Chapter 2

Related Theories

Project development steps are actually categorized into three phases. [Chantaro, and Thongprasert, 1991]

1. **Pre-investment phase** This phase involves project environment scanning, project feasibility study, and decision making.

2. **Investment phase** After project approval, many tasks are to be organized and performed by project staff. They are, for example, engineering designs, negotiation & contract, construction, recruitment & training, and so on.

3. **Operation phase** Prior to project completion, all processes are beginning to run routinely for instance, production, quality control, maintenance., etc. Project responsibility has to be handed over from project staff to routine staff. Project staff are now taking account of following-up, monitoring, and controlling as planned.

Project feasibility study in investment in manufacturing facility is predominately concerned with marketing, manufacturing, finance, and other management implications.

1. Market study [Kotler, 1997]

The aim of studying the market is to identify marketing size, market share, and opportunity. In market opportunity analysis, being used in this thesis, comprises macro-environment, micro-environment, SWOT and TOWS matrix analysis, product decision, market segmentation, market targeting, demand / price estimation.

2. Manufacturing or engineering study [Chantaro, and Thongprasert, 1991]

Manufacturing tasks include manufacturing technology selection, description of the process, production program, machine equipment, plant location and its layout, raw material technology, and other management implications.

2.1 **Manufacturing technology selection** Many points of view are to take seriously into account. These are process technical data, and its discussion.

2.2 **Plant location and layout** Several significant factors are involved in making plant location decision. These are for example :

2.2.1 Distance from plant to material, infrastructure source, and marketplace.

2.2.2 Tax or industrial regulations

2.2.3 Land : size, space, renting cost and so on.

2.2.4 Material & activity flow .,etc.

2.3 Production program Production program dictates the level of production activities with respect to time scale. In consistency with sale projection and technical factors, production program will subsequently settled as an example (Table 2.1)

Table 2.1 An example of production program [Adapted from Chantaro and Thongprasert, 1991]

Phase	Construction		Pre-operation		Operation			
Year	1	2	3	4	5	6	7	8
Production program(%)	0%	0%	45%	70%	100%	100%	100%	100%

2.4 **Material technology** Raw materials which are expected to be used in production will be considered in terms of availability, technical properties, price and so on.

2.5 **Management Implications** [Chantaro and Thongprasert, 1991] Still, many projects have failed due to inefficient project management ; even though, marketing, finance, and engineering studies have readily dictated positive results. Those cases reflect the importance of management. Management study's objectives are to select the appropriate organization and to structure lines of command, wage / salary and fringe benefit ., etc.

3. Financial study [Chantaro and Thongprasert, 1991]

In financial study, the significant components are :

3.1 **Total Investment cost** Total investment cost comprises pre-operation capital expenditure, fixed asset capital expenditure, net working capital.

3.1.1 Fixed asset capital expenditure (Table 2.2) An example of fixed assets are land, road, building, reservoir, machine facility, vehicle .,etc.

3.1.2 Pre-operation capital expenditure (Table 2.3) This means all expenses incurred during pre-operation and construction phase. These expenses involve wage/salary for project staff, traveling, office rental, training, pilot production, etc.

Table 2.2 An example of projected fixed asset capital expenditures [Adapted from Chantaro and Thongprasert, 1991]

Phase	Construciton		Pre-operation		Operation			
Year	1	2	3	4	5	6	7	8
List								
Land Land development Building and facility .,etc								

Table 2.3 An example of pre-production capital expenditures [Adapted from Chantaro and Thongprasert, 1991]

Phase	Construciton		Pre-operation		Operation			
Year	1	2	3	4	5	6	7	8
List								
1. Environment scanning 2. Feasibility study 3. Project management 4. Training 5. Fee 6. Travelling expenses and Others								

3.1.3 Net working capital (Table 2.4) During operational phase, it is the expected amount of reserve for short term operation (within one year). These are, for example, raw material, salary / wage, fringe benefit, administrative expense, and others.

3.2 **Production cost** (Table 2.5) Production cost [Hilton, 1994] is traditionally composed of fixed cost and variable cost. Total variable cost changes in direct proportion to a change in the level of production volume whereas total fixed cost remains unchanged in total as the level of product volume varies. Variable cost are such as raw material, direct labor, depreciation, sale administration expenses .,etc.

Fixed cost are, for example, office building, interest expense, pre-operation expense ,etc.

3.3 **Administration cost** Administration expense can be illustrated in Table 2.6.

