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Strategy for the Development of Agro-based Clusters

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Abstract

Agriculture in developing countries is transforming from the production of cereal grains to high-value agricultural products (HVPs) and processing them to meet the standards demanded in the market. The production of HVPs is usually geographically clustered and, hence, such areas may be termed as agro-based clusters (ABCs). However, not all ABCs process products to meet high quality demand. We categorize ABCs into agriculture clusters (AC), where no processing is involved, and agro-industrial clusters (AIC) where processing, including value addition, is a significant activity to meet the quality requirements of export and supermarkets. The major challenge for developing countries is to develop ABCs and to transform their ACs into AICs. From the literature review on contract farming, ABCs, and industrial clusters (ICs), we conclude that although a few studies highlight individual components, no attempt has been made to formulate a consolidated strategy for this transformation. This study attempts to demonstrate that in addition to providing improved technologies and basic rural infrastructure, mobilizing stakeholders into various groups, such as farmers' cooperatives and agro-processors' associations; providing technological and managerial training of stakeholders through these groups; promoting their collective actions for innovations; and implementing an appropriate regulatory framework are the keys to transform ACs into AICs. Building from the differences and similarities between ABCs and ICs, we also conclude that the role of government support is much more important in the case of the former than in the latter.

Keywords: agro-based clusters, agro-industrial clusters, high-value products, contract farming, training of stakeholders, collective action

1. Introduction

Agriculture in many developing countries has been undergoing a transformation from the production of cereal grains to high-value products (HVPs), such as vegetables, fruits, and livestock products, and their processing according to the standards demanded by the market (Otsuka & Fan, in press).[1] This is explained by a host of factors, including generally low relative prices of undifferentiated products like grains; income growth and urbanization, which lead to increasing demand for differentiated and nutritious HVPs; and the liberalization of agricultural trade policies in developed countries, which opens up opportunities for exports of HVPs from developing countries (Reardon & Barrett, 2000; Swinnen & Maertens, 2007; Dorosh & Thurlow, 2014; Headey, 2013; Anderson, 2016). The World Bank (2007) argues that this transformation provides unprecedented opportunities for developing countries to improve the income of poor smallholder farmers.

In order to supply HVPs to export markets and supermarkets, fresh and processed HVPs must be safe and of high-quality (Reardon et al., 2005). The safety of food is now considered vital for the growth and transformation of agriculture, which are needed to feed a growing and more prosperous world population, for the modernization of national food systems, and for a country's efficient integration into regional and international markets (Jaffee et al., 2019). Such products must be produced without using

[1] Note that our definition of HVPs also includes some cereals, such as rice and corn, if they are produced and processed to fetch high value in the markets.

toxic chemicals, and they must be either graded, packed, and transported properly when sold as fresh products, or processed while they are fresh. In addition, consumers often demand certification of the inputs used in agricultural production and the residue on agriculture outputs. It is important to recognize that not only farmers but also the private sector and public and private development agencies have to play a major role in various functions and processes involved in the transformation of agriculture toward the production and processing of HVPs.

We argue in this paper that the processes of agriculture transformation can be promoted when the stakeholders in the entire value chain of HVPs are synergistically linked because such linkage improves their efficiency to meet the quality demands of the market. Although geographical concentration is more ubiquitous in manufacturing industries throughout the developing world (Ali et al., 2014; Long & Zhang, 2011; Sonobe & Otsuka, 2011, 2014), such concentration is also now increasingly being noticed in the production of HVPs (Galvez-Nogales, 2010). In addition, the processing firms for these products also tend to be geographically concentrated. Examples of studies that describe production and processing clusters of HVPs are provided by Briones (2015) in the Philippines; Ali (2020) in Pakistan; Cavatassi et al. (2011) in Ecuador; Chatterjee and Ganesh-Kumar (2016) in India; Galvez-Nogales (2010) in Asia, Africa, and Latin America; and Zhang and Hu (2014) in China. Since the area in which the production of manufacturing

products is concentrated is called an "industrial cluster" (IC), it may be appropriate to call geographically-concentrated agricultural production and its processing areas as "agro-based clusters" (ABC).[2]

In the context of increasing interest in HVPs internationally, the development of ABCs is now a central question of agricultural development and transformation. To the best of our knowledge, however, there has been no study that attempts to formulate a consolidated development strategy for ABCs. The purpose of this article is to formulate such a strategy based on a literature review, especially related to contract farming, ABCs, and ICs. Before doing so, however, we need to clearly define the term ABC and discuss its fundamental difference from and similarity with IC. We also would like to acknowledge that the function of this article is not a research but as review/opinion piece.

