

## STRATEGIC PROCESS DESIGN FOR FISH – BASED SMEs

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### ABSTRACT

*Fish is a primary commodity in Maluku, with the potential of fish production is 1,627 million tons or 20% of national total fish production. This huge potential unfortunately, is not been escorted yet with fine fish processing which is still 33% or 528.000 tons. This is caused by low fish processing to next level of product, while the level of fish consumption of Maluku people is the highest in Indonesia, that is 50,2%. This research is aimed to design process for fish – based Small and medium enterprises (SMEs). I choose two examples of SMEs, Smoked Fish SMEs and Fish Ball SMEs.*

*The researcher used approach of study case method. Data collected using observation and interview. The design process itself is an analytical process using steps, such as: identification of the SMEs, choosing of Response Strategic to Customer Demand, choosing of Manufacturing Process, and choosing of Strategic of Production Planning and Control System. Each steps will be analyzed sensitively using the real data and spesific geographical condition of Maluku. The results are identification of three level characteristics, design of strategic response to demand, design of manufacturing process, and design of Strategic PPC System for tne two SMEs.*

**Keywords:** *smoked fish, Ikan Asar, three level characteristics, PPC, SMEs.*

### 1. INTRODUCTION

Maluku is a province of Indonesia which has a huge potential of fish catch. Maluku was declared as National Fish Barn in 2011, with 20% of national potential of fish catch are availabled in this area. Base on preliminary study, Maluku has 1,627 million tons of fish per year (Yulistyo Mudho, 2011). This Acknowledgement opens the opportunity to develop industry in fishing. According to Herawati (2002), most of fish processing activities in Indonesia are still apply for traditional methods and in home industry scale. One cause of the low usage of around 33% of the potential is inadequate fish processing facilities. (Bertindak Untuk Rakyat, 2012). In Maluku, much of fish catch production has only be processed in a half form and then exported to foreign markets. Another more directly sold to traditional markets and a few were storage in *cold storage*. There are some SME's of fish processing, but still running in limited capacity and kinds of fish, like smoked fish (*Ikan Asar*), fiabon ikan, *nugget* ikan, and fish meat ball.

According to the data of Dinas Kelautan dan Perikanan (2011), Maluku was the highest

fish customer, that is 50,2 kg/kapita. Most of the consumption in form of fresh fish (primary product). When the fish availabled in abundant inventory, unsold fish has only been freezed and sold when the inventory was decreased as the result of seasonal change. Especially for Maluku, a high opportunity to be developed is Small Scale Enterprises, since the geographic condition of Maluku is far from distribution centers of Indonesia, and the narrow space of hinterland in Maluku. To make balancing between the production of fish catching, the high consumption of fish, and the importance of next level of fish processing, then it will be needed to make a strategic design process for SMEs, by considering the system characteristics such as: (1) specified on fish processing with limited durability of fish, (2) manufacture system on level of *home industry* in dfferent | 2 ons (not in a cluster), (3) abundant inve , (4) dynamic number of demand and varying level of demand. Thus, the strategic process design should be configurable for higher production capacity to maintain production continuity in such many limited constraints, especially in relevant to material inventory and requirement to produce a good product that

satisfied the customer, good quality, and delivery time.

## 2. THEORETICAL BACKGROUND

A production (or manufacturing) planning and control (MPC) system is concerned with planning and controlling all aspects of manufacturing, including materials, scheduling machines and people, and coordinating suppliers and customers. An effective MPC system is critical to the success of any company. An MPC system's design is not a one-off undertaking; it should be adaptive to respond to changes in the competitive arena, customer requirements, strategy, supply chain and other possible problems (Vollmann et al., 2005, p. 1).

