

THE CAUSALITY AND THRESHOLD LEVELS OF INNOVATIVE WORK AND ENTREPRENEURIAL BEHAVIOURS OF MILLENNIAL FARMERS: DO FAMILY CHARACTERISTICS MATTER?

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ABSTRACT

Background: Millennial farmers' innovative and entrepreneurial behaviors have been discussed in the literature. However, the contribution of farmer family characteristics is widely ignored.

Purpose: Therefore, this study investigates the causality between millennial farmers' innovative and entrepreneurial behaviors by considering family characteristics in the Boyolali and Klaten regencies.

Design/methodology/approach: The estimation methods used are Granger Causality Test and Cross-Section Threshold Regression.

Findings/Result: The study findings reveal that innovative work has a one-way causality with entrepreneurial behavior, farmer age has a one-way causality with innovative and entrepreneurial behaviors, and the number of family members has a one-way direction with entrepreneurial behavior. Threshold levels of innovative work and entrepreneurial behaviors were 34 and 71, respectively. In simple terms, the level of entrepreneurial behavior is higher and better than the level of innovative behavior of millennial farmers. The study findings imply that the local government should facilitate and assist the process of improving the innovative and entrepreneurial behaviors of millennial farmers in the regions.

Conclusion: This research enhances the literature on innovative work behavior and entrepreneurial behavior by showing their relationship. This research also shows the contribution of family characteristics to innovative work behavior.

Originality/value (State of the art): The study of the causality of innovative and entrepreneurial behaviors of millennial farmers by considering family characteristics has yet to be widely conducted.

Keywords: innovative behavior, entrepreneurial behavior, millennial farmers, causality, threshold

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INTRODUCTION

Despite only contributing 14.43% to the gross domestic product (GDP), the agricultural sector remains a mainstay in Indonesia's economic development (Bappenas, 2014). Furthermore, the contribution will decrease at the level of 12.40% in 2022 (Central Bureau of Statistics, 2023). The low contribution of the agricultural sector to GDP is partly due to agricultural labor issues, environmental degradation as a result of the green revolution, and poverty caused by declining productivity and policies less favorable to farmers. In particular, Sudaryanto et al. (2021) found that economic diversification is one of the solutions to overcome poverty in the agricultural sector. Besides, they argued that the rural transformation can be reflected in the form of changes in the value of agriculture from staple foods to high-value commodities. This phenomenon leads to growing rural household income and poverty reduction in rural areas. The change in the value of agriculture towards high-value agricultural commodities that can overcome poverty in the agricultural sector shows that the shift from conventional to modern agricultural economic behavior is an absolute requirement for transformation in the agricultural sector.

The demand for the transition from conventional agriculture to modern agriculture requires the ability of agricultural sector actors to face future challenges when entering the industrial revolution. Another problem in the industrial revolution is how the agricultural sector can attract the next generation of farmer families to become the next young farmers or millennial farmers in the current era. Most farms in Indonesia are family farms. In the last ten years (2003–2013) of farming households data, the number of farming households in Indonesia is decreasing (Syahyuti, 2016). Bappenas (2014) has elaborated on a decrease in farmer households from 31.2 million (2003) to 26.1 million (2013). However, the decline in farming households was followed by an increase in agricultural companies over the same period, from 4,011 companies (2003) to 5,486 companies (2013). In particular, the smallholders can be characterized as having a land area of less than 0.5 ha, using only labor from within the family, using low mechanization, prioritizing family food needs, and growing staple food commodities primarily for the family (Syahyuti, 2016).

Syahyuti (2016) provided the future direction of agriculture: it is time for farms managed by families

to also shift into agricultural companies, namely farms oriented towards profitable businesses. The demand for agricultural transformation towards modern agriculture is increasingly necessary to appeal to the younger or millennial generation. The younger generation's interest in agriculture arises when the farm is managed in a modern way with a combination of entrepreneurship in the agricultural system (Widiyanti et al. 2018). They have addressed agricultural business in an appropriate way such as production (creativity, cooperation, and management), capital (partnerships, innovative products, and bank loans), and marketing (online marketing, partnerships, and networks) (Nurlaela et al. 2023). Silva (2017) emphasized the importance of an efficient and profitable way of farming to appeal to the millennial generation. Efficiency and profit can be obtained through technology, innovation, and entrepreneurship.

