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IMPLEMENTATION STRATEGY OF SUSTAINABILITY AND HIGHEST BEST USE (SHBU) APPROACH FOR FELDA LAND DEVELOPMENT

Muhamad Asri Abdullah Kamar[1], Salbiah Mokhtar[2], Mohd Fadzil Abdul Rashid[3], Siti Mazwin Kamaruddin[4], Suzanah Abdullah[5]

[1,2,3,5]*Department of Built Environment Studies and Technology,*
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA, PERAK BRANCH, MALAYSIA
[4]*Centre of Studies for Town and Regional Planning,*
College of Built Environment,
UNIVERSITI TEKNOLOGI MARA, SELANGOR BRANCH, MALAYSIA

Abstract

Sustainability and Highest Best Use (SHBU) approach is believed to be useful in assisting the Federal Land Development Authority (FELDA) to develop its land towards improving settlers' prosperity and livelihood. This research aims to demonstrate a proposed strategy for implementing the SHBU using a mixed methods approach which integrates interviews and Geographical Information System-based Multiple-criteria Decision Analysis (GIS-based MCDA). The interview component seeks to obtain feedback and development aspirations from respondents in FELDA Gunung Besout 03, while GIS technology generates and displays the findings in spatial forms to empower decision-making. Data were analysed using content analysis and spatial analysis accordingly. The findings from interview shows that generally, the SHBU approach is suitable for land development. Besides, GIS-based MCDA reveals four types of future land development spanning about 796 hectares encompassing cropland, residential areas, and small business centres. The findings become the basis for crafting the implementation strategies aimed at developing FELDA land within the study area.

Keywords: FELDA, highest best use, land development, strategy, sustainability

[1] Senior Lecturer at Universiti Teknologi MARA Perak Branch. Email: masri418@uitm.edu.my

INTRODUCTION

Generally, the Federal Land Development Authority (FELDA) has successfully increased the socio-economic status of targeted groups through the development of settlement areas. This achievement has had positive impacts on FELDA settlers such as ensuring stable income, adequate infrastructures, and overall prosperity. However, many FELDA households have a low living level (Government of Malaysia, 2019). Many factors contribute to this, including unproductive crop activities, commodity market volatility, a lack of reform strategies, high debt, and a variety of other issues, as highlighted by Datuk Seri Mustapa Mohamed, former Minister in the Prime Minister's Department (Economy), on the FELDA recovery plan (Bernama, 2021). As a result, many FELDA lands have yet to be used to their full potential, which contradicts their desired goals.

Hence, innovative efforts should be designed to optimize the FELDA land uses. Rashid et al. (2023) and Mokhtar et al. (2023) introduced the Sustainability and Highest Best Use **(**SHBU) framework, which is a missing link approach to the existing FELDA blueprint, particularly the Settlers Development Programme (SDP) and Smart Plantation Management System (SPMS). As a continuation, this paper attempts to emphasize the application of the SHBU by using a mixed methods approach. It incorporates interviews and Geographical Information System-based Multiple-criteria Decision Analysis (GIS-based MCDA) to strengthen SHBU's results in making the decisions for FELDA land development. Specifically, two objectives set for this research which are to identify the suitability of the SHBU approach for land development based on an interview, as well as to apply the SHBU based on GIS-MCDA for determining potential areas for future land development.

LITERATURE REVIEW

Introduction to SHBU in the FELDA Development Context

Walacik et al. (2020) posited that the concept of sustainable development involves more than the 'green' issue, and thus can create an added value for real estate analysis. Meanwhile, Pratama (2019) explained that the Highest Best Use (HBU) refers to utilizing an asset in the most possible and optimal way, taking into consideration physical feasibility, legal permission, financial viability and maximizing the asset's value. From these definitions, it can be said that sustainable development and the HBU promote the best effort in land development. Both concepts consider many aspects such as economic, social, environment and legal factors in land development.

Furthermore, Rashid et al. (2023) integrated sustainability and highest-best use into a new approach called SHBU to bring about positive changes and

synergize FELDA. That approach based on five dimensions, parallel to the fundamental issues of FELDA land development. Those dimensions are FELDA Business Centre (FBC), FELDA Residential Compound (FRC), FELDA Agropreneur (FAgp), FELDA Industry-based Crops (FIbC), and SHBU Plan Management (SPM).

