

Feasibility Study of Construction Additional Production Lines on Jelly Drink Plant at PT XYZ

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ABSTRACT

Demand forecasting is the first step for production planning and control to fulfil market demand. In line with economic growth in Indonesia, number of jelly drink's sale PT XYZ also increasing especially in 2011-2013 period. Unfortunately, PT XYZ has an issue to fulfil its demand in eastern area, and increasing production is one of solution to solve it. This research aims to analyze market demand of jelly drink in eastern area for the next five years, select the optimal location in which plant production capacity need to be increased and feasibility study of construction additional production lines. Winter's additive time series method is used to analyze market demand and Comparative Performance Index (CPI) method is used to select the location for jelly drink's plant. Net Present Value (NPV), Internal Rate of Return (IRR), and Pay Back Period (PBP) are the parameter for financial aspect on this research. Demand forecasting shows increasing in market demand on 2014-2018 period with 16% MAPE value. The optimum location to increase its production lines is Sidoarjo Plant, East Java. Two production lines can be added with increasing 24.3 million cartoon per year of production. Production aspect, human resources and financial parameter shows that this project is economically justified to execute.

Keywords-- Feasibility Study, CPI, Winter's Additive, Jelly Drink

I. INTRODUCTION

PT XYZ is Indonesian national company that leading in food and beverages. PT XYZ has some affiliates with specific line of business to fulfil their market demand. One of its affiliate focusing on Jelly drink and sale it around Indonesia. In their 3rd years, they have significant increasing in sales. This is in line with Indonesian economic growth. Figure 1 shows the jelly drink sales in 2011-2013 period that increase 20 million cartoon every year.

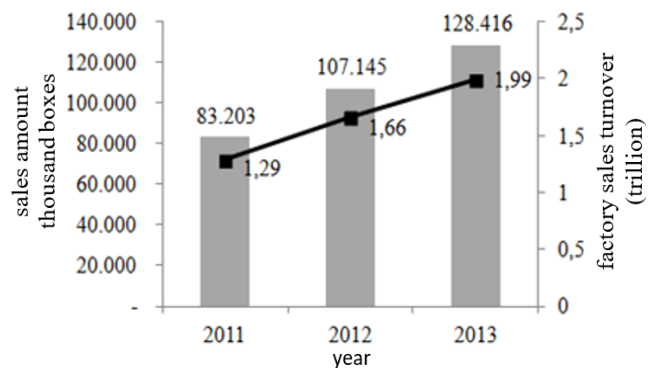


Figure 1: Jelly Drink's Sales of PTXYZ

Increasing in jelly drink sales make PT XYZ need to have strategy to fulfil market demand in efficient way. If the production capacity less than market demand, PT XYZ can lose their market share and decreasing their profit. In other hand, if the production capacity is bigger than market demand, it will make new issue in company cash flow. Thus demand forecasting plays important rules to optimize company profit.

Logistic strategy also become vital aspect to fulfil market demand in Indonesia. Currently PT XYZ divide their logistic area into two major areas: Western area and Eastern area. All demand in western area will be supplied by their plant located in western area and all demand in eastern area will be supplied by the plant in eastern area.

Market demand for eastern area on 2013 was 41.3 million cartoon per year whereas the production capacity was only 32.4 million cartoon per year. Table 1 shows demand trend of PT XYZ on 2010-2014 period. There's significant increase for demand in eastern area. To close that gap, western plant also need to supply the jelly drink to eastern area. Although loss of sale can be avoided but it makes additional cost for logistic. Increasing production capacity in eastern plant with comprehensive analysis need to be performed.

