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Developing an integrated human resource empowerment model for female agricultural laborers: evidence from Aceh Besar, Indonesia

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Abstract: Female agricultural laborers play a central role in rural household economies, yet they often remain outside formal human resource development and labor support systems. This study developed an integrated human resource empowerment model for female agricultural laborers in Aceh Besar, Indonesia, using an exploratory sequential mixed-methods design combined with a research and development approach. Data were collected from 150 participants through field observations, interviews, focus group discussions, documentation, and expert review. Qualitative data were analyzed thematically, while quantitative data were examined using descriptive statistics, group comparisons, and multiple linear regression. On average, female agricultural laborers contributed 37.6% of total household income (95% CI: 36.1%–39.1%). Training participation, access to productive capital, membership in women farmer groups, and agricultural work experience were positively associated with their income contribution. Despite this contribution, women continued to face limited access to skills development, technology, markets, institutional representation, and decision-making, alongside the double burden of agricultural and domestic work. The resulting model integrates productive-economic empowerment, social-institutional strengthening, and religious-cultural support. It provides a context-sensitive framework for improving competencies, workforce participation, bargaining capacity, and worker well-being in informal rural employment.

Keywords: empowerment model, female agricultural laborers, household economic welfare, rural livelihoods, women's economic empowerment.

1. Introduction

Women constitute an important segment of the rural agricultural workforce and contribute substantially to household production, income generation, and livelihood continuity. In many rural communities, women combine domestic responsibilities with paid and unpaid agricultural work, including land preparation, planting, harvesting, post-harvest processing, small-scale trading, and household-based production. Their participation becomes particularly important when household income is seasonal, unstable, or insufficient to meet basic needs [1]. Despite this contribution, female agricultural laborers are often treated as supplementary workers rather than as productive human resources whose competencies, well-being, and workforce participation require systematic institutional support.

From a human resource management perspective, female agricultural laborers form part of the informal rural workforce. Their productivity and economic contribution depend not only on the availability of employment but also on skills development, access to technology, work-related knowledge, organizational

support, labor participation, and opportunities to take part in economic decision-making. However, rural labor arrangements frequently place women in low-paid, insecure, and weakly protected positions. Female agricultural laborers commonly have limited access to training, capital, market information, agricultural technology, social protection, and formal representation. They also experience a double burden because productive agricultural work is performed alongside domestic and caregiving responsibilities. These constraints can reduce training participation, work productivity, bargaining capacity, and worker well-being [2].

Previous studies related to women's participation in agriculture can be grouped into three main research strands. The first strand examines women's contribution to agricultural production and household income. These studies demonstrate that women's productive activities can strengthen household economic resilience, reduce dependence on a single income source, and support expenditure on food, education, agricultural inputs, and small businesses [3–5]. Nevertheless, women's agricultural work is frequently undervalued because it occurs in informal employment arrangements and is often interpreted as an extension of their household responsibilities rather than as economically valuable labor.

The second research strand focuses on women's empowerment interventions, particularly education, vocational training, financial inclusion, entrepreneurship development, and collective organization. Education and skills development can strengthen women's agency, self-confidence, productive capacity, and participation in economic decision-making [6–8]. Similarly, community-based empowerment programs can improve business capacity and economic participation when program design is responsive to local needs and employment conditions [9]. However, training alone may produce limited and temporary outcomes when it is not connected to capital, market access, technology, institutional networks, and continuous organizational support. From a human resource development perspective, effective intervention therefore requires an integrated process that links competency development with enabling work conditions and institutional participation.

The third research strand examines how social, religious, and cultural conditions shape women's economic participation. In rural communities, women's ability to engage in paid work, attend training, join organizations, or participate in decision-making may depend on household responsibilities, family support, community expectations, and locally accepted gender roles. Religious and cultural values can provide social legitimacy and community support for women's productive activities, but they can also limit mobility, time availability, and participation when empowerment programs are not designed sensitively. Therefore, religious-cultural context should not be treated merely as a background characteristic. It should be considered an operational component that influences workforce participation, training accessibility, institutional engagement, and the sustainability of empowerment interventions.

