Horticulture constraints in Aceh toward agricultural era 4.0

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Abstract. This study aims to: (1) present the characteristics of leading horticultural farming in Aceh, (2) compare the conditions of existing traits with those that should live in entering digital agribusiness, (3) identify the constraints in agribusiness to enter digital era, and (4) find the solution of the constraints. Descriptive analysis, tabulation, and comparison are used as the analytical tools in this study. The results show that leading horticultural agribusiness in Aceh have problems in adapting digital era because today’s agribusiness characteristics still outperform. Constraints are attributed to the internal factors of those who plays essential roles in agribusiness. Those factors are: older age of agribusiness actors, low educational attainment, unfamiliar with digital technology, and limited access to land and capital. This study find that government acts, such as improving social assistance, mentoring and coaching, are crucially needed to support agribusiness actors competing in digital era.

1. Introduction

The utilization of digital information can actively increase the accessibility of farmers and intermediary traders to market information, farm inputs, consumer trends, technology, and innovations in each subsystem in agribusiness. All of these things can improve the economic efficiency of production and marketing [1]. [2] states that in this digital era, the use of information and communication technology is paramount to sustain agricultural development in one country. In Indonesia, the use of information and communication technology in agriculture has been applied by several farmer groups to access information and promote their products using facilities provided by the Community Training and Learning Center (CTLC) in Pancasari (Bali) and Pabelan (Salatiga), formed by Microsoft in collaboration with nonprofits organizations under the Potential Unlimited Program [2].

The application of information and communication technology enables farmers to form a network and access market information, both locally and globally. By mastering information and communication technology, agribusiness agents can increase their incomes, competitiveness, bargaining position, product diversification and value-added, marketing efficiency, and the sustainability of their farming. For this reason, it is necessary to develop, manage, and utilize agricultural information, directly and indirectly, to support agricultural development, even with limited actors and resources [3].

The barriers to the utilization of information and communication technology in horticultural agribusiness, stated by the International Society for Horticultural Sciences (ISHS) in [2] is that limited capabilities of agribusiness agents such as training disparity, awareness of the benefits of information and communication technology, time, costs of the technology used, integration system and software availability. Digital utilization in sustainable agricultural development requires educational processes and capacity building since technical and skill disparities still exist in the e-business system. At the same time, the obstacles in developing countries are no direct economic benefits received by the
agents, lack understanding of digital value-added, limited time to use technology, and out of information on how to utilize digital.

Other challenges to the utilization of information and communication technology are limited access to telephone and electronic networks in rural and remote areas, scarcity of digital services due to high investment and operational costs. Therefore, it is crucial to apply a digital application strategy following field conditions under local capabilities [4]. Application of digital agribusiness technology requires some readiness, namely the readiness of actors, the readiness of land, and the readiness of innovation and technology. Actors' readiness includes age, level of education, the absorption rate in utilizing the innovation and technology management in agribusiness. This study identifies the obstacles of leading horticultural agribusiness in Aceh in the use of digital technology to compete in the global market.

The current Agribusiness development should be administered in one unity, such as the unity of actors, the unity of information, and the unity of innovation and technology from all subsystems involved in agribusiness. By doing so, the behavior of the actors and the information that exists between the agribusiness actors and processes will develop. The process of communication and information using conventional media such as books, mass media that are limited by geography, is now being replaced by digital media that has limited geographic, physical and disclosure restrictions. Therefore, one can control the assets of other countries without physically mastering them.

Economic globalization forces us to utilize digital technology in order to be competitive and sustainable in agribusiness. It is known that the digital revolution emerged since the 1980s with changes in mechanical and analog technology to digital technology and continues to grow to this day. The development of this technology became massive after the invention of the personal computer, a system designed and organized automatically to receive and store input data, process it, and produce output under the control of electronic instructions stored in memory that can manipulate data quickly and precisely. The development of digital computer technology, especially microprocessors, increases performance, and this technology allows for various devices that are personally owned, including in agribusiness [5].

This study spots the obstacles in utilizing digital technology in leading horticultural agribusiness in Aceh. Entering the stage of agricultural industrialization means that farmers have to consider not only the product or the service but also its linkages with other supporting activities such as supplying input, harvesting, storing, processing, and marketing the products (the concept of supply chain management in agribusiness).

2. Methods
2.1 Location
The research located in 3 places where the leading horticultural commodities produced (chili, potato and orange): Krueng Raya and Darul Imarah Districts in Aceh Besar, Pegasing and Bebesan Districts in Central Aceh, and Bukit and Permata Districts in Bener Meriah. The survey is conducted for 5 (five) months, namely from May to October 2019.