Table I: Demand History Of Eastern Area PT XYZ

Month	Request Period (box/es)			
	2010	2011	2012	2013
January	1.112.323	2.943.473	2.667.811	3.427.792
February	1.058.978	2.568.926	1.733.645	3.754.607
March	1.067.589	2.323.413	2.707.439	2.873.320
April	1.380.514	2.696.836	2.708.861	2.838.933
May	2.107.413	1.451.963	2.560.405	3.596.866
June	1.165.111	2.104.637	2.935.800	4.094.668
July	1.509.696	1.922.098	2.639.031	4.002.451
August	1.738.692	2.690.455	3.790.132	3.626.897
September	1.319.814	2.553.939	2.941.977	3.708.799
October	1.180.861	2.657.543	3.165.403	3.367.287
November	964.404	2.554.805	3.585.184	3.113.071
December	1.074.393	3.129.025	3.338.842	2.959.385
Total	15.679.787	29.597.112	34.774.529	41.364.078

Source : PT XYZ

Eastern area divided into several market district such as Surabaya, Kalimantan, Sulawesi, Maluku, Irian Jaya, NTB, NTT and Bali. Currently PT XYZ has three plants in eastern area: Banjarmasin Plant to supply Kalimantan area. Makasar Plant to supply Sulawesi area, and Sidoarjo plant to supply the rest of market district in eastern area.

Research Purposes

1. To perform demand forecasting of PT XYZ in the next five years.
2. To decide the optimal location in which plant that production capacity need to be increased.
3. To perform feasibility study of increasing production capacity on eastern area.

Research Scopes

1. Primary and secondary data are used, including history of business development, annual sales report, investment and production cost specifically for eastern area on 2011-2013 period.
2. Winter Additive time series method is used on this research.
3. Ceteris Paribus assumption for economic and political condition is used to decide the optimum location for increasing production capacity. Market aspect, production and operation aspect, organization and management aspect also evaluated in this research.

II. METHODOLOGY

Research Framework

This research was performed on February-July 2014 period, held on head quarter of PT XYZ in Bintaro, Jakarta. Observation and interview method was used to collect primary and secondary data. Figure 2 shows the framework for this research.

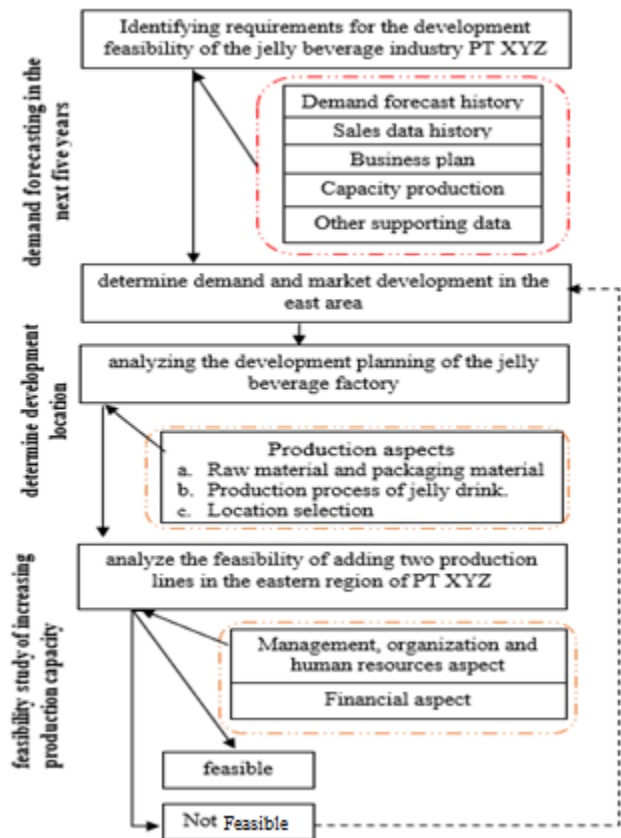


Figure 2: Research Framework Business Development of Jelly Drink PT XYZ

Winter additives time series method with MINITAB ver.15 statistic software, is used to forecast the market demand for jelly drink in next five years. This method will analyze market aspect to get big picture in the next few years. Winter's method is suitable to use for seasonal data [1].

The feasibility study of project can be analyzed thru some aspect such as technical aspect, managerial and administrative aspect, organization aspect, marketing aspect and also financial aspect [2].

Production and operation aspect focusing on location selection, raw material availability, production capacity and production process of jelly drink itself. Comparative Performance Index (CPI) method will be used for location selection [3].

Organization structure, qualification of employee, employee training program are included in organization and human resources aspect on this research [4].

