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Mapping Alternative Agricultural Enterprises among Youth with Rehabilitation Experience in Aceh, Indonesia

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ABSTRACT: Youth involvement in drug-related activities is a social challenge that requires both rehabilitation approaches and the provision of productive livelihood opportunities. Agricultural enterprises have the potential to support social reintegration by developing economic activities based on local resources. This study aims to identify and map alternative agricultural enterprises based on the experiences, interests, and readiness of youth with rehabilitation experience in Aceh. A quantitative descriptive survey was conducted from January to May 2026 in Banda Aceh, Lhokseumawe, and Langsa, involving 248 respondents aged 14–21 years. Data were collected using structured questionnaires and analyzed through descriptive statistics, Likert-scale indices, cross-tabulations, and Chi-square tests. The results show that 76.2% of respondents had previous experience in agricultural activities, primarily through family-based farming. No statistically significant associations were found between prior agricultural experience and the demographic or social characteristics examined ($p > 0.05$). Interest in and readiness for agricultural enterprises were relatively high, with index scores ranging from 88.55% to 96.05%. Interest in agriculture as a source of income reached 95.16%, while the preference for agricultural enterprises over employment involving the risk of unlawful activities reached 96.05%. Horticulture and vegetable farming were the most preferred options (24.19%), followed by oil palm (19.35%), cattle farming (14.11%), and broiler production (11.29%). These findings provide an empirical basis for designing empowerment programs through training, access to land and capital, business mentoring, and market linkages. However, this study maps opportunities and readiness based on respondents' self-reported information and therefore does not establish a causal relationship between participation in agriculture and reductions in drug-related behavior.

1. INTRODUCTION

Drug trafficking and abuse constitute social problems that affect not only individual health but also family life, educational continuity, economic security, and social cohesion within communities (Latt et al., 2024). These issues are of particular concern when they involve adolescents, as adolescence is a critical developmental stage characterized by identity formation, the development of social relationships, and the shaping of future aspirations (Goliath & Pretorius, 2016; Nawi et al., 2021; Yi et al., 2017). During this stage, adolescents may encounter various environmental influences that shape their behavioral choices, including potential exposure to substance use and drug distribution networks. Therefore, adolescent involvement in drug-related activities should be understood as an issue encompassing health, social, and economic dimensions (Austin et al., 2010; Guxensa et al., 2007; Li et al., 2017). Addressing this issue requires more than law enforcement and rehabilitation; it also necessitates consideration of the conditions that influence adolescents' life choices and their opportunities to engage in productive activities and secure legitimate livelihoods (Pedersen et al., 2018; Suwanchinda et al., 2018; Wurdak et al., 2016; Zapolski & Clifton, 2019).

In this context, the social and economic environment plays an important role in shaping both adolescents' vulnerabilities and their opportunities. The transition to adulthood is characterized by increasing independence, identity exploration, and the need for social recognition (Kalungi et al., 2024; Rizzolo et al., 2024). This process can encourage creativity and productive participation, but it may also increase susceptibility to peer influence and risky environments. Family support, educational engagement, access to positive activities, and the availability of local employment opportunities can broaden the range of choices available to adolescents (Eekhoudt et al., 2024; Kim & Kim, 2025). Conversely, economic pressure, social exclusion, lifestyle aspirations, and recruitment by peer groups may increase the appeal of illegal activities, particularly when social and economic support systems are limited (Huff et al., 2023; Johnson & Emmanuel Janagan, 2024; Sancho-Domingo & Carballo, 2024). These conditions indicate that adolescent involvement in drug-related activities cannot be explained solely in terms of individual behavior; rather, it must be examined within the broader environmental context that shapes their opportunities, needs, and choices. Accordingly, prevention and recovery approaches should consider the strengthening of skills, social relationships, self-confidence, and livelihood prospects that can support productive lives.

The importance of such an approach becomes increasingly apparent when considering the consequences of drug-related involvement for adolescent development. Substance abuse can adversely affect physical and psychological health, education, and social development, while involvement in drug networks may increase the risks of criminal sanctions, exploitation, violence, and stigma (Brewer et al., 2023; Chen et al., 2022; Frøyland et al., 2025). These consequences may interact and prolong socioeconomic vulnerability. Educational disruption, for example, can restrict access to legitimate employment opportunities, while stigma may hinder social reintegration and access to support networks. In Indonesia, the National Narcotics Agency of the Republic of Indonesia (Badan Narkotika Nasional Republik Indonesia, 2023) reported a drug abuse prevalence rate of 1.73% among the population aged 15–64, equivalent to approximately 3.3 million people in 2023. In the same year, the Agency recorded 1,427 drug-related cases and 1,880 suspects in Aceh. These figures illustrate the scale of the challenges associated with addressing drug-related problems, although they do not directly indicate the causes of adolescent involvement or the proportion of cases involving younger age groups. Therefore, understanding local conditions is essential for designing approaches that are responsive to the social, economic, and cultural characteristics of Acehnese communities.