Although these three research strands provide important insights, the literature remains fragmented. Studies on women's agricultural labor commonly emphasize income contribution, while empowerment studies often focus separately on training, entrepreneurship, financial access, or organizational participation. Limited attention has been given to an integrated human resource empowerment framework that connects competency development, productive resources, institutional support, worker well-being, and religious-cultural legitimacy. Existing agricultural empowerment approaches also tend to focus on female farmers, entrepreneurs, landowners, or formal group members, while female wage laborers and informal agricultural workers

receive less attention. Furthermore, claims that economic, institutional, and cultural dimensions should be integrated are rarely accompanied by a clear input–process–output–outcome mechanism explaining how these dimensions interact to strengthen women’s workforce participation and household economic resilience.

Aceh Besar, Indonesia, provides an important context for examining this issue. Agriculture and plantations remain central to rural livelihoods, and women participate in agricultural labor to support household income. Female agricultural laborers in the region face seasonal employment, uncertain earnings, limited technological support, restricted access to capital and markets, and weak institutional representation. At the same time, they possess practical agricultural knowledge, work experience, household financial management capabilities, and social networks that can support collective economic activities. Women farmer groups, village institutions, agricultural agencies, and community organizations may therefore function as human resource development mechanisms by facilitating training, information exchange, collective marketing, financial access, and worker participation. Aceh Besar’s strong religious and cultural environment also makes it necessary to design empowerment initiatives that receive support from families and local communities [10].

This study draws on community empowerment and human resource development perspectives. Community empowerment emphasizes capacity building, access to productive resources, participation, collective organization, and the ability of individuals and groups to address their own economic challenges [11,12]. Human resource development adds a workforce-oriented perspective by emphasizing competency development, skills training, knowledge acquisition, organizational support, employee participation, and worker well-being. In the context of female agricultural laborers, these perspectives suggest that sustainable empowerment requires more than income-generating assistance. It requires coordinated investment in women’s competencies, productive resources, institutional representation, bargaining capacity, and socially acceptable workforce participation [13–16].

Accordingly, this study aims to develop an integrated human resource empowerment model for female agricultural laborers in Aceh Besar. It examines their socio-economic and employment conditions, measures their contribution to household income, identifies competency and institutional gaps, analyzes local resources and religious-cultural considerations, and formulates a context-sensitive model based on field findings, focus group discussions, and expert review. The proposed model integrates three interrelated dimensions: productive-economic empowerment through competency development and access to productive resources; social-institutional strengthening through collective organization and stakeholder support; and religious-cultural support for socially legitimate and sustainable workforce participation.

This study contributes to the literature in three ways. First, it reframes female agricultural laborers as informal rural workers and productive human resources rather than merely as supplementary household income earners. Second, it proposes an integrated model that connects skills development, financial literacy, technological access, institutional strengthening, market participation, family-community support, and worker well-being through a coherent empowerment pathway. Third, it extends human resource management and development discussions to informal agricultural employment, where conventional organizational structures are limited but workforce development, labor participation, and employee well-being remain important. The proposed model may provide a practical reference for local governments, agricultural institutions, village administrations, women farmer groups, cooperatives, and workforce development programs in designing locally responsive interventions.

2. Materials and methods

2.1. Research design

This study employed an exploratory sequential mixed-methods design integrated with a research and development approach [17]. The study was conducted in four stages. The initial qualitative phase explored the employment conditions, competency needs, institutional constraints, household responsibilities, and religious-cultural considerations of female agricultural laborers. The findings from this phase were used to develop and refine the questionnaire administered in the subsequent quantitative phase [18]. The qualitative and quantitative findings were then integrated to formulate the initial empowerment model. Finally, the model was refined through focus group discussions and expert review.

2.2. Research site and period

The research was conducted from March to July 2025 in five agricultural villages in Aceh Besar Regency. Three villages Data Makmur, Kayee Kunyet, and Paya-Ue, were located in Blang Bintang District, while Ajee Pagar Air and Lubok Batee were located in Ingin Jaya District. These locations were selected purposively following preliminary field mapping because women were actively involved in agricultural labor, post-harvest activities, small-scale farming, and household-based productive activities. The villages also showed variations in market access, agricultural commodities, women farmer group participation, and proximity to institutional services.

