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Role of Decision-Making Dynamics and Farm Participation in Succession: The Case of Philippine Coffee Farming Households

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Abstract

Succession is crucial to ensure agricultural sustainability, food security, and rural development in the agriculture sector. Existing succession studies analyze how demographics, farms, and social characteristics affect the likelihood of having a successor. There is scarce literature on how household members' decision-making involvement and farm participation affect the likelihood of succession. The effect of access to agricultural services was also examined in this study. A Probit model was used in the analysis using information from 755 coffee farming households in nine (9) regions of the Philippines. One of the key findings is that the likelihood of farm succession is more strongly influenced by gender-specific farm activity engagement than by the extent of involvement in farm decision-making. To increase the likelihood of farm succession, any intervention and extension should incorporate a component that actively engages youth in the farm's day-to-day operations. Active membership of the household head in an agricultural organization and women's access and participation in agricultural training can significantly increase the likelihood of succession. The study supplements theoretical literature on farm succession by providing measurements on inclusive farm activity participation, decision-making within the household, and how it affects farm succession likelihood, a critical factor that should be considered in analyzing farm succession.

Keywords: *Gender-specific participation, decision involvement, women and youth inclusion, farm succession*, *Probit model*

JEL Classification: C35, J16, Q12

INTRODUCTION

Family farming involves the agricultural, forestry, fisheries, pastoral, and aquaculture production, operated by a family and predominantly reliant on family labor, including both men and women (FAO, 2013). There is a shift in the view of smallholders and family farmers from being part of the hunger problem to now being central to its solution (McIntyre et al., 2009 & Silva, 2014, as cited by Graeub et al., 2015). Family farms contribute 80% of the global food supply (FAO's SOFA report, 2014a), and Graeub et al. (2015) estimated that family farms constitute 98% of all farms and occupy at least 53% of global agricultural land and produce at least 53% of the world's food. The undeniable importance of family farms leads to an increasing interest of economists in the field. One of the areas of interest for economists on family farms is the issue of farm succession. Farm succession is defined as the process by which the ownership and management capacity of the family farm business is transferred to another family member, usually the next generation (farm intergenerational succession) (Gasson & Errington, 1993; De Massis et al., 2008). Intergenerational succession represents the renewal of the family farm and can potentially act as a helpful corrective in addressing the apparent increasingly aged population of principal farmers (Harris & Mishra, 2012). Thus, it is vital to repairing the demographic imbalance in the agricultural sector.

An eroding interest in agriculture among potential successors would affect farm intergenerational sustainability. Lobley (2010) emphasized that farm succession is the most critical stage of sustaining a family business. The prime objective of family farms is to have successful succession by passing control in the hope of improving the business for the next generation (Gasson & Errington, 1993).

In 2008, the Philippine government and the World Rural Forum proposed the International Year of Family Farming (IYFF). Other countries supported this and were finally endorsed by the United Nations (U.N.) in 2011 and appointed FAO as the facilitating agency. The IYFF is an initiative to highlight the vital role that family farmers play in a community's well-being, food security, and economics, among other things. It seeks to support the development of policies conducive to promoting sustainable family farming and create a better understanding of the needs, constraints, and potential of family members. It also helps create a pro-family farming policy in which the farmers themselves, women, men, and youth can articulate their perspectives, needs, and aspirations.

In the Philippines, the agriculture sector has continuously shrunk since the 1960s and only contributed to around 9% of the 2018 GDP. The average farm size has been continuously declining since the 1970s. Family farming is rapidly a dying profession in the Philippines. Based on the 2017 Department of Agriculture survey, the average age of farmers in the Philippines is 60 years old. Aging of farmers is common in developing countries, where younger workers tend to opt for nonfarm occupations (Moya et al., 2015). Workers in agriculture tend to be older and on average age faster than other workers in services and industry (Briones, 2017). Assuming an average life span of 70, the Philippines might reach a critical shortage of farmers in just 15 years (House Bill No. 5336, 2017). In the long-term longitudinal data of the country's agricultural survey, the average age of farmers is increasing, from a mean age of 46 years in 1966 to 59 years in 2016. The survey replaced numerous respondents over time who have exited farming (Briones, 2017).

Compounding the problem of farm exit is a younger generation that is mostly leaving the rural areas nationwide, depleting the pool of potential agricultural workers and leading to farming exit and failure of farming succession. The youth is the future of food security (FAO, 2014); the succession and sustainability of agriculture depend on the younger generation. A closer analysis of the challenges faced by rural youth, including their empowerment while engaging in agriculture, might provide strategies to enhance and sustain their involvement in the sector. It might also maximize the potential capacity of this sizeable and growing demographics by providing them with appropriate intervention and policy support and ensuring the success of family farming.

