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Competency development through empowerment: A model for millennial vegetable farmers in West Java Highlands

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ABSTRACT

The decreasing interest in agriculture among younger generations threatens Indonesia's food security, particularly as food demand rises. Enhancing millennial farmers' competencies is essential due to their limited experience and formal education. This study develops an empowerment model aimed at increasing competencies among millennial vegetable farmers in West Java. Using a cross-sectional survey and Structural Equation Modeling (SEM) with AMOS, this research examined how factors such as environmental and institutional support, participation, and motivation influence competencies. Model fit was confirmed with indices including Comparative Fit Index (CFI) = 0.936, Goodness-of-Fit Index (GFI) = 0.920, Adjusted Goodness-of-Fit Index (AGFI) = 0.900, Tucker-Lewis Index (TLI) = 0.921, and Root Mean Square Error of Approximation (RMSEA) = 0.047. Findings highlight that nearest environment support and intrinsic motivation are key factors shaping farmers' perceptions and competencies, while institutional support significantly affects perceptions but has a less direct influence on competence. Active participation and motivation were positively correlated with enhanced competence. This empowerment model underscores the importance of combining institutional support with strategies to increase motivation and engagement, offering actionable insights for policymakers and practitioners to improve the effectiveness and sustainability of millennial farmers in vegetable farming.

KEYWORDS: competency development, empowerment model, millennial vegetable farmers, West Java Highlands

Introduction

The agricultural landscape in Indonesia is undergoing a significant transformation, marked by a declining number of farmers, even though the country is traditionally known for its agrarian economy (Rondhi et al., 2018). This trend is particularly pronounced in West Java, where a substantial proportion of farmers are nearing retirement age, with 36.30% aged 45-49 and only 24.06% aged 30-44 (Jabarprov, 2022). The diminishing interest of the younger generation in agriculture presents a critical challenge for Indonesia's food sovereignty, especially as the demand for food supply continues to rise annually (Widhiyastuti et al., 2023). The highlands of West Java, encompassing the regions of Garut, Bandung, Cianjur, and Bogor, are pivotal in the production of horticultural commodities, predominantly vegetables (Hietkamp, 1994). Addressing the challenge of declining youth engagement in agriculture necessitates improving the competencies of young farmers by integrating technological advancements to enhance food production efficiency (Ahaibwe et al., 2013). The primary objective is to expand agricultural land and increase the technological proficiency of young farmers to elevate their farming activities.

The competency in mastering agricultural technology is influenced by various factors, both internal and external to millennial farmers (Widiyanti et al., 2023). Hence, developing a comprehensive empowerment model is crucial for fostering the competencies of millennial farmers in vegetable farming in the highlands of West Java. Community empowerment, as articulated by Robert Chambers (1995), encompasses an economic development model that integrates social values, epitomizing a new paradigm of development that is people-centered, participatory, empowering, and sustainable (Chambers, 1995). Key socio- demographic determinants such as non-formal education, farming experience, business type, and land size significantly impact the competencies of millennial farmers (Haryati et al., 2024). Additionally, factors like environmental support, institutional backing, participation, and motivation play crucial roles in shaping these competencies (Howard-Grenville et al., 2008). Despite numerous theoretical frameworks and implemented programs, there remains a noticeable gap in translating these into sustained interest and engagement of younger generations in agriculture (Gosnell et al., 2019). This is juxtaposed with the increasing annual demand for food supply and the high number of productive-age workers whose technological competencies in agriculture remain underdeveloped (Chinsinga et al., 2021). Therefore, an effective empowerment strategy tailored for millennial farmers is imperative.

This study aims to devise an empowerment model tailored to millennial farmers, enhancing their competencies in vegetable farming. Specifically, the research seeks to: analyze the current competency levels of millennial farmers, investigate the relationship between their characteristics and competencies, and evaluate the influence of environmental support, institutional support, participation, and motivation on the perceptions and competencies of millennial farmers in the highlands of West Java. This research employs a cross-sectional survey method, assessing the competencies of millennial farmers at a single point in time.