Understanding farmers' innovative and entrepreneurial behaviors toward more efficient agriculture by considering the global environment is essential for academics, practitioners, and policymakers. Li et al. (2022) reviewed several studies examining the relationship between innovation and entrepreneurial behavior as a prerequisite for business success. Moreover, Endres & Woods (2010) suggested that entrepreneurial behavior consists of motives and actions that enable an entrepreneur to make decisions as a creator of profitable opportunities and as an exploiter of these opportunities. Entrepreneurial leadership can foster and strengthen innovative behavior (Malibari & Bajaba, 2022). If most of the existing literature highlights entrepreneurial and innovative work behaviors in companies with large and complex organizations, what about those of micro-enterprises such as family farms? The household (family) farm can be defined as an agricultural enterprise characterized by the overlap between three functional units, namely: production unit (farm), consumption unit (household), and kinship unit (family). In its regeneration, a family farm requires labor from family members (Djurfeldt, 1996).

Entrepreneurial behavior is determined by entrepreneurial attitudes and intentions (Abun et al. 2018, Bui et al. 2020). Entrepreneurial behavior is also influenced by individual, situational, psychological, social, and experiential factors (Wanyonyi & Bwisa, 2015). In entrepreneurial agriculture, farming is not only a meaningful way to increase farmers' income

levels, but also an important step to encourage the revitalization of rural talents (Li et al. 2022). Faria & Mixon (2016) identified entrepreneurial farmers as those seeking more efficient and profitable farming methods. Market-orientated entrepreneurial farmers can look forward and accept calculated risks, create new products, adopt new technologies, and innovate them in their use. They are more concerned about the long-term viability of their business, thus willing to make efforts to ensure its sustainability.

Kahan (2012) noted that the behaviors of entrepreneurial farmers can be interpreted as having the skills to capture value in the value chain, improving and managing efficiency in production, promoting new technologies and innovations, maintaining land management, improving management skills, having trust and respect in the business, promoting group entrepreneurship, and managing farm businesses according to long-term plans. In another study, Puspitasari et al. (2022) examined the entrepreneurial behavior of horticultural farmers and found similar traits of them being diligent, responding to opportunities, innovative, risk-taking, and independent. In their research on strawberry farming, Besides, farmers' entrepreneurial behavior was shown by the characteristics of risk-taking, responding to opportunities, innovation, and independence (Wijayanti et al. 2022).

Innovative behavior is an individual's ability to generate, promote, and implement solutions, create and communicate ideas, and involve others in the transformation process (Lukeš, 2013). Dej Jong & Hertog (2008), De Jong & Hertog (2010), and Heliawaty et al. (2020) reported four stages of innovative work behavior include exploring opportunities, championing, generating ideas, and implementing them. Shah et al. (2022) combined several research results and determined five stages of innovative work behavior, which include opportunity exploration (OE), idea generation (IG), idea promotion (IP), idea realization (IR), and reflection (Ref). Besides, several factors can influence a person's innovative behavior. Srirahayu et al (2023) mapped three variables supporting innovative work behavior, namely: leadership, organization, and individual characteristics. On the other hand, Udin & Shaikh (2022) reported determinant factors of knowledge sharing and work passion on innovative work behavior such as innovative, creative farmers (exploring opportunities), seeking new ideas for farming, and improving personal and farm performance.

Innovative farmers can motivate and stimulate their workforce, encourage them to generate their own ideas, and show initiative and proactive attitudes when applying new technologies and practices (Cofre-Bravo et al. 2019; and Aguilar-Gallegos et al. 2015). Innovative farmers also adopt new technologies to gain profits, strive for efficiency, and adapt to the changing environment (Hermans et al. 2017).

Several studies have found a correlation between farmer and farm characteristics with farmer's innovativeness and entrepreneurship. Walder et al. (2019) and Yagüe-Perales et al. (2020) in their research showed that farmers' age is related to their innovation activities. In addition to farmers' age, farm size also influences their innovative behavior (Yagüe-Perales et al. 2020, Supatminingsih & Tahir, 2022). The family also plays a role in shaping farmers' innovativeness and entrepreneurship (Dumasari, 2014, Mukti et al. 2022). Mukti et al. (2022) found that new business ideas or business activities generally involve family members or farmer households.