Financial aspect on this research will be evaluated thru Net Present Value (NPV), Internal Rate of Return (IRR), and Pay Back Period (PBP) [5]. Below formulas are used on financial analysis on this research:

1. Net Present Value (NPV)

$$NPV = \sum_{t=1}^{t=N} \frac{CF_t}{(1+i)^t} - \text{Initial investment}$$

Where

CF_t : Net cash flow on t period

i : Discount Rate

N : Expected period

2. Internal Rate of Return (IRR)

$$\text{Initial investment} = \frac{\sum_{t=1}^{t=N} CF_t}{(1+i)^t}$$

Where

CF_t : Net cash flow on t period

i : Discount Rate

N : Expected period

III. RESULTS AND DISCUSSION

Demand Forecasting of Jelly Drink on Eastern Area PT XYZ

The jelly drink's sales on sunny season (April to October) is higher than on rainy season (October to April). The seasonal fluctuative on 2010 to 2013 is having relatively same magnitude as shown on table 1.

Winter time serie's method with additive modelling is used for datas that have increasing in time series but stable on magnitude fluctuation [6]. Demand history is used to forecast demand in next five years (2014-2018 period) by using MINITAB ver.15 software. Figure 3 shows the result of demand forecasting.

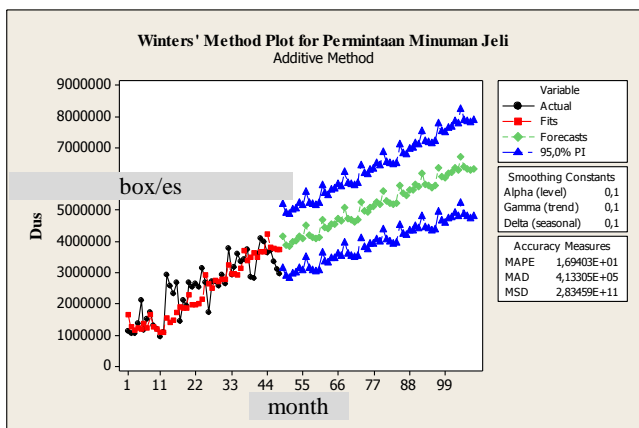


Figure 3: Demand forecasting of jelly drink on Eastern area PT XYZ

Demand forecasting using Winter additive time series method resulting 16% Mean Absolute Percentage Error (MAPE) value. This value shows that the forecast is acceptable to use. In erm of reliability, the forecast is accepted if MAPE value is less than 20%. Demand

forecasting of jelly drink PT XYZ for 2014-2018 period is shown on table 2.

Table II: Demand Forecasting Data of Jelly Drink on Eastern Area PT XYZ (2014-2018)

Month	Request Period (box/es)				
	2014	2015	2016	2017	2018
Januar	4.159.5	4.706.8	5.254.1	5.801.3	6.348.6
y	26	13	00	87	74
Februa	3.896.7	4.444.0	4.991.3	5.538.5	6.085.8
ry	29	16	03	90	77
March	3.846.9	4.394.2	4.941.5	5.488.8	6.036.0
	49	36	23	10	97
April	3.998.2	4.545.5	5.092.8	5.640.0	6.187.3
	35	22	08	95	82
May	4.020.3	4.567.6	5.114.9	5.662.2	6.209.4
	46	32	19	06	93
June	4.172.7	4.720.0	5.267.3	5.814.6	6.361.9
	59	46	33	20	06
July	4.099.7	4.647.0	5.194.2	5.741.5	6.288.8
	13	00	87	74	61
August	4.526.4	5.073.7	5.621.0	6.168.2	6.715.5
	31	18	05	92	79
Septe	4.189.7	4.737.0	5.284.3	5.831.6	6.378.9
mber	87	73	60	47	34
Octobe	4.138.9	4.686.2	5.233.5	5.780.8	6.328.0
r	47	33	20	07	94
Nove	4.091.5	4.638.8	5.186.1	5.733.4	6.280.7
mber	99	85	72	59	46
Decem	4.145.9	4.693.1	5.240.4	5.787.7	6.335.0
ber	06	93	80	67	54
Total	49.286.926	55.854.369	62.421.811	68.989.254	75.556.697

Sourcea: data analysis

This situation can be handled by logistic division of PT XYZ. Product distribution strategy is a key point in selling jelly drink product. With this fact, PT XYZ believes increasing production capacity is a must to fullfil market demand that increase every year.

