Sustainability design for development of Gayo’s Science Park’s

R Jaya†, M Ferizal†, R Ardiensyah†, Husaini†, I Mirza†, Ishar†, Asis†, M Ismail† F F Rahmah† and Yusriana‡

†Assessment Institute for Agricultural Technology of Aceh, Jl. Panglima Nyak Makam No. 27 Lampineung Banda Aceh, Provinsi Aceh, Indonesia
‡Department of Agricultural Processing Technology, University of Syiah Kuala, Darussalam Banda Aceh, Indonesia

*Email: jaya.rachman@yahoo.co.id

Abstract. Development of the Gayo’s Science Park’s (GSPs) aims to improve the regional economy based on commodity Gayo coffee. Sustainability aspect assessed including technique, economic, social as well as ecology. The objective of this paper was to design the sustainability development of the (GSPs). In this paper we only limits on qualitative judgment of the GSPs development design. In technical aspect discusses how to increase productivity Gayo coffee which currently ranges 650-700 kg ha⁻¹, even though the potential productivity reaches 1.2-1.5 ton ha⁻¹. For the economic aspect focuses on how the GSPs continuing coffee-based production down-stream. In this design also discussed the ecological, technical and social aspects such as increasing productivity, use of organic matter on agriculture as well in plants cultivation conservation zone. To sustain the GSPs, we design a business that will be developed, namely through construct the small-plants (5 kg per running production) and Gayo coffee superior seeds supplier. Therefore, we use several techniques to construct its planning, such as business plan canvas and qualitative SWOT analysis, as well as introducing the innovative technology and site-plan.

Keywords: Small-plants, business plan canvas, SWOT

1. Introduction

Gayo Plateau is a part of the Bukit Barisan Mountain, which is located in Aceh Province. This area consists of 3 districts, such as Bener Meriah, Central Aceh and Gayo Lues. The altitude of this area about 600-1600 m above sea level, based on fact it’s suitable for Arabica coffee. For long time ago, Arabica coffee from Gayo has been known to the world, due to excellent quality and in terminology coffee called as specialty coffee. For Gayo communities, coffee has provided 90% of their livelihoods, in another word this commodity is main source of the regional economic. However, nowadays the current income of the Gayo farmers is declining due to low productivity of coffee which is about 600-700 kg/ha [1], this is caused by pest and disease, mostly unproductive plants (> 20 years) as well as not implementing the Good Agriculture Practices (GAP). On the other side, demand of Gayo coffee has been increase, especially from major cities of Indonesia, such as Jakarta, Bandung, Medan and Banda Aceh. Production Gayo arabica coffee in 2017 reaches 61.011 ton with a value 200 million US dollar. There are gaps between the low of productivity and high demand of Gayo arabica coffee. To overcome this gaps, many effort have been made by government (central and local), including providing superior seed, training GAP, providing and assistance of equipment coffee processing, technical support to
increase the building capacity for local extension workers. However those programs have not been conducted in an integrated and sustainable.

Related to the gaps, since 2015 the Indonesian government through the Ministry of Agriculture has been initiated the development of a science park, one of which is the Gayo’s Science Park’s (GSPs). The Science parks were defined as a place to disseminate agricultural technology innovation which was produced by university and institution of research and development as well as non government organization (NGO), particularly to increase end-user skill such as farmer, tenant as well as extension worker [2],[3],[4]. The development of science and technology in a country relates to the number of science parks in the country. One example is the United States, which is the pioneer in building of the science park [5]. Furthermore, The silicon Valley Science Park initiated by Stanford University, as well as at South Korea by Daegu [6], Cugar Science Park in Singapore [7] and Kulim High-Tech in Malaysia [8].

Referring to the model of technical development, science park was an integration of the government, business, university and society. This is a development of the triple-helix concept [9]. In design of science park, the designing facilities and infrastructure is very important to support all business activities [10]. The objective of this paper was to design sustainability of GSPs. In this paper, we only limits qualitative judgment of GSPs development design.