The organization of this paper is as follows. We define ABCs in Section 2, while Section 3 presents the development implications of the differences between ABC and IC. Section 4 discusses market failures that impede the transformation of such clusters, whereas Section 5 examines the role that contract farming between farmers and private enterprises plays in overcoming market failures. Section 6 postulates that training of farmers, agro-processors, and traders, and the promotion of farmers' cooperatives and agro-

[2] Galvez-Nogales (2010) uses the term "agricultural cluster," which seems to correspond to our "agro-based cluster." We will further discuss the issue of definition in the next section.

processors' associations are key drivers of innovations in ABCs.[3] Section 7 presents our conclusions and the policy implications of our findings.

2. What are Agro-based Clusters (ABCs)?

2.1. IC vs. ABC

According to Porter (1998), an IC is a geographically proximate group of interconnected companies and associated institutions in a particular field linked by commonalities and complementarities. This definition, however, may not be applicable to ABCs, because in many cases, agriculture producers are scattered over larger areas, outputs are sold to traders, and inputs are purchased from suppliers often through arm's-length transactions. In other words, in many ABCs, input suppliers and traders are hardly a 'geographically' proximate group of "interconnected companies." Thus, in comparison to ICs, in our definition of ABCs, "geographical connectivity" is applied to a much larger area, and more emphasis is placed on the market connectivity of stakeholders in various activities along the geographically longer value chain.

2.2. AC vs. AIC

Following Porter's definition, we define an ABC as "a geographically proximate and interlinked group of commercial farmers of a product or a group of closely-related products, and related

[3] In order to avoid the confusion, we use the term "cooperative" for a group of farmers and "association" for a group of agro-processors.

interconnected companies for input supply, service provision, and processing." The ABC can be further classified into "agricultural cluster (AC)," in which fresh but low-quality agricultural products are marketed without strict grading and processing, and "agro-industrial cluster (AIC)," in which agricultural products are graded or processed by industrial factories before marketing (see Figure 1). The range of stakeholders connected with each other is generally longer, and the strength of their connectivity is relatively weaker in AC than in AIC. In AC, farmers directly purchase inputs from input-suppliers, and no value addition and processing is done because agricultural products are destined for local wet markets and non-quality conscious city markets. Because the demand for high-quality products in these markets is low, producers in AC are often unaware of the quality parameters of products. The traders and wholesalers try to meet the quality requirements of the consumers in a very broad sense through rudimentary grading of the produce after it is received from farmers without following quality standards.

On the other hand, in AICs, farmers, agro-processors, and marketing agents are more closely "connected," sometimes through contract farming, in which a contractor usually provides inputs on credit and production instructions to farmers. Truly valuable HVPs are produced in AICs, where the quality of products is strictly assessed before it is received from the farmers, or graded by agro-processors or specialized wholesalers dedicated to agro-processors and supermarkets following strict grading standards (Reardon et al., 2003, 2009). The outputs of AICs are destined for export, supermarkets, or quality-conscious urban markets (Figure 1). Such an AIC consists of farmers (or their cooperatives) growing a

particular product; agro-processors, including pack-houses; and traders, including specialized wholesalers. The supermarkets, exporters, traders, and processors enforce and monitor the safety of products and standards in farming and processing operations, which are crucial components of AICs. As research and credit play essential roles in the development and progress of AICs, related research institutions and financial institutions are essential parts of AICs. Moreover, certification agencies play an important role in AIC development.

2.3. Advantages of clustering

Like many manufacturing industries, the production and processing of HVPs are generally clustered (e.g., Galvez-Nogales, 2010; Ali, 2020), which itself is proof that clustering is more efficient than non-clustering in either case. In fact, according to the Global Cluster Initiative Survey conducted on 500 clusters around the world, 85% of cluster initiatives have improved their competitiveness, 89% have helped the cluster to grow, and 81% have met their goals. In contrast, only 4% have been disappointing and did not lead to much change (Solvell et al., 2003).