Location Selection of Jelly Drink Plant on Eastern Area PT XYZ

Many plants are measured by its production capacity. Production capacity is the plant capability to convert raw material (input) to become product (output) in certain period. Production capacity number of jelly drink is described on cartoon per year. It is assumed that jelly drink selling on 2014 and 2015 are 49.2 million and 55.8 million cartoon per year respectively. With this number, it is better for PT XYZ to increase production capacity as much as 24.3 million cartoon every year, which equal with two production lines. Table 3 shows demand forecasting for PT XYZ.

Table III: Production Capacity of Eastern Area PT

Year	Capacity Production (Box/es)	Demand Forecaste (Box/es)	Diference (Box/es)	Cap/Lini/Year	Dem and NeedsLini
2014	32.400.00	49.286.926	16.886.926	12.150.000	1,4
2015	32.400.00	55.854.369	23.454.369	12.150.000	1,9
2016	32.400.00	62.421.811	30.021.811	12.150.000	2,5
2017	32.400.00	68.989.254	36.589.254	12.150.000	3,0
2018	32.400.00	75.556.697	43.156.697	12.150.000	3,6

Source : PT XYZ

In 2014 PT XYZ need additional 16.8 million cartoon per year (equal to 1.4 production line), whereas in 2015 they need additional 23.4 million cartoon per year. With this fact, it is better for PT XYZ to add two additional production lines to fulfil market demand. With 75% production efficiency's target on 2014, this additional two production lines will give 18.2 million cartoon per year of additional production. With 100% production efficiency target on 2015, it equal with 24.3 million cartoon per year of additional production. Moreover, to fulfil market demand on 2016 and 2017, PT XYZ need to add one production line on 2017 and one more production line on 2018, with total of production line will become 8 lines on 2018. This production lines are gradually increase so that it can be evaluated periodically.

Production and Operation Aspect

Production and operation aspect on this research is focusing on following item [8]:

- a. Raw material and packaging material.
- b. Production process of jelly drink.
- c. Location selection

a. Raw Material and Packaging Material

Raw material includes main material (water, sugar, jelly extract) and additional material (nata de coco, food preservative, acid controller, and flavor additive). Packaging material divides into primary packaging (cup and seal) and secondary packaging (straw and cartoon).

b. Production Process of Jelly Drink

Production of jelly drink is not new things for PT XYZ since they already run this plant start back on 1974 and start to produce jelly drink on 2002. Production process of jelly drink is showed on Figure 4.

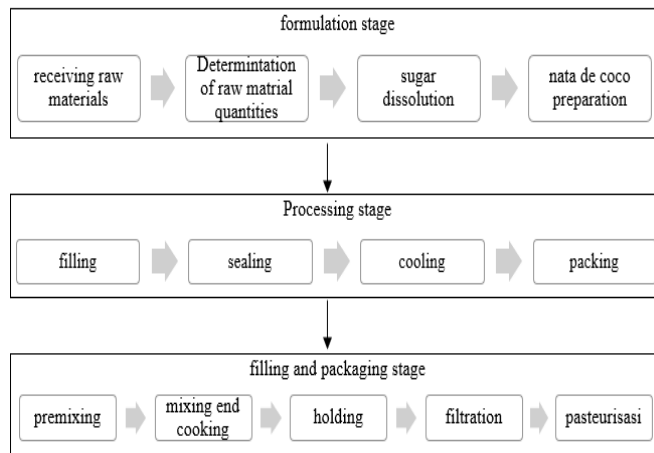


Figure 4: Process Flow Diagram of Jelly Drink Production PT XYZ

c. Location Selection

Location selection is a key point in determining the successful of plant building. Some aspect that need to consider in plant building are [9]:

1. Availability of market.
2. Local regulation.
3. Availability, cost and productivity of human resources.
4. Availability of raw material, telecommunication and electricity supplier.
5. Cost of landfill and construction

Consideration above item, PT XYZ has some alternatives which are: NTB, NTT, East Java and Bali. Location selection analysis uses Comparative Performance Index (CPI) method. Table 4 shows the result of this CPI. Scoring system and criteria has been consulted with the expert. The best location to increase production lines is in East Java with total index 201. In line with demand forecasting, it is advised to add two production lines.

