model.

The testing plan consists of: -

1. Setting the testing environment – Set up a computer that is going to use for testing, then install Excel program to the computer.
2. Preparing the testing cases – Create the testing cases by simulating several situations that could occur based on PLC concept.
3. Unit test – During construction model, each process will be tested.

4. Integration test – After finishing, each process of the model will be integrated, then the model will be tested by the testing cases.

As a result, the initial recommendation model could be able to generate the possible sets of sales growth and gross margin from possible range of each product group based on life cycle. It is possible that the initial recommendation model could not generate the appropriate result due to limitation of the model. For example, Product Life Cycles vary in length resulting in the difficulty of defining duration (life of each stage) in the model.

4.3 Limitation and Model Enhancement

- Many possible sets of sales growth and gross margin of each product group of each period are qualified and judged by management. It depends on each management perspective and experience.
- Products/services not all follow PLC concept require management judgment, such as duration of each stage of product life cycle.
- The range of sales growth, sales proportion, gross margin, and period in the model are quantified based on characteristics of PLC concept. It may not be suitable for some companies – start up companies.
- Product Life Cycles vary in length. How long a whole product life cycle takes, and the length of each stage, varies across products. The cycle may vary from as little as 90 days to as long as 100 or more years, as for gasoline-powered automobiles. Hence, management judgment is crucial.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In order to meet the total sales and gross profit target, the company must manage sales growth and gross margin of each product through its life cycle. As a result, the initial recommendation model is formulated by applying the PLC concept, the model quantifies sales growth and gross margin of each product group based on the PLC characteristics. The model simulate sales growth and gross margin from possible range of each product group based on its life cycle in order to meet the total sales growth and gross margin of the company. Many possible sets of sales growth and gross margin in each year throughout the life cycle of each product group are the outcome of the initial recommendation model. These outputs require management judgment in order to commit resources to drive each product group. There are some limitations of the initial recommendation model that need to be qualified, as follow:

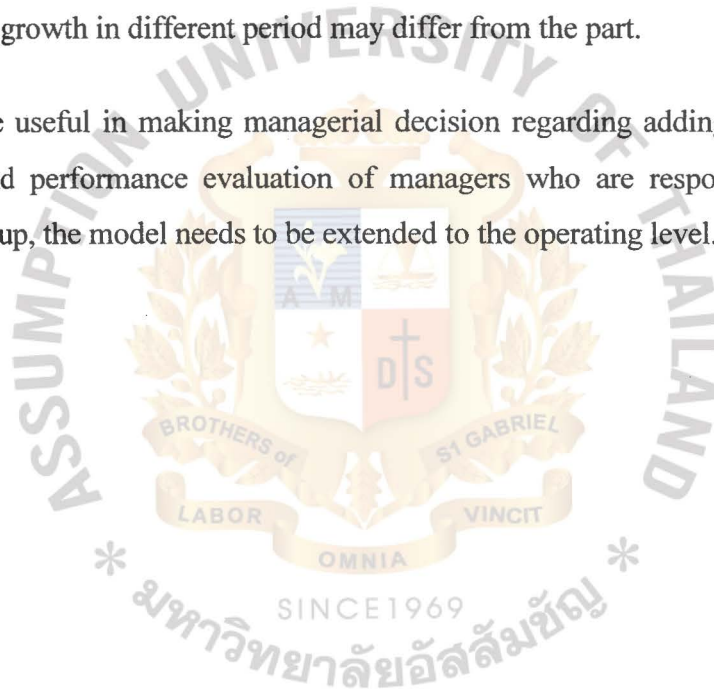
- Many possible sets of sales growth and gross margin of each product group of each period.
- The range of sales growth, sales proportion, gross margin, and period in the model.
- Product Life Cycles vary in length resulting in the difficulty of defining duration (life of each stage) in the model

The model, however, should be extended to the operating margin level in order to be more widely used. The results at the operating level will measure the performance of manager more accurately.