Current Implementation of SHBU

Previous works have applied the SHBU for FELDA land development through different methods, each seeking to achieve specific purposes. For instance, Kamar et al. (2022) utilized a qualitative approach to obtain feedback from the respondents in relation to adopting the SHBU. Besides that, Rashid et al. (2023) applied the SHBU as a quantitative approach by using GIS-based MCDA to identify the potential areas for future development. Both approaches have their own strengths and weaknesses. For example, the findings from the qualitative approach cannot be visualized in the spatial form, while the results from GIS-based MCDA do not consider the feedback from the respondents. But both fit their roles and purposes in demonstrating the suitability of the SHBU for FELDA land development decision-making.

Therefore, this research attempts to utilize a mixed methods approach. It combines qualitative and quantitative data collection and analysis within a single study (Molina-Azorin et al., 2018). It is understood that the mixed methods approach has some limitations, such as time and resource constraints. However, this research overcomes these limitations by incorporating both qualitative and quantitative approaches. Integrating qualitative community insights and quantitative spatial analysis offers a comprehensive approach to decision-making processes.

RESEARCH METHODOLOGY

This research employs a mixed methods approach. It comprises interviews and GIS-based MCDA, which are considered qualitative and quantitative, respectively.

An Interview

An interview is selected because the first objective of this research is to identify the feedback regarding the suitability of adopting the SHBU approach based on five dimensions for FELDA land development. Merriam (2009) stated that there is no definite answer in determining the ideal sample size for qualitative research. However, Walker (2012) believed in the data saturation concept, suggesting that once sufficient information is gathered to replicate the study, a smaller sample size is enough. Earlier studies often involved interviews with a small number of respondents. For example, Fabeil et al. (2020) conducted interviews with only

two informants. Hence, in this study interviews were conducted with the key informants from two representatives of FELDA Gunung Besout 03.

The first informant was the Manager of FELDA Gunung Besout 03, while the second informant was the Head of Settlers as he was among the first generations of settlers. The interviews were conducted face-to-face in the study area on the 10th of November 2021. More respondents were invited for the interview. Unfortunately, only two had attended the session. It was due to fluctuation of COVID-19 cases nationwide. Moreover, the emergence of new viruses such as Delta and Omicron had increased the people's fear about being infected. However, it is strongly believed that both respondents had vast knowledge and experience about the study area. The audio recorded interviews were later transcribed by the research assistant and the notes taken by the researchers were then analysed to obtain rich information.

GIS-based MCDA

A GIS-based MCDA approach is an excellent analysis tool for dealing with and managing spatial decision problems (Prieto-Amparán et al., 2021). In this research, the land development planning decision-making includes identifying both the suitability of land for crops and future physical potential projects such as creating a business centre. Figure 1 shows the process of generating the SHBU's FELDA land development using a GIS-based MCDA approach proposed by Rashid et al. (2023). This paper will discuss it briefly. Further elaboration on that approach can be obtained from Rashid et al. (2023). It includes two steps:

i. Step 1 (HBU Domain): Assessing crop available land.
ii. Step 2 (Sustainability Domain): Assessing area for future development.

The following process involves three main stages to accomplish the execution of the SHBU model which are generating criterion maps and sub-criterion maps; weighting criterion maps; and creating outcomes which are composite maps of cropland suitability and future physical development. Only areas within a two-kilometre radius from the central points of the case study were delineated for the SHBU model execution. This limitation arose from cost constraints associated with acquiring Unmanned Aerial Vehicle (UAV) images and generating GIS data layers.

Step 1: Assessing Crop Available Land

a) Generating the criterion map

The assessment of cropland is done at Stage 001 and Stage 003 of plantation area. It is based on five determined criteria which are crop map, slope level, access network, fertile area, and water body (Table 1). Each criterion had gone through

two important processes prior to generating a composite map of cropland suitability which were classification, and criterion scores standardization. Each classification process involved various geospatial analyses in the ArcGIS software, such as buffers, clips, merges as well as vector to raster conversion. For example, the crop criterion map was classified into three sub-criterion maps.