This study fills the empirical gaps in two ways. First, this study examines the linkage between innovative work and entrepreneurial behavior by considering the family characteristics of millennial farmers. Second, this study employs a cross-section threshold regression to provide better levels of innovative work and entrepreneurial behavior for millennial farmers. Therefore, this study investigated the causality and threshold levels of innovative work and entrepreneurial behavior of millennial farmers in the Boyolali and Klaten Regencies. Several factors of farmers' family characteristics were set as explanatory variables covering farmers' age, number of family members, and family farm size.

The contribution of this study can be explained in several ways. First, the study of the causality of innovative and entrepreneurial behaviors of millennial farmers by considering family characteristics has yet to be widely conducted. Second, the measurement of millennial farmers' innovative behavior level is determined by several factors: opportunity exploration, idea generation, championing, and application. Third, the policymakers can facilitate and gradually assist the process of instilling and sustaining innovative and entrepreneurial behaviors among millennial farmers in the Boyolali and Klaten Regencies.

METHODS

This study uses the explanatory survey method. The respondents in this study were millennial farmer members of three farmer groups that had received entrepreneurship training and been assisted by the Institute for Rural Technology Development (LPTP) of Surakarta. The three farmer groups are the *Karya Muda* farmer group, which has 18 members; the Sekar Dewani Women Farmer Group, which has 15 members; and the Margo Mulyo farmer group, which has 10 members. *Karya Muda* and *Sekar Dewani* farmer groups are from Mriyan Village, Tamansari District, and Boyolali Regency, while the Margo Mulyo farmer group is from Mundu Village, Tulung District, and Klaten Regency. In total, the number of respondents in the study was 43 farmers. The purposive sampling technique was used with the following criteria: millennial generation farmers who have participated in entrepreneurship training conducted by LPTP Surakarta or other parties. The data collection was conducted in November 2020. The data was collected by conducting direct interviews using questionnaires regarding farmers' perceptions of their innovative and entrepreneurial behavior. The measurement of farmers' innovative work and entrepreneurial behavior variables is explained as follows (Table 1).

In simple terms, the level of interrelationship among the variables above can be explored using the correlation

method. The correlation calculation results show that the correlation level between IB and EB is 0.06. This means that the correlation between the two is positive but very weak. Furthermore, the correlation between IB and A, F, and L are -0.27, -0.30, and 0.14, respectively. This means that an increase in millennial farmers' labor innovation is responded to by a decrease in farmers' age level and number of family members. In contrast, the correlations between EB and A, F and L are 0.13, 0.06, and 0.28, respectively. Such a condition describes that higher levels of entrepreneurship are responded to by an increase in the farmer's age and number of family members. Interestingly, an increase in innovative work and entrepreneurial behaviors is responded well by farm size.

The Econometric Technique

Previous empirical studies emphasize the contribution of entrepreneurial behavior and innovative behavior in an agricultural business (Amir, 2015; Wanyonyi & Bwisa, 2015; Faria & Mixon, 2016; Khoshmaram et al. 2020; Li et al. 2022; Puspitasari et al. 2022; and Wijayanti et al. 2022). However, the causality and threshold regression of entrepreneurship and innovative behaviors for millennial farmers are largely ignored. Therefore, this study investigates the causality and threshold level using the Granger Causality Test and Cross-Section Threshold Regression.

Table 1. Research variables

Variables	Description	Mean	Minimum	Maximum
IB	Innovative work behaviour was measured using four indicators, namely (1) exploring opportunities for problem-solving (opportunity exploration), (2) the ability to build new ways to address needs (idea generation), (3) seeking support and building cooperation (championing) and (4) putting new ideas into practice (application). The four indicators were explored in 18 question items with three alternative answers: often (score 3), sometimes (score 2), and never (score 1).	41	28	54
EB	Entrepreneurial behaviour was measured using eight indicators: (1) capturing the value chain, (2) improving efficiency, (3) adopting innovation, (4) land management, (5) having management skills, (6) trust and respect in business, (7) willingness to foster group entrepreneurship and (8) having a long-term business plan. The eight indicators were explored in 30 question items with three alternative answers: often (score 3), sometimes (score 2), and never (score 1).	70	52	79
A	Age of the farmer. Data in years.	32	17	43
F	Number of family members. Data in units of people.	3	1	6
L	Farm size. Data in square meters	3120	500	15000