One approach that may be considered to expand social reintegration opportunities for adolescents with rehabilitation experience is the development of productive livelihoods. Law enforcement and rehabilitation remain essential components of drug-related interventions; however, the sustainability of recovery is also associated with adolescents' ability to develop skills, achieve greater independence, and access legitimate economic opportunities (Hogue et al., 2021; Siregar, 2019). Socioeconomic conditions, including poverty, unemployment, family dysfunction, peer influence, weak social control, and pressures associated with identity formation, may contribute to adolescents' vulnerability to risky activities (Fast et al., 2017; Hooman Keshavarzi, 2015; Little & Steinberg, 2006; Wojciechowski, 2021). Furthermore, advances in information technology and social media may create new channels through which illegal networks can reach and recruit adolescents (Oksanen et al., 2021). These conditions highlight the importance of expanding access to productive activities that can support adolescents' social and economic well-being. In this regard, mapping livelihood opportunities represents an initial step toward understanding which types of activities may be appropriate for the needs, capabilities, and circumstances of the target population, while recognizing that rehabilitation, education, family support, and social reintegration remain essential.

Agriculture is one sector that warrants consideration in mapping these livelihood opportunities because it encompasses diverse economic activities based on natural resources. Agricultural enterprises extend beyond crop cultivation to include livestock production, fisheries, agricultural processing, and product marketing. This diversity provides adolescents with various opportunities to participate in agricultural value chains, either through primary production or supporting business activities that do not necessarily require direct access to land. In addition to its potential as a source of income, agricultural activities can provide opportunities to develop practical skills, responsibility, teamwork, and business management capabilities. Such activities may also connect adolescents with families, farmer groups, agricultural extension workers, local markets, and supporting institutions. Nevertheless, agricultural business opportunities cannot be assumed to be equally accessible to all adolescents, as access to land, capital, technology, training, and markets may vary considerably. Therefore, it is necessary to map previous agricultural experience, interest, readiness to participate, and business preferences to identify alternative agricultural enterprises relevant to adolescents with rehabilitation experience. Such mapping provides a basis for understanding the potential and needs of the target population in the context of agricultural livelihood development in Aceh.

The potential for developing agricultural enterprises as alternative livelihoods is particularly relevant in Aceh, given the province's natural resources, agricultural land, diverse local commodities, and established farming traditions and knowledge within its communities. These conditions provide opportunities for developing various types of enterprises, ranging from food crop and horticultural cultivation to plantations, livestock production, fisheries, and agricultural product processing and marketing. However, the availability of agricultural resources does not automatically ensure the participation of younger generations in these economic activities. Limited access to land, capital, technology, training, and markets may create barriers to starting an enterprise, while perceptions of income uncertainty and the relatively low attractiveness of agricultural employment may influence their choices. This situation indicates that agricultural enterprise development must take into account the characteristics and capacities of prospective entrepreneurs. For adolescents with rehabilitation experience, mapping alternative enterprises should include both land-based activities and non-cultivation opportunities, such as agricultural product processing and marketing. Accordingly, identifying alternative enterprises based on prior experience, interest, readiness, and access to resources is important for understanding the potential participation of this group in the agricultural sector.

Within the broader context of alternative livelihood development, information on agricultural business opportunities for adolescents with rehabilitation experience, particularly in Aceh, requires more specific investigation. The availability of natural resources and the agricultural commodity potential of a region does not necessarily correspond to the experiences, interests, and readiness of the target population to engage in business activities. Therefore, it is necessary to understand the extent of adolescents' previous involvement in agricultural activities, the types of enterprises that appeal to them, and their readiness to participate in various agriculture-based economic activities. In addition, differences in access to land, capital, skills, and supporting resources must be considered when identifying feasible enterprise alternatives. Mapping these aspects is important to ensure that agricultural enterprise development is based not only on regional potential but also on the characteristics, capabilities, and preferences of the target population. Thus, identifying alternative agricultural enterprises can serve as an initial step toward formulating more appropriate productive livelihood opportunities for adolescents with rehabilitation experience in Aceh.

Against this background, this study aims to map alternative agricultural enterprises among adolescents with rehabilitation experience in Aceh. Such mapping is necessary to examine the relationship between respondents' characteristics and their previous agricultural experience, while also identifying their levels of interest, readiness, and preferences regarding various types of agricultural enterprises. Previous agricultural experience provides an indication of respondents' exposure to and initial knowledge of agricultural activities, whereas their interest and readiness help identify business opportunities perceived as suitable by the target population. Specifically, this study seeks to identify and map alternative agricultural enterprises with potential for development as productive livelihood options for adolescents with rehabilitation experience in Banda Aceh, Lhokseumawe, and Langsa. The specific objectives are to describe respondents' sociodemographic characteristics and agricultural experience; analyze the associations between selected characteristics and previous farming experience; assess their interest in and readiness to engage in agricultural enterprises; and identify their preferred types of agricultural businesses. The findings are expected to provide an empirical foundation for designing agricultural enterprise development programs that take into account local resource potential, as well as the characteristics and needs of the target population.

2. MATERIALS AND METHODS

2.1 Research Design, Period, and Study Locations

This study employed a quantitative descriptive survey design to describe respondents' characteristics, agricultural experience, perceptions, interests, and readiness to participate in alternative agricultural enterprises. Data collection was conducted from January to May 2026 in Banda Aceh, Lhokseumawe, and Langsa, Aceh Province, Indonesia. These three locations were purposively selected based on information regarding drug-related vulnerability and rehabilitation records obtained from relevant institutions. According to the source data, rehabilitation records for the 2015–2024 period documented 620 clients in Langsa, 486 in Banda Aceh, and 382 in Lhokseumawe (BNN Provinsi Aceh, 2025). The locations were also selected to represent variations in local social and cultural conditions.