3.4 **Projected income statement, cash flow statement, and balance sheet**

Based upon all the above plans, income statement, cash flow statement, and balance sheet are to be created accordingly. These three statements basically picture the overview of projected project operation and financial position. [Eugene and Gapenski, 1994]

Typically, balance sheet indicates a project financial status at a point in time whereas income statement presents the income for the period between two balance sheet dates. The statement of cash flow depicts how cash flows through the project during a certain period of time. Income statement and cash flow statement can be shown as Table 2.7 and Table 2.8 respectively.

Table 2.4 An example of projected net working capital requirement [Adapted from Chantaro and Thongprasert, 1991]

Phase	**Cycle**		**Construction**		**Pre-operation**		**Operation**	
Year	**Duration**	**Freq.**	1	2	3	4	5	6
List	Day	Cycle/yr						
1. Current asset - Account receivable - Inventory - Cash in hand - Others								
Total current asset								
2. Current liabilities Account payable Others								
Total current liabilities								
Net working capital								

Table 2.5 An example of projected production cost [Adapted from Chantaro and Thongprasert, 1991]

Year		2	3	4	5	6	7	8	9
Variable	Raw material								
	Packing								
	Direct labor								
	Others								
Fixed	Depreciation								
	Maintenance								
	Utilities								
	Administration and others								
Total expected cost									

Table 2.6 An example of projected administration cost [Adapted Chantaro and Thongprasert, 1991]

Year List	2	3	4	5	6	7	8	9	10
1. Salary and wage 2. Depreciation and Amortization 3. Insurance 4. Transportation 5. Others									
Total expected cost									

3.5 Feasibility assessment [Eugene and Gapenski, 1994] In economic decision-making, a couple of popular financial indicators have been employed in reality. These are :

3.5.1 Net present value (NPV) An NPV indicates whether the project's cash flows and provides the required rate of return on invested capital. Positive NPV means the project's cash flows yield an excess return and brings about improvement in stockholder value.

Table 2.7 An example of projected income statement [Adapted from Chantaro, and Thongprasert, 1991]

Year / List	2	3	4	5	6	7	8	9
1. Net sales Product A Product B 2. Other income								
Total revenues								
3. Cost of sales 4. Selling and Administration Expenses Net profit before tax 6. Corporate income tax								
Total cost and expenses								
Net profit								

3.5.2 Sensitivity analysis Sensitivity analysis is a technique, aiming to monitor how sensitive NPV will fluctuate in response to a specified change in a single parameters, while others remain constant.

4. Financial feasibility analysis software [Agarwal et al., 1995]

Model construction typically involves the following parts. These are :

4.1 Input / output variable Input variables 's value may come from internal or external sources. Output variables, subsequently, result from incorporating model formulation and tools as mentioned later. An example of balance sheet and income statement can be demonstrated as Table 2.9.

4.2 Model formulation This model formulation functions by arranging the relationship among all input variables and output variables with respect to specified algorithmic deals. Some of them are shown as Table 2.10.

4.3 Tools Tools are the specified algorithmic procedures, aiming to execute the model and generate outputs. In this case, spreadsheet software (e.g., Microsoft Excel) is capable of providing some of them, for instance regression, optimization, and

so on. Besides, Table 2.11 represents the models and variables which may be established on this financial feasibility software package.

Table 2.8 An example of projected cash flow statement [Eugene and Gapenski, 1994]

Year / List	3	4	5	6	7	8	9
Cash flow from operating activities - Net income - Adjustment to net income to Determine cash provided by Operations							
Net cash flow from operating activities							
Cash flow from investing activities - Net cash provided by investing Activities **Cash flow from financial activities** - Net cash provided by financial Activities							
Net cash							

4.4 System modeling [Turner, 1996]

To be able to easily come across such software configuration, system modeling tool, called "IdefO", will be used as a methodology to picture how input / output variables are organized. IdefO models are made of the following :

4.4.1 IdefO diagram The diagrams are composed of boxes and arrows. Boxes represent activities for instance, prepare document, process material .,etc., while arrows represent the objects, or data / information. In case of this feasibility software, activities mean the relationships among variables as Table 2.8 being exemplified previously. For arrow can also be categorized into four types.

