

Factors Controlling the Development of Fruit Processing Industries:

A Case Study of East Java, Indonesia

by

I.B. Suryaningrat

**Faculty of Agricultural Technology
University of Jember, Indonesia**

Abstract

Fruit Processing Industries (FPIs) in East Java, are a key part of agroindustrial activities there. In terms of economic development, these strongly contribute to creating employment opportunities and higher income. In relation to agroindustry, three basic components in any agroindustrial system are procurement of raw material, processing and marketing. How to encourage fruit processing, as an agroindustrial activity and area potential, has become a vital issue and a major priority for area development in East Java. Understanding the problems in FPIs would give support to success cases.

Based on a sample survey of five districts in East Java province (Banyuwangi, Jember, Lumajang, Probolinggo and Malang), this paper reviews controlling factors, based on three basic components of the agroindustrial system. The paper concludes that FPIs are technological problems showed a strong relationship with FPIs' overall performance. Achievement of technology tends to be a determinant factor in processing activities. Understanding these factors can aid policy makers of FPIs in designing and implementing appropriate programs.

Introduction

Agroindustrial sector as a sub-system of agribusiness, has unique advantages of utilizing agricultural raw material in agro-product processing. Some problems associated with the food industry found in other countries, are the shortage of raw material, quality, lack of continuous supply of seasonal raw material, inadequately trained labor force, costly imported packing material, and infrastructure and technological deficiencies (Hicks, 1991).

As agro-processed products are becoming very competitive in the world market, it is important to understand the problems faced by FPIs. The perception of problems by FPIs' owners or operators could influence their activities. For policy makers, understanding of such problems will aid in formulating policies conducive for the development of small and medium industries (SMIs) (Walsh, 1988).

Common criteria for classification of industries is the number of employees, small-scale (1-4 workers), medium scale (5-10 or 11-19 workers), and large-scale (20-99 workers). Small and medium industries are often considered together (Soon, 1984). For the developing countries, SMIs which still are fairly labor intensive, the criterion of employment of less than 50 workers is still applicable (Theng and Boon, 1996).

Mishra (1999) and Tambunan (2000) reported that the most SMIs are still using traditional technology for processing. Tambunan and Keddie (1998), from their study on SMIs in Yogyakarta, revealed that with simple technology and low skill, the ability of SMIs to make innovations in their product and production process will be very limited.

Krishnankutty (2000) in his study argued for setting up the society to facilitate SMIs activities and help adoption of technology.

Tambunan (2000) revealed that passive marketing, selling product locally, unstable demand, difficulties in transportation, limited market and dependence on retailer or wholesalers for marketing are common problems in SMIs.

This study identified the determinant factors in fruit processing industries (FPIs) which are including small and medium fruit processing industries (SMFPIs) and big fruit processing industries (BFPIs). The data used for analysis was obtained through a survey conducted in the study area.

Methods

A questionnaire was prepared to obtain required data from the selected industries. The questions were related to procurement of raw material, processing, and marketing activities. Questions were designed to assist in analyzing current status of SMFPIs. A few other factors felt to be relevant to the local context were included too. The question styles employed were questions requiring open and closed responses and others which used a Likert scale to obtain attitudinal data. Respondents were encouraged to include other useful information based on their individual experiences and knowledge.

Questionnaire was addressed to 63 fruit processing SMIs randomly chosen from five districts in East Java consisting of Banyuwangi, Jember, Lumajang, Probolinggo and Malang. These five districts are major supplier of fruits in Indonesia and provide significant amount of raw material to fruit processing SMIs. The questionnaire was filled in during visits, meetings and interviews with key person or representative of SMFPIs.