5.2 Recommendations

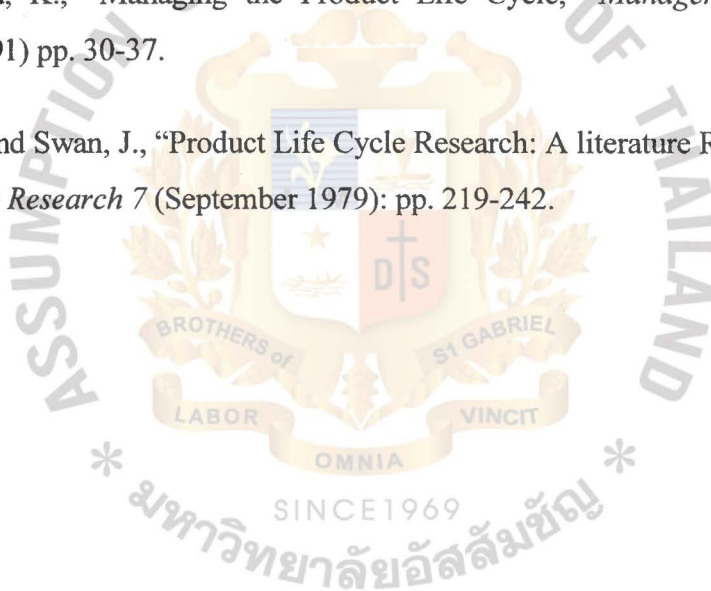
Although the initial recommendation model could be able to help the company and management to manage products through product life cycle, the model still has some limitations that should be improved in further study. The recommendation points are addressed as follows:

1. Customize the simulation model to be more user friendly.
2. To be more accurate for sales growth and gross margin ranges, the empirical study may be useful. However, the competition in the future may shorten product life cycle, sales growth in different period may differ from the part.
3. To be more useful in making managerial decision regarding adding or dropping a product, and performance evaluation of managers who are responsible for each product group, the model needs to be extended to the operating level.



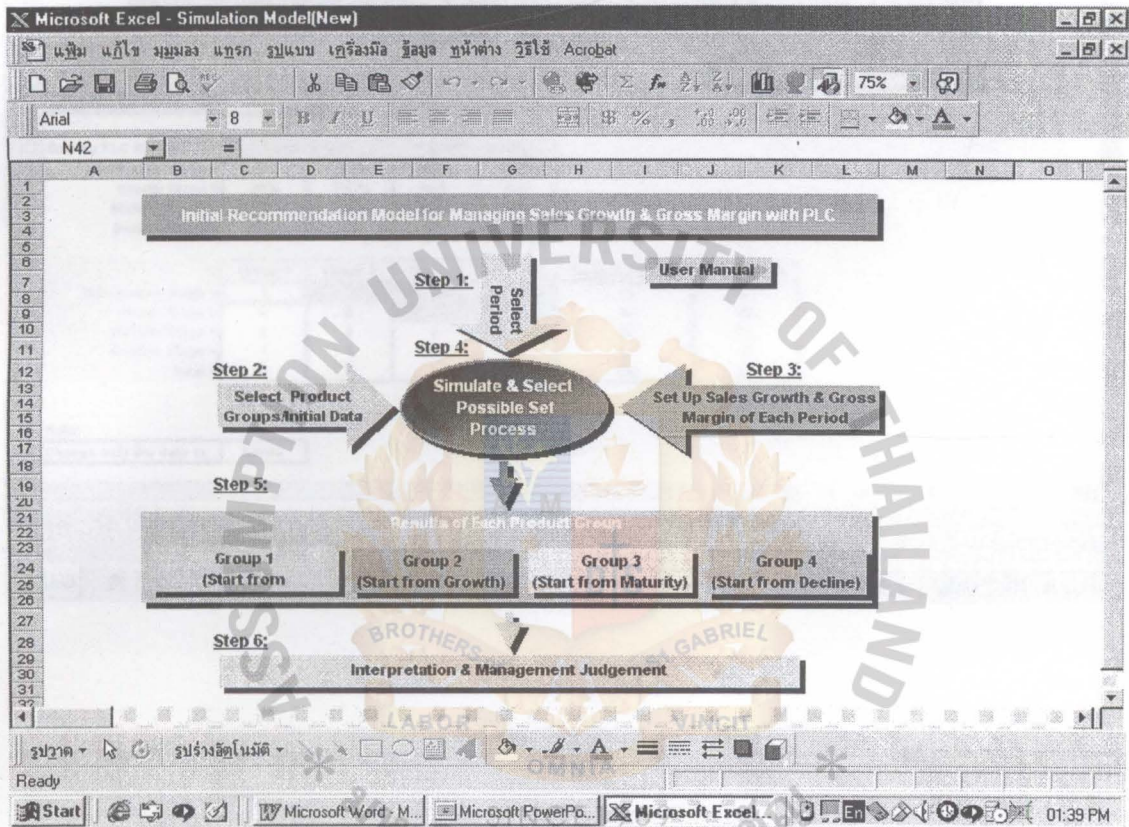
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- [4] Blumenfeld, K., "Managing the Product Life Cycle," *Management Review* 80 (March 1991) pp. 30-37.
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APPENDIX