2.2 Study Population and Sampling Framework

The study population comprised adolescents aged 14–21 years in three areas of Aceh Province: Banda Aceh City, Lhokseumawe City, and Langsa City. The selection of these locations was based on considerations related to the vulnerability to drug trafficking

and abuse, as well as rehabilitation data recorded by the Aceh Provincial National Narcotics Agency (BNN Provinsi Aceh, 2025) during the 2015–2024 period. According to these records, Langsa had the highest number of rehabilitation clients, with 620 individuals, followed by Banda Aceh with 486 individuals and Lhokseumawe with 382 individuals. Accordingly, the total operational population used as the basis for determining the sample size was 1,488 individuals.

The sample size was determined using Slovin's formula, with a margin of error of 10% (e = 0.10), as follows:

$$n = \frac{\mathrm{N}}{1 + \mathrm{N}(e)^2}$$

Where: (n) represents the sample size, (N) represents the population size, and (e) represents the acceptable margin of error. The sample size was calculated separately for each study location based on the number of recorded rehabilitation clients. The calculation yielded 86 respondents from Langsa City, 83 respondents from Banda Aceh City, and 79 respondents from Lhokseumawe City, resulting in a total sample of 248 respondents.

Respondents were selected using purposive sampling, a non-probability sampling technique based on criteria relevant to the research objectives. The inclusion criteria were: (1) adolescents aged 14–21 years; (2) residence in one of the three study locations; and (3) a history of drug rehabilitation. The operational population used for sample-size calculation was based on rehabilitation records from the three locations. The sampling frame therefore should not be interpreted as a complete census of all adolescents with rehabilitation experience in Aceh. Recruitment was facilitated through relevant rehabilitation institutions, which helped contact potential participants and arrange appointments. Respondents attended the agreed interview locations and completed the structured questionnaire. Participation was voluntary, and confidentiality was maintained.

2.3 Research Instruments and Data Collection

Primary data were collected using a structured, closed-ended questionnaire administered to respondents. The instrument covered respondents' sociodemographic characteristics, knowledge of agricultural enterprises, family farming background, previous agricultural experience, perceptions of agriculture as a source of income, access to land, access to training and facilities, interest, and willingness to participate in agricultural activities. Attitudinal statements were measured using a five-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, and 5 = strongly agree. The questionnaire also recorded respondents' preferences for alternative agricultural enterprises. The available study documentation does not establish that the questionnaire underwent formal statistical validation or reliability testing. Therefore, the findings are interpreted as descriptive responses to the administered questionnaire, and no claims of established psychometric validity or reliability are made.

2.4 Data Analysis

Data were analyzed using descriptive statistics and bivariate analysis. Categorical variables including study location, age group, sex, educational attainment, activity status, previous agricultural experience, and reported role in drug-related activities were summarized as frequencies and percentages. The proportion of respondents reporting previous agricultural experience was accompanied by a 95% Wilson confidence interval.

Responses to the five-point Likert items were summarized using mean scores and response indices. Each statement was analyzed and reported separately; the five interest and readiness indicators were not combined into a single composite score. The response index was calculated as follows:

$$I = \frac{\sum_{i=1}^{N} X_i}{N \times S_{\max}} \times 100\%$$

Where I represents the response index (%), Xi represents the score assigned by respondent i, N represents the number of valid responses to the item, and Smax represents the maximum Likert-scale score (5). An index of ≥80% was classified as high, following the classification used in the study dataset.

Cross-tabulation was used to examine associations between previous agricultural experience (yes/no) and respondents' characteristics, including location, age group, sex, education, activity status, and reported role in drug-related activities. Pearson's Chi-square test was applied when expected-frequency assumptions were met. Fisher's exact test was used for comparisons involving small, expected cell counts. Statistical significance was assessed at $p < 0.05$.

Preferences for alternative agricultural enterprises were analyzed using the frequency and percentage of respondents selecting each business option. Perceived business suitability was assessed using four indicators: perceived fit with respondents' abilities, market opportunities, income potential, and confidence in business sustainability. The mean score across these four indicators was converted into an index as follows:

$$IK = \frac{\bar{X}}{5} \times 100\%$$

Where IK represents the perceived business suitability index (%), $\overline{(X)}$ represents the mean score across the four assessment indicators, and 5 represents the maximum Likert-scale score. This index reflects respondents' perceptions of suitability and is not an objective assessment of technical or financial feasibility. High index values for options selected by relatively few respondents were therefore interpreted cautiously.

Overall, the analyses mapped previous experience, self-reported interest and readiness, and preferences. They did not directly measure respondents' ability to establish or sustain an agricultural enterprise or establish a causal effect of agricultural participation on drug-related behavior.