SME's is

Mainly, there are three points to be considered by the management of an industry when they want to design a strategic process for a manufacturing system, that are:

1. Response strategy to customer demand  
This strategy defined how a manufacturing industrial company will overcome or respond to the customer need. This strategy can be classified into 5 categories, are: Design-to-Order, Make-to-Order, Assemble-to-Order, Make-to-Stock, and Make-to-Demand.
2. Design strategy of manufacturing process  
Design Strategy of Manufacturing process defines how an industrial product can be made or processed, Basically, this can be classified in 5 categories, are: Project, Job Shop, Line Flow, Flexible Manufacturing System (FMS), and Agile Manufacturing System (AMS).
3. Strategy of Manufacturing Planning and Control System  
This defines how an industrial will plan and control a manufacturing system when performing short or medium operation period in product making. The management can choose one or more than one or combine of these 6 manufacturing planning and controlling system:
  - Project Management
  - Manufacturing Resource Planning

- Just-in-Time
- Continuous Process Control
- Flexible Control System
- Agile Control System

A management should consider all those strategy before choosing an exact or proper manufacturing process, and so do in SME's.

## 3. RESEARCH METHOD

This research located in a smoked fish SME. It is a traditional company with none or less technology implemented in processing. Methods to be used in this research can be divided into two parts:

1. Data Collecting; observation and interview
2. Data Analysis: three level characteristics identification of manufacturing

We took the object of this research was a SME, which produced smoked fish. The reason to choose this SME is:

- its product, smoked fish, or, in local term, it called *Ikan Asar*, is spesific product of Maluku
- its uses fish as raw material with high availability in the sea of Maluku
- this SME and the other same kind of product SME's have forming a center of smoked fish market, located in Galala, City of Ambon.

## 4. RESULT AND DISCUSSION

### 4.1 Three Level Characteristics Identification

Level 1: Process Level

1. Inputs
  - a. Raw Material
    - 1) Direct ingredient: Cakalang Fish (from Galala) and Tuna Fish from Tulehu.
    - 2) Fuel: wood.
  - b. Labor  
The SME has a leader and 3 daily workers.

Table 1. Wage System

Job Description	Number of workers	Waging Method
Daily workera		
Clean um the fish	1	Regular monthly wage Rp 600.000,-
Fish wahing		
Fish cut in half		
Fish stick with bamboo		
Fish arrangement on fish smoking barn	1	
Fish smoking		

c. Technology

The company applies manual technology system, that is men's hand. This manual technology consists of:

Table 2. Technology System of The Company

Job Description	
Fish cleaning	Chopping knife
Fish wahing	Water, container
Fish cut in half	Chopping knife
Fish stick with bamboo	Bamboo
Fish arrangement on fish smoking barn	
Fish smoking	Fish smoking barn

d. Finance

- 1) First finansial resources (capital) was a self investment; about Rp 500.000,00 - Rp 1.000.000,00. Now, the production has already supported with the KUR of Rp 13.000.000,00.
- 2) Most of the costs is for buying fresh fish. When there's none or less supply of cakalang, the price of 1 kg of freeze Cakalang is Rp 20.000/tail, while 2 kg of Cakalang and Tuna priced Rp 50.000/tail.

2. Output

a. Product

This SME produces ready-to-eat Smoked Cakalang (Tongkol) and Tuna (Figure 1).

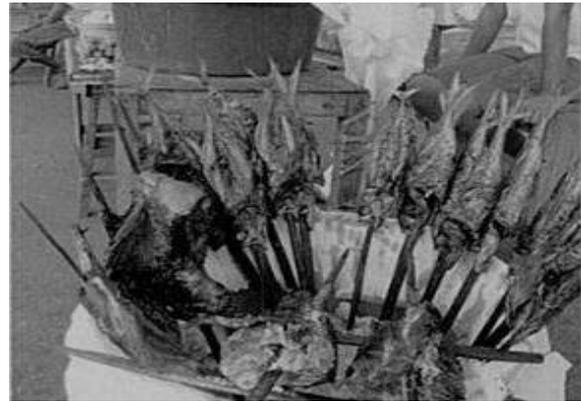


Figure 1. *Ikan Asar*, Special Food of Maluku

b. Revenue

A stick of *Ikan Asar* is sold about Rp 20.000,00 – Rp 25.000,00, depends on the fish size. In a day, the smoked fish can be sold until 25 – 30 sticks or approximately 900 sticks/months The selling is small stands of *lapak*, located in Jl. Kapt. Pierre Tendean, Galala, Ambon.