Despite the totemic importance of succession in the family farm business in the agriculture sector, there are only a few studies conducted in this area. Among the few published works include the comparison of succession status of the type of farms. Bohak et al. (2011) compared succession between organic and conventional farms. The team of Aldanondo Ochoa et al. (2007) analyzed the effect of farm location and off-farm employment opportunities on succession. Some studies used specific indicators such as farm assets (Calus et al., 2008), and farmers' perceptions and opinions (Kebler, 2012). The analysis of the probability of farm succession, the likelihood of having a designated successor, and the timing of succession/closure (Glauben et al., 2004; 2009) is considered the most comprehensive in terms of the number of variables used, and the econometric approach. The probability of farm succession was also analyzed by Mishra et al. (2010) and Sotomayor et al. (2011) using household demographics and farm characteristics. These foreign-conducted studies established most of the household-level variables' effect on farm succession. However, these studies did not explore the effect of gender-specific farm participation, decision-making involvement, and access to external agricultural services. Philippine family farm studies focus on production, technology, and policy analysis. There is a scarcity of literature that focuses on the actors of family farms- the members of the household and their internal dynamics. Little is known about women and youth inclusion in terms of their farm participation and decision-making involvement. Thus, this study examined how gender-specific farm participation and decision-making involvement, along with other factors, affect the likelihood of succession.

Research on farm succession is an essential input on policymaking in the agriculture sector, considering that succession considerably influences farmers' behaviors. The issue of succession is synonymous with population retention issues among rural communities. Rural communities are vital to support local economies, protect natural resources, and provide for the industrial components of the economy (Harris et al., 2012). Policymakers, local leaders, and rural communities have a direct stake in the economic well-being of farmers and local agricultural businesses. Understanding household dynamics, on-farm activity participation, decision-making, and how it affects succession is crucial in agricultural sustainability policy initiatives. The tremendous diversity of family farms worldwide calls for context-specific studies necessary to design and assess policies affecting family farms reasonably. There is a need to focus on agricultural research and development on family farms. The need to create a long-term public commitment to agricultural research that supports family farms is essential and vital to public goods (FAO, 2014; Sumberg et al., 2012).

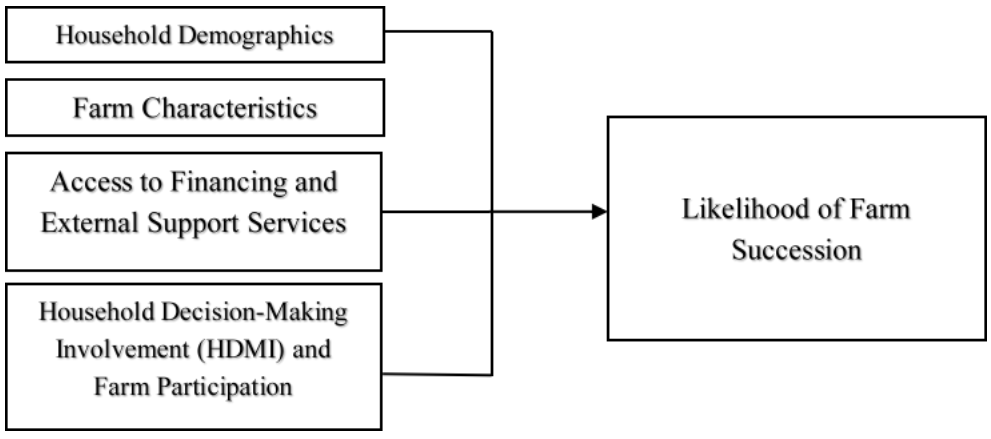
Conceptual Framework

Based on the literature, many household and community-level variables were important determinants in understanding farm succession. The most explored variables in the previous studies are household demographics and farm characteristics, which are important determinants of succession. These variables were included in this study, together with the inclusion of the gender-specific agricultural decision-making involvement (HDMI), and gender-specific farm participation which was not yet explored in the literature (Figure 1).

The HDMI was summarized into an index consisting of involvement in 13 agricultural decision points: (1) crops to plant or produce, (2) production technology, (3) availment of financial assistance and credit, (4) where to borrow funds, (5) inputs to procure, (6) selling and marketing decision, (7) the price level to negotiate, (8) whether to do value-adding activity, (9) the distribution and sharing of the sales, (10) how and where to spend the income from production, (11) what farming equipment and facilities to purchase, (12) who will use the procured equipment, and (13) labor management.

Figure 1

Conceptual Proposition of the Study



Farm participation of women and youth in the family farm operation includes participation in: (1) pre and planting phase activities (seed/plant selection, nursery establishment, land preparation, planting and transplanting), (2) plant management and maintenance (weeding, fertilizer application, soil and conservation, and pruning), (3) harvesting and post-harvest activities (harvesting/picking, drying, hulling, sorting, storage, and packing), and (4) selling/marketing the product.