Table 2.9 An example of projected balance sheet and income statement [Agarwal et al., 1995]

Assets	**Liabilities**
CA current asset C cash MS mkt_securities AR account receivable Pre prepaid expense INV inventory RI raw material inventory SI supplies inventory WP work in process inventory FI finished good inventory	**LE liabilities and equity** **L liabilities** CL current liabilities AP account payable TP tax payable IP interest payable STD short term debt LD long term debt
FA fixed assets PE plant and equipment CDE cumulative depreciation	**Equity** CE common equity RE retained earnings EAT earning after tax EBT earning before tax OPI oparating income SR sale revenue CGS cost of goods sold DE depreciation expense OR other revenue IE interest expense OFE office expense ADE administrative expenses TE tax expense DIV dividends

Table 2.10 An example of balance sheet and income statement variables and their relationships [Agarwal et al., 1995]

GI gross income	Sale revenue (SR) – Cost of goods sold (CGS)
EBT earning before tax	Gross income (GI) – Administration expense (ADE)
	– Depreciation expense (DE) – Interest expense (IE)
EAT earning after tax	Earning before tax (EBT) – Tax expense (TE)
ROI return on investment	Earning before tax (EBT) / Assets (A)
DR debt ratio	Long term debt (LD) / Assets (A)

* Input arrows To be able to produce output, input arrows represent material, data that is consumed or transformed by an activity. Typically, input arrows go through the activity from left side of the box.

* Control arrows Control arrows are to govern, or trigger the activity while being performed. That mean regulation, policy, standard, or policy. No activity is allowed to be free of some types of control. Each activity has to have at one control arrow. Control arrows typically enter activity box from top of the box.

* Output arrows Output arrows represent material, or information by activity. At least one output must actually be generated by each activity.

* Mechanism arrows Mechanism arrows mean dedicated resources to perform activity. It can be in terms of machinery, equipment, or people and so on.

4.4.2 Decomposition An activity can be hierarchical decomposed into sub activities. As a rule, decomposition can be made at minimum three sub-activities, conversely maximum at six sub-activities.

4.4.3 Text description Despite IdefO aiming to simplify a system through graphical presentation and hierarchical decomposition, text description is also required to elaborate some parts (e.g. activity description, relationships among variables)

Table 2.11 An example of models and variables on financial feasibility software [Agarwal et al., 1995]

Model	Input variables	Output variables
1. Market	Sale projection Expected demand Product ranges Expected sale price	Market share
2. Material	Raw material, accessory type Raw material, accessory price Build of material	Raw material cost Accessory cost (eg., packing cost)
3. Management	Indirect labor (position/salary) Direct labor (position/salary)	Indirect labor cost Direct labor cost
4. Production	Fixed cost Indirect labor cost Fixed asset Administration cost Variable Raw material cost Direct labor cost Accessory cost Production program (%)	Production cost
5. Income statement	Table 7	Profit / loss
6. Cash flow statement	Table 8	NPV
7. Sensitivity	Selected fluctuated variables (e.g., -20%, -10%, 0%, +10%, +20%)	

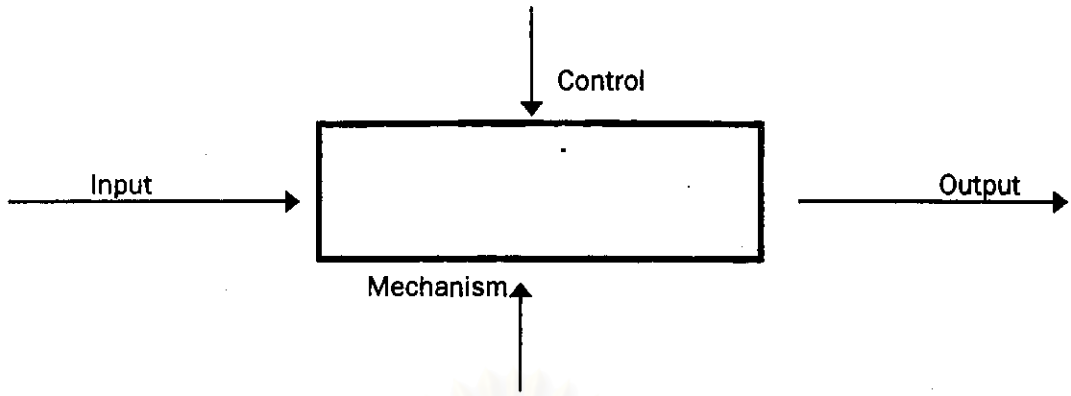

Figure 2.1 Fundamental unit of IdefO model [Turner, 1996]