c. Profit

Turn over of the SME is approximately Rp 22.500.000,00, with net profit of Rp 15.000/stick.

d. Pollution

From production activities, here are some pollutions:

- Solid form: fish scales and bones
- Liquid form: Feces, residue of fish washing
- Gas form: unpleasant smell, smoke from fish smoking barn

3. Process

- 1) Fish cleaning and washing should be done to fresh fish and has no physical defect. Fish gills and unused up of fish womb through fish mouth. The fish the cleaned and leaked through.
- 2) Fish cutting and sticking  
Fish is cutted in half and sticked through to each slice with a 40 cm bamboo stick.
- 3) Fish smoking  
Fish are smoked by arranging those fish on the smoked barn shells during 1 hour. Woods are used as fuel.



Figure 2. Fish Smoking

## Level 2: Operation Level

### 1. Planning

#### a. Material Flows

Primary raw materials are Cakalang and Tuna, bought from fishermen anchored at Galala. Most company buy 30 fish every day and directly dan processed to become smoked fish. They don't have inventory for raw materials, but they have inventory of finished products which have not been sold. Maximum period storing for the product is 5 days if stored in refrigerator.

#### b. Scheduling of Job

There's no work scheduling in the production process. Workers work every day. It's because small number of products and short chain of production process. Beside that, no spesific job for each workers. In another words, each worker does different jobs every day. Most buyers are visitors or tourists, beside people of Ambon itself as daily consumption.

#### c. Machine Maintenance

The company has no spesific maintenance for the facilities except cleaning the smoking barn shells and production floor.

### 2. Marketing

The marketing has done through their own small stands or *lapak*

#### a. Pricing

Product price is determined base on size of the fish and fish availability in the market. One stick of Ikan Asar sold on the price of Rp 20.000,00 – Rp 25.000,00, depends on the fish size .

#### b. Promotion

The company haven't been using special promotion, only a *mouth to mouth* promotion.

#### c. Post-sales (warranties)

There is no post sale servicefor the product. This is common for food producers. To make sure their product is still save to consume, they usually graft the expired date of the product.

### 3. Environment

- Solid form: fish scales and bones
- Liquid form: Feces, residueof fish washing
- Gas form: unpleasant smell, smoke from fish smoking barn

### 4. Accounting

The company has no spesific accountant system. It only applies generally about:

- How much raw material to be bought?
- How much wages to be paid?
- How many other expending to be spent?

### 5. Human Resource

#### a. Organizational structure

There is no organizational structure, only difference between owner and workers. The owner mainly do general controlling even sometime he also does some jobs like fish smoking.

#### b. Work force

The company has 4 people include an owner and 3 workers.

#### c. Training

The company hasn't been implementing special trainingfor the workers. The new recruited man has only told directly about what he should be done. Usually the new workers has already understand how to do their jobs. A job which need spesific skill is prochedure of fish smoking. This prochedure establishes taste, texture, durable of the Ikan Asar.

### 6. Legal

#### a. Product liability

The company hasn't implementing *product liability* yet, whereas its product is food.

#### b. Occupational and Health Safety Act

The company is not supporting their the workers with consumption or accomodation. Along production process, the workers has no covered

with safety tools such as mask and gloves.

Level 3: Strategic Level

1. New Technologies

The company still uses traditional fish smoking fireplace which uses wood as fuel. Once the company was given an smoking oven from Kementerian Kelautan dan Perikanan, but this tool has more minuses than the traditional fireplace (Table 3).

