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THE ACCELERATION OF TECHNOLOGY INNOVATION SYSTEM OF FOOD CROPS PROCESSING AND AGRICULTURAL MACHINERIES AND EQUIPMENT TO SUPPORT FOOD SECURITY

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1. Introduction

The government, the private sector, and the community should cooperate to make investment on agricultural processing to create added value for all stakeholders. Investment to accelerate technology innovation system of food crops processing and agricultural machineries and equipment cover several aspects, namely: (1) technology services, (2) input availability for product processing technology, (3) research activities related to technology application, (4) institutional development to accelerate technology information on food crops processing and agricultural machineries, (5) infrastructure availability to ease input and output flow as well as marketing activities, and (6) availability of farm land to ensure the availability of raw materials for agricultural processing development. Agricultural processing influenced by lack of knowledge, availability and access to food processing technology innovation, market, capital, and food consumption shifting trend to instant food system.

The objectives of this research are: (i) To identify the availability of food crops technology innovation and agricultural machineries and equipment; (ii) To study the effective application of dissemination system of food crops processing and agricultural machineries and equipment; (iii) To learn the development and prospect potential of agricultural processing; (iv) To analyze factors affecting and problems associated with technology adoption of food crops processing and agricultural machineries and equipment; and (v) To formulate recommendation on strategy to accelerate adoption of food crops technology processing and agricultural machineries and equipment.

This research was conducted in the Provinces of East Java, Central Java and Lampung with respondents covering farmer’s households, agro-based processing industries of home, small and medium industries, and also related institutions, such as local food crops office and industry office. The selected commodity at which processing are applied cover corn and sweet potato (East Java Province), cassava (Central Java Province), and banana (Lampung Province). Data, information and knowledge obtained and derived from this research are analyzed descriptively to draw research conclusions.

2. Statement of Problems

Problems encountered and should be responded by this research is how to accelerate food crops processing and agricultural machineries and equipment to support food security. For this purpose, this research should identify the availability of various food crops technology innovation, specifically those that have been introduced and produced by the Agency for Agricultural and followed by the identification of factors Research and Development (AARD). The next step is to study the application performance of the technologies at household level and analyze factors affecting its adoption at post-harvest and production processing activities. In-depth study on the affecting factors includes the problems and constraints on technical, economical, institutional/supporting facilities, and socio-cultural aspects.

To support food security program, the identified factors affecting the adoption of agricultural technology adoption are focused on several food crops, i.e., corn, sweet potato, cassava and banana. The analysis is directed to formulate policy recommendation to accelerate the technology innovation system and its adoption in efforts to support food security program.

3. Outstanding Findings

a. Identification of technology innovation of food crops processing and agricultural machineries and equipment

Most of technology produced by the AARD through the Agricultural Post-harvest Research Institute, Agricultural Machineries and Equipment Research Institute, and Assessment Institute of Agricultural Technology is categorized as laboratory level innovation, means that no scaling-up activities being applied. If there are some of the technologies have been
applied by the users, these innovations are considered and limited to the function of the institutions that introduce the technology, such as those produced and disseminated by the Cereal and Roots Research Institute (Balitkabi).

Since 2007, the Ministry of Agriculture has been developing roots- and cereal-based agro industries by providing processing equipment, guidance and operational cost at food production centers. This program has been conducted by the Directorate General of Agricultural Processing and Product Marketing (Ditjen P2HP). This support is organized through agricultural budget facility (Tugas Pembantuan) to facilitate 46 processing units of local flour/starch products managed by the federation of farmer’s group (Gapoktan) spread in many regions.

b. The effective system dissemination of food crops processing technology and agricultural machineries and equipment

The interaction dynamics and co-evolution of three main actors directly involved in technology flow process (technology developers, technology users, and government) are the foundation of the success of food crops technology innovation acceleration. Frequent problems encountered in technology transfer and agricultural processing dissemination, among others, are: (a) Technology recommendations are not suitable with the needs and or financial conditions; (b) Technology recommendations are limited produced; and (c) Raw materials for the introduced technology are not available at local level.

Dissemination techniques implemented by the Agricultural Post-harvest Research Institute is effective, specifically those with electronic media (internet), such as: (a) Input production development to increase crop production; (b) Pilot study of production to understand quantity consistence and production quality; (c) Supervision and close cooperation on processing technology application; (d) Development and improvement of product quality through quality control activities; (e) Business management and partnerships (ownership, risk and profit share, business sustainability assurance); (f) Packaging design and product logo/brand development; (g) Promotion and marketing development to accelerate the adoption of technology by stakeholders (woman’s farmer group, NGOs, local government institutions, and other private sectors); (h) Guidance and promotion through direct demonstration of processing operation and group discussions; (i) Performance evaluation and modification/improvement of production equipment; (j) Demonstration model of processing and cooperative unit; (k) Quality management system on post-harvest and processing activities; (l) Guidance on managerial aspect and business development (agribusiness management, processing, promotion and marketing); and (m) Procurement of processing tools and equipment.

c. Development potential and agricultural processing prospect

Agricultural productions are almost available at all times for further processed. In relations to this research, banana is produced intercropping with other crops and not intensively managed but the production is available throughout the year. Other commodities, such as corn, sweet potato, and cassava are planted in monoculture and managed intensively. Most of the production is sold as fresh produce. These crops should be available as raw materials for further process to obtain added value.