APPENDIX 1: MAIN MENU OF THE MODEL



APPENDIX 2: INITIAL DATA SCREEN

Microsoft Excel - Simulation Model(New)

Initial Data

User Manual Main Menu

Selected Period: Yearly Select drop-down list

Specify PLC Range For:

	Sales Growth		Gross Margin	
Introduction Stage =	5%	20%	50%	90%
Growth Stage =	20%	150%	30%	70%
Maturity Stage =	0%	20%	20%	40%
Decline Stage =	-50%	0%	0%	15%

	Group 1	Group 2	Group 3	Group 4	Sales Proportion	Gross Profit
Introduction Stage =	1				15	10
Growth Stage =	2	2			40	20
Maturity Stage =	2	2	3		35	10
Decline Stage =	1	1	1	1	10	2
Total =	6	5	4	1	100	42

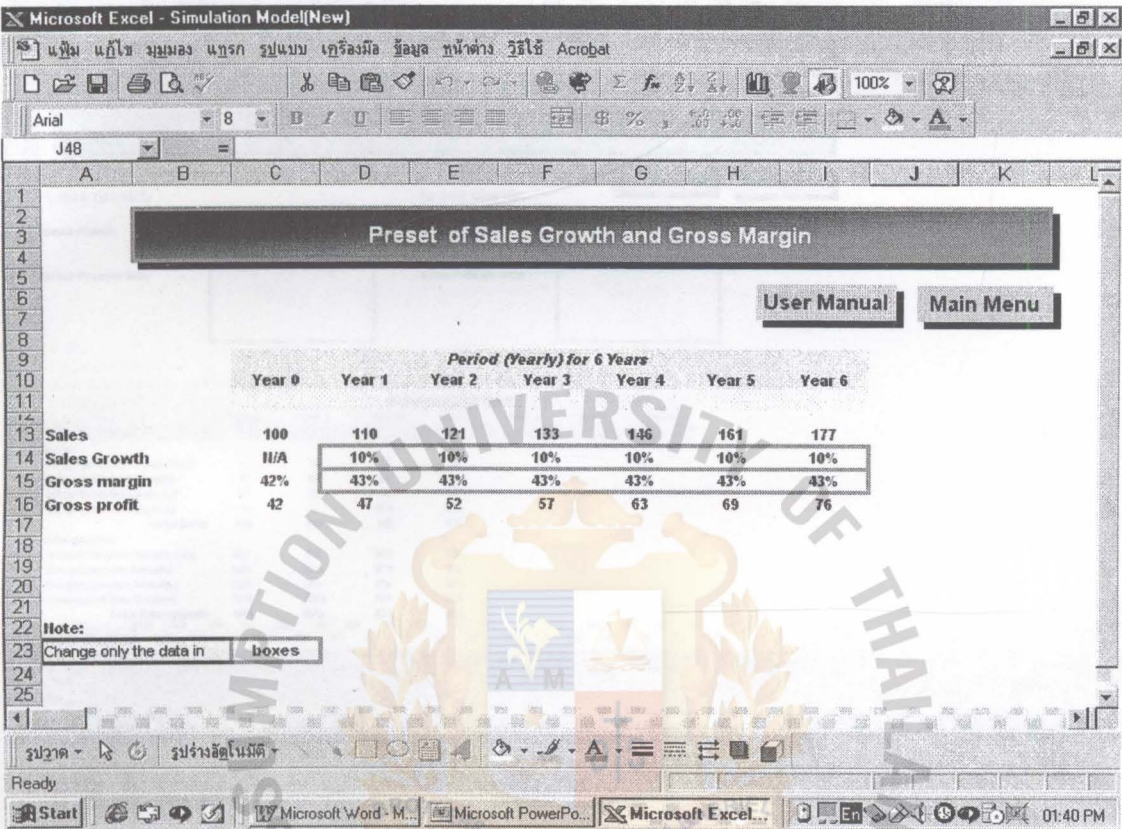
Note:

Change only the data in boxes

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APPENDIX 3: PRESET OF SALES GROWTH AND GROSS
MARGIN SCREEN



APPENDIX 4: SIMULATION & POSSIBLE SETS SCREEN

Microsoft Excel - Simulation Model(New)

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Simulation and Possible Sets

User Manual Main Menu

Sales Growth Gross Margin

Select Period: Select Period:

Select Possible Sets: Select Possible Sets:

Summary of Product Group

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Sales:							
Group (start from Introduction)	15	15	19	25			
Group (start from Growth)	40	52	68	88			
Group (start from Maturity)	39	39	39	39			
Group (start from Decline)	10	7	N/A	N/A			
Total Sales	104	113	125	152			
Sales growth:							
Group (start from Introduction)	N/A	0%	26%	40%			
Group (start from Growth)	N/A	33%	30%	24%			
Group (start from Maturity)	N/A	0%	0%	0%			
Group (start from Decline)	N/A	-33%	N/A	N/A			
Total Sales growth	N/A	10%	10%	17%			

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APPENDIX 5: RESULTS OF PRODUCT GROUP1 SCREEN

Microsoft Excel - Simulation Model(New)

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Group 1 (Start from Introduction Stage)

User Manual Main Menu

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Sales	15	16	19	26			
Sales Growth	N/A	5%	20%	40%			
Gross margin	67%	50%	60%	70%			
Gross profit	10	8	11	19			

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APPENDIX 6: RESULTS OF PRODUCT GROUP2 SCREEN

Microsoft Excel - Simulation Model(New)

Group 2 (Start from Growth Stage)

User Manual Main Menu

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Sales	40	52	68	68		
Sales Growth	N/A	30%	30%	0%		
Gross margin	50%	60%	40%	40%		
Gross profit	20	31	27	27		

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APPENDIX 7: RESULTS OF PRODUCT GROUP3 SCREEN

Microsoft Excel - Simulation Model(New)

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Group 3 (Start from Maturity Stage)