This study identified the determinant factors in small and medium fruit processing industries (SMFPIs) and big fruit processing industries (BFPIs). Correlation analysis was used to determine factors which has strong relationship among basic component factors, total score and total sales as determinant factors. The total score and total sales of industries are represented the industry performance. The detail factors of basic components used are:

1. **Company Profile** factors: (1) time existence, (2) age of owners, (3) education, (4) technology used, (5) number of employee.
2. **Procurement of Raw Material** factors: (1) ways of procurement, (2) resource, (3) quantity, (4) continuity, (5) purchasing power, (6) quality, (7) handling and transport, and (8) storage facility.
3. **Processing and Technology Activity** factors are divided into three parts. The first part is **processing activity**: (1) technological achievement, (2) technological problem, (3) quality achievement, (4) location of raw material, (5) location of market, (6) transportation, (7) others processing facility, and (8) product defect. The second part is **activity control**: (9) scheduling of raw material, (10) inventory, (11) capacity testing, (12) contamination, (13) temperature control, (14) chemistry control, (15) nutrition, and (16) packaging. The third part is **training experiences** which include: (17) raw material handling, (18) technology, (19) general management, (20) organization, (21) capital source, (22) marketing, and (23) quality control.
4. **Marketing Activity** factors: (1) consumer level, (2) place of sale, (3) using of label, (4) selling area, (5) product appearance, (6) packaging, (7) color, (8) taste, and (9) promotion.

This analysis based on the score of the questionnaire filled by industries (SMFPIs and BFPIs) consist of raw material, processing and marketing. The result of analysis is classified based on the following criteria: very strong with r value 0.80 to 1; strong with r value 0.60 to 0.79; medium with r value 0.40 to 0.59; weak with r value 0.20 to 0.39; very weak with r value 0 to 0.19.

Result and Discussion

5.4.1 Identification of Determinant Factors in SMFPIs

Table 1 shows that education ($r=0.72$) and technology ($r=0.66$) have strong relationship with marketing activity. This indicates that education and technology are considered as determinant factors of marketing activities. Through higher education level, the owners or managers have more ability to market their products. Higher level of technology is required to maintain better quality of product that strongly affect to higher total sales.

Table 1: Relationship (r) between SMAIs Profile and Basic Components of Agroindustries.

Factors	Raw material	Processing	Marketing
Time existence (year)	-0.12 (very weak)	-0.20 (weak)	-0.32* (weak)
Age of owners	-0.15 (very weak)	-0.16 (very weak)	-0.09 (very weak)
Education	0.37**(weak)	0.49**(medium)	0.72**(strong)
Technology Used	0.23 (weak)	0.48**(medium)	0.62**(strong)
Number of Employee	0.44**(medium)	0.42**(medium)	0.46**(medium)

** . Correlation is significant at the 0.01 level (2-tailed)

* . Correlation is significant at the 0.05 level (2-tailed)

Table 2 shows that storage has strong relationship ($r=0.60$) with the total score as the performance of SMFPIs. This indicates that storage is the most important factor in raw material procurement in SMFPIs. This study revealed that storage facilities need to be improved to maintain better quality raw material quality strongly affect finished product quality. Quantity and quality of raw material are other factors with significant medium positive relationship ($r=0.55$ and $r=0.53$) tends to be a strong factors. Better quality and quantity of raw material supply strongly affect processing activity and finished product.

Table 2: Relationship (r) among Raw material Factors, Total Score and Total Sales

Raw Material Factors	Total score		Total sales	
	r	Criteria	r	Criteria
Obtaining of RM (procurement)	0.24	Weak	0.06	very weak
Resource	0.38**	Weak	0.08	very weak
Quantity	0.55**	Medium	0.18	very weak
Continuity	0.47**	Medium	0.30*	weak
Purchasing power	0.48**	Medium	0.09	very weak
Quality	0.53**	Medium	0.27*	weak
Handling and transport	0.49**	Medium	0.36**	weak
Storage	0.60**	Strong	0.23	weak

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Three parts of processing factor consists of processing activities, control activities and training experiences were evaluated. Table 3 shows that technological problem has strong relationship ($r=0.60$) with total score as a performance of processing activities. Related to technological aspect, achievement technology has medium relationship ($r=0.57$) tends to be a strong relationship. This indicates that those two factors dominate the processing activities in SMFPIs. This also related to capital investment and skill of operator as major problems in technological aspect. Most of SMFPIs are still using traditional and simple technology strongly affect to product quality. Up grading

technology as one of processing activities is suggested to improve quality of finish products and SMFPIs' performance.