2.3. Population, sample size, and participant recruitment

The target population comprised women aged 18 years or older who had worked as paid or income-earning agricultural laborers for at least six months. A total of 150 respondents were selected using purposive quota sampling, with an equal quota of 30 respondents from each village. The sample size was determined operationally to provide sufficient observations for descriptive analysis, village-level comparisons, and exploratory multivariable analysis while preventing respondents from one village from dominating the sample.

Participants were recruited with assistance from village officials, agricultural extension workers, women farmer group administrators, and community facilitators. Women who were not members of formal agricultural groups were identified through community mapping and participant referrals. A total of 157 women were initially approached; four declined to participate, while three questionnaires were excluded because essential household income information was incomplete. The final quantitative sample therefore consisted of 150 respondents (**Figure 1**).



Figure 1. Field data collection with female agricultural laborers in several agricultural areas of Aceh Besar

2.4. Qualitative participants and focus group discussions

Twenty-five female agricultural laborers were purposively recruited for the initial qualitative phase, with five participants representing each study village. The participants were selected using maximum variation criteria, including age, education, agricultural work experience, access to training, women farmer group membership, and type of agricultural employment. The findings from these interviews were used to identify key variables and refine the questionnaire applied in the subsequent quantitative phase.

Three focus group discussions were conducted, each involving eight participants. The first group consisted mainly of younger agricultural laborers and women with fewer than five years of work experience. The second involved experienced laborers and women farmer group members. The third consisted of participants with different income contribution levels and varying access to institutional support. Twelve focus group participants had previously participated in individual interviews, while the remaining twelve were selected from the quantitative sample. Each discussion lasted approximately 90-120 minutes.

2.5. Data collection instruments and procedures

Data were collected using a structured household questionnaire, a semi-structured interview guide, a field observation checklist, a focus group discussion guide, and an expert model assessment form. The questionnaire recorded age, education, marital status, household size, number of dependents, type of agricultural work, work experience, working hours, wages, training participation, access to technology, capital and markets, group membership, income sources, and total household income.

The interview guide contained 14 main questions covering employment experiences, skills, training needs, income allocation, access to productive resources, institutional participation, decision-making, double workload, family support, and religious-cultural acceptance. Interviews lasted approximately 40–70 minutes and were conducted in Indonesian or Acehnese according to the participants' preferences. Interviews and focus group discussions were audio-recorded with consent and transcribed verbatim. Field observations documented working conditions, agricultural tasks, tools, physical workload, work schedules, and interactions among workers.

2.6. Household income measurement

Income was measured using a three-month recall period and converted into an average monthly value expressed in Indonesian rupiah. Women's income included agricultural wages, harvest-related payments, post-harvest processing income, small-scale trading income, livestock-related income, and other productive activities personally undertaken by the participant. Total household income included the participant's income, the spouse's income, income from other household members, agricultural enterprises, household businesses, and other regular sources [19].

The study used estimated net income. Direct production and operating costs were deducted from gross business or agricultural revenue. Daily wage income was calculated by multiplying the average wage by the number of working days during the reference period. Seasonal income was converted into a monthly average by dividing net income earned during one agricultural cycle by the number of months in that cycle. Payments received in the form of agricultural produce were converted into monetary values using the prevailing average market price in the respective village. Women's household income contribution was calculated using the following formula:

$$\text{Women's income contribution} = \frac{\text{women's income}}{\text{total household income}} \times 100\%$$

2.7. Data management and missing data

Questionnaires were reviewed immediately after completion to identify missing or inconsistent responses. Participants were contacted again when income-source information required clarification. Three questionnaires with missing core income variables were excluded before the analysis, and no statistical imputation was applied to the primary income variables. Missing responses in nonessential socio-demographic variables accounted for less than 1% of the dataset and were analyzed using available-case procedures. Extreme income values were compared with questionnaire notes and retained when they reflected genuine differences in agricultural season, working days, or income-generating activities.