User Manual Main Menu

Period (Yearly) for 4 Years

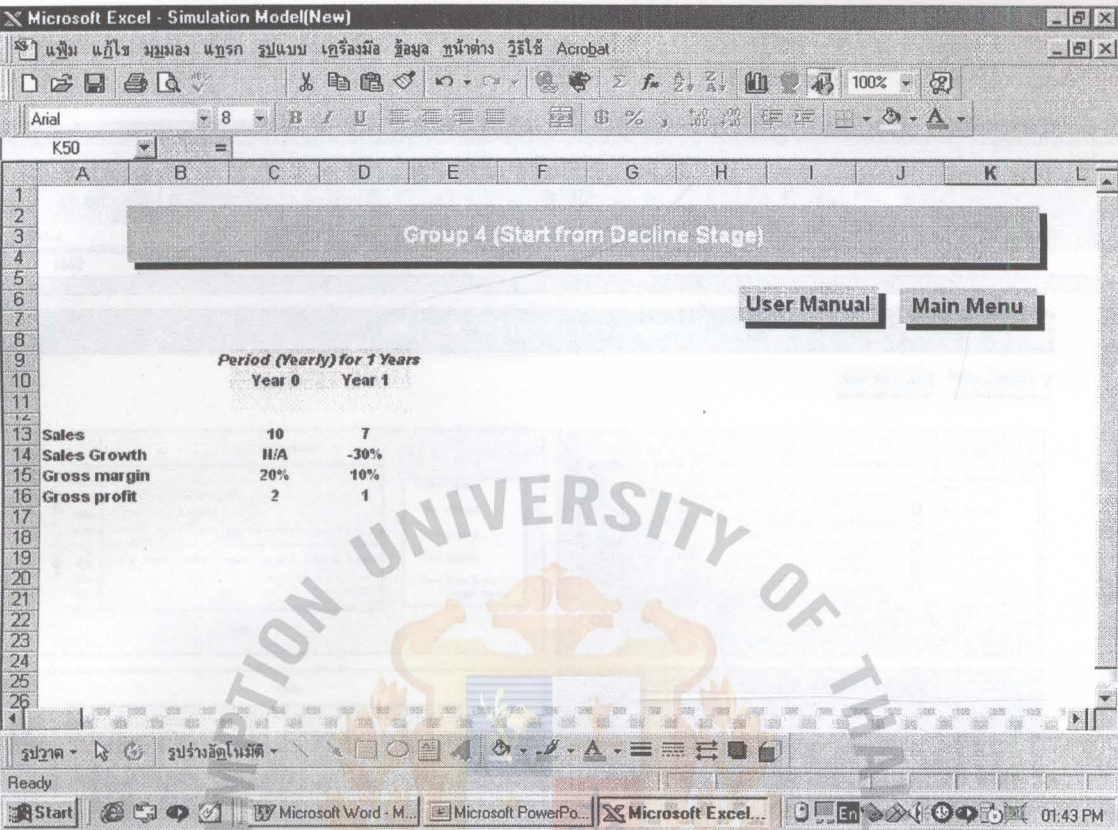
	Year 0	Year 1	Year 2	Year 3	Year 4
Sales	35	35	35	39	
Sales Growth	II/A	0%	0%	10%	
Gross margin	29%	20%	40%	30%	
Gross profit	10	7	14	12	

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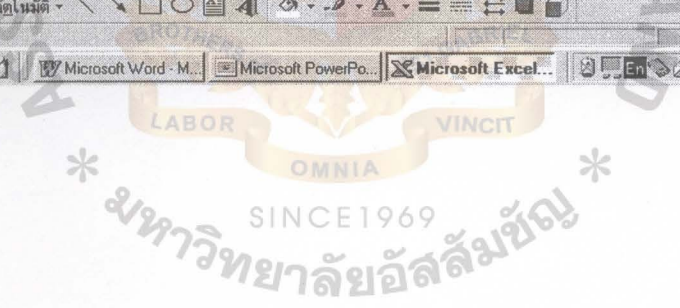
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APPENDIX 8: RESULTS OF PRODUCT GROUP4 SCREEN



JUDGEMENT SCREEN



GLOSSARY

Product Life Cycle is the stages through which a product passes from its launch to withdrawal from the market based on the level of sales and their rate of growth.

Profit is the difference between revenue earned and the costs of producing a good or service.

Market is any situation where goods and/or services are offered for sale and purchased.

Market Share is a firm's sales in relation to total industry sales expressed as a percentage.



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