Agricultural household access to external services that increase agricultural utility through

improved productivity is also believed to have impact to succession decision. These external services include access to financing, inputs, business development services, post-harvest facilities, and capacity-building activities (training, exposure trips, and industry-wide gatherings).

DATA AND METHODOLOGY

This study was based on the 2018 household survey data[1] of the Philippine Coffee Advance and Farm Enterprise project of the ACDI/VOCA funded by the United States Department of Agriculture (USDA). Thus, the variables used in the analysis were limited to the items collected based on the questionnaire of the survey. The dataset contains observations from 755 coffee farming households from nine (9) regions of the Philippines. The data include information on demographics, farm characteristics, women and youth inclusion in decision-making, farm participation, and access to agricultural services. The focus actors are men (refers to the male head), women (the female head), and the youth (male and female members aged 15 to 29 years old). There are 13 agricultural decision items examined which include: crops to plant, technology to use, availing of credit, the use of borrowed funds, inputs to procure, selling of produce, price negotiation, value-adding, income distribution, use of income, equipment, and facilities to purchase, the use of the equipment, and labor management. The degree of decision-making involvement of men, women, and youth members is summarized using the household decision-making involvement (HDMI) index. Each decision item in which the household member has major involvement will be given 1 point, 0.5 for minor involvement and 0 for no involvement in decision-making. The individual decision-making index is calculated as the ratio of the points and the number of decision items? The calculated average index's value is the summation of the individuals' index divided by the number of individuals. The value of the index is between 0 and 1; the closer the value to 1 means higher decision-making involvement.

The measure of gender-specific farm activity participation was measured as the average percentage of the number of farm activities participated by men, women, and the youth. There are 13 farm activities included that are categorized as farm preparation (plant, land preparation, planting, and transplanting), farm maintenance and harvesting (weeding, fertilizer application, soil, and conservation, pruning, and harvesting), and post-harvest activities (drying, packing, and selling). To capture succession, the survey asked the question: "In general, aside from the household head and spouse, who among the members of the household are interested and willing to continue the farm?" The response is categorized into adult male and female and youth male and female. A "none" response if no household member is willing to continue the farm operation. To make this qualitative information viable for econometric analysis, a response of "none" is coded as 0 implies "no succession." Otherwise, a value of 1 when there is any adult and youth household member signifies the willingness to continue the farm after the retirement or the expiration of the parents.

The Probit model was used to estimate the likelihood and understand the factors of farm succession decisions among coffee farming households. A Probit model is one of the types of regression model with a dichotomous value of the dependent or response variable estimated using the method of maximum likelihood (ML). It allows for the testing of the effects of several variables on the probability of the response variables. The general form of the Probit regression model is given as:

$$\Pr(Y = 1 \mid X) = \Phi(X\beta)$$

The denotes the probability of a choice in which $Y = 1$, if the household has feasible farm succession, and 0 otherwise. The Φ is a non-linear function of $X\beta$ and hence, OLS cannot be used. The X is the vector of independent variables, and the β is a vector of estimated coefficients corresponding to the X.

1 There are assumptions in the use of the dataset, these are (1) that there are homogeneity among coffee farming households, (2) participants of the survey provided non-biased and accurate information during the interview, and (3) the data collection method was appropriate to solicit pertinent information.

In the Probit model, $\Phi(X\beta)$ can be expressed as $\Phi(X\beta) = \int_{-\infty}^{Z} \frac{1}{\sqrt{2\pi}} exp\left(-\frac{Z^2}{2}\right) dZ$ where $Z = X\beta$ this is the cumulative standard normal distribution function, and it ranges between zero and one for all values of $X\beta$. The error term follows a standard normal distribution, and the estimator is the maximum likelihood estimator. To estimate the parameters of the Z - scores, $Z = X\beta$ was expanded to determine the probability of farm succession ($FarSuc$) given a set of independent variables. The expanded model is as follows:

$$\begin{aligned} FarSuc = \beta_0 &+ \beta_1 age + \beta_2 educ + \beta_3 hhsize + \beta_4 perc_{farminc} + \beta_5 perc_{nonfarminc} \\ &+ \beta_6 yearsfarm + \beta_7 farmsize + \beta_8 credit + \beta_9 borrow_{need} \\ &+ \beta_{10} ext_{postfaci} + \beta_{11} ext\_support + \beta_{12} ext\_bds + \beta_{13} value_{add} \\ &+ \beta_{14} part_{men} + \beta_{15} part_{ymale} + \beta_{16} part_{women} + \beta_{17} part_{yfemale} \\ &+ \beta_{18} hdmi_{men} + \beta_{19} hdmi_{ymale} + \beta_{20} hdmi_{women} + \beta_{21} hdmi_{yfemale} \\ &+ \beta_{22} train_{men} + \beta_{23} train_{women} + \beta_{24} prodorg_{men} + \beta_{25} prodorg_{women} \\ &+ \beta_{26} trained\_youth + \beta_{27} outlook + \mu \end{aligned}$$