The major advantage of clustering is low transaction costs due to the geographical proximity of transacting parties (Marshall, 1920) (e.g., part-suppliers and assemblers in the case of ICs and farmers and agro-processors in the case of AICs). Another advantage is the ease of imitation of innovative ideas by non-innovative firms/farmers. Additional advantages of clustering are less costly and more effective service provision, such as the dissemination of research results and training of stakeholders, availability of

trained workforce at competitive rates, and networking of stakeholders to achieve the common goals of the cluster (Galvez-Nogales, 2010).

3. Development Implications of the Differences between ABC and IC

Conceptually, the relationship between farmers and agro-processors in AICs is similar to that between part-suppliers and assemblers in IC. There are, however, unique differences between ABC and IC, which have implications for development strategies.

3.1. Ease of imitation in ABC

The first implication arises from the greater ease of imitation of new technologies in an ABC (where agricultural operations are carried out by a large number of similar agricultural producers in open fields) than in an IC (where operations are done by a limited number of manufacturers engaged in the production of differentiated products behind closed doors) that creates a bigger gap between private and social returns to innovations in the former than in the latter. Thus, from a social perspective, there is likely to be greater discouragement of private sector-led innovations in an ABC. Hashino and Otsuka (2016) argue that in order to stimulate the sustainable development of ICs, either the collective action of private firms to internalize the benefit of innovation or the support of the public sector for innovations is called for.

We argue that stronger collective action and greater public support for innovations[4] are needed for the development of ABCs than for ICs, especially to transform an AC into an AIC. Despite the greater role of the public sector, the role of the private sector in introducing innovations is critical in AICs.

3.2. Quality uncertainty of agricultural products

The second implication arises from the undifferentiated products produced in many ACs and the increasing demand for differentiated products in urban and international markets, which stimulates the development of AICs. Compared to industrial products, the quality parameters of agricultural products (e.g., taste, aroma, shape, color) are region-specific and difficult to define uniformly at the international level (Ali, 2000). Due to this difference, quality assurance mechanisms implemented by the government become very important in the transition from AC to AIC. Although internationally-accredited certification companies become very important in making such assurance in AIC, we would like to argue that achieving such assurance individually is very expensive. Therefore, the collective action of farming communities not only reduces the cost but is also more effective in quality assurance.

3.3. Difficulty in collective action in ABC

Third, a large number of agro-processors in AICs are spread over large areas due to the bulkiness of their raw materials and, hence, it is difficult for them to organize collective action. The geographical

[4] "Innovation" in this paper does not necessarily mean a large breakthrough as envisaged by Schumpeter (1912) but refers primarily to a number of small productive changes in production technology, management, and marketing.

dispersion of farm producers, along with their low literacy rate, also creates difficulty in organizing collective action. These difficulties tend to delay the adoption of innovations in the ABCs, resulting in greater stagnation in both ACs and AICs as compared to ICs, unless government plays an active role in introducing innovation into the entire value chain. Thus, the role of public sector research and extension systems in ABCs is much more critical than in ICs where the private sector, including producers' associations, plays a significant role in introducing and disseminating innovations. Because of the closer proximity of most producers in ICs, the cost of introducing new interventions is relatively low.

3.4. Costly transaction in ABC

Fourth, the cost of supplying agricultural products to agro-processors in an AIC is much higher than that of supplying parts to assemblers in IC. This is, again, because of the bulkiness of the materials supplied and poor local infrastructure in rural areas.[5] Thus, unless significant investment is made on the local transportation infrastructure, the development of AICs is constrained by exorbitant transportation costs. Similarly, input supplies to ACs and AICs are very costly unless a road infrastructure is developed. Cavatassi et al. (2011) and Chatterjee and Ganesh-Kumar (2016) found that access to markets and transportation infrastructure play key roles in the development of ABCs.

3.5. Serious financial constraints in ABC

[5] Hicks (2004, p. 5) has noted that closeness to abundant available raw material supplies in establishing agribusiness is more important than even the availability of cheaper labor.