2.8. Quantitative data analysis

Quantitative data were analyzed using IBM SPSS Statistics 29, with Microsoft Excel used for data checking and monthly income conversion. Descriptive statistics included frequencies, percentages, means, medians, standard deviations, ranges, and 95% confidence intervals. Women's income contributions were grouped into five categories: below 20%, 20.0%–29.9%, 30.0%–39.9%, 40.0%–49.9%, and 50% or above. Group differences were examined using appropriate parametric or nonparametric tests. Multiple linear regression was used to identify factors associated with income contribution, with statistical significance set at $p < 0.05$.

2.9. Qualitative data analysis

Interview and focus group transcripts were analyzed thematically using NVivo 14. Two researchers independently conducted familiarization, coding, categorization, theme development, and interpretation. Coding focused on employment insecurity, skills, access to capital and markets, institutional participation, double workload, worker well-being, family support, and religious-cultural acceptance. Coding differences were resolved through discussion or consultation with a third researcher. Data saturation was reached when the final four interviews produced no new substantive themes.

2.10. Model development procedure

The model was developed through four stages: preliminary assessment, needs analysis, initial model formulation, and refinement. Qualitative themes, quantitative findings, and relevant human resource development literature were integrated into three dimensions: productive-economic empowerment, social-institutional strengthening, and religious-cultural support. The proposed activities, stakeholder roles, outputs, and outcomes were then refined through focus group discussions and expert assessment.

2.11. Expert review and model assessment

Five experts reviewed the model, representing human resource management, agricultural economics, gender studies, agricultural extension, and Acehnese religious-cultural studies. A 20-item instrument assessed conceptual relevance, clarity, feasibility, stakeholder suitability, and cultural appropriateness using a four-point scale. The model obtained a mean score of 3.58 and an Aiken's V coefficient of 0.89. Expert feedback led to clearer stakeholder roles, flexible training schedules, stronger family involvement, and measurable indicators of skills, income, participation, and worker well-being.

2.12. Mixed-methods integration

Qualitative and quantitative findings were integrated through a joint-display process. Field narratives concerning training limitations, institutional weakness, domestic workload, and cultural support were compared with quantitative patterns in training access, group membership, income contribution, working hours, and capital access. Model components were retained when supported by multiple data sources, stakeholder priorities, or expert review.

2.13. Trustworthiness and member checking

Trustworthiness was strengthened through source and method triangulation, independent coding, member checking, and an audit trail. Information from laborers, village stakeholders, extension workers, questionnaires, interviews, observations, and focus groups was compared. Member checking involved 15 participants from the five villages through two feedback sessions. Their comments led to stronger consideration of seasonal income, irregular working hours, childcare responsibilities, and flexible training schedules.

2.14. Ethical considerations

All participants received information about the study and provided written informed consent. Participation was voluntary, and respondents could withdraw at any time. Personal identifiers were replaced with anonymous codes, and electronic data were stored in password-protected files. The actual ethics committee name, approval number, and date must be reported in the final manuscript. Separate consent is required for publication of identifiable photographs; otherwise, participants' faces must be anonymized.

3. Results

3.1. Participant characteristics

The study included 150 female agricultural laborers, with 30 participants recruited from each of the five selected villages. Most participants were married and were between 30 and 49 years of age. More than half had completed junior or senior secondary education, while only a small proportion had received education beyond senior secondary level.

Agricultural work experience varied considerably. Approximately 42.7% of participants had worked in agriculture for five to ten years, while 30.0% had more than ten years of experience. Slightly more than half were members of women farmer groups. However, fewer than one-third had previously participated in agricultural, entrepreneurship, or financial management training, and only 26.0% reported having access to formal or group-based productive capital, as shown in **Table 1**.

