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Identification of Determinant Factors in Processing and Technology: A Case Study of Fruit Processing Industries (FPIs) in Indonesia

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Abstract

Presently, problems related processing and technology as a part of basic component of agroindustry are still faced by agroindustrial development program in Indonesia,especially of fruit processing industries (FPIs). This condition needs to be reviewed to find determinant factors to support possible policies for agroindustrial development so that agricultural sector will support agroindustries. Using purposive random sampling the respondents were chosen from 5 districts from East Java province consisting of Banyuwangi, Jember, Lumajang, Probolinggo and Malang. These five districts are the supplier of fruit resources in large quantity to fruit processing industries. In this study, questionnaire was addressed to 79 FPIs in the study area. Correlation analysis was used to find relationship between strong factors influencing enterprises performance and processing activities as basic component of agroindustries. The present situation and determinant factors related to processing and technological activities were identified. The result revealed that technological problems, scheduling of raw material, inventory, and production capacity were identified as determinant factors in processing activities in small, medium and big FPIs. Achievement of technology and general management were found to be determinant factors of small and medium FPIs. In term of big FPIs, contamination, temperature control, nutrition, packaging, raw material handling and organization were found as strong influencing factor to their processing and technological activities. Government support in terms of arranging training programs about raw material handling, quality control, new technology, providing soft credit, and improved transportation facilities, were strongly required for the development of FPIs in the study area.

Keywords: determinant factors, processing, technology, fruit processing industries

Introduction

The fruit processing enterprises are commonly available in East Java. Most of them are small and medium industries (SMIs). SMIs can be seen as an important to create employment and generate income particularly in rural areas. However, technology, quality of products and skills of human resources become a critical factor for these rural based enterprises. Industrial Department of Indonesia (1998) argued that 32% of agro-processing problems in SMIs are due to mainly process technology. The study by Sandee (1995) showed that the most of SMIs use traditional technologies producing items of low quality.

For SMIs owners or operation managers, the perception especially of technological problem can influence their behavior, knowledge acquisition, and business performance (Walsh, 1988). On the other hand, for policy makers, such understanding, among other things, will aid in formulating policies and developing SMIs programs. For the academics, knowing the problems can help in directing their research effort to find appropriate solutions (Banks and Taylor, 1991).

Mishra (1999) and Tambunan (2000) reported that the most of SMIs are still using traditional technology. Use of improved technology was limited in most of the units. The

study in Orissa, India (Mishra, 1999) argued that 18 per cent of units admitted lack of finance, four per cent of units revealed no information or guidance for improved technology. Similarly, two per cent of units informed non-availability of improved technology in terms of machines, tools, and equipment in nearby locality. Some of the enterprises admitted that they had procured machines and instruments from far-off places at a high price.

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 innovation for their product and production process will be very limited. The experience in West Europe showed that innovation is a critical factor for the development of SMIs.

Huang and Brown (1999) reported that related to production and operation management problem, quality assurance was an issue faced by many SMIs. They required advice on developing quality assurance systems. This was usually required by larger customers or attempts to gain a perceived competitive advantage in the market place.

This paper attempts to assess the current situation especially in processing technology activities of FPIs in the study area base on technological problems in fruit processing SMIs. This study identified the determinant factors in small and medium fruit processing industries (SMFPIs) and big fruit processing industries (BFPIs). The data used for analyze were obtained through survey in the study area.

Materials and Methods

Methods

Questionnaire was addressed to 63 fruit processing SMIs, randomly chosen from five districts in East Java. These districts are Banyuwangi, Jember, Lumajang, Probolinggo and Malang. The questionnaire was filled in through visiting, meeting and interviewing key persons or representative of SMFPIs.Most of the factors required to know about certain agroindustries in addition to those identified from the literature (some of which were reviewed earlier) were included in the questionnaire. A few other factors felt to be relevant to the local context were also included. In this study, questionnaire were classified into ways of obtaining technology, problems in using technology, control of processing activities, product defects, and training experiences. To encourage high response rate, the open-close questionnaire was kept short. Some spaces were provided to allow respondents to include other comments of their own.