Table 3: Relationship (r) among Processing and Technology Factors, Total Score, and Total Sales

Processing Factors	Total score		Total sales	
	r	Criteria	r	criteria
Processing Activity				
Achievement of technology	0.57**	Medium	0.12	very weak
Technological problem	0.60**	Strong	0.15	very weak
Quality achievement	0.54**	Medium	0.13	very weak
Location of Raw material	0.32**	Weak	0.11	very weak
Location of market	0.44**	Medium	0.01	very weak
Transportation	0.47**	Medium	0.07	very weak
Other facilities (electricity & water)	0.36**	Weak	0.33**	weak
Defect products	0.24	Weak	0.24	weak
Control Activity				
Scheduling of raw material	0.63**	Strong	0.08	very weak
Inventory	0.69**	Strong	0.23	very weak
Capacity testing	0.74**	Strong	0.12	very weak
Hygiene test	0.01	very weak	0.01	very weak
Contamination	0.22	Weak	0.15	very weak
Temperature control	0.42**	Medium	0.22	weak
Chemistry control	0.18	very weak	0.08	very weak
Nutrition	0.37**	Weak	0.20	weak
Packaging	0.40**	Medium	0.30*	weak
Training Experience				
Raw material handling	0.17	very weak	0.09	very weak
Technology	0.47**	Medium	0.08	very weak
General management	0.68**	Strong	0.24	weak
Organization	0.25**	Weak	0.04	very weak
Capital source	0.49**	Medium	0.16	very weak
Marketing	0.49**	Medium	0.15	very weak
Quality control	0.51**	Medium	0.04	very weak

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 5.7 shows that scheduling for procurement of raw material, inventory, and capacity testing have strong relationship ($r=0.63$, $r=0.69$, and $r=0.74$) with the total score as a performance of processing activities in SMFPIs. Scheduling of raw material supply strongly to the continuity of processing process. Inventory system is needed to maintain

the quality of raw material to be processed. This study revealed that some of SMFPIs pay low attention for scheduling, providing inventory system, and conducting capacity test.

In term of training experience, Table 3 shows that general management has strong relationship ($r=0.68$) with total score as performance of the SMFPIs. This indicates that general management training was strongly required to improve the SMFPIs' performance. Government officer including training center was suggested to improve facilities and material of training program to support SMFPIs to reach better performance.

Table 4: Relationship (r) among Marketing Factors, Total Score and Total Sales

Marketing Factors	Total score		Total sales	
	r	Criteria	r	criteria
Consumer level	0.50**	Medium	0.13	very weak
Market channel (place)	0.62**	Strong	0.03	very weak
Using of label	0.65**	Strong	0.31*	weak
Selling area	0.60**	Strong	0.36**	weak
Product appearance	0.65**	Strong	0.24	weak
Packaging	0.89**	very strong	0.32**	weak
Color	0.58**	Medium	0.17	weak
Taste	0.70**	Strong	0.06	weak
Promotion activity	0.72**	Strong	0.26*	weak

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 4 shows that packaging has very strong relationship ($r=0.89$) in marketing activities. Market channel ($r=0.62$), using of label ($r=0.65$), selling area ($r=0.60$), product appearance ($r=0.65$), taste ($r=0.70$), and promotion activities ($r=0.72$) have strong relationship with total score. This study revealed that packaging was the most common activities in SMFPIs particularly in marketing activities. On the quality factors packaging tends to be a strong factor. Some of SMFPIs did packaging in simple and traditional way that strongly affects quality and appearance of product. Considering the problems and the strong factors found in this study, it was suggested to improve marketing activities supported by facilities to achieve better performance of SMFPIs.