Fifth, lack of finance is probably a more critical factor in the adoption of innovation in ABCs, mainly because the cost of finance is likely to be higher in ABCs than in ICs as banks are hesitant about going to rural areas to work with a large number of dispersed small clients, most of them having little or no collateral to borrow loans (Khandker, in press). Moreover, government bias towards extending financial support to ICs leaves little financial space for ABCs.

3.6. Input quality uncertainty in ABCs

Finally, the quality of inputs used in ABCs, especially seeds, planting materials, and pesticides, seems to be much more difficult to judge visually at the time of purchase, compared to parts used in ICs where input quality standards are relatively well established. Therefore, the government's role in defining standards and mechanisms to monitor the quality of inputs is essential in the development of ABCs.

4. Market Failures Impeding the Transformation of ACs into AICs

In order to transform "traditional agriculture," we must upgrade ACs to AICs, where the participation of interconnected (not necessarily geographically contiguous) private firms, be it processors, supermarkets, or traders, play a major role in the value chain. To meet changing quality demand parameters, the roles of innovators, researchers, and financiers become very important for the development and survival of AICs. Additionally, mechanisms to assure the quality of agricultural products are necessary in AICs because the quality of agriculture products is neither uniform nor easily identifiable. However,

there are several constraints related to the functioning of markets that have to be addressed before such transformation can be achieved (Otsuka and Zhang, in press).

4.1. Need for new knowledge of agricultural production

Low-quality products produced by the traditional system in ACs are generally not suitable for AICs. Hence, new HVPs (e.g., high-quality milk for pasteurization, special varieties of potatoes for potato chips, and tomatoes for tomato sauce), many of which are new to farming communities in developing countries, have to be introduced to transform ACs into AICs. In order to produce high-quality and safe pasteurized milk, for example, exotic cows must be raised in hygienic cowsheds, the use of antibiotics and other toxic chemical inputs and adulteration must be stopped, chilling and pasteurizing machines must be installed to reduce bacteria and increase the milk's shelf life, and milk must be transported by trucks with cooling facilities. Since pasteurized milk is new, the majority of milk farmers do not know how to produce raw milk appropriate for pasteurization, and extension workers and researchers are not familiar with improved production methods for such raw milk. Similarly, many farmers are not knowledgeable about high-quality vegetable seeds and fruit seedlings, the prohibition on the use of toxic pesticides, and the appropriate spacing of planting, even though they are all important components of producing high-quality and safe agricultural products. Obviously, a major constraint in transforming ACs to AICs is farmers' lack of appropriate knowledge about the need to change their production practices for AICs. Their limited

capacity to use new technologies, which generally are complicated and capital intensive, can be another constraint.

4.2. Malfunctioning of input and credit markets

The non-availability of suitable quality inputs is mainly due to the malfunctioning of markets. Since exotic cows are new, their market may not exist, or even if it exists, it may not work competitively at the early stage of development. Similarly, markets of improved seeds and planting materials, safe pesticides, and nutritious concentrated feeds are often absent, and their counterfeits are widely circulated. The inability to judge input quality at the time of purchase also becomes a major cause of market failure. The absence of efficient credit markets in rural areas aggravates the problem, as the purchase of new inputs is costly. Without functioning input and credit markets, and initial encouragement by the government, the transformation of ACs into AICs may not be possible. In order to improve the input-output marketing system, the provision of basic infrastructure like roads and electricity in rural areas is also crucial.

4.3. Quality uncertainty of HVPs

It is clear that the production cost of HVPs in AICs is much higher than that of low-quality and unsafe products in ACs. Thus, farmers do not adopt improved cultivation practices for HVPs without proper price incentives to compensate for their additional cost. On the other hand, consumers cannot easily distinguish between high-quality and safe products and low-quality and unsafe products. Therefore, they may not be willing to pay high prices for safe HVPs, even if their potential demand for HVPs is high.

Indeed, according to Ortega et al. (2011) and Ifft et al. (2012), consumers place more premium on the products if their quality and safety are verifiable and traceable or if production methods meet international standards. Thus, product quality uncertainty is also one of the major constraints in the development of AICs. Herein lies the critical and indispensable role that private-sector market agents, such as supermarkets and large urban retailers, must play. The government's role in establishing a regulatory framework to implement and monitor quality standards is also very important.