3. RESULTS AND DISCUSSION

3.1 Respondent Characteristics

The study involved 248 adolescents with a history of drug rehabilitation in Banda Aceh, Lhokseumawe, and Langsa. The sample was predominantly composed of respondents aged 18–21 years (96.0%), while those aged 14–17 years accounted for 4.0%. Male respondents constituted 94.0% of the sample. In terms of educational attainment, the sample primarily represented high school graduates (67.7%), followed by respondents with junior high school education (16.1%), tertiary education (9.3%), and elementary education (6.9%). Most respondents were employed (57.2%), while 24.2% were unemployed and 18.6% were students or university students.

This sample composition is important when interpreting the findings, as the results primarily reflect the experiences of older, predominantly male adolescents undergoing drug rehabilitation rather than those of the entire adolescent population in Aceh. Consequently, the relatively high or low responses observed in this sample cannot be directly generalized to younger age groups or female respondents.

Table 1. Respondent Characteristics

Characteristics	Categories	n	%
Age	14–17 years	10	4,0
	18–21 years	238	96,0
Sex	Male	233	94,0
	Female	15	6,0
Educational attainment	Elementary school	17	6,9
	Junior high school	40	16,1
	Senior high school	168	67,7
	Tertiary education	23	9,3
Activity status	Student	46	18,6
	Employed	142	57,2
	Unemployed	60	24,2

3.2 Previous Experience in Agricultural Activities

Previous experience in agricultural activities was reported by 76.2% of respondents, indicating that agriculture had been part of the life experiences of the majority of the study sample. In contrast, 23.8% reported having no prior agricultural experience. The most frequently reported form of involvement was assisting their parents (34.3%), followed by helping their uncles (12.5%)

and participating in rice cultivation activities (11.7%). Parents were also identified as the primary source of initial exposure to agricultural activities, accounting for 63.3% of respondents. This pattern suggests that early exposure to agriculture commonly occurs through family relationships and informal learning processes rather than exclusively through formal education or training. These findings imply that program design can build upon the existing agricultural knowledge and experiences of some participants while still providing basic agricultural orientation and practical training for the nearly one-quarter of respondents who have no prior experience in agricultural activities.

Table 2. Previous Agricultural Experience and Sources of Initial Exposure to Agricultural Activities

Indicator	Category/Activity	n	%
Previous agricultural experience	Yes	189	76,2
	No	59	23,8
Forms of agricultural involvement	Assisting parents	85	34,3
	Assisting an uncle	31	12,5
	Assisting in rice cultivation	29	11,7
	Oil palm planting	15	6,0
	Planting and managing areca nut, clove, and durian crops	14	5,6
	Assisting with rice farming and plantation activities	13	5,2
	Vegetable cultivation	1	0,4
	Assisting a cousin with cattle raising	1	0,4
	No agricultural experience	59	23,8
Sources of initial exposure to agriculture	Parents	157	63,3
	Uncle	31	12,5
	Cousin	1	0,4
	None	59	23,8

3.3 Profile of Drug Involvement

The reported profile of drug involvement indicates that the most common age at first involvement was 12–14 years (35.1%), followed by 15–17 years (29.0%), 18–20 years (22.2%), and 4–11 years (13.7%). The majority of respondents identified their role as drug users (90.3%), while 9.7% reported combined roles involving drug use, agency, and courier activities. Methamphetamine (locally known as sabu) was the most frequently reported substance of first use (65.3%), followed by cannabis (19.0%) and ecstasy (15.7%). These figures describe the surveyed rehabilitation population. They should not be interpreted as estimates of the prevalence of drug involvement among adolescents in Aceh more broadly, nor do they establish the causal factors underlying drug involvement.

Table 3. Profile of Reported Drug Involvement among Respondents

Indicator	Category	n	%
Age at first involvement	4–11 years	34	13,7
	12–14 years	87	35,1
	15–17 years	72	29,0
	18–20 years	55	22,2
Reported role	Drug user	224	90,3
	User, agent, and courier	24	9,7
First substance used	Cannabis	47	19,0
	Methamphetamine	162	65,3
	Ecstasy	39	15,7

3.4 Interest, Readiness, and Preferences for Alternative Agricultural Businesses

The five indicators of interest and readiness recorded high response indices, ranging from 88.55% to 96.05% (Table 4). The highest mean score (4.80; index 96.05%) was recorded for the statement that respondents would prefer an agricultural business

to employment that might involve unlawful activities. Interest in agriculture as a source of income reached 95.16%. Willingness to learn agricultural skills from the beginning had a mean score of 4.59 (91.85%), while willingness to participate in agricultural training if available had a mean score of 4.46 (89.19%). The lowest score concerned the perception that agriculture represents a realistic business opportunity for young people (mean 4.43; index 88.55%). Although this was the lowest indicator, it remained within the high category.

These results indicate a positive reported orientation toward agriculture as a potential livelihood option. However, the difference between interest in earning income from agriculture (95.16%) and the perceived realism of agricultural business opportunities (88.55%) may indicate a gap between willingness to participate and confidence in practical feasibility. This difference was not statistically tested and should be interpreted descriptively. Reported interest and readiness represent self-reported attitudes and intentions, not evidence that respondents already possess the resources or capabilities required to establish and sustain an enterprise.