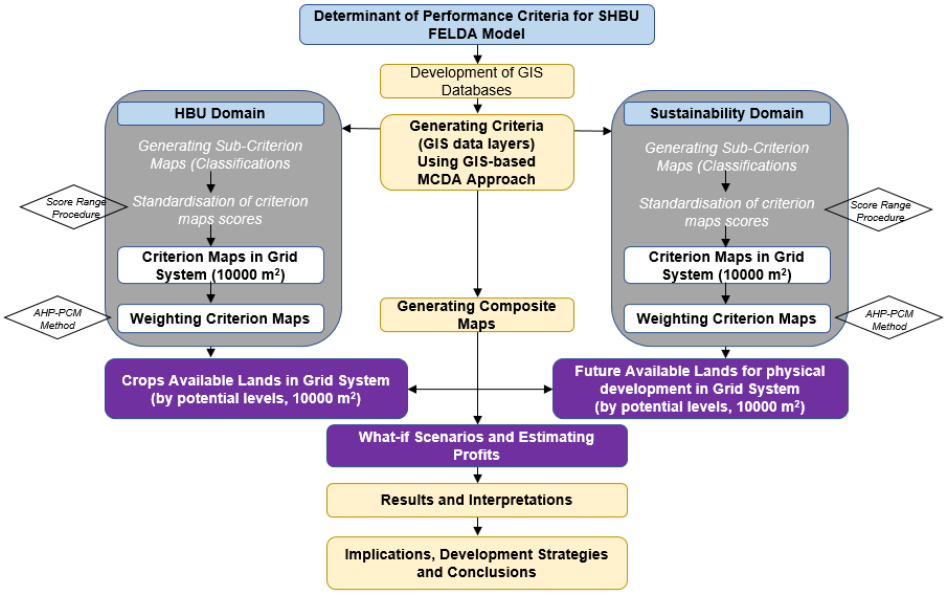

Figure 1: A GIS-based MCDA approach
Source: Rashid et al. (2023)

Each sub-criterion map had different level of importance (or effect) on the cropland suitability. They were evaluated and given raw scores based on the magnitude of their effects. The greater the effects on cropland suitability, the higher score was given. To enable direct comparison, the sub-criterion maps were converted into a uniform measurement unit, using the standardization of criterion scores method. The value of the standardized scores ranges from zero to one, where the lowest score is zero, and the highest score is one. Then, the criterion maps were converted into a grid system in the value of 10000 m^2 to complete the process of generating the criterion maps of the cropland assessment.

b) Weighting the criterion map

The important stage before generating the composite map of cropland suitability is the weighting criteria. This was necessary because the five criterion maps of the cropland suitability assessment had varying degree of importance in the

overall assessment. Hence, exercises to determine their relative importance were required. This issue was addressed by applying MCDA-based Analytic Hierarchy Process based Pairwise Comparison Matrix (AHP-based PCM).

Table 1: Criteria and standardized scores for cropland potential level

Criterion Maps with Weights	Sub-criterion Map in Raster System (Classifi-cations by 10000 m^2)	Justifications	Raw Score	Stan-dardiza-tion of Scores
Crop map	Productive area.	Area with productive oil palm trees.	2	1.0
	Productive area but require replanting.	Area with unproductive oil palm trees (above 25 years old).	1	0.5
W = 0.402	Non-productive area with constraint (or merged with constraint area).	Constraint area due to a higher slope level and difficult to access.	0	0.0
Slope level	Suitable areas for crops (slope level 0-12 degree).	Acceptable slope levels for oil palm and others (multiple interim crops).	3	1.0
W = 0.273	Suitable areas for crops (slope level 13-20 degree).	Acceptable slope levels for oil palm and others (short term crops).	2	0.7
	Suitable areas for crops (slope level 21-25 degree).	Acceptable slope levels for oil palm and others (medium-long term crops).	1	0.3
	Constraint areas (slope level above 25 degree).	Constraint slope levels for oil palm.	0	0.0
Access network	Areas within radius (buffer) 100m.	Areas with a higher accessibility (for crops management).	1	1.0
W = 0.110	Areas outside radius (buffer) 100m.	Areas with a lower or no accessibility (for crops management).	0	0.0
Fertile area	Vacant estate lands (with no existing crops).	Areas that can take into consideration for crops planting (based on the current physical features).	1	1.0
W = 0.146	Vacant estate lands with constraint (or merged with constraint areas).	Constraint areas due to a higher slope level and difficult to access.	0	0.0
Water body	Areas within radius (buffer) 50m.	Area with a higher accessibility to water resource- for crop management.	2	1.0
W = 0.068	Areas outside radius (buffer) 50m.	Area with a lower accessibility to water resource- for crop management.	1	0.5
	The existing river/water bodies (as constraint).	Constraint area (no development on river / water bodies).	0	0.0

Source: Rashid et al. (2023)

c) Generating the composite map

The final stage is generating the composite map by applying the standardized scores for each sub-criterion across the five criterion maps (within the GIS raster system), and the respective weights assigned to each criterion map. This process employs a Weighted Linear Combination (WLC) or scoring technique that is based on the concept of a weighted average (Rashid et al., 2023).