5.4.2 Identification of determinant factors in BFPIs

Table 5 shows that time existence of industries has strong positive relationship ($r=0.60$) with marketing activities of BFPIs. This indicates that the existence of big industries has strong effect to marketing performance. Time existence represents the market share of the company or the product. Longer of time existence gives more chance to reach bigger market. Technology used or level of technology has medium relationship ($r=0.55$) tends to be a strong relationship with raw material activities. Particularly in BFPIs, higher technology used has strongly relationship with large quantity of raw material requirement in processing activities.

Table 5: Relationship (r) between BFPIs profile and basic components

Company Profile	Raw Material	Processing	Marketing
Time existence (year)	-0.15 (very weak)	-0.11 (very weak)	0.60* (strong)
Age of owners	0.51 (medium)	0.43 (medium)	0.40 (medium)
Education	0.05 (very weak)	0.30 (weak)	0.20 (weak)
Technology used	0.55 (medium)	0.42 (medium)	0.42 (medium)
Number of employee	0.15 (very weak)	0.26 (weak)	0.07 (very weak)

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 6 shows that continuity and resource have very strong and strong relationship ($r=0.81$ and $r=0.70$) with total score as a performance in big industries. Continuity of raw material was strongly required by BFPIs to support processing activities. This study revealed that BFPIs procured raw material requirement mostly from market and contract system to maintain the continuity of raw material supply. Related to large quantity and continuity of raw material, BFPIs supplied the requirement from other districts as a resource of raw material.

Purchasing power ($r=0.55$) and quality of raw material ($r=0.56$) tend to be a strong factor in raw material activity. This study also revealed that there was a competition to buy raw material in the market, because of large quantity requirement. Most of big agroindustries (89 percent) agreed that quality was the driven factor that has strong effect to the consumers.

Table 6: Relationship (r) between Raw material Factors and Total Score

Raw Material Factors	Total score	
	r	Criteria
Obtaining of RM (procurement)	0.06	Very weak
Resource	0.70*	Strong
Quantity	0.43	Medium
Continuity	0.81*	Very strong
Purchasing power	0.55	Medium
Quality	0.56	Medium
Handling and transport	0.11	Very weak
Storage	0.22	Weak

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 7 shows that technological problems, location of market and defect product have strong and very strong factors relationship ($r=0.60$, $r=0.73$, and $r=0.89$, respectively) in processing activities. Higher technology plays important role for big agroindustries to maintain better quality of product and to reduce defective products. Most BFPIs (89%) agreed that technology was the driven factor of activity support the quality of product. This indicates that technology is still a determinant factor to support better quality.

In case of control activities, all of the factors have the strong and very strong relationship to the performance of BFPIs. This indicates that better control activities strongly affect to better performance of BFPIs. This study revealed that all of control activities were done perfectly by BFPIs to maintain better quality of products. Especially in contamination control, it has very strong relationship, stronger than other factors. In

some BFPIs like banana pure product and fruit chips, contamination control practiced in perfect condition. To maintain this perfect condition BFPIs provided in high technology.

In case of training experience (Table 7), raw material and organization have strong relationship ($r=0.60$ and $r=0.77$) with total score as the performance of BFPIs. This indicates that these training programs strongly affect better performance of BFPIs. Better raw material handling influences strongly to the quality of finished product. Large quantity of raw material supply needs better handling process to maintain the quality of raw material. Training experience in organization is strongly required to manage complicated process in BFPIs and to improve the performance in general.