The Granger Causality Test reveals the relationship between innovative work (IB) and entrepreneurship behavior (EB) by considering farmer family characteristics (X). The family characteristics can be denoted by the age of the farmer, the number of families, and farm size. Equation (1) elaborates on the causality between innovative work and entrepreneurship behavior. Meanwhile, Equation (2) describes the causality between entrepreneurship behavior and innovative work.

$$IB_i = \alpha_0 + \beta_1 EB_i + \beta_2 X_i + \varepsilon_i \quad (1)$$

$$EB_i = \alpha_0 + \beta_1 IB_i + \beta_2 X_i + \varepsilon_i \quad (2)$$

The hypotheses of Equation (1) and (2) can be written in the several ways. First, α_0 should be more than ($>$) 0. The α will contribute significantly and positively to IB and EB when the independent variables are constant. Second, β_1 and β_2 should be more than ($>$) 0. The β_1 denotes the significant and positive impact of EB on IB or IB on EB (the causality effects). Besides, the β_2 indicates the significant and positive impact of farmer family characteristics. The farmer family characteristics include the age of the farmer, number of family members, and farm size.

This study employs a Cross-section threshold regression (Hansen, 2000). The basic equation of the threshold regression of the innovative behavior and entrepreneurship behavior can be formulated as follows:

$$IB_i = \alpha_0 + \beta_1 EB_i + \beta_2 A_i + \beta_3 F_i + \beta_4 L_i + \varepsilon_i \quad (3)$$

$$EB_i = \alpha_0 + \beta_1 IB_i + \beta_2 A_i + \beta_3 F_i + \beta_4 L_i + \varepsilon_i \quad (4)$$

IB and EB are innovative behaviors and entrepreneurship behaviors for 43 millennial farmers. Besides, A, F, and L denote the age of the farmer, number of families, and farm size, respectively. The i equals 1, 2, ..., n. The α and β are constant and parameters of independent variables, respectively. The ε is an error term. The hypotheses of Equations (3) and (4) are $\beta_2 - \beta_4$ should be more than ($>$) zero or have a positive impact on innovative and entrepreneurship behaviors.

Equations (3) dan (4) can be rewritten to express the cross-section threshold regression model as follows:

$$IB_i = (\beta_1 EB_i + \lambda_1 X_i)I(EB_i \leq \gamma) + (\beta_2 EB_i + \lambda_2 X_i)I(EB_i > \gamma) + \varepsilon_i \quad (3)$$

$$EB_i = (\beta_1 IB_i + \lambda_1 X_i)I(EB_i \leq \gamma) + (\beta_2 IB_i + \lambda_2 X_i)I(EB_i > \gamma) + \varepsilon_i \quad (4)$$

EB in the Equation (5) and IB in the Equation (6) are the threshold variables. X denotes explanatory variables, namely: A, F, and L. The γ shows the unknown threshold parameter, while $I(.)$ equals an indicator function of low or high regime. Meanwhile, ε is the error term.

The Equations (5) and (6) can be formulated in threshold form, resulting in:

$$IB_i = \begin{cases} \beta_0^1 + \beta_1^1 EB_i + \beta_2^1 X_i + \varepsilon_i, & EB_i \leq \gamma \\ \beta_0^2 + \beta_1^2 EB_i + \beta_2^2 X_i + \varepsilon_i, & EB_i > \gamma \end{cases}$$

$$EB_i = \begin{cases} \beta_0^1 + \beta_1^1 IB_i + \beta_2^1 X_i + \varepsilon_i, & IB_i \leq \gamma \\ \beta_0^2 + \beta_1^2 IB_i + \beta_2^2 X_i + \varepsilon_i, & IB_i > \gamma \end{cases}$$

β_1^1 equals the parameter for millennial farmers with a low regime, while β_1^2 denotes the parameter for millennial farmers with a high regime.

Amir (2015), Wanyonyi & Bwisa (2015), Faria & Mixon (2016), Khoshmaram et al. (2020), Li et al. (2022), Puspitasari et al. (2022), and Wijayanti et al. (2022) elaborated the significant impact of innovative and entrepreneurial behaviors on agricultural business. The condition indicates that innovative behavior will stimulate entrepreneurial behavior, and vice versa. Therefore, this study investigates the causality between those variables. Besides, the farmer characteristics will be set as explanatory variables such as age of farmer, number of family, and farm size. The causality between those variables by considering farmer characteristics can be formulated into a research framework (Figure 1).