Step 2: Assessing Available Areas for Future Physical Development
The assessment of land for future physical development is conducted at the settlement area. It is based on five determined criteria which are reserve (alternative development) land, access network, slope level, water body and legal aspect (if any). Basically, this assessment follows a similar procedure to the initial one, but with a different set of data. The set of data used along with its sub-criteria and weight, is outlined in Rashid et al. (2023).

Study Area
The study area for this research is FELDA Gunung Besout 03. It is in Trolak region, Mukim of Sungkai, District of Batang Padang, Perak, Malaysia. It was selected because Trolak is one of 11 regions of FELDA that recorded a low average monthly income for settlers in oil palm plantation (RM3220.15) during the first half of 2021 (Jabatan Perladangan FELDA, 2021). There are 21 settlement areas within Trolak region itself. However, this research only focused on FELDA Gunung Besout 03 due to limitations in researchers' capacity.

FINDINGS AND DISCUSSIONS

Findings of Interviews and Discussion

Upon the feedback from both informants, it is worth noting that the SHBU approach is suitable for FELDA land development, especially in Gunung Besout 03. The proposed five dimensions are deemed appropriate. However, some requirements need to be considered carefully before adopting this approach.

FELDA Industry-based Crops
Briefly, the respondents highlighted these four requirements to be considered:

a. Only oil palm plantation is allowed in the study area.
b. Illegal oil palm plantation is found on FELDA reserve land.
c. Poor drainage leads to flood, especially in Stage 003 of plantation area.
d. Soil erosion occurs at the farm, especially in Stage 003 of plantation area.

The finding underscores the importance of maintaining the oil palm plantation as the primary crop in the study area. In addition, the up-stream and down-stream activities are highly encouraged to maximize profits within the palm oil industry. For instance, in down-stream activity, Aziz et al. (2020) recommended that recently manufactured high-rate anaerobic reactors serve as the most suitable and efficient pre-treatment technique for maximizing the extraction of biogas from palm oil mill effluent.

FELDA Business Centre
Basically, the respondents asserted the challenges as follows:

a. There is no vacant land to create FBC in the study area.
b. The location of the study area is unsuitable for FBC, where even previous night market was not successful.
c. The location of FBC should be within the combination of three FELDA areas.

The study indicates that the viability of FBC depends on the size of the area and its population to ensure its success. Therefore, the optimal location of FBC should be at the centre of Trolak region, providing equal distances from surrounding areas.

FELDA Residential Compound
The respondents highlighted the following challenges:

a. There is no vacant land to create FRC in the study area.
b. The proposed 100 units plus of houses in FELDA Gunung Besout 02 for second generation settlers are insufficient.
c. Poor drainage system contributed to soil erosion at some parts of the settlement area.

The study shows that FRC needs a vacant and large area to accommodate more residential units for the second generation of FELDA settlers. This is to address the issue of insufficient housing supply within the FELDA scheme (Government of Malaysia, 2019). With this initiative, the study area would be able to retain its workforce, as youths do not need to migrate to other places in search of suitable housing.

FELDA Agropreneur
The respondents emphasized three potentials and certain requirements as follows:

a. The study area boasts many potential tourism products, including the scenic view at Bukit Selfie, tours of oil palm farms, and the tranquil environment of FELDA villages.
b. To address the shortage of labour in farming, it is crucial to attract the younger generation of FELDA settlers to the oil palm industry. For instance, students in schools should be exposed to oil palm trees, and FELDA, together with the government should impart knowledge and skills related to oil palm plantation operation and management in other suitable educational institutions.
c. Strengthening the cooperation in business, especially in farm operation.

The findings reveal a need to educate the settlers especially the younger generation to become successful agropreneurs. This intention can be achieved by enhancing the tourism products such as Bukit Selfie. Encouraging the FELDA's youths to engage in the oil palm industry could alleviate the labour shortages on the farms They can also be trained to become capable farm managers and entrepreneurs. Johari et al. **(**2020**)** found many young agropreneurs have succeeded in various agricultural endeavours such as crop cultivation.