The $FarSuc$ is the dichotomous dependent variable with a value of 1 if household farm succession is feasible/likely, and 0 otherwise. The β_s are parameters to be estimated, and u is the error term. The independent variables include the age and formal education level of the male head, the size of the household, the percentage of household income from farming and the percentage of income from non-farming sources, the number of years of farming, and the size of the farms in hectares. The discreet independent variables include access to credit and financing (1 if the household has access, 0 otherwise), the need for more borrowing (takes the value of 1 if the household has needs for more capitalization/borrowing, 0 otherwise), access to post-harvest facilities (1 if with access, 0 otherwise), access to agricultural extension services (1 if with access, 0 otherwise), access to business development services (1 if with access, 0 otherwise), and doing value-adding activities (1 if the household is doing value-adding, 0 otherwise), The gender-specific variables include farm activity participation, and the degree of agricultural decision-making involvement of men, women, and the youth; men and women access and attendance to training and membership to producers organization. The outlook refers to the perceived five years industry outlook of the household head, which takes a value of 1 for optimistic, and 0 otherwise.

The estimated parameters of the Probit do not measure marginal effect, unlike the parameters generated in the linear regression model. The Probit marginal effect at the mean (AME) will be generated for both continuous and discreet independent variables for ease of interpretation of results. Diagnostic tests were conducted to ensure the validity of the estimates. Count r-squared (count R^2), McFadden Pseudo R^2, and Likelihood Ratio test were used to examine the goodness-of-fit of the model. The variance inflation factor (VIF) was used to examine the presence of multicollinearity or severe correlation among the regressors of the model. The area under the receiver operating characteristics (ROC) curve or the c-statistic was used to examine the predictive ability of the model. The estimation of parameters used Stata Version 15, licensed to the University of Southeastern Philippines.

RESULTS AND DISCUSSION

Demographic and Farm Characteristics of the Farmers

The mean age of coffee farmers is 52 years old; the recorded eldest farmer is 86 years old, while the youngest is 21 years old (Table 1). The average age of farmers in the country is 59 years old (Briones, 2017); thus, coffee farmers are relatively younger. In terms of the number of years of formal education, the mean years of schooling is seven (7) years. The average household size is around 4.4; this is the same as the average household size for the whole country in the 2015 census of 4.4, as reported by the Philippine Statistics Authority (PSA).

Table 1

Demographic and Farm Characteristics of Sample Coffee Farming Households

Variable	Mean	Std. Dev.	Min	Max
Age of male head (in years)	51.9	13.6	21.0	86.0
Education of male head (in years)	6.9	3.7	0.0	18.0
Household Size	4.4	1.8	2.0	14.0
Years of Farming	23.2	13.9	1.0	70.0
Farm Size (in hectares)	1.4	1.8	0.01	20.0
Coffee Yield/ha. (in MT)	0.48	0.57	0.002	4.67

Source: Survey data tabulation

On average, the coffee farming household has farming experience of around 23 years, cultivating mono-crop coffee or a combination of coffee and coconut, coffee and cacao, and fruit trees. There is around 83% of total respondents with more than 10 years of farming experience with a maximum value of 70 years. The average farm size of coffee farmers is 1.4 hectares, and this is almost the same as compared to the national average area per farm/holding of 1.29 hectares (PSA Census of Agriculture, 2012). About 86% of the total farms are below 3 hectares. Of these, 41% are between 1.0 hectares to 2.9 hectares, and 45% are below 1.0 hectares. A majority (61%) of the coffee farmers are members of organizations, of which 41% are member cooperative/farmer associations, and 9.3% are members of an indigenous peoples group.

The produce from coffee farming may come in different forms, such as cherries, green coffee beans (GCB), and dried cherries. The GCB is the standard form used to report coffee production. Thus, production was standardized into GCB. On average, coffee farmers produce 0.48 metric tons of GCB per hectare. Yield in the study area is relatively high as compared to the national average of 0.32 MT per hectare (PSA as cited in Philippine Coffee Industry Road Map 2017-2022). The difference is due to the exclusion of extremely low-producing provinces in the survey, such as MIMAROPA and Central Visayas, with an average yield of 0.10 MT/ha and 0.06 MT/ha, respectively (yield as reported by PSA, 2015). In terms of product value-adding, only around 13% of farming households are doing or engaged in value-addition activities. These value additions may include improving the quality of existing coffee products by improving post-production efficiency through adopting appropriate tools and equipment (dehulling, fermentation, and others), and by implementing processes to increase the price and expand the market.