Table 3. Characteristics of Technology for Fish Smoking

Traditional Fireplace	Oven
<p>1. Designed with simple equipments, consists of 4 layers with distance between each layer is 20 cm.</p> <p>2. Smoking process has done from the top layer to bottom layer. Fire flame has matched with the position on the layers. If there is still upper layer, then the flame will be made bigger while if it's already reach the lowest layer, then the flame will be made smaller.</p> <p>3. There is no smoke temperature controller and has only estimated by feelings. If the temperature is felt to be match, so the flame will be hold on that size. If it isn't, then the flame will be re-size.</p> <p>4. There is no smoking time indicator, only count on experience or feelings.</p>	<p>1. The oven maker wasn't consider the heat circulation so quality of final product is less good than fish smoking with traditional fireplace.</p> <p>2. The oven is easier to be broken.</p>

2. Research and Development

The company wasn't frequently change the basic form of the product. Product development was in improving packing box covered with banana leaf on the fish product before the box closed to prevent from fish smell.

3. New Markets

Promotion is by mouth to mouth, so that there always be opportunities for new markets. Until now, the product has reach many parties, including domestic and foreign tourists.

4. Partnerships

Main competencies of the company (Core competence) are:

- a. The company established in 2006 and the owner has his own experience in making Ikan Asar and this experience makes him really understand all things

around this business and its marketing.

- b. This company has its regular fish supplier.

- c. From capital side, this company is quiet strong since they already get financial support (KUR) from local bank.

5. Finance

From capital side, this company is quiet strong since they already get financial support (KUR) from local bank.

6. Socio/Political

The company has no spesific strategy to overcome soc ial/political issues.

Table 4. Three Level Characteristics

No	Atribut	Ada	Tdk ada	Keterangan
<b>Level Proses</b>				
1	Bahan baku	√		Bahan baku ikan
2	Tenaga kerja	√		4 orang
3	Teknologi	√		Manual
4	Finansial	√		Modal mandiri dan bank
5	Produk	√		Ikan Asar
6	Revenue	√		Pemualan Rp. 22.500.000,00
7	Profit	√		± Rp. 13.500.000,00 bulan
8	Pollusi	√		Limbah padat, cair, dan gas
9	Proses	√		Tradisional
<b>Level Operasi</b>				
1	Matenal flow	√		Tidak ada persediaan bahan baku.
2	Scheduling of job		√	-
3	Machining maintenance	√		Pembersihan
4	Pricing	√		Tradisional: berdasarkan desain
5	Promotion		√	-
6	Post-sales		√	-
7	Environmental	√		Air sisa samng, debu, produk rusak
8	Accounting	√		Tradisional
9	Organizational structure		√	Hanya perbedaan pemilik-pekerja
10	Work force	√		4 orang termasuk pembik
11	Traning		√	-
12	Product liability		√	Ada produk untuk wadah makanan
13	Occup. & health safety act		√	-
<b>Level Strategis</b>				
1	New technologies		√	-
2	Research & development	√		Pengemasan dus
3	New market	√		
4	Partnerships	√		Pengalaman & loyalitas pelanggan
5	Finance		√	
6	Socio/Political		√	

a. Response Strategic Towards Customer Demand

First, we should consider response strategic towards customer demand. Base on the results of Identification, the company is a Batch production according to operation flow and product variation. A characteristics of this production system is that it has:

- Short production process for each product
- A production line can be used to some product type. In this term, smoked fish with different size and kinds of fish can be processed in the same production line

- The system is for general purpose, not only for specific production  
 From the view of operational goal to overcome the customer needs, then the company can be categorized as **Make-To-Stock**. The production make items to be finished and paced as inventory before customer's orders come. Even actually there is stock, but they didn't mean to make product as inventory. This fact has also supported by the short durability of raw fish. So the strategic towards customer demand as can be figured as in Figure 3.



Note: Square with thick line means primary match, while square with thin line means secondary match between manufacturing process and respond to demand

Figure 3. Matrice of Demand Respond and Manufacturing Process

It seems that the suitable respond strategy to demand is **Make-To-Order**, since product Ikan Asar (smoked fish) has a short durability period and the production should be done in batch even in small size batch.