2.2. Samples
This research uses survey method. The respondents are those who play a central role in the development of agribusiness, namely: farmers, intermediary traders from producers to consumers, traders and distributors of farm inputs, and the supporters of agribusiness development such as stakeholders from Horticultural Department, Field instructors, Villagers, Researchers, and Agribusiness Development Experts. Data is collected using a structured questionnaire according to the main actors and supporters of the development of horticultural agribusiness.
Table 1. Number of sample in this research, 2019.

| Respondent                                                                 | n  |
|---------------------------------------------------------------------------|----|
| Cayenne farmers (based on land area: narrow, medium and large)            | 10 |
| Horticultural farmers (based on land area: narrow, medium and large)      | 10 |
| Orange farmers (based on land area: narrow, medium and large)             | 10 |
| Intermediary trader of cayenne (collectors, wholesalers and intercity traders) | 6  |
| Intermediary trader of horticultural products (collectors, wholesalers and intercity traders) | 6  |
| Intermediary trader of tangerine (collectors, wholesalers and intercity traders) | 6  |
| Traders and distributors of cayenne farm input (seeds, fertilizers, pesticides) | 3  |
| Traders and distributors of horticultural farm input (seeds, fertilizers, pesticides) | 3  |
| Traders and distributors of tangerine farm input (seeds, fertilizers, pesticides) | 3  |
| Stakeholders from the Horticultural Department                            | 6  |
| Field instructors                                                         | 6  |
| Villagers                                                                 | 6  |
| Horticultural researchers                                                 | 3  |
| The experts of horticultural and agribusiness development                 | 3  |
| **Total**                                                                 | **81** |

2.3. Data analysis

a) we descriptively present the characteristics of leading horticultural farming in Aceh.
b) We compare the ideal condition of agribusiness in the Digital Era with the real condition happening now.

According to Line Jobs in [6], several characteristics attach in agribusiness farming of digital era are that:
1. The age of the farmers is relatively young.
2. farmers possess a high level of education.
3. The creation of innovation is high.
4. Increased production is high.
5. Online marketing
6. The use of computers and the internet is mandatory.

The conditions of agricultural land should:
1. The number of productive lands is increasing.
2. The rent prices of agricultural land are low.
3. Farmers own a large area of land.
4. farmers as the landlord.
5. The land conversion rate is low.

The level of innovation and technology adoption should:
1. Modern technology is applied.
2. Sufficient funds for innovations are available.
3. farmers have acknowledged the value of technology
4. The absorption of innovations is high.

c) We identify the constraints in order to meet the requirements of the characteristics of agribusiness agents, agricultural land, and technology in the digital era.

d) We find the solution of the constraints based on the recommendation from farmers, community leaders, experts and stakeholders.
3. Results and discussion
In this section, the characteristics of agribusiness agents, the comparison between the ideal conditions and the real condition of the digital era, and the obstacles and solutions will be discussed.

3.1 Characteristics of farmers in leading horticultural agribusiness in Aceh
Several actors involved in agribusiness are farmers, intermediary traders, the government, entrepreneurs, and experts. This study analyzed the characteristics of farmers and intermediary traders since they play essential roles in agribusiness. The following shows the characteristics of the leading horticultural farmers in Aceh.

Table 2. Characteristics of farmers of leading horticultural product in Aceh, 2019.

| Characteristics of Farmers | Cayenne Farmers | Potato Farmers | Tangerine Farmers | Horticultural Farmers |
|----------------------------|-----------------|----------------|-------------------|----------------------|
| 1.Age (Years)              | 46              | 46             | 45                | 45                   |
| 2.Education (Years)        | 9               | 8              | 10                | 9                    |
| 3.Area of Land (Ha)        | 2.20            | 1.39           | 1.20              | 1.60                 |
| 4.Planted area of horticultural commodity (Ha) | 0.92 | 0.54 | 0.90 | 0.78 |
| 5. Rent land (Rp/ha)       | 2,200.000       | 1,500,000.00   | 1,833,333         |                      |
| 6. Production (Ton)        | 0.83            | 6.97           | 0.30              | 2.20                 |
| 7.Productivity (Ton/ Ha)   | 0.90            | 12.59          | 0.33              | 4.60                 |

Table 2 shows that the horticultural farmers are in productive ages (45 years) with a low education level (<SMP). Farmers are demanded to be young and highly educated to compete in the digital era, assuming young age is more adaptable to this era.