Table 4. Respondents' Interest and Readiness to Engage in Alternative Agricultural Businesses

No.	Indicator	Score 1	Score 2	Score 3	Score 4	Score 5	Total Score	Mean	Index (%)	Category
1	Interested in agriculture as a source of income	0	0	0	60	188	1.180	4,76	95,16	High
2	Willing to learn agricultural skills from the beginning	0	0	34	33	181	1.139	4,59	91,85	High
3	Perceives agriculture as a realistic business opportunity for young people	0	0	47	48	153	1.098	4,43	88,55	High
4	Prefers agriculture over employment involving activities that may lead to legal violations	0	0	1	47	200	1.191	4,80	96,05	High
5	Willing to participate in agricultural training if available	0	0	34	66	148	1.106	4,46	89,19	High

Note: The indicators were measured using a five-point Likert scale (1 = lowest level of agreement; 5 = highest level of agreement)

Respondents' preferences varied across enterprise types (Table 5). Horticulture and vegetable production were the most frequently selected options, chosen by 60 respondents (24.19%), followed by oil palm cultivation (48; 19.35%), cattle farming (35; 14.11%), and broiler production (28; 11.29%). Other options included hybrid coconut and integrated fisheries (18 respondents each; 7.26%), rice processing (14; 5.65%), fruit marketing (13; 5.24%), cocoa cultivation (13; 5.24%), and duck farming (1; 0.40%).

The perceived suitability index ranged from 80% to 100% (Table 5). The highest index values should be interpreted alongside the number of respondents selecting each option. A 100% index for an enterprise selected by only a small number of respondents does not establish that the enterprise is objectively more feasible or profitable. In particular, duck farming was selected by only one respondent. The index reflects perceived suitability based on the four assessment indicators, rather than verified technical or financial feasibility.

Table 5. Respondents' Preferences for Alternative Agricultural Business Options

No.	Alternative Agricultural Business	Number of Respondents (n)	Proportion (%)	Mean Perceived Suitability	Index (%)
1	Horticulture/vegetable production (chili, tomato, cucumber, melon, and other vegetables)	60	24,19	4,25	85,00
2	Oil palm cultivation	48	19,35	4,42	88,33
3	Cattle farming	35	14,11	5,00	100,00
4	Broiler chicken farming	28	11,29	4,49	89,82
5	Hybrid coconut cultivation	18	7,26	4,50	90,00
6	Integrated fish farming (tilapia, catfish, and common carp)	18	7,26	4,00	80,00
7	Rice processing/milling	14	5,65	5,00	100,00
8	Fruit marketing	13	5,24	5,00	100,00
9	Cocoa cultivation	13	5,24	5,00	100,00
10	Duck farming	1	0,40	5,00	100,00
	Total	248	100,00	-	-

3.5 Practical Implications of Preferences for Alternative Agricultural Enterprises

The preference mapping provides an initial basis for designing livelihood-development activities for adolescents and young people with rehabilitation experience. Program priorities should not be determined solely by the number of respondents selecting an enterprise or by a high perceived-suitability index. Selection should also consider participants' interests, individual abilities, previous experience, access to productive resources, local agroecological conditions, investment requirements, production risks, and market opportunities.

Horticulture and vegetable production, selected by 60 respondents (24.19%), may be considered for initial pilot activities. Activities could include short-cycle vegetable production, demonstration plots, practical cultivation, integrated pest and disease management, input use, and basic production planning. Its suitability will depend on land and water availability, input costs, cultivation skills, and reliable market channels.

Oil palm cultivation, selected by 48 respondents (19.35%), may be considered conditionally, particularly for participants with access to family land or opportunities to work with existing smallholder plantations. As a long-term plantation activity, it requires suitable land, investment for establishment and maintenance, and reliable marketing arrangements. Participation could also begin through work or service opportunities within existing value chains rather than requiring each participant to establish a plantation independently.

Cattle farming, selected by 35 respondents (14.11%), may be developed through group-based or collective enterprise models. Such models may enable shared responsibilities and facilities, but require assessment of capital, feed availability, housing, animal-health services, and husbandry skills. Broiler production, selected by 28 respondents (11.29%), may also be considered at small or group scale. Its relatively short production cycle may allow faster business turnover, but the enterprise is exposed to feed and chick prices, disease risks, housing requirements, and fluctuations in selling prices.

Preferences for rice processing (14 respondents; 5.65%) and fruit marketing (13; 5.24%) indicate that agricultural participation need not be limited to primary production. Collection, sorting, processing, packaging, distribution, and marketing may offer opportunities for participants with limited access to land. Hybrid coconut and cocoa should be considered in relation to agroecological suitability, land access, and longer production horizons. Integrated fisheries may be appropriate where water resources and technical support are available. Duck farming, selected by one respondent (0.40%), should not be treated as a broad program priority on the basis of this result alone.

To translate interest into actual economic participation, training should be integrated with practical production, simple business planning, financial literacy, access to inputs, market information, business mentoring, and periodic evaluation. Partnerships with

farmer groups, cooperatives, local enterprises, rehabilitation institutions, and relevant government agencies may help provide sustained support. Participants should be assessed individually, and training pathways should accommodate both those with previous agricultural experience and those without it.