5. Contract Farming and Cooperatives as a Way Out?

5.1. Contract farming and market failures

In this section, we assess the possibility of using contract farming in overcoming the constraints to developing ABCs, especially in transforming ACs into AICs. It is important to recognize that contract farming between farmers and agro-processors, supermarkets, or exporters is designed to overcome market failures in technological and managerial information services, input and credit markets, and output marketing (Barrett et al., 2012; Otsuka et al., 2016). The contractor provides improved inputs on credit and management instruction to farmers in return for the delivery of a specified quantity of quality products at a specified time at a predetermined price or in accordance with a pricing formula, which is indicated by the two-way arrow in Figure 1. If the contractor is a supermarket or specialized wholesaler, it ensures the supply of high-quality and safe products for consumers. If the contractor is a large agro-processor, it is

likely to have a reputation as a producer of high-quality and safe products. If the contractor is an exporter, it must have acquired certification of supplying products that satisfy sanitary and phytosanitary standards required by importing countries. In this way, contract farming overcomes multiple market failures.

5.2. Role of farmers' cooperative

While there is no question that contract farming enhances the production efficiency of farming and can improve the quality of products in developing countries, its effect on equity is not clear. A large number of case studies found that contract farmers are large landlords or wealthy farmers (e.g., Mishra et al., 2016; Michelson, 2013; Ragasa et al., 2018) and a recent review article by Ton et al. (2018) endorses such finding. Thus, small farmers may be left behind by contract farming.

To overcome the issue of exclusion from quality markets for HVPs, small farmers may organize themselves into a cooperative, which signs the contract to reduce the transaction costs of traders, who otherwise have to make contracts with a large number of small farmers scattered over a large area. In fact, such contracts are found in a large number of countries (Roy & Thorat, 2008; Maertens & Vande Velde, 2017; Wang et al., 2014; Winters et al., 2005). Furthermore, smallholder cooperatives, which supply HVPs primarily to domestic markets, have been emerging in a large number of developing countries, including Nicaragua (Michelson, 2013); Kenya (Rao et al., 2012); China (Ito et al., 2012; Jia & Huang, 2011); Vietnam (Wang et al., 2014); Ethiopia (Bernard et al., 2008; Francesconi & Heerink, 2011); and India

(Trebbin, 2014). Several case studies found a facilitating role of cooperatives, particularly in product marketing (Escobal & Cavero, 2012; Sauer et al., 2012; Verhofstadt & Maertens, 2014).

5.3. Contract farming and farmers' income

Even if small farmers participate in contract farming, whether their incomes increase significantly is an empirical question. The available evidence on the issue is inconclusive. Case studies by Maertens and Vande Velde (2017) and Mishra et al. (2016), among others, and literature reviews by Bellemare and Lim (2018) and Bellemare and Bloem (2018) conclude that contract farming increases income and profit. On the other hand, Ragasa et al. (2018), Soullier and Moustier (2018), Bellemare (2018), and Olounlade et al. (2020) did not find significant impacts of contract farming on the income and profitability of contract farmers. Otsuka et al. (2016) question whether farmers under contract farming are significantly better-off because contracting farmers passively accept inputs and production instruction without making any major production decisions.[6]

In short, although relying on contract farming to develop ABCs in developing countries may lead to improved production, productivity, and quality, there is a risk that it may not lead to significant improvement of the welfare of a large number of smallholders. This may weaken small farmers' interest in participating in contract farming. Therefore, we have to think of a different strategy for inclusive

[6] In some cases, agricultural cooperatives make critical production decisions for member farmers. In these cases, contract farming will increase income and profit of individual farmers (Ito et al., 2012; Fisher & Qaim, 2012).

development of ABCs, other than sole reliance on contract farming. This does not imply, however, that contract farming is useless; on the contrary, it is useful as an important source of credit. In other words, we advocate the so-called marketing contract, in which major production decisions are made by farmers and credit is provided by the contractor, rather than the production contract in which farmers' autonomy in production is limited and inputs are provided on credit by the contractor (Otsuka et al., 2016).