**b. Manufacturing Process**

The design of manufacturing process is depend of production volume and the level of standarization. The Product type of the SME can be seen in Figure 4.

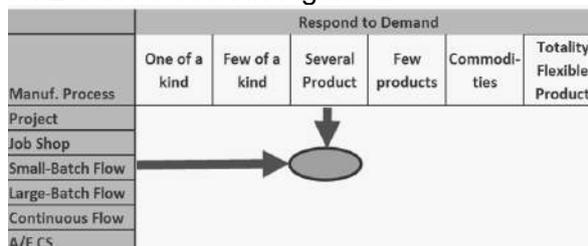
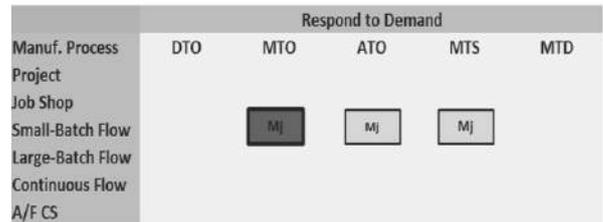


Figure 4. Matrice of Product Type and Manufacturing Process

**c. Manufacturing Planning and Control System**

Design of production planning and control system of a company should consider dependency between design of manufacturing process and design of respond to demand, as shown in Figure 5.



Note: The big M means major applicability of Material Capacity Requirements Planning – MRP II System. Square with thick line means primary match, while square with thin line means secondary match between manufacturing process and respond to demand.

Figure 5. Matrice of Manufacturing Process and Respond to Demand

From Figure 5, we can explain that for Small Batch Process with Make-To-Order, the system M&CRP has been a traditional choose.

**d. Material Requirement Planning using Lot Sizing Techniques.**

Using the data:

Table 5. Demand of Smoked Fish

Periode (T)	1	2	3	4	5	6	7	8	9	10	11	12
Permintaan (Dt)	3.197	3.348	3.476	3.643	3.426	3.714	3.135	3.092	3.851	3.566	3.493	3.460

**1. Fixed Order Quantity (FOQ)**

Order quality is determined by the highest of Net Requirements, 3851.

- Price per unit (c)	=	Rp	25.000
- Procurement cost	=	Rp	2.400.000 /procurement
- Holding cost (It)	=	1% x value of holding inventory	
		250 /tail	
		2%	
- Setup time	=	0	
Total Demand	=	41.401	
Total Order Quantity	=	46.212	
Lot Size =	=	3.851	
Order Frekwency	=	12	
Procurement cost	=	Rp	28.800.000
Holding Cost	=	Rp	8.353.750
Total cost	=	Rp	37.153.750
Ordering Number	=	41.401	
R	=	41.401	

Then the calculation for FOQ is as Table 6:

Table 6. Lot Sizing with FOQ

Period (T)	0	1	2	3	4	5	6	7	8	9	10	11	12
Net Requirements (Rt)		3.197	3.348	3.476	3.643	3.426	3.714	3.135	3.092	3.851	3.566	3.493	3.460
Order Quantity (Qt)		3.851	3.851	3.851	3.851	3.851	3.851	3.851	3.851	3.851	3.851	3.851	3.851
Inventory		654	1.157	1.532	1.740	2.165	2.302	3.018	3.777	3.777	4.062	4.420	4.811

2. Economic Order Quantity (EOQ)

Average Demand (D)	=	3.450 fish/month
Total Demand	=	41.401
EOQ	=	28.194
Total inventory	=	212.334
Order Frequency	=	2
Holding cost	Rp	53.083.566
Order cost	Rp	4.800.000
Total cost	Rp	57.883.566

Calculation for EOQ is as Table 7.