Literature Review

The analysis of cultural dimensions in literature offers a profound understanding of societal norms and interpersonal relationships. Hofstede's (1984) Cultural Dimensions Theory provides a robust framework to explore these dynamics within literary works, facilitating an in-depth examination of how cultural values are represented and challenged in narratives (Sjöström 2021:101). Local culture is essential for every region as it can reflect and symbolize a specific area to others (Dwi Saputra, et al., 2022). Hofstede's Cultural Dimensions Theory, developed by Geert Hofstede, identifies six key dimensions that describe the effects of a society's culture on the values of its members, and how these values relate to behavior. These dimensions are Power Distance Index (PDI), Individualism vs. Collectivism (IDV), Masculinity vs. Femininity (MAS), Uncertainty Avoidance Index (UAI), Long-Term vs. Short-Term Orientation (LTO), and Indulgence vs. Restraint (IVR). Each dimension of Hofstede's (1984) theory encapsulates distinct cultural traits. PDI measures the acceptance of unequal power distribution within a society, IDV contrasts the focus between individual and collective goals, and MAS examines the distribution of emotional roles between genders. UAI indicates a society's tolerance for ambiguity and uncertainty, LTO assesses the extent to which a society embraces long-term commitments over short-term gains, and IVR explores the degree to which a society allows relatively free gratification of basic human desires.

Previous research has employed Hofstede's framework to analyze cultural dimensions in various contexts. For example, Setyami (2021:59) used the theory to explore gender dynamics and cultural norms in Javanese literature, revealing insights into societal expectations and the role of women in traditional settings. Similarly, Muarifin and Waryanti (2022:50-51) examined Javanese cultural values in literature, highlighting the representation of religious and accommodative value. Applying Hofstede's framework in literary analysis provides a structured approach to understanding the cultural intricacies within a novel. This method allows researchers to dissect how cultural norms and values are constructed, represented, and challenged, offering a deeper understanding of the characters' motivations and the societal structures they navigate (Ramolula & Nkoane, 2023: 70). By analyzing cultural dimensions, researchers can uncover the underlying cultural dynamics that influence narrative development and thematic elements. Junaidi (2017) conducted the research about local literature. He states that pupils will know about their own cultures in Kedurang society by using *andai-andai* as material learning. They also will realize that they have to maintain that unique culture. Listening to *andai-andai* folktales provides children with insights into Pasemah culture, encompassing traditions, social norms, communal life, and indigenous knowledge related to food, flora, agricultural practices, and domestic artifacts (Junaidi, et al., 2024). Literary works mirror human experiences and life such folktales (Junaidi, et al., 2024).

The present study applies Hofstede's Cultural Dimensions Theory to *Genduk Duku* to provide a systematic analysis of the cultural norms and values within the novel. This study explores how power distance, collectivism, gender roles, uncertainty avoidance, long-term orientation, and restraint are portrayed in the narrative. This analysis not only deepens our understanding of the novel's thematic elements but also contributes to broader discussions about cultural values in literary works.

Method
Study Design and Settings
This study utilizes an observational analytic design with a correlational approach, aiming to examine the relationships between variables. Following Creswell's (2017) framework, the research aimed to identify, explain, predict, and test relationships based on existing theories (Creswell & Creswell, 2017). A cross-sectional methodology is employed, assessing the competencies of millennial vegetable farmers in fostering millennial character traits at a single point in time. The study adopts a survey method with a quantitative approach. Problem formulation is supported by research objectives and hypotheses, tested through applied statistics. The research is explanatory, examining relationships, influences, and causal connections (Mohajan, 2020). The study was conducted in the highlands of West Java, an area with the largest population of millennial farmers (1,649 individuals) engaged in various agricultural sectors including food crops, horticulture, medicinal plants, livestock, fisheries, and plantations. Data references include the Minister of Agriculture's Decree No. 434 on Millennial Farmer Ambassadors and Lead Farmers for Agricultural Development. Four counties were selected based on their significant national agricultural contributions: Bandung, Cianjur, Garut, and Bogor. The study was carried out from September to December 2023.

Population and Sample
The population consists of 218 millennial vegetable farmers in West Java Province, based on Ministry of Agriculture Decrees and Regulations (Kepmentan) 434 of 2021 regarding Millennial Farmer Ambassadors and Lead Farmers. The first step involved selecting research zones dividing West Java into northern, central, southern, and Jabotabek (Jakarta, Bogor, Tangerang, Bekasi) zones. Counties with the highest number of millennial farmers and significant agricultural potential were chosen: Bandung (north zone, 64 farmers), Cianjur (central zone, 91 farmers), Garut (south zone, 41 farmers), and Bogor (Jabotabek, 22 farmers), totaling 218 farmers. Data were collected from these farmers and 20 additional informants, including local agricultural extension leaders and coordinator.