Examining the composition of the household income of the coffee farmers revealed that their average household income is around PhP214,647 which is way below the average household income of the country at PhP313,000 (FIES, 2018). However, in terms of expenditure, a coffee farming household has sufficiently low household expenditure PhP130,981 as compared to the national average household expenditure of PhP239,000 (FIES, 2018). This resulted in relatively higher annual household savings of coffee farming households PhP83,665 as compared to the national average household savings of PhP75,000 (Table 2).

A breakdown of the household income revealed that around 57% is sourced from nonfarm activities, 37% from farm activities, and only about 6% from off-farm operations of the household. The primary type of nonfarm income sources of household members includes professional services (as doctors, teacher, and accountant, among others), employment in government or private, micro/small enterprises, and remittances, which contributed around 34%, 15%, 13%, and 10%, respectively. Income from crops, mainly coffee, contributed about 35% of the total income, while raising livestock and poultry contributed 2%.

Table 2

Average Annual Household Income and Expenditure (in Philippine Peso)

Items	Mean	% Share
Annual Farm Income	79,226.1	36.9
Income from Crops	74,630.4	34.8
Income from livestock and poultry raising	4,595.7	2.1
Annual Off-farm Income	11,795.7	5.5
Annual Nonfarm Income	123,625.3	57.6
Annual Total Income	214,647.0	
Annual Expenditure	130,981.8	
Annual Savings/Dissaving	83,665.26	

Source: Survey data tabulation

Gender-specific Farm Activity Participation

The gender-specific household participation rates in typical coffee farming activities can be categorized by stages of farm production. These include farm preparation activities, farm maintenance, harvesting, and post-harvest activities. Results revealed that men are dominant in participation in all types of farm activities of the households. On the other hand, women's participation is high in activities like harvesting cherries (75%), drying (67%), and selling (60%). Women's involvement in the coffee farming act as supplemental family labor for major farm activities such as harvesting, and pre-selling to selling activities (Table 3).

Table 3

Gender-specific Farm Activity Participation Rate (%), by Category

Items	Men	Women	Male Youth	Female Youth
Farm Preparation				
Seed/plant selection	28.8	6.7	10.8	0.7
Land preparation	40.4	12.1	22.5	4.1
Planting	63.8	27.6	35.1	14.4
Transplanting	34.6	13.3	18.1	3.0
Farm Maintenance and Harvesting				
Weeding	76.0	46.3	57.3	24.0
Fertilizer application	43.1	16.8	19.5	4.1
Soil and water conservation	29.7	14.2	10.8	2.6
Pruning	82.7	46.1	50.2	15.1
Harvesting/picking	87.4	75.0	71.8	42.4
Post-harvest Activities				
Drying	81.1	66.4	61.7	43.2
Packing	25.4	17.8	16.7	9.6
Selling	69.2	59.4	29.6	26.9

Source: Survey data tabulation

Women are more meticulous in harvesting; they tend to avoid strip harvesting (the inclusion of green beans in a branch with the red beans), thus minimizing loss, as compared to men and the youth. It was observed that in the majority of the households, men and women (both have more than 50% participation) have joint participation in activities that are crucial for coffee quality (harvesting and

drying) and the actual selling of the beans. Men and youth male members are observed to handle farm establishment and maintenance activities. In terms of youth participation, it shows that males are more active than females in all farm activities. Thus, the pattern of farm activity participation rate among household members revealed that at the initial stages of farm activities, men and youth males are more dominant in doing farm activities, while women and youth females handle household chores and other nonfarm activities. Women and youth females supplement farm labor from harvesting to post-harvest activities.