Table 1. Characteristics of the Participants

Characteristic	Category	n	%
Age	18–29 years	45	30.0
	30–39 years	52	34.7
	40–49 years	37	24.7
	≥50 years	16	10.6

Continuation Table:

Characteristic	Category	n	%
Education	Primary school or below	35	23.3
	Junior secondary school	48	32.0
	Senior secondary school	56	37.3
	Diploma or higher	11	7.4
Agricultural work experience	<5 years	41	27.3
	5–10 years	64	42.7
	>10 years	45	30.0
Women farmer group membership	Member	78	52.0
	Non-member	72	48.0
Previous training participation	Yes	46	30.7
	No	104	69.3
Access to productive capital	Yes	39	26.0
	No	111	74.0

The employment profile indicates that female agricultural laborers possessed substantial practical work experience but received limited formal human resource development support. Training participation and access to productive capital were especially low compared with their level of workforce involvement.

3.2. Women's contribution to household income

The mean monthly net income earned by female agricultural laborers was Indonesian Rupiah (IDR) 1,720,000, while the average total monthly net household income was IDR 4,580,000. The mean contribution of women's income to total household income was 37.6%, with a median of 37.2% and a standard deviation of 9.4 percentage points. The 95% confidence interval ranged from 36.1% to 39.1%, as detailed in **Table 2**.

Table 2. Descriptive Statistics of Women's and Household Income

Income variable	Mean	Median	SD	Minimum	Maximum
Women's monthly net income	IDR 1,720,000	IDR 1,650,000	IDR 650,000	IDR 650,000	IDR 3,800,000
Total monthly household net income	IDR 4,580,000	IDR 4,350,000	IDR 1,320,000	IDR 2,100,000	IDR 8,600,000
Women's income contribution	37.6%	37.2%	9.4	16.8%	62.5%

The largest group of participants, representing 36.0% of the sample, contributed between 30.0% and 39.9% of total household income. A further 28.7% contributed between 40.0% and 49.9%, while 13.3% contributed at least half of total household income (**Table 3**).

Table 3. Distribution of Women's Household Income Contribution

Contribution category	n	%
Below 20%	7	4.7
20.0%–29.9%	26	17.3
30.0%–39.9%	54	36.0
40.0%–49.9%	43	28.7
50% or above	20	13.3
Total	150	100.0

Agricultural wages represented the main source of women's income. Additional earnings were obtained from post-harvest processing, small-scale trading, livestock activities, and household-based production. Participants reported that their income was mainly used for food, children's education, agricultural inputs, debt repayment, health expenses, and small business capital (**Figure 2**).

**Figure 2.** Focus group discussion with female agricultural laborers in Aceh Besar

3.3. Differences in income contribution across participant groups

Women who had participated in training contributed a significantly larger proportion of household income than women who had never attended training. Similar differences were observed for access to productive capital and membership in women farmer groups.

Participants who had attended training recorded an average contribution of 42.3%, compared with 35.5% among those without training experience. Women with access to productive capital contributed an average of 43.1%, compared with 35.7% among women without access. Members of women farmer groups contributed an average of 40.5%, while non-members contributed 34.5%, as presented in **Table 4**.

Table 4. Women's Income Contribution by Selected Characteristics.

Characteristic	Group	Mean contribution	p-value
Training participation	Yes	42.3%	<0.001
	No	35.5%	
Access to productive capital	Yes	43.1%	<0.001
	No	35.7%	

Continuation Table:

Characteristic	Group	Mean contribution	p-value
Women farmer group membership	Member	40.5%	< 0.001
	Non-member	34.5%	
Work experience	<5 years	34.8%	0.018
	5–10 years	37.7%	
	>10 years	40.0%	

3.4. Factors associated with women's income contribution

Mean income contribution also differed moderately across villages, ranging from 35.6% in Paya-Ue to 39.2% in Data Makmur. The overall village-level difference was statistically significant but relatively small ($p=0.041$). Multiple linear regression indicated that access to productive capital, training participation, women farmer group membership, and agricultural work experience were positively associated with women's household income contribution. The overall model was statistically significant and explained approximately 31% of the observed variation in the contribution ratio (Table 5).

Table 5. Factors Associated with Women's Household Income Contribution.