The respondents highlighted certain requirements to be considered before implementing the FAgp. Their insights are based on experience with SDP projects. Usually, projects conducted by individuals under SDP lack continuity as there were no successors to take over the projects after the original participants passed away.

This finding discloses the challenge faced by FAgp based on previous SDP projects where many projects came to a halt with the death of the participants. Hence, the proposed FAgp model operated by individuals should include a protégé to ensure continuity in the case of the participants' demise.

SHBU Plan Management

The respondents highlighted three requirements to be considered as follows:

a. Only 117 settlers (43.2%) surrendered their farm to FELDA management. Other 154 settlers (56.8%) managed the farm themselves.
b. Loss of oil palm plantation income was due to settlers selling the palm fruits to other oil palm mills.
c. Lack of manpower has caused ineffective harvest of many tonnes of oil palm fruits. It caused a great loss of income to the settlers and the FELDA.

The finding shows that before implementing SPM, specific requirements must be met as not all settlers are in agreement regarding farm management practices. Only 43.2% of settlers have relinquished their farms to FELDA management. Hence, initiatives should be taken to attract other settlers to join the FELDA farm management. Besides, to prevent the loss of income from the oil palm plantation, all settlers are encouraged to sell their yields exclusively to FELDA oil palm mills. Additionally, efforts should be made to motivate all settlers, especially the youth to become successful farm operators with attractive income. This initiative could alleviate the issue of labour shortages on the farm.

Therefore, conducting the interviews has successfully gathered valuable feedback and development aspirations from the respondents in the study area. However, interviews have limitations in representing the findings in spatial forms. Hence, other techniques are needed to provide geospatial results of the SHBU's dimensions to enhance decision-making process.

Findings of a GIS-based MCDA and Discussion
This section covers the potential lands for crop and future physical development.

Potential Cropland
Figure 2 depicts the results of GIS-based MCDA for cropland in the study area. Almost all croplands (100.00%) are suitable for plantations (Table 2).

Potential Future Physical Land Development
Figure 3 illustrates the results of GIS-based MCDA for physical land development at settlement area. It has identified the location and size of land (about 39.15 hectares) which is suitable for future development (both the most potential and potential areas). It has the potential for developing a housing area with a small business centre that would cater to the needs of residents.

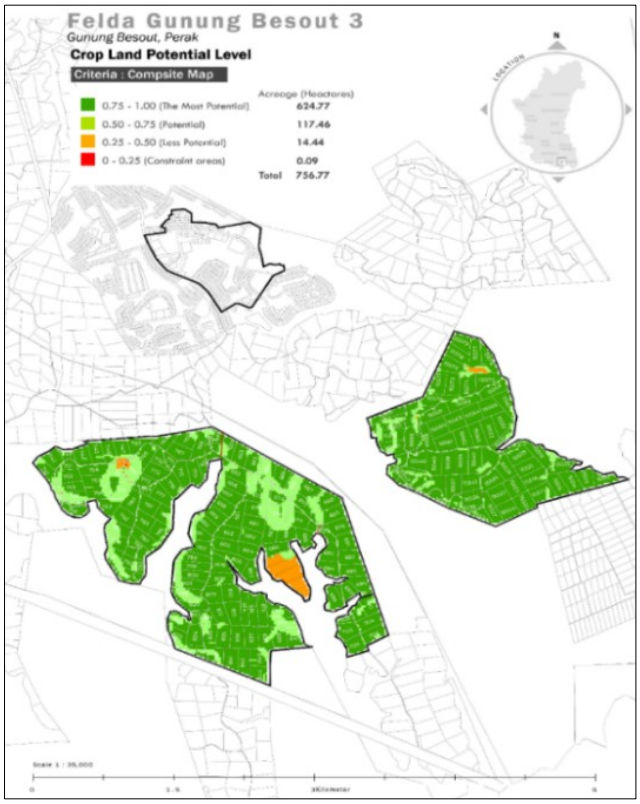

Figure 2: Cropland by Potential Level in the Study Area

Table 2: Cropland Potential Level

Potential Levels	Acreage - Hectare (%)	Explanation
The most potential	624.77 (82.56)	It is the most productive area for cultivating oil palm trees, supplemented by interim crops planted alongside the oil palms, particularly in the areas where replanting is underway.
Potential	117.46 (15.52)	This area is also designated for oil palm plantation with mitigation to better manage the trees, production and harvesting process.
Less potential	14.44 (1.91)	This area is reserved for oil palm plantation with all the needed mitigations to better manage the trees, production, and harvesting process.
Constraint area	0.09 (0.01)	The vast land area has the potential to be developed into plantation-based tourism, recreational and adventure sports activities.
Total	**756.77 (100.00)**	

It is proven that GIS is very fruitful in giving the result of analysis in the spatial form. A GIS-based MCDA approach is an excellent analysis tool for dealing with and managing spatial decision problems (Prieto-Amparán et al., 2021). However, GIS has a limitation that it fails to incorporate the aspirations and suggestions of residents. Consequently, a GIS-based MCDA approach also cannot function as a stand-alone method but requires other techniques for support.