Data analysis

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 the level of influence among basic agroindustry components. The total of score and total sales of industries represent the industry performance.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) other processing facilities, and (8) product defects. 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. This analysis is based on the score filled by industries (SMFPIs and BFPIs) in the

questionnaire in relation to raw material, processing and marketing. The classification of interpretation of r values are very strong (0.8 – 1), strong (0.60 - 0.79), medium (0.40 - 0.59), weak (0.20 - 0.39) and very weak (0.00 - 0.19).

Result and discussion

Identification of determinant factors of SMFPIs

Three parts of processing factor consisted of processing activities, control activities and training experiences were evaluated. Table 1 shows that technological problem has a strong relationship with total score as it has significant effect on processing activities. Related to technological aspect, achievement of technology has medium relationship. This indicates that those two factors dominate the processing activities in SMFPIs. This also relates to capital investment and skill of operators as major problems in technological aspect. Most of SMFPIs are still using traditional and simple technology which strongly affect product quality. Up grading technology as one of processing activities is suggested to improve quality of finished products and SMFPIs' overall performance.

Table 1 shows that scheduling for procurement of raw material, inventory, and capacity testing have strong relationship with the total score indicating the performance of processing activities in SMFPIs. Scheduling of raw material supply strongly affect the continuity of processing process. Inventory system is needed to maintain the quality of raw material to be processed. This study revealed that some SMFPIs pay low attention for scheduling, providing inventory system, and conducting capacity test.

In terms of training experience, Table 1 shows that general management has strong relationship with the performance of the SMFPIs. The result indicated that general management training is strongly required to improve the SMFPIs' performance. Government officers training centers, should improve facilities and training material to support SMFPIs to reach better performance level.

Table 1: Relationship among processing and technology factors, total score, and total sales

Processing Factors	Total score	
	r	criteria
Processing Activity		
Achievement of technology	0.57**	medium
Technological problems	0.60**	strong
Quality achievement	0.54**	medium
Location of raw material	0.32**	weak
Location of market	0.44**	medium
Transportation	0.47**	medium
Other facilities (electricity & water)	0.36**	weak
Defective products	0.24	weak
Control Activity		
Scheduling of raw material	0.63**	strong
Inventory	0.69**	strong
Capacity testing	0.74**	strong
Hygiene test	0.01	very weak
Contamination	0.22	weak
Temperature control	0.42**	medium
Chemical control	0.18	very weak
Nutrition	0.37**	weak
Packaging	0.40**	medium
Training Experience		
Raw material handling	0.17	very weak
Technology	0.47**	medium
General management	0.68**	strong
Organization	0.25**	weak
Capital source	0.49**	medium
Marketing	0.49**	medium
Quality control	0.51**	medium

Identification of factors affecting BFPIs performance

Table 2 shows that technological problems, location of market and defective products have strong and very strong relationship (r=0.60, r=0.73, and r=0.89, respectively) with processing activities. Higher technology plays an important role for big agroindustries to maintain better quality of product as well as to reduce defective products. Most BFPIs (89 per cent) agreed that technology is the driving factor for the quality of product.

Table 2: Relationship 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
Hygiene test	0.71*	Strong
Contamination	0.89**	Very strong
Temperature control	0.71*	Strong
Chemical 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).

In case of control activities, all factors have the strong and very strong relationship on the performance of BFPIs. This indicates that better control activities improves the performance of BFPIs. This study also revealed that all control activities were done perfectly by BFPIs to maintain better quality of products e.g. contamination control. In some BFPIs like banana puree product and fruit chips, contamination control is practiced accurately. To have this, BFPIs are equipped with high level of technology.

In case of training experience (Table 2), raw material and organization have strong relationship with total score. This indicates that these training programs strongly affect the performance of BFPIs. Better raw material handling influences strongly the quality of finished product. Large quantity of raw material supply needed 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 overall performance in general.

Understanding of determinant factors of SMFPIs and BFPIs may help their owners, managers and operators to manage various operational functions of these industries. For the policy makers, it will help to form policies to support those areas of greatest potential for improvement of fruit processing industries.

Conclusion

Technological problems, scheduling of raw material, inventory, and production capacity were identified as determinant factors in processing activities in small, medium and big FPIs. Achievement of technology and general management were found to be determinant factors of small and medium FPIs. In term of big FPIs, contamination, temperature control, nutrition, packaging, raw material handling and organization were found as strong influencing factor to their processing and technological activities.Soft credit for capital investment, training programs for quality and management skills improvement, and providing simple, multi function and low price technology are the proposed policies for processing technology improvement.

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