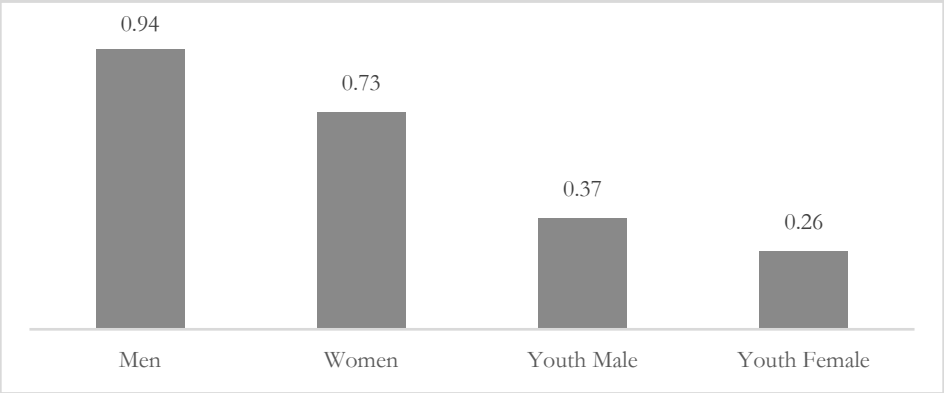
The average time spent per week by men doing farm activity is 29 hours a week, while women spent 19 hours a week doing farm work. The time spent by male youth is 18 hours a week, while female youth spend 12 hours per week. In general, it shows that women and female youth participation in farm activities, as well as time spent in farming, are relatively lower as compared to the time spent by their male counterparts. It implies that farming or agricultural work in the Philippines is still regarded as masculine. The nature and timing of women's involvement in farm activities might be the reason for the relatively lower time spent on the farm. To recall, women supplement farm labor during harvesting and post-harvest activities. These activities are shorter in days as compared to other activities that are commonly performed by men and male youth.

Degree of decision-making involvement

The average HDMI index of men across decision items is 0.94 (Figure 2). This means that men are planners, thinkers, and decision-makers in terms of general agricultural activities. The women's average index is 0.73, which is way above the minor involvement (Index=0.5). This implies that there is a considerable number of households that make joint decision-making on issues on agriculture. In terms of youth involvement, both males and females have limited involvement in household decision-making, recorded below the minor involvement index of 0.37 and 0.26, respectively.

Figure 2

Average Gender-Specific Agricultural Decision-making Index



To emphasize the area in which women and youth need involvement improvement, the disempowerment in the agricultural decision-making index was derived. The index was computed as:

$$\text{Index}_{dis} = \text{1- household decision-making index (HDMI)}$$

The closer the value of the index to 1, the lesser the involvement in decision-making, while the opposite means higher involvement. Men are seen to be the most empowered among household members across decision items. However, if we rank the decision items by $\text{Index}_{dis,}$ it shows that men's empowerment is very high on major farm field-related decision points such as what crops to plant,

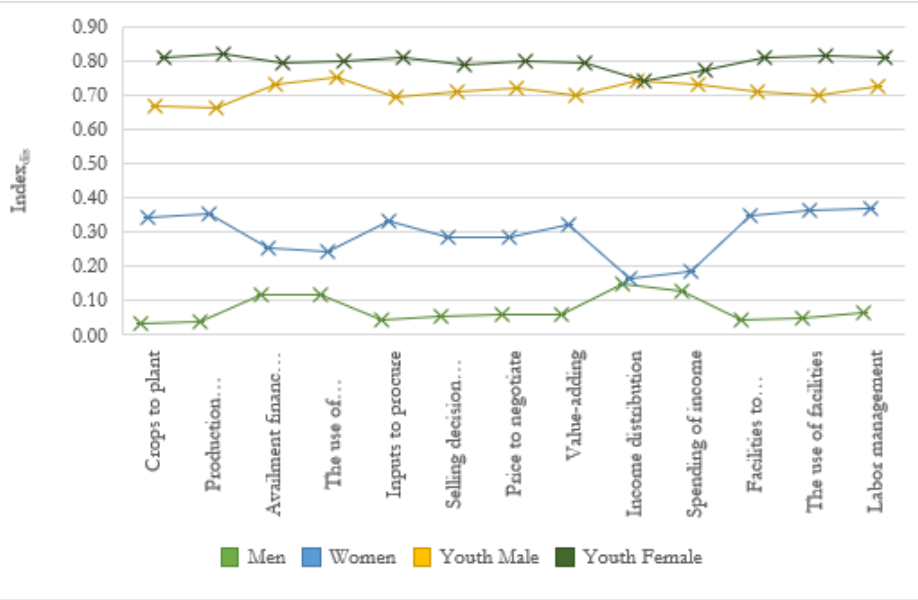
what production technology to use, what inputs to procure, and what farm equipment and facilities to procure. The same pattern is observed among young males (Figure 3).

On the other hand, women and female youths are consistently empowered on issues related to the financial decisions of the household. Women are most empowered in the decision on the distribution of income from farming production, on issues on how and where to spend the income from farming, including issues whether to avail of financial assistance or credit and how to use the borrowed funds. Youth female is consistently having higher disempowerment across the decision points.

Thus, gender role seems to affect decision-making dynamics within the household that is based on the traditional household model. The degree of decision involvement reflects the gender roles of the household members, like farm technology to use, use of farm equipment and machinery, and crops to plant, which are seen as masculine; men and youth male members have higher decision involvement on these decision points. On the other hand, women and youth females exert more involvement in decision points that are seen as feminine, like borrowing funds, availing of financial assistance, and the use of income.