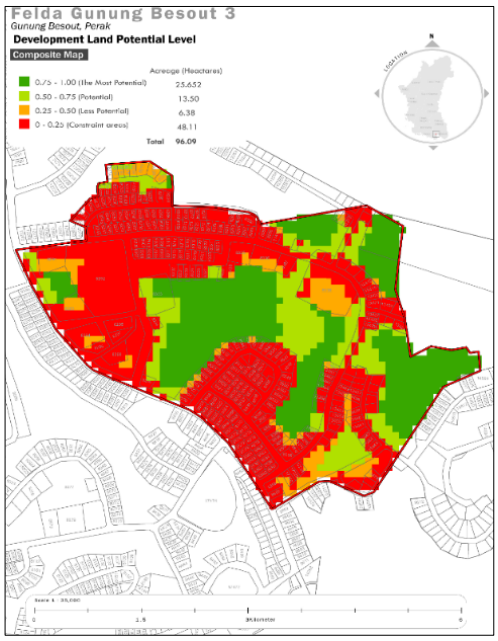

Figure 3: Future Physical Development Land by Potential Levels

Enhancement of SHBU Results: Interviews and GIS-based MCDA

The results from both methods prove to be more affluent and refined for making development decisions. Table 3 outlines the essential summary of the findings from the interviews and GIS-based MCDA. It would indicate that the potential opportunities outweigh the challenges. More importantly, it could identify the specific development projects for the study area, such as the identifying suitable locations for housing areas with small business centres to meet the local demands, SDP agricultural projects and SDP marketing hub. Table 3 shows improved research findings as it combines interview data with GIS-based MCDA results, which offers a more comprehensive perspective. Hence, this paper proposes a mixed methods approach to SHBU (Figure 3). A better understanding can be achieved, for example, by triangulating one set of results with another, thereby strengthening the validity of inferences (Molina-Azorin et al., 2018). This method should be employed in the future to obtain superior outcomes from the SHBU.

With regards to the critical summary findings, Table 4 outlines the proposed development intervention strategy of the SHBU aimed at optimizing the FELDA land development. It is formulated after considering the findings from both interviews and GIS-based MCDA. The strategy includes aspects related to crop management, physical development, and enhancement of the SHBU. Hence, integrating the proposed strategy with existing FELDA initiatives such as SDP and SPMS can lead to better outcomes.

Table 3: Critical Summary Findings of an Interview and GIS-based MCDA

Dimensions	Challenges (C)			Potentials (P)			Findings
	L1	L2	L3	L1	L2	L3	
Felda Industry-based Crop (FIbC)	/	/	/	/	/	/	C1 - only oil palm plantation is allowed. C2 - illegal oil palm plantation is found on FELDA reserve land. C3 - poor drainage leads to flood and soil erosion in Stage 003 of plantation area. P1 - potential for interim crops (SDP projects), managed by cooperation. P2 - potential for enhancing Bukit Selfie and oil palm farms as tourism attractions. P3 - potential for adventure sports at hilly area.
FELDA Business Centre (FBC)	/			/	/		C1 - FBC should be proposed at Trolak regional level to support its viability. P1 - the adjacent business centre in Gunung Besout 01 should be strengthened. P2 - GIS shows available reserve land which can be developed as a small business centre.
FELDA Residential Compound (FRC)	/	/		/			C1 - respondents said no vacant land for FRC. C2 - the proposed 100 units of houses for the second-generation settlers are insufficient. P1 - GIS shows available FELDA reserve lands that can be developed as a housing area.