6. A Consolidated Strategy for the Development of ABCs

6.1. Improvement of product quality

The first step to transform ACs into AICs is to improve the quality of agricultural products. For this purpose, the availability of improved seeds or root stocks of fruit trees is essential. A longer-term solution is to invest in agricultural research to breed improved varieties and select root stocks suitable for the local climate. High-quality seeds and root stocks must be certified, and the government must monitor their sale through a robust monitoring system. Appropriate infrastructure and efficient communication system can reduce the cost of transporting inputs to farmers and outputs to processors. Moreover, an

appropriate regulatory framework would be required to monitor the quality of inputs and outputs and ensure the quality to their users.

More importantly, to effectively use improved quality inputs, training for improved cultivation practices must be offered to farmers, seed companies, and nursery operators, particularly in ACs where agro-processors are absent. In terms of Figure 1, we propose to improve the quality of input supplies and the efficiency of farming. Even in AICs, agro-processors may not be interested in providing general management knowledge to farmers because it is a public good. Thus, the public sector must offer appropriate management training programs in both ACs and AICs.

In this connection, three important points must be noted. First, since the production of improved HVPs and the rules of contract farming with contractors in AICs (such as keeping records of input use and sales) are new, only a limited number of knowledgeable public-sector extension workers is likely to be available. Thus, the public sector must consider the use of private consulting companies and foreign advisers with expertise on HVPs and new management procedures in AIC, in addition to nurturing new HVP experts. Second, in order to ensure that training programs are offered to farmers and seed/seedling companies at large, rather than mainly to elite farmers and big seed companies, they must be monitored by the public sector or an institution aimed at monitoring the training programs.[7] Third, the training program

[7] Implementing efficient public-sector extension is a major issue in agricultural transformation (Takahashi et al., 2020; Ali et al., 2018).

for farmers must include the promotion of agricultural cooperatives, which are expected to monitor the production activities of member farmers and make contracts with the contractor on behalf of member farmers.

6.2. Improvement of marketing

The second step is to promote the marketing of fresh and improved-quality HVPs. In the case of AC, the constraint is the absence of agro-processors or specialized wholesalers. Our first recommended solution is to train farmers (or their cooperatives) not only about production but also grading and marketing.[8] If farmers can learn what types of products are highly demanded in markets, how market prices reflect the quality of farm products, and how such products can be produced, they are likely to receive income accrued not only to their manual work but also to their management activities. In this way, their income can be significantly enhanced. Training about grading and marketing for farmers in AICs will also be useful to strengthen their bargaining powers and improve their management abilities. Since traditional extension workers are not knowledgeable about grading and marketing of HVPs, trainers may have to be recruited from the private sector or donor agencies. It may also be useful to train middlemen, commission agents, and collectors about improved marketing methods to maintain the quality of products.

6.3. Strengthening agro-processing

[8] Japan International Cooperation Agency (JICA) offers the Smallholder Horticulture Empowerment Program in sub-Saharan Africa, which trains farmers about production and marketing. Anecdotal evidence suggests that this program is successful in stimulating farmers to produce HVPs for domestic markets in sub-Saharan Africa.

In the case of AC, it is hoped that new agro-processors enter the business once the quality of agricultural products is significantly improved in the cluster. In China's potato cluster, the increased production of potatoes suitable for potato chips and French fries stimulated the rapid expansion of potato processing sectors (Zhang & Hu, 2014) as it improved the profitability of chip processing. Due to the importance of the emergence of these agro-processors in transforming ACs into AICs, we suggest that the government should incentivize their establishment in small units in rural areas, at least in the initial stage.[9] Technical skills and liquidity to run these units are major constraints (Hicks, 2004; Winter-Nelson & Temu, 2005). To overcome these constraints, the government's initial financial and technical support through farmers' groups is critical. Later, the private sector may also like to operate through these groups as they have the comparative advantage of knowing the local dynamics of the value chain (Ali, 2020). Complementary policy should be implemented to facilitate the formation of farmers' groups and their cooperation with foreign investors in agro-processing, who have invested in supermarkets and agribusinesses in developing countries (Reardon et al., 2003, 2009; Swinnen & Maertens, 2007). Learning from foreign companies facilitated by the government is the crux of the successful industrial policy in South Korea and Taiwan in the 1960s to 1980s (Amsden, 1989; Wade, 1990).