Program implementation should protect participants' privacy, dignity, and rights. A history of rehabilitation is sensitive personal information and should not be disclosed to farmer groups, businesses, buyers, or other parties without an appropriate basis and the participant's informed agreement. Participation should be voluntary, and selection should be based on interests, abilities, and support needs rather than labels associated with rehabilitation history. For participants under 18 years of age, program delivery must follow applicable child-protection principles and appropriate consent procedures.

3.6 Discussion of Empirical Findings and Implications for the Development of Alternative Agricultural Enterprises

The findings provide an initial empirical basis for considering agriculture as one possible productive livelihood option for adolescents and young people with rehabilitation experience in Aceh. Among the 248 respondents in Banda Aceh, Lhokseumawe, and Langsa, 76.2% reported previous experience in agricultural activities. Such experience was commonly acquired through family-based farming, particularly through involvement with parents. This finding suggests that agriculture is already familiar to many respondents and may therefore serve as a practical starting point for livelihood skills-development programmes. Nevertheless, participation in family farming does not necessarily indicate the ability to manage an agricultural enterprise independently, particularly in relation to production planning, financial management, business decision-making, risk management, and marketing.

To further examine the distribution of previous agricultural experience across respondent characteristics, bivariate analyses were conducted. The results showed no statistically significant associations between previous agricultural experience and any of the characteristics examined: study location ($\chi^2 = 0.518$, df = 2, $p = 0.772$), age group (Fisher's exact $p = 0.459$), sex (Fisher's exact $p = 1.000$), educational attainment ($\chi^2 = 2.350$, df = 3, $p = 0.503$), activity status ($\chi^2 = 3.466$, df = 2, $p = 0.177$), and reported role in drug-related activities ($\chi^2 = 0.372$, df = 1, $p = 0.542$). These findings indicate that the study did not identify sufficient statistical evidence of associations within the sample; they should not, however, be interpreted as proof that such relationships do not exist. The small number of respondents in some categories, particularly those aged 14–17 years and female respondents, also calls for caution when interpreting subgroup comparisons.

Beyond previous experience, respondents' expressed interest and readiness provide further insight into the potential for agricultural livelihood development. The high interest and readiness indices, ranging from 88.55% to 96.05%, indicate a generally positive orientation toward agricultural enterprises. Interest in agriculture as a source of income reached 95.16%, while preference for agricultural businesses over employment potentially involving unlawful activities reached 96.05%. These findings suggest that positive attitudes toward agriculture may provide an entry point for livelihood programming. However, expressed willingness should be distinguished from actual business capacity, access to productive assets, and the ability to sustain an enterprise. Notably, the difference between the index for interest in agriculture as an income source (95.16%) and that for the perceived realism of agricultural opportunities (88.55%) suggests that willingness may not always be accompanied by equal confidence in the practical feasibility of such opportunities.

This distinction has important implications for programme design. Moving from expressed interest to actual participation is likely to require an assessment of participants' individual circumstances and access to essential resources, including land, start-up and working capital, technical competencies, family support, production inputs, market access, and ongoing mentoring. Accordingly, training should be connected to practical production and marketing opportunities rather than delivered solely through classroom-based instruction. Demonstration activities, basic business planning, financial literacy, access to production inputs, market information, and partnerships with farmer groups, cooperatives, local enterprises, and relevant government agencies may help translate interest into meaningful economic participation. The form and intensity of support should be tailored to participants' capacities, circumstances, and preferred types of agricultural activities.

The respondents' enterprise preferences provide a useful basis for identifying potential areas for such practical support. Horticulture and vegetable production were the most frequently selected options (24.19%), followed by oil palm (19.35%), cattle farming (14.11%), and broiler production (11.29%). Horticulture may be considered for initial pilot activities because it can be developed at different scales and generally has shorter production cycles than many plantation crops. Its suitability, however, depends on land and water availability, input costs, cultivation skills, and reliable market channels. Oil palm is a longer-

term plantation activity requiring suitable land, initial investment, regular maintenance, and access to appropriate marketing arrangements. Cattle farming requires capital, feed resources, housing, animal-health services, and husbandry skills, whereas broiler production has a relatively short production cycle but is exposed to feed-price changes, disease risks, and fluctuations in chick and selling prices. These considerations provide a general comparison of enterprise requirements; the present study did not undertake comparative investment, profitability, or financial-feasibility analyses. Therefore, respondents' preferences should be treated as an initial indication of interest rather than a definitive basis for selecting enterprise interventions.

From a rehabilitation and social reintegration perspective, agricultural livelihood programmes should be implemented as part of a broader, participant-centred support system rather than as stand-alone economic interventions. Participation in agricultural activities may provide opportunities to develop practical skills, establish productive routines, strengthen social interactions, and build connections with families and community-based organisations. These potential contributions, however, depend on an enabling environment that promotes dignity, inclusion, and equal opportunities. Programme implementation should therefore avoid labelling or discriminating against participants based on their rehabilitation history. Confidentiality should be maintained throughout recruitment, training, mentoring, and business development, while participation should remain voluntary and consistent with appropriate safeguarding procedures, particularly for respondents who are minors. Collaboration among rehabilitation service providers, families, farmer groups, educational institutions, local enterprises, and relevant government agencies may help create a more supportive environment for participants' gradual engagement in productive economic activities.