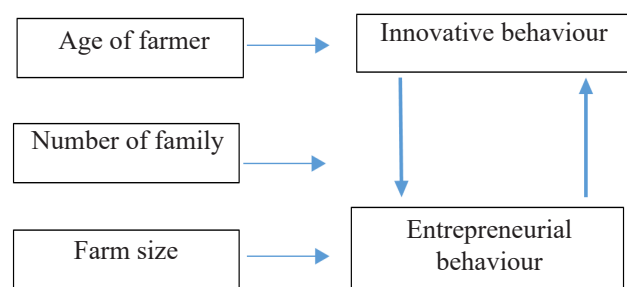


Figure 1. The research framework

The research framework can be written in the form of hypothesis development as follows:

- H1: Innovative behavior and entrepreneurship behavior have two-way causality
- H2: The age of the farmer has a significant impact on innovative (entrepreneurial) behavior
- H3: The number of the family has a significant impact on innovative (entrepreneurial) behavior
- H4: The farm size has a significant impact on innovative (entrepreneurial) behavior

RESULTS

The Main Result

This study selects two dependent variables innovative behavior (IB) and entrepreneurial behavior (EB). Besides, there are three independent variables, namely: the age of the farmer (A), the number of families (F), and farm size (L). The descriptive statistics of those variables can be seen in Table 2. The table points out that the minimum values of IB and EB are about 28 and 52, respectively. Meanwhile, the maximum values of the two variables are 54 and 79, respectively. The condition means that the value of EB is higher than that of IB.

The farmers have an age between 17–43 years old. Interestingly, they have several families between 1 –

6 persons. In addition, the farm size is between 500-15000 square meters.

The relationship between innovative work and the entrepreneurial behaviors of millennial farmers in Boyolali and Klaten Regencies can be explored using a causality approach. Therefore, the Granger Causality test was applied with the results as shown in Table 3. This table reveals that innovative behavior (IB) has a one-way causality to millennial farmers' entrepreneurial behavior (EB) at the 10% significance level with lag 1. This finding means that a higher level of innovative behavior will have implications for increasing the entrepreneurial behavior of millennial farmers.

Age of millennial farmers (A) has a one-way causality to innovative behavior at the 1% significance level with lag 1 and 2. This means that an increase in the age of millennial farmers can lead to an increase in innovative behavior. However, millennial farmer age only has a one-way causality to entrepreneurial behavior at the 10% significance level with lag 2. The difference in the causality results of millennial farmers' age on innovative and entrepreneurial behavior shows that innovation is faster than entrepreneurship. Furthermore, the number of family members of millennial farmers (F) has a one-way causality to entrepreneurial behavior at the 10% significance level with lag 1. Consequently, millennial farmers need family support to achieve a faster entrepreneurial behavior process and level.

Table 2. Descriptive Statistics

Variables	Mean	Std Dev.	Min.	Max.
Innovative behavior (IB)	41	6	28	54
Entrepreneurial behavior (EB)	71	7	52	79
Age of farmer (A)	32	7	17	43
Number of family (F)	4	1	1	6
Farm size (L)	3121	2614	500	15000

Table 3. Results of Granger Causality Test Estimation

Variables	Lag 1	Lag 2
IB causes EB	(3.14)*	-
A causes IB	(9.13)***	(7.78)***
A causes EB	-	(2.79)*
F causes EB	(3.51)*	-
Observations	42	41

Note: The t-statistics are reported in the parentheses (). ***, ** and * are the significant level at the 1%, 5% and 10%, respectively

Table 4 reveals the threshold levels of innovative work and entrepreneurial behaviors among millennial farmers in the Boyolali and Klaten regencies. The threshold level of innovative work is 34. This condition indicates that the level of innovative behavior of millennial farmers in both regions is relatively low. In addition, this level of innovative behavior can have implications for the level of entrepreneurial behavior. Meanwhile, the farmland ownership factor significantly and positively affects entrepreneurial behavior under Global OLS and Regime 2. The number of family members significantly and positively impacts entrepreneurial behavior under Regime 1. The total number of observations is 43 respondents, distributed as follows: 7 respondents in Regime 1 and 36 respondents in Regime 2.