Variables
Independent variables included millennial farmer characteristics (X1) (age, education, training, experience,

land size), support from the immediate environment (X2) (family, friends, extension workers, farmer group leaders, members), and institutional support (X3) (extension, government, higher education). Millennial farmer participation (X4) (planning, implementation, supervision) and motivation (X5) (physiological, safety, social, ego, self-actualization) were also considered. Moreover, the dependent variables were perceptions of millennial farmers (Y1) (role as a farmer, farming activities, farmer groups, extension workers) and competencies of millennial farmers (Y2) (complex problem-solving, critical thinking, teamwork coordination, technical competencies, and managerial competencies).

Validity and Reliability

Validity was assessed through content validity, verified by consulting with supervisors to ensure the instrument covered all conceptual framework aspects. Item validity was determined using Pearson's product-moment correlation coefficient, with correlations above 0.3 deemed valid (Humphreys et al., 2019). Reliability was measured using Cronbach's Alpha via SPSS, with values above 0.70 indicating good reliability (Taber, 2018).

Data Collection

Primary data were collected through structured interviews, field observations, and in-depth interviews with farmers and relevant officials by the questionnaire (see Appendix 1). Secondary data were obtained from institutional records, with additional insights from key informant interviews. Observations and literature reviews complemented the primary data.

Data Analysis

Descriptive analysis provided an overview of farmer characteristics, support, participation, and motivation by tabulating data and analyzing response trends. Pearson Chi-Square was used to find significant relationships between farmer characteristics and perceptions/competencies. Structural Equation Modeling (SEM) using AMOS software examined the significant influences of immediate environment support (X2), institutional support (X3), participation (X4), and motivation (X5) on millennial farmer perceptions (Y1) and competencies (Y2). SEM also assessed the significant influence of perceptions (Y1) on competencies (Y2). To test the indirect effects of immediate environment support (X2), institutional support (X3), participation (X4), and motivation (X5) on competencies (Y2) through perceptions (Y1), the Sobel-test was employed (Byrne, 2013). To assess the overall quality of the fitting, we employed various indices to evaluate the model fit: Goodness of fit index (GFI) with a recommended value greater than 0.9 is considered to represent a good fit, root mean square error of approximation (RMSEA) recommended value below 0.08 indicates a perfect fit (Hair, 2009), Tucker's Test of Fit Index (TFI) and Comparative fit Index (CFI) recommended value equal to or greater than 0.95 represents a good fit (Hair, 2009), Meanwhile, the normal fit index (NFI) has an acceptance level equal to or greater than 0.80 (Prudon, 2015).

Result and Discussion
Validation and Reliability

The validation test involved correlating each question with the scores for each variable using the product-moment correlation technique appropriate for ordinal data scales. The validity test results for the measurement tools on the growth and learning perspective were deemed valid, with items showing a correlation coefficient above 0.3. Specifically, all items across various constructs, including environmental support, institutional support, millennial farmers' participation, motivation, perception, and competence, demonstrated validity with coefficients well above 0.3. For instance, family support (0.738), peer support (0.635), and government support (0.898) showed high validity, indicating these items are suitable for further reliability testing (see Appendix 2).

The reliability test measured the consistency of the instruments used. An instrument is considered reliable if it yields consistent results across multiple administrations (Prudon, 2015). Using Cronbach's Alpha coefficient calculated via SPSS, the reliability of each variable was determined, with coefficients all above 0.7, indicating a high level of reliability (Taber, 2018). For example, the reliability coefficient for millennial farmers' motivation

was 0.905, and for their competence, it was 0.846 (see Appendix 3). These results signify that the instruments used for these variables are highly dependable and consistently measure the intended constructs.

Participants Characteristics

The study sample consisted of 218 millennial farmers aged below 39 years (see Table 1). Their educational backgrounds varied, with 31.65% having primary education, 25.69% secondary education, 36.70% high school education, and 5.96% higher education. In terms of non-formal education, 22.48% never participated, 29.82% participated rarely (0-3 times), 35.32% sometimes (4-6 times), and 12.38% often (>6 times). Experience in farming varied, with 71.56% having less than 5 years, 9.17% between 5-10 years, and 19.27% over 10 years. Most farmers (64.68%) worked on small farms (<0.5 ha), while 25.69% had medium-sized farms (0.5-2 ha), and 9.63% managed larger farms (>2 ha).