[9] A large number of small-scale agro-processing opportunities exist in rural areas, some of which have been discussed in Ali (2020) and UNIDO and 3ADI (2013). Hicks (2004) has listed such opportunities in several Asian countries, especially those small scale agro-processing projects in Japan that are supported by the government and controlled by farmers' organizations. However, before promoting any such opportunity, the government must possess sufficient knowledge about their economic viability in the local condition.

In the case of some AICs, there are already agro-processors. It is, however, a mistake to assume that they are sufficiently efficient and innovative. According to recent studies of manufacturing enterprises in developing countries, the lack of proper management of industrial firms is the major constraint on their performance (Bruhn et al., 2010; McKenzie & Woodruff, 2014; Sonobe & Otsuka, 2011, 2014; Otsuka et al., 2018). Furthermore, the management training of entrepreneurs has significant impacts on the performance of those firms, as revealed by a randomized controlled trial of management training (Bloom et al., 2014; Mano et al., 2012; Higuchi et al., 2015; Higuchi et al., 2019; Higuchi et al., 2020). Thus, it makes sense for the public sector to provide both technical and managerial training to agro-processors so as to stimulate "innovations" or significantly improve their production and management practices.

The knowledge imparted in training agro-processors is a local public good, as it is useful for many similar firms in the cluster. Therefore, as in the case of farmers' cooperatives, agro-processor associations can play a significant role in organizing training programs and inviting instructors. Indeed, agro-processor associations contributed to the development of AICs in Japan and contemporary developing countries, such as China, by introducing innovative ideas from other areas and abroad (Hashino & Otsuka, 2016; Zhang & Hu, 2014).

6.4. Establishment of Project Management Unit (PMU)

In addition to strengthening agricultural research, providing technology and management training, promoting collective activities for innovations, and providing appropriate rural infrastructure, considering

the complexity of AICs in which many stakeholders are involved, we would like to recommend the establishment of a project management unit (PMU), to promote the cluster-based agriculture transformation approach. The PMU should coordinate and design the need-based training programs for various clusters, and monitor their performance, with due attention to the fair treatment of smallholders. Particularly important is to ensure balanced or simultaneous improvement of the quality of inputs and HVPs and efficiency of agro-processing and marketing because AICs can generate significant benefits only if input-suppliers supply high-quality inputs and high-quality HVPs are produced by farmers, processed by agro-processors, and marketed to urban and international markets (see Figure 1). The PMU should also mobilize stakeholders into various groups, facilitate them for collective action, formulate input-output quality standards, and ensure implementation at each cluster-level. Since the PMU must coordinate the interests of diverse stakeholders, its members ought to consist of representatives of farmers, input suppliers, agro-processors, wholesalers, exporters, and supermarkets. As it will channel government support in providing training, incentivize the establishment of small agro-processing units in rural areas, and establish an appropriate regulatory framework, it may be better if it is headed by an appropriate government entity like the government's planning and development agency.

7. Concluding Remarks

There is a strong interest in developing countries to transform agriculture from its heavy dependence on staple crops to an increased production of HVPs that can meet the quality requirements of supermarkets and export markets. No consolidated strategy, however, has been developed to facilitate this. We establish in this article that synergistically linking processors with producers in ABCs through farmers' groups holds the key to achieving this transformation. Since the demand for HVPs is increasing globally, it is timely that a strategy for this transformation is formulated.

This study clearly recognizes that the emergence and development of private firms engaged in agro-processing are indispensable for the transformation of agriculture. Hashino and Otsuka (2016) argue that two key factors are affecting the successful development of ICs: (1) training of producers and (2) their collective action for innovations. The formation and development of ABCs, however, is more complex, because of several critical differences between ABCs and ICs, such as (1) involvement of a larger number of geographically-diverse stakeholders; (2) easier imitation of innovations; (3) difficulty in assessing input and product quality; (4) subjective nature and regional perspectives related to product quality; (5) lack of rural infrastructure; and (6) more pervasive market failure in supplying quality inputs, technologies, and finance necessary for the transformation.