Furthermore, the threshold level of entrepreneurial behavior is 71. This confirms that the level of entrepreneurial behavior is relatively high. In addition, the threshold estimation results based on Regime 2 explain that all family characteristic factors have positive implications for the level of innovative behavior of millennial farmers. For example, farmers' age and the number of family members significantly and negatively affect the level of innovative behavior. Conversely, farm size has a significant and positive impact on the level of innovative behavior. The total number of respondents is 43, with 22 respondents in Regime 1 and 21 respondents in Regime 2.

Robustness Check

The estimation results of the Granger Causality Test and Cross-Section Threshold Regression show that the factors of family characteristics can determine the level of innovative behavior of millennial farmers. In contrast, these factors are not proven to significantly affect millennial farmers' entrepreneurial behavior. Therefore, a robustness check using cross-section estimation could be performed on the estimation findings.

Table 5 describes the results of the cross-section estimation of the millennial farmers' innovative and entrepreneurial behaviors in the Boyolali and Klaten Regencies. The table reveals that the farmer's family characteristics determine the level of innovative behavior of millennial farmers. For example, the farmer's age and the number of family members have a significant and negative effect on millennial farmers' innovative behavior level. This means that a higher age and number of family members can create a relatively lower quality of innovative behavior. In contrast, the farmland area has a significant and positive impact on the innovative behavior of millennial farmers. Consequently, a larger farmland area can encourage an increase in the quality of millennial farmers' innovative behavior.

Table 4. Threshold levels of innovative work and entrepreneurial behaviors of millennial farmers

	Threshold Level of Innovative Work (IB)			Threshold Level of Entrepreneurship (EB)		
	Global OLS	Regime1 (q<=34)	Regime2 (q>34)	Global OLS	Regime1 (q<=71)	Regime2 (q>71)
Intercept	70.135*** (4.170)	77.616*** (25.191)	74.502*** (5.061)	51.029*** (4.377)	37.959*** (5.226)	56.699*** (6.163)
A	-0.089 (0.129)	-1.044 (0.919)	-0.106 (0.115)	-0.186 (0.127)	-0.069 (0.122)	-0.342* (0.182)
F	0.208 (0.900)	8.112*** (2.472)	-0.868 (1.013)	-1.575** (0.721)	0.229 (1.039)	-2.038** (0.857)
L	0.002** (0.001)	-0.002 (0.001)	0.003*** (0.001)	0.002** (0.001)	0.002** (0.001)	0.002** (0.001)
R-squared	0.257	0.601	0.105	0.299	0.257	0.308
Heteroscedasticity Test (P-Value)	0.424			0.168		
Threshold Estimate	34			71		
0.95 Confidence Interval	[32,47]			[63,77]		
LM-test for no threshold	7.475			7.623		
Bootstrap P-Value	0.312			0.250		
Observation	43	7	36	43	22	21

Note:

1. The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.
2. The dependent variable of a threshold level of innovative work is entrepreneurship
3. The dependent variable of a threshold level of entrepreneurship is innovative work

Table 5. Results of Cross-Section Estimation

Variables	IB	EB
C	50.39 (13.59)***	67.25 (15.76)***
A	-0.17 (-2.06)**	0.02 (0.18)
F	-1.43 (-1.90)*	0.15 (0.18)
L	0.01 (1.80)*	0.01 (1.63)
Adjusted R-squared	0.14	0.01
F-statistics	3.36**	1.14
Observations	43	43

Note: The t-statistics are reported in the parentheses (). ***, ** and * are the significant level at the 1%, 5% and 10%, respectively

The findings of causality contribute to the existing literature on innovative work and entrepreneurship behaviors for millennial farmers. However, the literature is concerned with enhancing and identifying the determinant factors of innovative work and entrepreneurship behaviors in agricultural business (Amir, 2015; Wanyonyi & Bwisa, 2015; Faria & Mixon, 2016; Khoshmaram et al. 2020; Li et al. 2022; Puspitasari et al. 2022; and Wijayanti et al. 2022). Consequently, the findings can be stimulated to estimate the certain (optimal) level of innovative work and entrepreneurship behaviors. Therefore, this study estimates the threshold levels of these behaviors for 43 farmers using Cross-Section Threshold Regression.