2. Methodology

2.1. Logical Framework

The main focus of our design was how business activities managed by GSPs would sustain. The meaning of sustainability in our design was business activities regarding social, economic, ecology and technique dimensions (Figure. 1). The concepts of sustainability referred to [11],[15] which discusses trade-off social, economic and environmental aspects in a development area. According to [1], in design; a sustainable Gayo coffee supply chain was critical to assess third aspects. An economic aspect related to profit business, technique aspect was to produce a high-quality product, social related to fairness distribution profit as well as to increase the quality of life, and ecology discussed organic fertilizer and pesticide use, as well as land use for conservation. The system approach was used in this design due to complex problems to reach the goal. According to [12] system approach was very suitable to be applied to development, based on several actors and dimensions.

GSPs will be developed in Gayo Research Station. Therefore, our design based on the current condition of it. Furthermore, the development was not from zero, meaningful our design uses existing facilities such as office buildings, warehouses, Gayo coffee gardens, nurseries and human resources [16]. Only several facilities just completed according to need. This design involved academicians, local government (province and sub district), Gayo coffee businessmen and non-government organizations.

2.2 Technical design

Development GSPs has been undertaken since January 2019, but initial planning was carried out in middle 2018 through several iterations. The justification Gayo plateau area as the site of science park was this region one of the development center national Arabica coffee and there was also Gayo coffee research station. According to figure 1, we can see that achievement of the sustainability of development GSPs involves 4 dimensions, which each dimension consists of several components. Furthermore, renovation building and installation equipment and machinery activities were to supporting to hire innovation technologies application.

To collect the data, we interviewed some experts who understand the concepts of development in Gayo areas through the Focus Group Discussion (FGD). Background experts were academicians, practitioners, researchers and extension workers. The qualifications of the experts were minimum Ph.D. degrees for academicians and researchers who have experience in developing coffee commodities at least 10 years, for practitioners minimum have experience in business Gayo coffee 20 years, whereas for extension workers have the experience minimally 15 years. Data collection was carried out from mid-2018 to early 2019. To describe the business plan, we obtained by a business plan canvas methods.
This technique was suitable for identifying new business [13], whereas SWOT analysis was used to arrange a strategic business model [14].

3. Result and Discussion

3.1. Economic Dimension
According to the result of discussion with the experts (Figure 2), the economic dimension consisted: the potential business of Gayo arabica superior seeds (Gayo 1 and 2 varieties), predicted demand of it’s up to 5 million for 5 years ahead, roasting services, improving of quality coffee powder (ready to use), local and international market penetration and availability raw material. A discussion of this matter was related to how business in GSPs could be undertaken sustainably. Refer to [1], showed that the majority Gayo’s Arabica coffee plant had not productive, due to the age of coffee plants for more than 20 years. With the land of the Gayo coffee area almost 100.000 ha, at least 1.6-1.7 million superior seed was needed to replanting at Gayo plateau. These facts showed that potential business to develop in GSPs.

Nowadays, the local government of Bener Meriah, Gayo Lues and Central Aceh District has been undertaking a replanting program, but superior seeds used from North Sumatera Province. It was not accordance with Gayo farmer’s need. To describe the business plan in GSPs, we illustrated it in the business plan canvas (Table 1).
Table 1. Business plan canvas of GSPs

| Key partners                  | Key activities                                           | Key resources                                           |
|-------------------------------|----------------------------------------------------------|---------------------------------------------------------|
| Gayo coffee farmers           | Production of superior seeds of Gayo’s arabica coffee    | Gayo arabica coffee Research Station (17 ha)            |
| Middle Man                    | Production of Gayo’s arabica coffee powder (ready to use)| Gayo coffee garden owned by farmers                     |
| Gayo coffee business man      | Roasting services                                        | Small-plants to produce downstream                     |
| Local government (province and district) | Education-tourism based on Gayo’s arabica coffee |                                                          |
| Ministry of Agriculture Republic of Indonesia (Directorate General of Plantation) |
|                               |                                                          |                                                          |
| Value prepositions:           | Customers relationships:                                 | Channel:                                                |
| GSPs as providing superior seeds of Gayo 1 and 2 varieties | Merchandise to customer | Social media                                            |
| Specialty Gayo’s coffee powder (ready to use).  | Panorama & education in Gayo Research Station            | E-commerce                                              |
| Quality guarantee of roasting services | Discount for travel agents | AIAT of Aceh WEB                                        |
|                               |                                                          | Travel agents                                           |
| Customer segments:            | Cost structure:                                          | Revenue stream:                                         |
| Tenants                       | National budgeting by AIAT of Aceh                      | Selling of superior seeds (Gayo 1 and 2 varieties)      |
| Farmers and local government  | Other non-binding financing                              | Roasting services                                       |
| Local and foreign tourist     |                                                          | Education-tourism based on Gayo’s arabica coffee        |
| Students                      |                                                          | Organic fertilizer and bio-urine                        |
|                               |                                                          | Gayo coffee powder (ready to use)                       |