Table IV: CPI Result of Location Selection

Location alternative	Criteria			
	HDA (Rp)	Supplier Distance (KM)	Demand (Box/es)	UMP (Rp)
Jawa Timur	6.000 ^a	591 ^b	3.805.448 ^c	1.000.000 ^d
Bali	5.000 ^a	974 ^b	1.142.554 ^c	1.321.000 ^d
NTB	1.000 ^a	1.104 ^b	1.883.631 ^c	1.210.000 ^d
NTT	1.000 ^a	2.307 ^b	513.262 ^c	1.150.000 ^d

Source : ^alocal government regulations (2011)

^bapple mapssoftware (2014)

^cPT. XYZ (2013)

^dBPS (2014)

Feasibility Study of Additional Two Production Lines on Eastern Area PT XYZ

a. Management, Organization and Human Resources Aspect

Production capacity in Sidoarjo plant, east java will be increased as per result of CPI analysis. Since this plant already operated before, it just needed additional human resources to run additional production line. The recruitment includes: production operator, technician and quality controller. The new organization is showed in Figure 5.

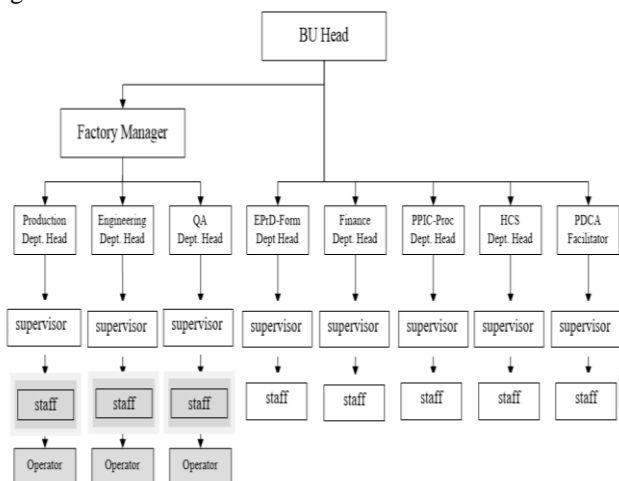


Figure 5: Organization of jelly drink plant PT XYZ

Since Sidoarjo is an industrial area, it is not difficult to recruit additional human resources. In term of qualification, at least Diploma degree is needed for staff and high school graduated for production operator, technician and quality controller. The remuneration system refers to local regulation that shown on table 5.

Table V: Remuneration System

Job	workers	Salary/month
Head of team		
production (staff)	9	Rp3.500.000,00
Operator	2	Rp3.500.000,00

Source: PT. XYZ

b. Financial Aspect

NPV is the difference between current cash value compare to future cash value. Project is economically to be executed if NPV is bigger than 0. From the calculation for this project, NPV is 3631 million. Not only NPV, but also IRR value that evaluated to justify this project. As long as IRR value is bigger than market interest, the project is good to go. Simulation result for IRR giving 36% value, and market interest is 16%. PT XYZ set the acceptable value for IRR in 20-25%. PBP describe the duration how long all cost will be recovered [10]. PBP for this project is 2.5 years.

From all financial aspect described above, it's conclude that this project is economically justified and good to go.

IV. CONCLUSION

Based on the results of research in controlling raw material inventories, some conclusions were taken as follows:

1. Demand forecasting for jelly drink with Winter Additives time series method shows 16% MAPE value for 2014-2018 period.
2. The optimum location to increase production capacity is in Sidoarjo plant, East Java. Two production lines can be added resulting 24.3 million cartoon per year additional production.
3. Production aspect, human resources aspect and financial aspect has been evaluated and showing this project is economically justified and good to go.

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