This study reveals that a higher level of innovative work leads to a higher level of entrepreneurial behavior in millennial farmers. Besides, the age of millennial farmers stimulates a higher level of innovative work. In particular, innovative work can also be determined by farmer family characteristics. There are two factors affecting farmer innovative work the uncertain nature of the agricultural sector (climate and market uncertainty) and the explosion of pests. The implementation of an innovative practice can be stimulated by the trust of farmer families. For example, one of the millennial farmers in Mriyan Village stated that after his grandfather handed over the management of coffee land to him, he began to explore the land by intercropping with pepper plants. Likewise, the increase in the age of farmers is in line with the increase in their innovative work. Furthermore, intercropping by farmers increases their ability to apply risk management in their farms. Kahan (2012) noted that intercropping is a form of risk management in farming. The farmer experience will stimulate their creativity in the work (Li, 2022).

Furthermore, the level of entrepreneurial behavior is more than the level of innovative work. The condition means that the millennial farmers can adopt and practice entrepreneurship in agricultural business. They have a long-run business orientation to improve the quality of life and enhance agricultural productivity. However, they still face some constraints to enlarge the size of agricultural businesses using innovative work. The constraints include the limited programs of training and empowerment for farmers from the local and central governments, the limited business capital under low-interest rates for farming, and the higher level of uncertainty in agricultural business such as climate change and technology. Therefore, policymakers should pay more attention to stimulating and facilitating millennial farmers' farming to guarantee a higher level of entrepreneurship and innovative behaviors in the long run.

The current literature argues that entrepreneurial behavior at the village level can be determined by politics, social networks, and economics (Handono et al. 2023). In the context of the progress of agricultural business, entrepreneurial behavior can be linked with innovative behavior. Other previous empirical studies also emphasized the significant contribution of innovative behavior (work) and entrepreneurial behavior on farmers/agriculture. For example, Dahiya & Raghuvanshi (2022) set five determinants of innovative work behavior including opportunity exploration, idea generation, information investigation, idea championing, and idea implementation and application. Moreover, Adobor (2020) found that relatively tight social structures and relatively low institutional quality hindered farmers' entrepreneurial processes. The acceleration of farmers' knowledge of agricultural entrepreneurship and technology is difficult to achieve.

Interestingly, the farming families contributed significantly to business and entrepreneurship processes (Wilson & Tonner, 2020). Iza & Dentoni (2020) determined several factors that stimulated farmer entrepreneurship consisting of proactiveness, risk-taking, innovativeness, and entrepreneurial intentions. Janker et al. (2021) noted that the entrepreneurial identity can elaborate a farmer's entrepreneurial behavior. They found that work well-being is more appropriate to be conducted than conventional work. Conventional work has difficulty in accelerating entrepreneurship, diversification, and innovativeness.

Managerial Implications

The managerial implications can be illustrated in two ways. First, the millennial farmer communities can strengthen the quality of institutions to enhance innovative work and entrepreneurial behaviors. Second, the head of millennial farmer communities can collaborate with governments and non-government institutions to maintain the quality of innovative work and entrepreneurial behaviors.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This study investigates the causality between innovative work and entrepreneurship behaviors by considering the family characteristics of millennial farmers in the Boyolali and Klaten Regencies. The family characteristics of millennial farmers are set as explanatory variables including the age of the farmer, the number of families, and farm size. The number of observations is 43 millennial farmers. Besides, the Granger Causality Test and Cross Section Threshold Regression are employed. The findings reveal that innovative work behavior has a one-way causality with entrepreneurship behavior. In particular, the age of the farmer has a one-way causality with innovative work behavior. Furthermore, the threshold levels of innovative work and entrepreneurship behaviors were about 34 and 71, respectively. The condition means that the level of entrepreneurship behavior is higher than innovative work behavior. The family characteristics (age of farmer, number of families, and farm size) contribute significantly to the innovative work behavior of millennial farmers.

Recommendations

Millennial farmers can enhance the level of innovative work and entrepreneurship behaviors in the long run. The local governments should facilitate and assist in the process of improving innovative work and entrepreneurship by millennial farmers. Further study can consider constructing a composite index of innovative work and entrepreneurship behaviors for millennial farmers. The composite index can be utilized to control and evaluate the past, current, and future levels of innovative work and entrepreneurship behavior of millennial farmers.

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