Table 1. Distribution of Millennial Farmers' Characteristics

Characteristic	Sample Size (n)	Percentage (%)
Age		
< 39 years	218	100.00
Education		
Elementary School	69	31.65
Junior High School	56	25.69
High School/Vocational School	80	36.70
College	13	5.96
Non-Formal Education		
Never	49	22.48
Rarely (0-3 times)	65	29.82
Occasionally (4-6 times)	77	35.32
Frequently (>6 times)	27	12.38
Farming Experience		
Less Experienced (<5 years)	156	71.56
Moderately Experienced (5-10 years)	20	9.17
Experienced (>10 years)	42	19.27
Land Area		
Small (< 0.5 ha)	141	64.68
Medium (0.5-2 ha)	56	25.69
Large (>2 ha)	21	9.63

Structural Equation Modeling (SEM) Analysis

The construct reliability test, conducted using CFA with AMOS 18, demonstrated that all constructs had satisfactory reliability, with standardized loading estimates greater than 0.50, ideally above 0.70 (Hair et al., 2006). For instance, the construct reliability for institutional support was 0.76, and for millennial farmers' participation, it was 0.87, indicating robust reliability. The variance extracted test showed that all variables had values above the recommended threshold of 0.30, indicating good convergent validity (DeVon et al., 2007). For example, the variance extracted for millennial farmers' motivation was 0.89, and for their competence, it was 0.87, demonstrating that the latent variables explained more than half of the variance of their indicators (see Appendix 4).

The multicollinearity test results indicate that all research variables have Tolerance values above 0.1 and VIF (Variance Inflation Factor) values below 10, suggesting that multicollinearity is not a significant concern and the variables do not exhibit high correlation, allowing for reliable regression analysis (see Appendix 5).

Confirmatory factor analysis using AMOS 18 was conducted to assess the construct reliability and validity. The model was initially found to be not-fit, indicated by a chi-square value of 511.176 and a probability level of 0.000 (see Appendix 6). Subsequent model modifications improved the fit, resulting in a chi-square value of 213.503 and a probability level of 0.081, with GFI, AGFI, and TLI values above 0.90 and RMSEA of 0.03. These results confirm that the modified model is fit, with no multicollinearity issues. At least four indices should be presented to evaluate both the model fit and incremental fit group (Kline, 2023).
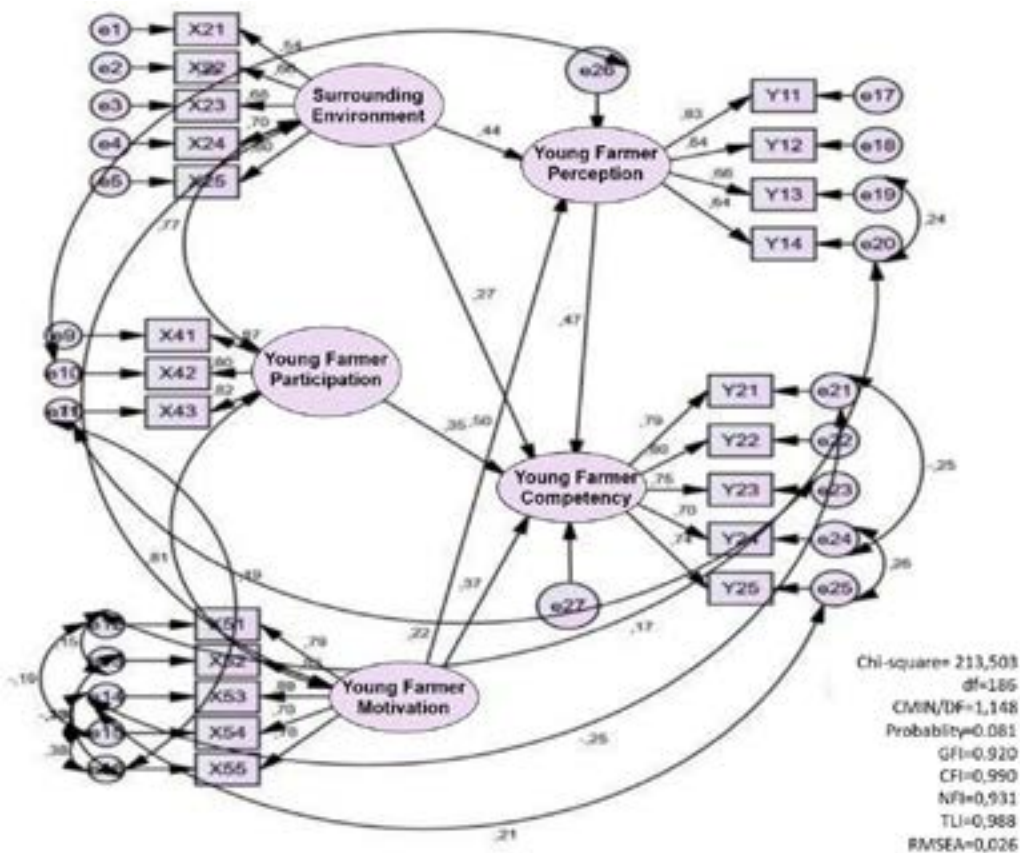