Tapioca flour industries have been widely developed in Pati and Magelang Regency of Central Java Province. Raw materials are not only supplied locally but also obtained from other surrounding regions. Tapioca flour marketing is prospective because of the increasing trend of flour-based food products.

Corn in Bojonegoro Regency of East Java Province is processed to produce tortilla (one of Mexican food products), corn rice mixed food, and corn-based fried food. These products are mostly produced by home industries and marketed locally although there are potential to expand its marketing destinations to other islands, especially for intermediate form of
production. Corn processing in Lamongan Regency of East Java is specifically produce *marning*, the local popular snack with limited marketing area.

The processing of banana to produce crispy snack in Lampung Province is promising taking into account the increasing local demand. The banana crispy medium industry in this region is not the competitor for the local and small industries because of the different of their market segment, marketing location, and packaging quality.

Agricultural processing development could be further improved through business partnership pattern, such as nucleus-plasma model at which medium industry could take a significant role as the driver and the home and small industries as the guided plasma. The other pattern of business partnership could also be developed, such as sub contract model at which the small industries could process and provide certain food products according to specific requirements by the medium industries. This sub contract model is currently performed in Pati, Central Java Province to produce several agro-based snacks.

d. Factors and problems affecting the adoption of food processing technology and agricultural machineries and equipment

Introduction of new technology and equipment would encourage a community to modify or develop such technology to the most suitable working condition and business scale. However, the ineffective implementation of introduction because of shortage in guidance and hands-on practice in order to make the users familiar with such new technology has affecting its acceleration adoption. This is situation need to improve if innovation technology would be adopted by a target group.

Working capital to support agro-based industry development is highly required. Government financial support through People’s Business Credit Program (*Kredit Usaha Rakyat*—KUR) is available for micro and small agro-industries but the community is not familiar with banking procedures. The low and subsidized interest KUR Program and the private companies’ Corporate Social Responsibility (CSR) financial support should be considered as alternative sources of capital to help the small agro-industries eradicate from lack of capital.

The availability of raw materials at all times is a pre condition enabling sustainable food crop processing activities. Raw materials can also be obtained from neighboring regions in addition to local production as long as the cost for such raw materials fit with the production cost. In this regard, the spirit of agro-based industries actors should be encouraged at high level to keep their interest in food diversification production to support food security.

3. Implikasi Kebijakan

Corn, sweet potato, cassava and banana have high potential to develop because of the availability of suitable land for such commodities. When raw materials are available, the availability of suitable technology and equipment is encouraged to anticipate various food products. The introduced technology and equipment should fit with the business actors need and should be well operated at commercial economic of scale.

In the context of technology adoption and processing industry prospect at household level, the role of the government is very important and the managing institutions to take care of the interest of the farmers-processors-sellers should have capacity to push three elements, namely (a) Applied technology creation to produce certain food products and enable an added value for each part of its business chain; (b) Implement the effective dissemination technique of applied technology to achieve technology use sustainability; and (c) Financial support through the available low interest credit, training on production technique, local and national promotion and exhibition.

To accelerate processing technology innovation, the government is suggested to (a) Empower capital structure and access to capital sources; (b) Improve technology mastering
at household level or micro/small scale industries; and (c) Improve human resource capacity to achieve a powerful and effective agro-based industry.

To accelerate technology innovation adoption, the following should be thoroughly considered: (a) production sustainability; (b) information availability; and (c) production quality and quantity improvement. In addition, business partnership between large companies and micro or small scale industries is strongly encouraged. In the mean time, the government should improve various policies to support: (a) consumption pattern using local foods; (b) knowledge and awareness on food diversification; and (c) non-rice food processing technology development. In this regard, the AIAT should be in a strategic position to speed the technology processing of local specific food production based on the local wisdom.

The national development strategy known as “triple track strategy” is characterized by pro-growth, pro-employment, and pro-poor, should allow investment and export acceleration. To this point, the strategy on food development could be implemented through vertical diversification on (a) the development of alternative raw materials; (b) post-harvest processing development for food crops; and (c) introduction of non-rice staple foods as alternatives to rice-based food.

The suggestion strategy to improve the performance of innovation system to support food security are: [1] Synchronization between technology being develop and problems faced by the farmers and food industries to meet domestic food consumer’s demand; [2] Incentives for farmers and food industries using national technology according to domestic and international market demand; [3] Revitalization of intermediary institutions to accelerate the process of technology adoption for farmers and local food industries; and [4] Availability of rules and regulations as the legal base to facilitate, stimulate, and accelerate the interaction between the business actors, the agro-based processing technology innovation systems, and other supporting institutions.