Dimensions	Challenges (C)			Potentials (P)			Findings
	L1	L2	L3	L1	L2	L3	
FELDA Agropre-neur (FAgp)	/			/	/	/	C1 - previous SDP projects conducted by individuals are not continuous. Nobody took over the projects when the participants died. P1 - FAgp is proposed and the individuals who participate in the project should have a protégé to continue the business if the participant died. P2 - the study area has many potential tourism products such as Bukit Selfie, an oil palm farm tour and a serene FELDA village. P3 - attract the youths to work in the oil palm industry to overcome the labour shortage.
SHBU Plan Manage-ment (SPM)	/	/	/	/	/	/	C1 - only 117 settlers (43.2%) surrendered their farm to FELDA management. Others (56.8%) managed the farm themselves. C2 - loss of oil palm income was due to settlers selling their yields to other oil palm mills. C3 - the shortage of employee has caused an inefficient harvest, loss of many tonnes of oil palm fruits. This has resulted in a great loss of income for both the settlers and FELDA. P1 - there is a potential to attract 56.8% of settlers to join FELDA farm management. P2 - all settlers should sell their yields to FELDA oil palm mills to increase the income. P3 - encourage the youths to become farm operators to address the labour shortages.

Note: L1 = Low, L2 = Medium, L3 = High

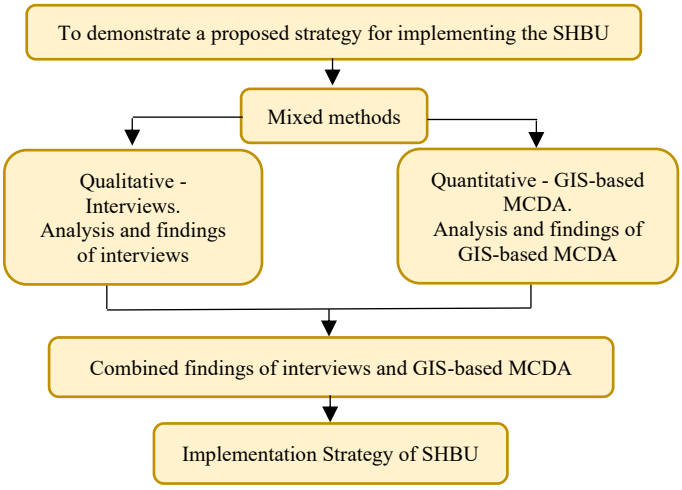

Figure 3: A Mixed Methods Approach to SHBU in Search for Implementation Strategy

Table 4: Proposed Development Intervention Strategy for the Study Area

Aspects	Proposed Implementation Strategies
Crop	● Planting interim crops at the potential area.
Future physicals development project	● Develop a housing scheme with a small business centre at the potential area. ● Enhance the recreation / tourism activities such as an open view at Bukit Selfie, farm tour at oil palm plantation area, tourism route in village area, adventure sports at the hilly area.
Enhancement of the SHBU	● Enhance SHBU Plan Management: o All oil palm plantation areas should be operated by FELDA management to achieve optimum operation and management. o All settlers should only sell their yields to FELDA oil palm mills to avoid the loss of oil palm plantation income. o Train the youth with current knowledge in oil palm operation and management to resolve the issue of labour shortage.

CONCLUSIONS

This research has achieved two study objectives. Firstly, it was found that the SHBU approach is suitable for FELDA land development in the study area. However, every dimension requires the fulfilment of additional requirements before execution. Secondly, about 795.92 hectares of potential area for future development were identified. Additionally, this research has utilized the SHBU results to inform decision-making concerning land development. It is hoped the proposed development intervention strategy of the SHBU will be able to optimize FELDA land development in the study area.

This research contributes to both new knowledge and practice. In terms of new knowledge, this research has contributed to methodology enhancement by proposing a mixed methods approach, which integrates interviews and GIS-based MCDA within the SHBU framework. Furthermore, it has demonstrated the suitability of the SHBU approach for land development and determined the potential areas for future development in spatial form. Practically, the proposed strategy can provide valuable input to relevant parties to enhance the study area.

This research has no intention of generalizing its findings. Nonetheless, it is believed that the findings of this research have the potential to be implemented in other FELDA schemes. This research has some limitations. For example, there was a lack of respondents to adequately represent the population in the study area. In addition, due to time and budget constraints, the application of GIS-based MCDA was limited to calculating spatial data within a two-kilometre radius from the centroid points. Furthermore, detailed data for the cropland criterion map, such as land fertility and land type, were also limited. Hence, future research could focus on improving these aspects accordingly. This would enable the crafting of a better implementation strategy for the future SHBU approach.

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