Taken together, these findings are consistent with the study's objective of mapping previous agricultural experience, interest, readiness, and enterprise preferences among young people with rehabilitation experience. They also provide a basis for considering agricultural livelihoods within the broader social and economic context of youth vulnerability. Previous studies cited in the conceptual framework, including (Marwa, 2023), (Chomczyński et al., 2023), (Rakhshani et al., 2025), (Saladino et al., 2021), (Brewer et al., 2023), and (Hamat et al., 2021), have discussed the relevance of social, economic, family, and peer-related factors, social control, and identity formation in understanding youth vulnerability and drug-related involvement. These perspectives support the consideration of livelihood opportunities as one component of broader rehabilitation and social reintegration efforts. However, these studies should not be treated as direct comparators for estimating the effects of agricultural engagement, as they do not necessarily examine the same population, intervention, or research outcomes. More importantly, the present study did not measure changes in drug-related behaviour before and after agricultural participation, nor did it compare participants receiving an agricultural intervention with a control group. Consequently, the findings establish an empirical basis for identifying potential agricultural livelihood options, but they do not demonstrate that agricultural engagement has a causal effect on drug prevention or rehabilitation outcomes.

Several implications for future research follow from these findings. Future studies should examine the implementation and outcomes of pilot agricultural livelihood programmes using longitudinal or intervention-based designs. Such research could assess changes in participants' technical skills, business performance, income generation, social participation, and sustained engagement in productive activities. It should also evaluate the availability of productive resources, enterprise investment requirements, market feasibility, and the forms of mentoring and institutional support needed to sustain participation. This would help determine whether the interest and preferences identified in the present study can be translated into viable livelihood opportunities and meaningful social and economic reintegration.

Table 6. Association between Respondents' Characteristics and Previous Agricultural Experience

Characteristics	Categories	Previous Agricultural Experience, n (%)	No Previous Agricultural Experience, n (%)	Statistical Test	p-value
Location	Banda Aceh	61 (73,5)	22 (26,5)	χ^2 = 0,518	0,772
	Lhokseumawe	61 (77,2)	18 (22,8)		
	Langsa	67 (77,9)	19 (22,1)		
Age	14–17 years	9 (90,0)	1 (10,0)	Fisher's exact test	0,459
	18–21 years	180 (75,6)	58 (24,4)		
Sex	Male	177 (76,0)	56 (24,0)	Fisher's exact test	1,000

	Female	12 (80,0)	3 (20,0)		
Education	Elementary school	11 (64,7)	6 (35,3)	χ^2 = 2,350	0,503
	Junior high school	30 (75,0)	10 (25,0)		
	Senior high school	132 (78,6)	36 (21,4)		
	Higher education	16 (69,6)	7 (30,4)		
Activity status	Employed	105 (73,9)	37 (26,1)	χ^2 = 3,466	0,177
	Student	33 (71,7)	13 (28,3)		
	Unemployed	51 (85,0)	9 (15,0)		
Reported involvement role	Drug user	169 (75,4)	55 (24,6)	χ^2 = 0,372	0,542
	User/agent/courier	20 (83,3)	4 (16,7)		

Horticulture and vegetable production were the most frequently selected enterprise option (24.19%), followed by oil palm (19.35%), cattle farming (14.11%), and broiler production (11.29%). Horticulture may be considered for pilot activities because it can be undertaken at different scales and generally has shorter production cycles than many plantation crops. Its suitability nevertheless depends on land and water availability, input costs, cultivation skills, and reliable market channels. Oil palm is a longer-term plantation activity that requires suitable land, initial investment, maintenance, and access to marketing arrangements. Cattle farming requires capital, feed resources, housing, animal-health services, and husbandry skills, whereas broiler production has a relatively short production cycle but is exposed to feed-price changes, disease risks, and fluctuations in chick and selling prices. These are general enterprise considerations; the present study did not conduct comparative investment, profitability, or financial-feasibility analyses.

Preferences for rice processing and fruit marketing indicate that participation in agriculture need not be limited to primary production. Collection, sorting, processing, packaging, distribution, and marketing may offer opportunities for participants with limited access to land. Integrated fisheries may also be considered in locations with adequate water resources and technical support. However, perceived suitability indices of 100% for some options should not be interpreted as evidence of objective feasibility or profitability. Some options were selected by relatively few respondents, and duck farming was selected by only one respondent. Enterprise selection should therefore combine participants' preferences with technical assessment, market analysis, cost and income estimates, and pilot testing.

The profile of reported drug involvement provides context for understanding the population included in the study, but it should not be generalized to all adolescents in Aceh. The sample consisted of respondents with a history of rehabilitation who met the study's inclusion criteria. Accordingly, the reported ages of first involvement, substances, and roles describe this sample only. The findings do not establish the causes of drug involvement or indicate the prevalence of such experiences among the wider adolescent population.

Within a rehabilitation and social-reintegration context, agricultural enterprise development should be regarded as one possible livelihood-support component that complements, rather than replaces, rehabilitation, education, psychosocial support, and family-based assistance. Participation in productive economic activities may create opportunities to develop practical skills, responsibility, work experience, and social connections. However, this study did not measure changes in drug-related behavior, rehabilitation outcomes, relapse, or the effect of agricultural participation on prevention. It therefore cannot establish that agricultural enterprises reduce drug-related behavior or prevent re-involvement in unlawful activities.