Predictor	Standardized β	p-value
Access to productive capital	0.24	0.001
Training participation	0.21	0.004
Women farmer group membership	0.18	0.015
Agricultural work experience	0.16	0.031
Educational level	0.09	0.184
Age	-0.05	0.487
Household size	-0.08	0.221

Model statistics: adjusted $R^2 = 0.31$, "F(8,141)=9.35", " $p<0.001$ ".

These findings identify associations rather than causal effects because the research used cross-sectional data and purposive sampling.

3.5. Employment Conditions and Capacity Gaps

Thematic analysis produced six major themes: household income stabilization, limited skills and technology, restricted access to capital and markets, weak institutional continuity, the double burden of productive and domestic work, and the importance of family and community support. Twenty-one of the 25 interview participants described their income as essential for stabilizing household expenditure during periods of seasonal or uncertain earnings. Women commonly prioritized food, children's education, fertilizer, seeds, and urgent household expenses (Table 6).

"My wages are used first for food, school expenses, and fertilizer. When there is no harvest, the household becomes very tight." Participant P07.

Eighteen participants reported limited access to technical training, product

processing skills, financial management, or digital marketing. Although they had practical agricultural experience, they had few opportunities to develop additional competencies.

“We know how to work in the field, but we have not been taught processing, packaging, or digital selling.” Participant P12.

Twenty participants described limited access to capital and dependence on local traders. Several participants stated that they had little influence over selling prices because they lacked alternative buyers, storage facilities, and collective marketing arrangements.

“The buyer usually decides the price. We accept it because we do not have another market.” Participant P19.

Sixteen participants reported that women farmer groups or community programs were not consistently active. Group activities frequently depended on temporary government or external programs.

“The group becomes active when a program comes, but meetings usually stop after the assistance ends.” Participant P03.

Nineteen participants described a double burden involving agricultural work, childcare, cooking, and other domestic responsibilities. This burden limited their ability to attend training, join meetings, or expand productive activities.

“I can attend training only after cooking and arranging childcare. If the schedule is too early, I cannot participate.” Participant P22.

Family and community support also influenced women’s participation. Seventeen participants stated that empowerment activities were more acceptable when schedules respected household responsibilities and when husbands or community representatives understood the intended economic benefits.

“My family supports the work when the schedule is clear and does not create conflict with responsibilities at home.” Participant P15.

Table 6. Qualitative Themes Identified from Interviews and Focus Groups

Theme	Participants mentioning the issue	Main empirical indication
Household income stabilization	21 of 25	Women’s income supported food, education, farming inputs, and urgent needs
Skills and technology gaps	18 of 25	Limited access to training, processing technology, and digital marketing
Capital and market constraints	20 of 25	Dependence on personal savings and local buyers
Weak institutional continuity	16 of 25	Group activities depended on short-term external programs
Double burden	19 of 25	Domestic work restricted training and economic participation
Family and community support	17 of 25	Participation increased when activities were socially accepted and scheduled flexibly

The interview counts indicate how frequently themes appeared within the qualitative subsample and should not be interpreted as population prevalence estimates.

3.6. Village-level resources and institutional conditions

As summarized in **Table 7**, the five villages showed different combinations of

agricultural resources, market access, group activity, and institutional support. Data Makmur had relatively active women farmer groups and more regular contact with agricultural facilitators. Kayee Kunyet had opportunities for horticultural and post-harvest activities, while Paya-Ue showed greater dependence on seasonal wage labor and weaker market access.

Ajee Pagar Air benefited from closer access to trading centers and relatively better access to small-scale capital. Lubok Batee had strong social cooperation and opportunities in plantation and livestock-related activities but experienced considerable seasonal income variation.

Table 7. Comparative Local Conditions Across the Study Villages.

Village	Dominant employment characteristics	Institutional condition	Main local potential
Data Makmur	Rice and horticultural labor	Relatively active women farmer group	Training coordination and collective activities
Kayee Kunyet	Horticulture and post-harvest work	Emerging group-based activities	Processing and product diversification
Paya-Ue	Seasonal rice labor	Limited group continuity and market access	Labor experience and agricultural production
Ajee Pagar Air	Mixed farming and small trading	Better access to markets and small capital	Market linkage and enterprise development
Lubok Batee	Plantation, livestock, and mixed labor	Strong informal social cooperation	Group-based production and income diversification

The village comparison shows that the proposed empowerment model requires a common framework but should allow local adaptation according to employment patterns, commodities, institutional capacity, and market accessibility.