Table 7. Lot Sizing with EOQ

Period (T)	1	2	3	4	5	6	7	8	9	10	11	12
Net Requirements (Rt)	3.197	3.348	3.476	3.643	3.426	3.714	3.135	3.092	3.851	3.566	3.493	3.460
Lot Size	28.194						28.194					
Inventory	24.997	21.649	18.173	14.530	11.104	7.390	4.255	29.357	25.506	21.940	18.447	14.987

3. Lot For Lot (LFL)

Calculation for LFL is as Table 8:

- Price per unit (c)	=	Rp	25.000
- Procurement cost	=	Rp	2.400.000
- Holding cost (It)	=	1% x value of holding inventory	
		250 /tail	
		2%	
Waktu ancap-ancang	=	0	
Total Demand	=	41.401	
Total Order Quantity	=	41.401	
Order Frekwency	=	12	
Procurement cost	=	Rp	28.800.000
Holding Cost	=	Rp	-
Total cost	=	Rp	28.800.000

Table 8. Lot Sizing with LFL

Period (T)	1	2	3	4	5	6	7	8	9	10	11	12
Net Requirements (Rt)	3.197	3.348	3.476	3.643	3.426	3.714	3.135	3.092	3.851	3.566	3.493	3.460
Order Quantity (Qt)	3.197	3.348	3.476	3.643	3.426	3.714	3.135	3.092	3.851	3.566	3.493	3.460
Inventory	-	-	-	-	-	-	-	-	-	-	-	-

4. Fixed Period Requirement (FPR)

Calculation for FPR is as Table 9.

- Price per unit (c)	=	Rp	25.000
- Procurement cost	=	Rp	2.400.000
- Holding cost (It)	=	1% x value of holding inventory	
		250 /tail	
		2%	
Waktu ancap-ancang	=	0	
Total Demand	=	41.401	
Total Order Quantity	=	41.401	
Order Frekwency	=	6	
Procurement cost	=	Rp	14.400.000
Holding Cost	=	Rp	5.205.750
Total cost	=	Rp	19.605.750

Table 9. Lot Sizing with FPR

Period (T)	1	2	3	4	5	6	7	8	9	10	11	12
Net Requirements (Rt)	3.197	3.348	3.476	3.643	3.426	3.714	3.135	3.092	3.851	3.566	3.493	3.460
Lot Size	6.545		7.119		7.140		6.227		7.417		6.953	
Holding Inventory	3.348	-	3.643	-	3.714	-	3.092	-	3.566	-	3.460	-

The results of these techniques can be compared as in Table 10.

Table 10. Comparison among Lot Sizing Techniques

Tehniques	Lot Size	Order Frequency	Total Cost
FOQ	46.212	12	Rp 37.153.750
EOQ	56.388	2	Rp 57.883.566
LFL	41.401	12	Rp 28.800.000
FPR	41.401	6	Rp 19.605.750

From the four techniques, the one with smallest lot size and lowest total cost is FPR. It means that the SME determines their lot sizes base on a specific time period with interval between time periods are fix with lot size according to the Net Requirement.

5. CONCLUSION

Base on the results we can conclude that:

1. SME of smoked fish (*Ikan Asar*) still categorized into small industry because of some factors, such as:
  - It has no body of law
  - The level of management specialization is still low
  - Personal contact among workers are tightly close.
  - A few kinds of products, with low economical scale
  - None or less of financial support from finance institution
  - Limited product market
  - Availability of raw material (fish) on market depends on climate, but the material collecting has done in limited number
  - The company only serve for small scale order.
  - Technology applied in the company is manual/traditional.
2. Dimention of the industry:
  - Base on characteristics, the industry is a tradisional industry
  - Base on function, it is a cullinary industry.

- Base on organization system, it is a non-industri
3. The specific design process for the smoked fish is a Small Batch Process with the strategic respond to demand is Make-To-Order, the system M&CRP has te design of production planning and control system.
  4. The best MRP techniques to determine lot size with minimum cost is Fixed Period Requirement (FPR).

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