Figure 3

Household Disempowerment in Agricultural Decision-making (Index$_{dis}$)



The Likelihood of Farm Succession

Among the surveyed households, 72% have children willing and interested to continue the farm. The majority (61%) are adult children, 24% are young males, and only 13% of households have young females interested in continuing the farm operation. The Probit estimation was used to empirically examine factors affecting the likelihood of having children interested in succeeding on the farm. The results presented in Table 4 are the estimated marginal effects evaluated at the variable mean and presented with different significance levels. The marginal effects of discreet choices (^{ab}) are the change from 0 to 1. The result revealed that households with educated male heads have a lower likelihood of farm succession. In terms of farm characteristics, farm size positively affects the likelihood of farm succession.

Furthermore, the need for credit/borrowing in the household positively and significantly affects the likelihood of succession. The need for additional capital represents a certain level of household farm activity, and it was observed that this need for borrowing is intended for production expansion

and to support the value-adding activities of the household. Thus, higher farm activity and the need to increase farm efficiency enhances the likelihood of farm succession.

A majority (72%) of the coffee farming households do not own post-harvest equipment, and only 17% have access to external support on farming equipment like milling machines, dehullers, and solar dryers. Furthermore, only around 13% have access to extension services. Though both access to post-harvest and extension services is low, both were empirically proven to increase the likelihood of farm succession.

The level of farm activity participation of men, women, and the youth positively affect the likelihood of succession. In contrast, the degree of decision-making involvement turns out to be insignificant. The result implies that any intervention that enhances the participation of men, women, and the youth to farm activities of the households, would likely result in feasible farm succession. Furthermore, the membership of the PDM to producer organization increases the likelihood of succession, as well as women's access and participation in training.

Table 4

Estimated Marginal Effects after Probit Estimation

Variables	Marginal Effects (dy/dx)	Standard. Error	Variable Mean(X)
Age	-0.0024^{ns}	0.0015	51.85
Educ	-0.0126**	0.005	6.9
Hhsize	-0.0040 ^{ns}	0.0095	4.38
Farm income (%)	0.0022**	0.001	44.46
Nonfarm income (%)	0.0028***	0.0009	45.64
Yearsfarm	-0.0001 ^{ns}	0.0015	23.19
Farm size	0.0397***	0.0142	1.4
Credit ^{ab}	-0.0551 ^{ns}	0.0557	0.13
Borrow_need ^{ab}	0.0769**	0.0331	0.5
Ext_bds ^{ab}	0.1022 ^{ns}	0.117	0.02
Ext_postfaci ^{ab}	0.1407***	0.039	0.16
Ext_support ^{ab}	0.0926*	0.0518	0.12
Value_add ^{ab}	0.0688 ^{ns}	0.0595	0.12
Part_men	0.0016**	0.0008	37.09
Part_ymale	0.0021*	0.0012	8.43
Part_women	0.0019*	0.001	15.88
Part_yfemale	0.0061***	0.0023	2.7
HDMI_men	0.0536 ^{ns}	0.0539	0.83
HDMI_ymale	0.0055 ^{ns}	0.0744	0.11
HDMI_women	-0.0031 ^{ns}	0.0441	0.55
HDMI_yfemale	-0.0121 ^{ns}	0.0958	0.05
Train_men ^{ab}	0.0226 ^{ns}	0.0396	0.34
Train_women ^{ab}	0.2354***	0.031	0.32
Prodorg_men ^{ab}	0.1965***	0.0341	0.28
Prodorg_women ^{ab}	-0.1124 ^{ns}	0.0777	0.1
Trained_youth	0.0132 ^{ns}	0.1159	0.03
Outlook ^{ab}	0.0205 ^{ns}	0.0327	0.45
Pr (Mean)	0.7959		

*Note: *** significant at 1% level of alpha, ** significant at 5% level, * significant at 10% level, ns denotes not significant. The (^{ab}) dy/dx is for the discrete change of the dummy variable from 0 to 1. L.R. is the likelihood ratio statistic, while VIF is the variance inflation factor.*

To examine the validity of the estimates, several diagnostic tests were conducted and presented in Table 5. The variance inflation factor was used to examine the presence of multicollinearity in the model. The results revealed that all variables have VIF less than 10, with an overall mean of 1.44. The model was estimated with the heteroskedasticity-robust standard errors to remedy any problem of heteroskedasticity. As a rule of thumb, the author assumed that heteroskedasticity is present in the model (Stock & Watson, 2003). In terms of the goodness-of-fit of the model, it shows that the model has a statistically significant likelihood ratio (L.R.) statistic, which implies that the estimated model fitted the data well. Furthermore, the count R^2 reveals that the succession model correctly predicted around 81% of all outcomes, with 91% with succession correctly classified (sensitivity), and 57% without succession group correctly classified (specificity) by the model.