Source: Assessment Institute for Agricultural Technology (AIAT) of Aceh

Figure 2. The roundtable discussion of sustainability GSPs development
3.2 Technique Dimension
Focus activities on technique dimensions were how to improve the productivity of Gayo Arabica at Gayo Plateau. Current existing of its 600-700 kg ha\(^{-1}\), these facts due to majority Gayo coffee plant was not productive (>20 years), pest and disease attack as well as declining of carrying capacity. In generally, Gayo coffee farmers’ reluctant to replanting with the pull out system, because they did not have alternative incomes to finance their daily needs [1]. In GSPs design, we introduced several innovative technologies to solve problem farmers such as: applying grafting technology. In complete, the intervention of technologies in GSPs can be seen in Table 2.

Table 2. The Intervention of technology in GSPs

| No. | Plant material aspects | Technologies intervention agriculture aspects | Outputs |
|-----|------------------------|-----------------------------------------------|---------|
| 1.  | Replanting of Gayo’s arabica coffee plant (not productive) by grafting technique based on Gayo1 and 2 varieties. | | 20-30% of Gayo’s coffee plants around GSPs will be replanted. |
| 2.  | Completing the genetic resources of arabica coffee (43 varieties) | | At least, 43 varieties of arabica coffee collection can be completed. |
| 3.  | Initiating the for Gayo arabica coffee as seed source | | Approved legal aspect to initiate the Gayo’ arabica coffee as seeds by Directorate General of Plantation Ministry of Agriculture Republic of Indonesia |
| 4.  | Implementation of organic fertilizer | | Production of organic fertilizer from pulp (by product) |

Post harvest aspects

| No. | Technologies intervention agriculture aspects | Outputs |
|-----|-----------------------------------------------|---------|
| 1.  | Development of small-plants to produce of Gayo arabica coffee product and roasting services | The small-plants to produce of Gayo’s arabica coffee product and roasting services can be developed |
| 2.  | Designing of Gayo’s arabica product packaging | Design of the Gayo’s arabica product packaging |
| 3.  | Start-up production of Gayo’s arabica coffee powder (5 kg per running production) and its feedback to scale up | Suitability of the production scale for Gayo arabica coffee powder |
| 4.  | Designing of the traceability system for GSPs product | Design of the traceability system for GSPs product |

Social-institution aspects

| No. | Technologies intervention agriculture aspects | Outputs |
|-----|-----------------------------------------------|---------|
| 1.  | Initiating of the “Koperasi GSPs” as business process implementation | Operations of the “Koperasi GSPs” as business process implementation |
| 2.  | Conducting the socialization of GSPs development to community, local government and business tourism actors | The GSPs development to community, local government and business tourism actors were socialized |
| 3.  | Initiating the networking with several travel agents to develop the eco-tourism | Networking design with several travel agents to develop the eco-tourism |

3.3 Business strategic
The strategy was defined as a way to achieve an objective of the program, furthermore related to the sustainability of GSPs development which is one of the important aspects of GSPs business operations system. The main business included the provision of Gayo arabica coffee superior seeds (Gayo 1 and 2 varieties), coffee powder, roasting services as well as education coffee tourism. Strategic business (Figure. 3), in our design used qualitative SWOT method (strength, weakness, opportunity, threat) [14].
**EFAS: External Factors Analysis Summary**

**IFAS: Internal Factors Analysis Summary**

**Figure 3. Qualitative SWOT Analysis**

4. **Conclusion**

The strategy of sustainability development of GSPs was to accelerate the application of technology innovation which was created by several institutions such as research and development institute, university and non-government organization (NGO). Basic concepts of GSPs involve the role of academicians, business, local government and society. Technically, the sustainability development of GSPs has considered economic (business) aspect, social, technical as well as ecology. The downstream product includes providing superior seeds such as Gayo 1 and 2 varieties, coffee powder, education of tourism as well as roasting services. These are designed to ensure the sustainability of GSPs.

5. **References**

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