This study has several limitations. Its descriptive cross-sectional design captures respondents' experiences, attitudes, and preferences at one point in time and cannot establish causal relationships or changes over time. Purposive sampling limits generalization beyond the participating respondents. The sample was predominantly male and concentrated in the 18–21-year age group, so the findings may not adequately represent younger adolescents or female participants. Self-reported information may also be affected by recall or social-desirability bias, particularly for sensitive questions about rehabilitation and drug-related experiences. In addition, the study did not directly measure access to land and capital, technical competence, family support, actual enterprise establishment, business survival, income changes, or social-reintegration outcomes.

Future research should evaluate pilot agricultural livelihood programs using longitudinal or intervention designs. Such studies should measure actual participation, skills development, enterprise performance, business continuity, income stability, market

access, and indicators of social reintegration over time. Further work should compare investment requirements, production costs, risks, and income potential across enterprise options preferred by participants, while examining the roles of families, farmer groups, cooperatives, rehabilitation institutions, local government, and market partners in providing sustained support.

Table 7. Initial Program Prioritization Directions Based on Respondents' Preferences

Type of Agricultural Business	Number of Interested Respondents	Perceived Suitability Index	Program Direction
Horticulture/vegetable production	60 (24,19%)	85,00%	Initial pilot priority; verify land, water, input availability, and market demand.
Oil palm cultivation	48 (19,35%)	88,33%	Conditional on access to suitable land and linkages with existing plantations.
Cattle farming	35 (14,11%)	100,00%	Consider group-based development; assess feed, housing, animal health, and capital requirements.
Broiler chicken farming	28 (11,29%)	89,82%	Small-scale or group-based enterprises supported by technical assistance and market access.
Hybrid coconut cultivation	18 (7,26%)	90,00%	Develop in areas with suitable land and agroecological conditions.
Integrated fish farming	18 (7,26%)	80,00%	Conduct location-specific pilot trials after assessing water suitability and technical support requirements.
Rice processing	14 (5,65%)	100,00%	Consider service-based or processing business models.
Fruit marketing	13 (5,24%)	100,00%	Develop roles in fruit collection, distribution, and marketing.
Cocoa cultivation	13 (5,24%)	100,00%	Conditional on suitable land and longer-term production planning.
Duck farming	1 (0,40%)	100,00%	Limited pilot testing only; the preference was expressed by a single respondent.

4. CONCLUSION

This study indicates that agricultural enterprises may be considered as one productive livelihood option for adolescents and young people with rehabilitation experience in Aceh. Among 248 respondents in Banda Aceh, Lhokseumawe, and Langsa, 76.2% reported previous experience in agricultural activities, most commonly through family-based farming. No statistically significant associations were found between previous agricultural experience and the respondent characteristics examined.

Respondents reported high levels of interest and readiness to consider agricultural enterprises, with indices ranging from 88.55% to 96.05%. The most frequently preferred options were horticulture and vegetable production (24.19%), oil palm (19.35%), cattle farming (14.11%), and broiler production (11.29%). These indices represent self-reported attitudes and preferences, not verified business capacity or objective financial feasibility.

The findings support the development of livelihood programs tailored to participants' experiences, interests, abilities, and resource conditions. Such programs may combine technical training, access to land and capital, production inputs, business mentoring, and market partnerships. Enterprise selection should be based on individual assessment and local feasibility, and implementation should protect confidentiality, dignity, voluntary participation, and the rights of younger participants.

Agricultural livelihood initiatives should complement rehabilitation and broader social-reintegration support. Because this study did not measure actual enterprise outcomes, changes in income, rehabilitation outcomes, or drug-related behavior, it cannot conclude that agricultural participation prevents drug involvement or relapse. Longitudinal evaluation of pilot programs is needed to assess participation, business sustainability, income, skills, and social-reintegration outcomes.

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AUTHOR CONTRIBUTIONS

All four authors contributed to the study concept and design, data analysis and interpretation, manuscript drafting, critical revision, and approval of the final manuscript.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest related to this study.

ETHICS STATEMENT

Before data collection, official research permission request letters were issued by the Graduate School of Universitas Syiah Kuala to the relevant rehabilitation institutions and the National Narcotics Agency (BNN) offices in Banda Aceh, Langsa, and Lhokseumawe. These letters constituted institutional requests for access and facilitation of data collection;. The rehabilitation institutions facilitated communication between the research team and the parents or legal guardians of respondents below 18 years of age. Verbal permission was obtained from parents or legal guardians, after which the respondents were informed about the study and asked whether they were willing to participate. Interviews proceeded only when both the parent or guardian and the respondent agreed. Interviews with respondents below 18 years of age were conducted at previously agreed rehabilitation facilities, with a parent or legal guardian accompanying the respondent. Respondents aged 18 years and above provided their own informed consent. All participants were informed that the information collected would be used for research purposes. Respondents' identities and personal information, particularly their rehabilitation histories, were treated confidentially, and findings were reported in a manner intended to protect their anonymity. Participation was voluntary.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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