Table 5

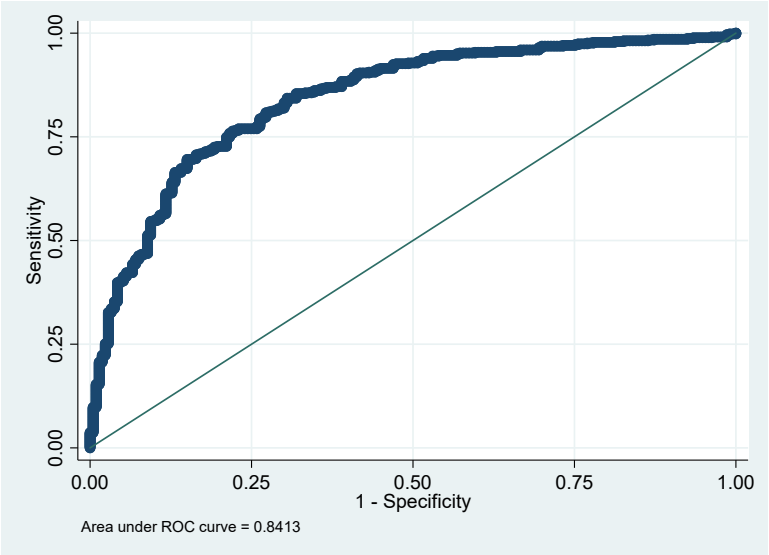
Results of the Diagnostic Test

Test	Result
Count R^2:	0.809
Sensitivity	90.41%
Specificity	56.81%
McFadden's R^2:	0.265
LR Statistic	237.872***
VIF>10	None
Mean VIF	1.44
Number of Iterations	4

*Note: *** significant at 1% level of alpha, L.R. is the likelihood ratio statistic, while VIF is the variance inflation factor.*

To further examine the model's predictive ability, the study calculated the area under the receiver operating characteristics (ROC) curve or the c-statistic (Figure 4). It is one of the most critical measurements for checking the model's classification performance. It measures how well the model discriminates between cases and non-cases. The result is visually presented in Figure 3. The c-statistic of the model is estimated at 0.84; this means that the succession model of this study is not worthless. The rule of thumb for this test is that the c-statistic should be greater than 0.70; if below this threshold, the model does no better than random chance.

Figure 4. *Estimated Area under the ROC Curve of the Model*



CONCLUSION AND RECOMMENDATIONS

The study was undertaken to explore other factors that might affect farm succession. The literature established the effect of demographics, farm characteristics, geographical location, and access to employment, among others. This is an attempt to understand how gender-specific farm-level activity participation, degree of decision-making involvement, and access to agricultural services affect farm succession. The study found that men are dominant in household decision-making on issues about agricultural enterprise and are the leaders in participation in all farm activities of the household. The empowerment of men is high on decision points related to crops to plant, technology to use, inputs, and farm equipment and facilities to procure.

On the other hand, the empowerment of women and female youth is relatively high on financial decision distributions of income and how and where to spend the income. Women have higher involvement, particularly in decisions about availing credit or financial assistance and the use of borrowed funds. Women involved in coffee farming usually act as supplemental family labor for major farm activities such as harvesting and pre-selling to selling activities. The majority of households are practicing joint decision-making, as reflected in the 0.73 mean HDMI index of women. Men and women complement each other (more than 50% participation) in activities crucial for coffee quality (harvesting and drying) and the actual selling of the beans.

Larger farms and robust enterprise activity positively influence farm succession, as evidenced by the increased need for credit to support value-adding activities. Therefore, providing farmers with training and financial assistance to adopt value-adding practices and encouraging them to access credit to support their value-adding activities would enhance farm succession rates. Access to post-harvest facilities and extension services significantly increases the likelihood of farm succession. Thus, investing in developing post-harvest facilities and expanding the reach of extension services to provide farmers with up-to-date information and technical advice would enhance succession. Social involvement of the male head through membership in the producer's organization and women's access to training increases the likelihood of succession. Improving the household's farm and nonfarm income increases the likelihood of succession. Participation in farm activities of household members is proven to increase the likelihood of farm succession significantly. Thus, intervention to enhance agricultural activities' inclusiveness for women and the youth would likely result in feasible farm succession. They are encouraging the active participation of all household members in farm activities to foster a sense of ownership and responsibility for the family farm. The degree of gender-specific decision-making involvement and the general industry outlook of the male head do not affect the likelihood of succession.

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CONFLICT OF INTEREST

The author reports no potential conflict of interest.

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