The area of arable land is 1.6 ha, but only 0.78 ha (48.75%) is used to produce horticultural products. This ineffective use of arable land could lower production, complicate the process of industrialization, and decrease land productivity. The increasing rate of unproductive land will reduce the competitiveness of horticultural farming in this digital era. Moreover, the rate of land rent is also high at 1,800,000 rupiah/ha/year, which can increase production costs and reduce competitiveness. Low production and small productivity will also reduce the competitiveness of horticultural farming in Aceh. The characteristics of intermediary traders of Leading Horticultural in Aceh showed below.

Table 3. Characteristics of intermediary trader of leading horticultural product in Aceh, 2019.

| Characteristics of Intermediary Trader | Cayenne Farmers | Potato Farmers | Tangerine Farmers | Horticultural Farmers |
|---------------------------------------|-----------------|----------------|-------------------|----------------------|
| 1.Age (Years)                         | 39.1            | 43.6           | 28.5              | 37.1                 |
| 2.Education (Years)                   | 9.9             | 11.2           | 8.3               | 9.8                  |
| 3.Experiences (Years)                 | 14.1            | 15.7           | 5.0               | 11.6                 |
| 4.Income(Rp/month)                    | 10,928,571      | 7,489,583      | 3,075,000         | 7,164,384            |
| 5.Numbers of the transaction          | 2.1             | 231.3          | 0.6               | 78                   |
From Table 3, it can be seen that the age of intermediary traders is younger, and the level of education is higher than those of horticultural farmers. This indicates that the performance of intermediary traders is better than horticultural farmers to undergo this digital era. With a better level of adjustment, intermediary traders consider being more successful in adapting digital technology compare to horticultural farmers.

3.2. The ideal conditions versus the real condition of horticultural agribusiness agents, land, and agribusiness technology in Aceh

From the literature study, we found several characteristics that are expected in entering the digital era. These can be seen in Table 4 below.

| Characteristics of Intermediary Trader | Cayenne Farmers | Potato Farmers | Tangerine Farmers | Horticultural Farmers |
|----------------------------------------|-----------------|----------------|-------------------|----------------------|
| (ton/day)                              |                 |                |                   |                      |
| 6. Percentage of getting a product from farmers (%) | 13              | 86.7           | 60                | 53.2                 |
| 7. Percentage of getting a product from sellers (%)  | 87              | 13.3           | 40                | 46.8                 |

Table 4 displays three characteristics that should exist in digital era. From those characteristics, only farmers characteristics that seems to be achievable since it can be fulfilled by the farmers without government assistance. Ideal condition in the digital era can be obtained through improving farmers characteristics by engaging young farmers, increasing farmers educational level, multiply production capacity, and improving access to online market.

3.3. Constraints faced in achieving ideal conditions.

The following will be shown the obstacles and causes of the emergence of obstacles for agribusiness farming in entering the digital era.
Table 5. Constraints and causes of agribusiness difficulties in the digital age.

| No | Characteristics | Constraints | The Causes of Difficulties |
|----|-----------------|-------------|---------------------------|
| 1. | Characteristics of Farmers: | | |
| | a. Ages: | Relatively old | Young people are less interested |
| | b. Education: | Low | Social-economic accumulation |
| | c. Innovation creation: | Passive | Not accustomed and omission |
| | d. Improved in production: | Decrease Not | Increased global temperatures |
| | e. Online marketing: | available Not | Low physical and economic access |
| | f. Computer utilization: | available | Low access |
| | g. Internet utilization: | Not available | Low access |
| 2. | Characteristics of Land: | | |
| | a. Land Use: | < 100 % | Lack of capital |
| | b. Land rental price: | High | Low ownership |
| | c. Land tenure: | Low | Low ownership |
| | d. Land ownership: | Cultivator | no land grant |
| | e. Land conversion rate: | High | uncontrollable |
| 3. | Characteristics of Innovation: | | |
| | a. Type of technology | Traditional | Low socioeconomic access |
| | b. Funds for innovations. | Not available | Low socioeconomic access |
| | c. Understanding the rate of technology | Difficult | Low education level |
| | d. The absorption rate of technology | Low | Low education level |

Table 5 shows that the cause of the difficulty of agribusiness entering the digital era is the accumulation of several conditions and occurring in the long run. The cause looks complex and needs to be handled thoroughly. The above causes generally occur from outside the farmer, so the solution for this is better government involvement because the government is the social responsibility for the prosperity of the people. The low access of farmers to supporting innovation and institutional technology can be seen in Table 6.