In order to establish quality-conscious ABCs with robust processing and value addition components, the government, in addition to supplying technologies and building rural infrastructure, must (1) mobilize stakeholders along the whole value chain (i.e., seed suppliers, farmers, agro-processors, and

traders) into various groups such as farmers' cooperatives and agro-processors' associations; (2) train stakeholders in the value chain through these groups; (3) promote their collective actions; and (4) set up an appropriate regulatory framework to implement quality standards. This article particularly emphasizes the critical importance of training not only for farmers, seed companies, and nursery operators but also for agro-processors and marketing agents. To establish small-scale processing firms in rural areas, liquidity to run processing units is observed to be the major constraint, which can also be overcome by private financial institutions along with incentives provided by the government through farmers' groups.

Discussion in this paper is a clear departure from the traditional model of agricultural development, which focuses exclusively on the improvement of farm production (Otsuka & Fan, in press). This study also proposes to enhance the innovative capacity of ABCs by promoting cooperatives of smallholder farmers and associations of agro-processors, which are expected to mobilize collective actions for innovations and facilitate training through these groups.

It is also noteworthy that since the needs and potentials of ABCs vary from cluster to cluster, the government has to adopt appropriate cluster-based approaches, which is another deviation from the usual provision of input subsidies in conventional agricultural development models. Finally, given the need for coordination of diverse stakeholders in the development of ABCs, we recommend the establishment of a PMU headed by the government planning and development agency with proper representation of all

stakeholders responsible for designing and monitoring training programs, promoting activities of farmers' cooperatives and agro-processors' associations, and coordinating the interests of diverse stakeholders.

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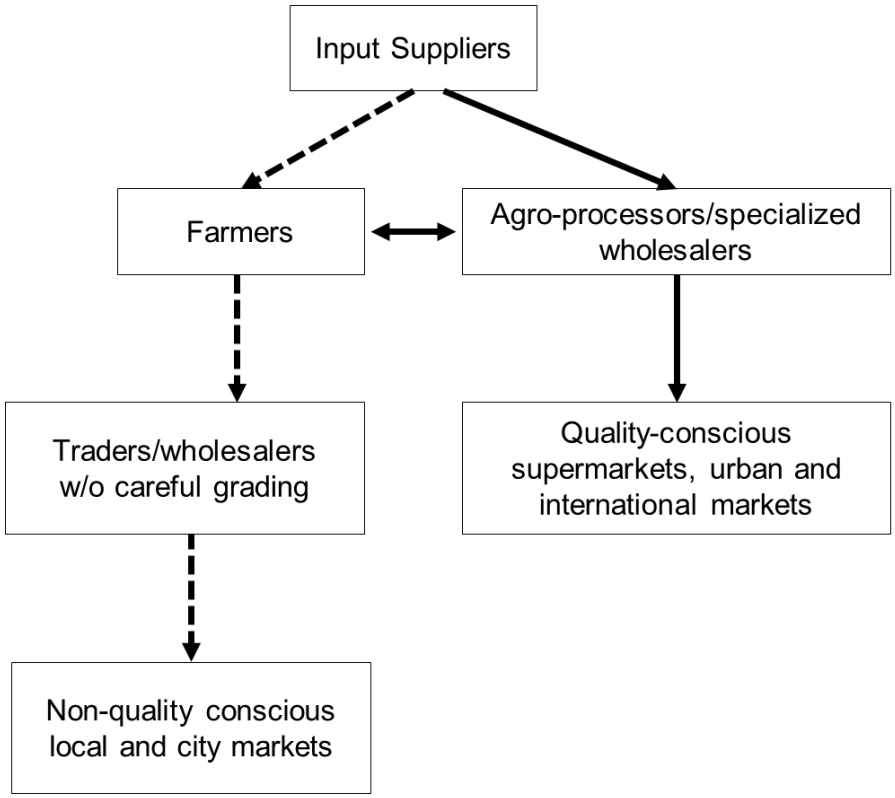

Fig. 1. A schematic view of the flow of inputs and agricultural products in an agricultural cluster (AC, represented by dashed lines) and agro-industrial cluster (AIC, represented by solid lines)