Figure 1. Modification of Confirmatory Factor Analysis Test

Initial confirmatory factor analysis showed the model did not meet the goodness-of-fit criteria, with a chi-square value of 511.176 and a probability level of 0.000. After model modifications, the chi-square value improved to 213.503 with a probability level of 0.081, indicating a good model fit. Goodness-of- fit indices like GFI, AGFI, and TLI were all above 0.90, and RMSEA was 0.03, confirming the model fit (Browne & Cudeck, 1992). In the final structural model (Figure 1), the direct effects were tested, revealing significant impacts. Table 2 indicate the environmental support had a significant positive effect on millennial farmers' perceptions (p-value < 0.05). However, institutional support did not significantly influence perceptions or competencies. The final model showed significant pathways, such as motivation directly affecting both perceptions and competencies (p-value < 0.05) (Kline, 2023).

Direct Effects in the Improved Model

Hypothesis	P-Value
Nearest environment support > Perception of millennial farmers	***
Motivation of millennial farmers > Perception of millennial farmers	***
Nearest environment support > Competence of millennial farmers	0.028
Participation of millennial farmers > Competence of millennial farmers	***
Motivation of millennial farmers > Competence of millennial farmers	0.005
Perception of millennial farmers > Competence of millennial farmers	***

These table suggest that nearest environment support and motivation significantly affect both the perception

and competence of millennial farmers. Additionally, participation and perception directly influence their competence, highlighting the importance of these factors in enhancing the capabilities of millennial farmers in vegetable farming in the highlands of West Java.

Discussion

To the best of our knowledge, this is the first study to comprehensively analyze the interplay between nearest environment support, institutional support, millennial farmers' participation, motivation, perception, and competence in the context of highland vegetable farming. This novel approach offers new insights into the dynamics influencing millennial farmers and their agricultural practices. Our findings affirm the validity and reliability of the measurement instruments used, with all variables demonstrating strong validity and internal consistency. This rigorous validation enhances the credibility of our results and supports the robustness of the conclusions drawn (Casadevall & Fang, 2016).

The profile of millennial farmers surveyed reveals a predominantly young demographic, characterized by a wide range of educational backgrounds. Despite their relative youth and the fact that many have limited formal education, a significant number of these young farmers have actively pursued further training through non-formal education programs. This proactive approach to skill development underscores their commitment to enhancing their agricultural expertise and adapting to modern farming practices (Swagemakers et al., 2019). Their engagement in continuous learning demonstrates a willingness to innovate and improve their farming techniques, which is crucial for the advancement and sustainability of the agricultural sector (Moschitz et al., 2015). The small land areas and limited farming experience suggest that these farmers are at the early stages of their agricultural careers, engaging primarily in small-scale operations. These initial phases of their farming endeavors indicate a foundational period where they are likely experimenting with various techniques and learning through hands-on experience (Żmija et al., 2020). Despite the modest scale of their current operations, their engagement and efforts reflect a crucial step in building their expertise and expanding their agricultural activities over time (Glover et al., 2021). This early engagement with youth in agriculture highlights the potential for growth and development as the field gains experience and resources (Geza et al., 2021). The significant role of nearest environment support, including family, peers, and extension services, highlights its importance in shaping farmers' perceptions and competencies (Khoshmaram et al., 2020; Liu et al., 2018; Saint Ville et al., 2016).