3.7. Expert assessment and refinement of the model

The proposed model was reviewed by five experts representing human resource management, agricultural economics, gender studies, agricultural extension, and Acehnese religious-cultural studies. The model received an overall mean assessment score of 3.58 out of 4.00 and an Aiken's V coefficient of 0.89, as shown in **Table 8**. Religious-cultural appropriateness received the highest score, while operational feasibility and clarity of stakeholder responsibilities received comparatively lower scores.

Table 8. Expert Assessment of the Proposed Model.

Assessment dimension	Mean score	Aiken's V
Conceptual relevance	3.72	0.93
Clarity and internal coherence	3.44	0.84
Operational feasibility	3.36	0.83
Stakeholder suitability	3.60	0.90
Religious-cultural appropriateness	3.78	0.95
Overall assessment	3.58	0.89

Experts and focus group participants recommended five principal modifications:

1. clarifying the responsibilities of village governments, agricultural agencies, women farmer groups, and financial institutions;
2. introducing flexible training schedules to accommodate women's domestic responsibilities;
3. strengthening family and community involvement;
4. including worker well-being as an explicit outcome; and
5. adding measurable indicators of competencies, income, institutional participation, and program continuity.

These recommendations were incorporated into the final proposed model.

3.8. Final integrated human resource empowerment model

The final model comprised three interrelated dimensions, as presented in **Table 9**. The first dimension, productive-economic empowerment, focused on competency development, financial literacy, technology, capital, product processing, and market access. The second dimension, social-institutional strengthening, focused on women farmer groups, collective enterprises, institutional partnerships, workforce representation, and bargaining capacity. The third dimension, religious-cultural support, focused on family involvement, community dialogue, culturally responsive schedules, and socially acceptable workforce participation.

The dimensions were not arranged as isolated or strictly sequential components. Competency development required institutional support, while access to capital and markets was more effective when women were organized collectively. Family and community acceptance influenced women's ability to participate in training, meetings, and productive activities.

Table 9. Final Structure of the Proposed Empowerment Model

Dimension	Empirical basis	Proposed mechanism	Immediate indicators
Productive-economic empowerment	Skills, technology, capital, and market gaps	Training, financial literacy, technology access, capital, and market linkage	Skills acquired, training participation, financial records, and market access
Social-institutional strengthening	Weak groups and limited representation	Group revitalization, collective enterprise, partnerships, and leadership development	Active meetings, membership, partnerships, and collective activities
Religious-cultural support	Double burden and need for social acceptance	Family engagement, community dialogue, and flexible program arrangements	Family support, attendance, reduced scheduling conflict, and community acceptance

The proposed pathway begins with access to training, technology, capital, institutional support, and family-community involvement. These inputs support competency development, collective organization, and culturally acceptable participation. The intended immediate outputs are improved skills, stronger groups, wider institutional networks, and better financial management. Proposed intermediate outcomes include higher productivity, stronger bargaining capacity, improved worker well-being, and greater income contribution.

4. Discussion

The findings indicate that female agricultural laborers are not merely supplementary income earners but important members of the informal rural workforce. Their average contribution of approximately 37.6% of total household income supported food consumption, children's education, agricultural inputs, health expenses, and small-scale productive investment. This result is consistent with previous evidence that women's agricultural and household-based economic activities strengthen livelihood resilience and reduce dependence on a single household income source [20,21]. Direct numerical comparison with other Indonesian rural areas remains limited because previous studies apply different definitions, income sources, and measurement periods. Nevertheless, the contribution recorded in Aceh Besar demonstrates that women's agricultural labor has substantial economic value and should be recognized within rural workforce development policies.