Table 6. Access of Leading Horticultural Farmers to Supporting Institutions in Aceh, 2019.

| Supporting Institution | Cayenne Farmers | Potato Farmers | Tangerine Farmers | Horticultural Farmers |
|------------------------|-----------------|----------------|-------------------|----------------------|
| 1. Source of Capital   |                 |                |                   |                      |
| Personal funds (%)    | 75              | 49.5           | 85                | 69.8                |
| Middleman (%)         | 23              | 40.7           | 5                 | 22.9                |
| Government / KUD (%)  | 2               | 9.8            | 5                 | 5.6                 |
| 2. Total Sources:     |                 |                |                   |                      |
| Number of             | 1.2             | 2.4            | 1.8               | 1.8                 |
| Coaching              |                 |                |                   |                      |
| (times/year)          | 2.3             | 1.2            | 1.0               | 1.5                 |
| 3. Distance to market (KM) | 15              | 19.3           | 6.0               | 13.4                |
| 4. Communication Facilities | 2.0          | 2.1            | 2.1               | 2.0                 |
| 5. Transportation Facilities | 2.0          | 2.4            | 2.4               | 2.2                 |
| 6. Source of Price Information |                 |                |                   |                      |
| Farmers (%)           |                 |                |                   |                      |
| Merchant (%)          | 92              | 85             | 90                | 89                  |
| PPL, radio, newspaper (%) | 5.0           | 8.0            | 5                 | 6                   |
Description:

1. Communication Facilities
   a. Television
   b. Television and telephone
   c. Television, telephone, radio
   d. Television, telephone, radio, and newspaper
   e. Television, telephone, radio, newspapers, and agricultural films.

2. Transportation
   a. Type of Transportation
      1. Public
      2. Motorcycle
      3. Small trucks
   b. Road Conditions
      1. Soil
      2. Gravel
      3. Asphalt

3. Source of Information
   a. Price Information
      1. Farmers
      2. Traders, markets
      3. PPL, Radio, Newspaper
   b. Information technology
      1. Family
      2. Farmers / Neighbors
      3. PPL, Radio, Newspaper

Table 6 exhibits that farmers have low capital (69.8%), lack of mentoring (1.5 times/year) and limited access to markets (13.4 km). In the digital era, farmers are required to go online in marketing their products. This way, they can dismiss distance to market that increases the cost of inputs, increases transportation costs, and reduces the effective price farmers receive for outputs.

3.4. The solution to achieve ideal conditions.
The solution is formed based on the causes attributed to the problem, as compiled in Table 7.

| Cause of problem: | Solution: |
|------------------|-----------|
| 1. Characteristics of Agricultural actors: | Socialization, guidance and market guarantee |
| a. Young people are not interested in agribusiness | Scholarships for farm families |
| b. Low education: | Socialization, coaching and the application of innovation |
| c. Lack of innovation: | Choose the right commodity for high temperatures |
| d. Increased global temperature | Guidance and provision of facilities |
| e. Low access to online marketing | Capital assistance and guidance |
| f. Low access to computers: | Provision of facilities and operational costs assistance |
| g. Low internet access: | Capital assistance By utilizing zakat |
| 2. Land used: | Management of agricultural rental prices and land distribution |
| a. Capital deficiency: | Distribution and guidance of land |
| b. Low land ownership: | Law on land tenure for farmers |
| c. Low land ownership: | Law on conversion restriction of agricultural land |
| d. Lack of provision of land: | Technology and innovation socialization |
| e. Lack of land conversion control: | Financial assistance for innovation and new technology |
| 3. Innovation and Technology | Increased applicative education |
| 1. Low socioeconomic access: | Increased applicative education |
| 2. Low socioeconomic access: | |
| 3. Low education level: | |
| 4. Low education level: | |

From Table 7, it concludes that government role give a significant impact to assist farmers successfully entering the digital era. On the other hand, Farmers need to improve their education level, knowledge, and motivation to be benefited by this digital time [7].
4. Conclusions
The conclusions and suggestions in this study are as follows:

a. Improvement in agribusiness farming conditions such as the actors doing agribusiness, land use, and innovation and technology comprehension, is required.

b. to create a successful agribusiness farming in this digital era, we need young farmers with high level education, high productivity growth, and unlimited access to agribusiness online market.

c. Internal constraints comes from agricultural actors such as the older age of farmers, the low level of educational attainment, lack of access to land, and limited access to capital and digital technology.

On the other hand, External constraints derived by the policies that are less supportive in assisting farmers to get access to technology, capital and agricultural land.

d. The recommended solutions to the problem are that increasing youth motivation to develop agribusiness, improving farmers education, increasing farmers access to land, assisting farmers to capital and technology, and developing digital technology skills.

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