The positive correlations observed underscore the necessity of a supportive social and institutional framework in facilitating effective farming practices (Knook & Turner, 2020). This finding corroborates previous research on the critical role of social support networks in agricultural development. By fostering an environment where farmers can access resources, share knowledge, and receive guidance, these networks significantly contribute to improved farming outcomes (Skaalsveen et al., 2020). The presence of robust social and institutional support can enhance the capacity of farmers to implement innovative techniques, manage risks, and ultimately achieve greater productivity and sustainability in their operations (Grando et al., 2020). Motivation and participation emerged as key factors influencing millennial farmers' competence and perception (Charatsari et al., 2017). The substantial direct effects of motivation on these variables emphasize the need for initiatives that foster intrinsic motivation through financial incentives, recognition, and personal growth opportunities (Diana, 2022). Active participation in farming activities also directly enhances competence, indicating that hands-on experience is vital for skill acquisition and development (Agboola et al., 2015). This evidence reinforces the importance of policies and programs that strengthen these support structures to promote agricultural advancement (Piñeiro et al., 2020)

The relationship between perception and competence is particularly noteworthy, as it highlights the impact of farmers' attitudes and beliefs on their effectiveness. Positive perceptions can lead to improved competence, suggesting that interventions aimed at enhancing farmers' confidence and resource awareness could yield better performance outcomes (Li et al., 2020). This suggests that interventions aimed at enhancing farmers' confidence and increasing their awareness of available resources could result in better performance outcomes (Antwi-Agyei & Stringer, 2021). Additionally, interventions designed to boost farmers' confidence and broaden their

understanding of available resources could substantially improve their performance outcomes (Raji et al., 2024) Although institutional support significantly influences perception, its direct effect on competence was not observed in the final model. This suggests that while institutional support is crucial for shaping perceptions and providing resources, its impact on competence may be mediated by other factors such as motivation and participation. This points to the need for a holistic support framework that combines institutional assistance with strategies to boost motivation and engagement. To maximize the effectiveness of support programs, it is crucial to address both institutional support and the psychological and participatory aspects that drive competence (Menconi et al., 2017). A holistic approach that combines these elements can better support farmers in developing their skills and achieving improved performance in their agricultural practices (de Janvry & Sadoulet, 2020; Muhie, 2022). The implications of these findings are significant for policymakers and practitioners. There is a need for targeted interventions that strengthen nearest environment support systems, enhance motivational strategies, and encourage active participation among millennial farmers (Barghusen et al., 2021). Additionally, policies should incorporate both formal and informal educational opportunities to support skill development and competency in farming practices (Šūmane et al., 2017).

This study has several limitations. Firstly, the sample size was limited, focusing on verified millennial farmers as per the Minister of Agriculture's Decree No. 434 of 2021, which resulted in a lengthy data collection process due to the dispersed locations of the farms (Keputusan Menteri Pertanian Republik Indonesia, 2021). Secondly, while individual characteristics were included as variables, and positively influenced perception and competence, some indicators were excluded from the structural model due to their inability to support the latent variables, possibly affecting the SEM analysis. Lastly, the proposed model for empowering millennial farmers is still in the formulation stage and has not yet been implemented, so its reliability and suitability for enhancing millennial farmers' competencies in vegetable farming remain not verified.

Conclusion

This study successfully devises an empowerment model specifically tailored to millennial vegetable farmers in the highlands of West Java, with the goal of enhancing their competencies. The current competency levels have been analyzed, and the relationships between farmers' characteristics, environmental support, institutional backing, participation, and motivation have been examined. Significant roles of nearest environment support and motivation in shaping farmers' perceptions and competencies have been highlighted by the findings. This underscores the necessity for a supportive social framework and targeted interventions that foster intrinsic motivation and encourage active participation. While institutional support is recognized as important for shaping perceptions, its impact on competence is mediated by factors such as motivation and engagement. A comprehensive support system that integrates institutional assistance with strategies to boost motivation and involvement is advocated by the research. Valuable insights for policymakers and practitioners aiming to improve the effectiveness and sustainability of millennial farmers in vegetable farming have been offered by this study.

Conflicts of interest

The authors declare no conflict of interest.

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