Table 7: Relationship (r)between processing factors and total score

Processing Factors	Total score	
	r	Criteria
Processing Activity		
Achievement of technology	0.54	Medium
Technological problem	0.60*	Strong
Quality achievement	0.46	Medium
Location of Raw material	0.23	Weak
Location of market	0.73*	Strong
Transportation	0.13	Very weak
Other facilities (electricity & water)	0.46	Medium
Defective products	0.89**	Very strong
Control Activity		
Scheduling of raw material	0.71*	Strong
Inventory	0.71*	Strong
Capacity testing	0.71*	Strong
Laboratory test	0.71*	Strong
Contamination	0.89**	Very strong
Temperature control	0.71*	Strong
Chemistry control	0.74*	Strong
Nutrition	0.74*	Strong
Packaging	0.71*	Strong
Training Experience		
Raw material handling	0.60	Strong
Technology	0.52	Medium
General management	0.04	Very weak
Organization	0.77*	Strong
Capital source	0.43	Medium
Marketing	0.27	Weak

Quality control	0.44	Medium
-----------------	------	--------

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Table 8 shows that market channel, product appearance, packaging and color of product have strong and very strong relationship ($r=0.60$, $r=0.71$, $r=0.85$, and $r=0.63$, respectively). This indicates that these marketing factors strongly affect to the performance of BFPIs. Better market channel or product distribution helps the consumer to find the products easier. Packaging, product appearance and color are often used as first consideration in buying process. Better packaging, product appearance and color are still suggested to BFPIs to maintain better product quality.

Table 8: Relationship (r)between Marketing Factors and Total Score

Marketing Factors	Total score	
	r	Criteria
Consumer level	0.43	Medium
Market channel (place)	0.60*	Strong
Using of label	0.14	Very weak
Selling area	0.56	Medium
Product appearance	0.71*	Strong
Packaging	0.85**	Very strong
Color	0.63*	Strong
Taste	0.43	Medium
Promotion activity	0.28	Weak

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Through identification of strong factors in fruit processing industries includes SMIs and BIs, their owners, operators and managers, may prepare themselves, through a varieties of activities such as information for technology, education and training program. Another, this identification also helps to training organizations, external consultants to identify areas of training and consulting. As well as for the policy maker, support their areas of greatest potential for improvement in fruit processing sector.

Conclusions

In terms of determinant factors of SMFPIs, education and technology found to have a strong relationship with marketing. Storage was strongly related to raw material procurement activities. Technological problems showed a strong relationship with SMFPIs' overall performance. Achievement of technology tends to be a determinant factor in processing activities. Procurement of raw material, inventory system and capacity testing should be considered as determinant factors of control activities.

Time of existence showed strong relationship with marketing activities of BFPIs. Resources availability and continuity of raw material are considered as determinant factors in raw material procurement activities. Technological problems, location of market and defective products are the determinants factors in processing activities.

References

- Hicks PA (1991), Food processing in Asia and the Pacific: An overview of Principles, Policies and Status. APO, Tokyo, Japan.
- Krishnankutty CN (2000), Bamboo weaving sector in Kerala: Current status and future possibilities for rural development. *Journal of Rural Development*, 19(3): 399-410.
- Mishra SN (1999), Can agroindustries be an effective tool for promoting rural development in Orissa. *Journal of Rural Development*, 18(2): 161-84.
- Soon TT (1984), Management guidance system for small and medium enterprise. APO, Japan.

International Agricultural Engineering Conference, Bangkok, Thailand, 7 – 10 December, 2009

Tambunan T (1994), Local orientation of rural small scale industries: An empirical study from Ciomas sub district West-Java Indonesia. *Asia-Pacific Journal of Rural Development*, 4 (1-2): 85-117.

Tambunan T (2000), Development strategy of rural small-scale industries with a cluster approach: A case of Indonesia. *Asia-Pacific Journal of Rural Development* 10 (1): 66-98.

Tambunan T and Keddie J (1998), Yogyakarta area leather goods cluster. UNIDO, Jakarta.

Theng LG and Boon JL (1996), An explanatory study of factors affecting the failure of local small and medium enterprises. *Asia-Pacific Journal of Management*, 13 (2): 47-61.

Walsh JP (1988), Selectivity and selective perception: An investigation of managers' belief structure and information processing. *Academy of Management Journal*, 31 (4): 873-96.

IAECC-2009