Training participation, access to productive capital, women farmer group membership, and agricultural work experience were positively associated with women's income contribution. These findings suggest that practical experience alone is insufficient when workers have limited access to competency development, technology, financing, and market information. Education and vocational development can strengthen women's agency and productive capacity, particularly when training is connected to organizational support and productive resources [22]. Women farmer groups may therefore function as informal human resource development institutions by facilitating knowledge exchange, collective marketing, institutional access, and stronger bargaining capacity [23].

The double burden of agricultural and domestic work emerged as an important structural constraint. Childcare, cooking, and household management reduced women's availability for training, meetings, and business development. This finding supports previous evidence that time constraints affect both the quantity and quality of women's agricultural participation [24,25]. Empowerment programs should therefore incorporate flexible schedules, family involvement, and worker well-being measures. Religious and cultural values may strengthen participation when programs receive family and community support, but these values should operate as enabling mechanisms rather than as restrictions on women's economic opportunities.

The novelty of the proposed model lies in the interaction among productive-economic empowerment, social-institutional strengthening, and religious-cultural support. Unlike approaches that primarily emphasize income generation, training, or individual decision-making, this model connects competency development with institutional continuity, worker well-being, family support, and community legitimacy. Skills development is expected to be more effective when accompanied by access to capital and markets, while institutional participation is more sustainable when women receive support from families and local communities. The model therefore extends empowerment beyond individual economic assistance and offers a context-sensitive human resource development framework for informal agricultural workers [26,27].

The practical implications are particularly relevant to Aceh Besar. The local government and village administrations should include female agricultural laborers in rural workforce databases and allocate support for competency-based training, social protection, technology access, and productive financing [28,29]. Agricultural agencies should connect training with equipment, extension services, and market access. Women farmer groups and cooperatives should facilitate collective purchasing,

savings, processing, and marketing, while financial institutions should develop financing arrangements suited to seasonal agricultural income. Program evaluation should include measurable indicators of skills, group participation, market access, bargaining capacity, income contribution, and worker well-being [30,31].

These findings should be interpreted cautiously. The study was limited to five villages in Aceh Besar and used purposive sampling, which restricts generalizability and may introduce self-selection bias because more active or institutionally connected women may have been more likely to participate. Income data were self-reported and may have been affected by recall error and seasonal variation. In addition, the cross-sectional design, absence of a comparison group, and lack of longitudinal follow-up prevent causal conclusions regarding the effectiveness of the proposed model. The model should therefore be understood as a contextually grounded framework requiring future implementation and evaluation across broader agricultural settings.

5. Conclusion

This study shows that female agricultural laborers constitute an important segment of the informal rural workforce in Aceh Besar. Within the study sample, their income contributed approximately 35%–40% of total household income and supported daily consumption, children's education, agricultural inputs, health expenses, and productive investment. The study proposes an integrated human resource empowerment model comprising productive-economic empowerment, social-institutional strengthening, and religious-cultural support. Its main contribution lies in connecting competency development, financial literacy, access to capital, technology and markets, group strengthening, worker well-being, and family-community support within a context-sensitive framework for informal agricultural employment.

The proposed model provides practical direction for the Aceh Besar government, village administrations, agricultural agencies, women farmer groups, cooperatives, financial institutions, and universities in designing workforce development programs for female agricultural laborers. However, the model should be interpreted as a proposed framework rather than as evidence of proven impact. The use of purposive sampling, self-reported income, cross-sectional data, a limited geographical setting, and the absence of a comparison group restricts generalizability and causal interpretation. Future research should implement and evaluate the model across broader agricultural settings using longitudinal or quasi-experimental designs, objective economic indicators, and measures of skills, institutional participation, bargaining capacity, and worker well-being.

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Informed consent statement: Informed consent was obtained from all participants prior to data collection. Each participant received a clear explanation of the study purpose and procedures, and provided written consent. For non-Indonesian speakers, information was read aloud in Acehese. All data were anonymized using participant codes.

Data availability statement: The data supporting this study are not publicly available due to participant privacy protection. De-identified summary data are presented in the manuscript tables and figures. The full anonymized dataset may be available from the corresponding author upon reasonable request.

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