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Farmer Regeneration in Indonesia: A Literature Review of the Determinants of Declining Youth Interest in the Agricultural Sector

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Abstract

Farmer regeneration has become a strategic issue in Indonesian agricultural development, as the agricultural sector faces an aging workforce and declining interest among young people in pursuing farming as an occupation. This study aims to systematically review the determinants of declining youth interest in the agricultural sector in Indonesia. The method employed is a Systematic Literature Review guided by the PRISMA 2020 framework. Literature was collected from Scopus, Google Scholar, ScienceDirect, SpringerLink, DOAJ, Garuda, SINTA, and national journal portals. The articles analyzed were selected based on inclusion criteria, namely publication between 2016 and 2026, written in Indonesian or English, available in full text or with complete metadata, and relevant to the issues of farmer regeneration, young farmers, and youth interest in agriculture. Of the 210 articles initially identified, 30 articles met the eligibility criteria and were analyzed using a thematic analysis approach. The findings indicate that declining youth interest in the agricultural sector is influenced by economic, structural, and social factors, as well as education and career aspirations, technology and digitalization, and institutional support. The conceptual synthesis shows that youth interest in becoming farmers is a key variable that mediates various determinants toward sustainable farmer regeneration. This study recommends the need for integrated policies

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through economic incentives, access to land and financing, agricultural digitalization, vocational agricultural education, and the strengthening of young farmer institutions.

Keywords: Agricultural sector; Farmer regeneration; Young farmers; Youth interest

INTRODUCTION

The agricultural sector plays a strategic role in the Indonesian economy, both as a provider of food, a source of livelihood for rural communities, and a pillar of national food security. Agriculture functions not only as a producer of staple food commodities, but also as a source of income, employment, and rural economic development. In a country with a large population such as Indonesia, the sustainability of the agricultural sector is essential to ensuring food availability, economic stability, and community welfare (Nurarifin & Kurniawan, 2025; Setiani et al., 2021).

Nevertheless, Indonesia's agricultural sector is currently facing serious structural challenges, one of which is the aging of farmers and the weak regeneration of the agricultural workforce. The age structure of agricultural labor shows the dominance of older farmers, while youth participation in agriculture continues to decline. This phenomenon indicates that the process of farmer regeneration has not yet progressed optimally. Susilowati, (2016) emphasized that the aging of farmers and the declining participation of young agricultural workers have important implications for the sustainability of agricultural development, particularly in responding to modernization, climate change, and market dynamics.

The problem of farmer aging is not merely related to the increasing age of existing farmers, but also to the weak interest of young people in entering and remaining in the agricultural sector. Rural youth tend to choose non-agricultural employment because it is perceived as more economically promising, socially prestigious, and capable of offering broader career opportunities. The mobility of rural youth toward industrial and service sectors further reinforces this tendency, causing agriculture to lose potential young workers (Malik et al., 2024; Ngadi et al., 2023).

Various studies have shown that declining youth interest in agriculture is influenced by multiple factors, including relatively low farm income, high production risks, limited access to land and capital, negative perceptions of the farming profession, and changing career aspirations alongside rising education levels. In addition, agriculture is often perceived as a traditional occupation that is less compatible with the lifestyle and

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expectations of today's younger generation (Arvianti et al., 2019; Makabori & Tapi, 2019; Saleh et al., 2021). These conditions intensify the crisis of farmer regeneration and may threaten the long-term sustainability of the agricultural sector.

In recent years, the issue of farmer regeneration has gained increasing attention in agricultural development discourse at both national and international levels. Previous studies have examined the factors influencing youth interest in agriculture, the roles of education and technology, the entrepreneurial capacity of young farmers, and the importance of institutional and policy support. However, these findings remain scattered across studies with diverse focuses and methodological approaches. Therefore, a review that systematically synthesizes these findings is needed to provide a more comprehensive understanding of the determinants of declining youth interest in the agricultural sector (Anwarudin et al., 2018; Borda et al., 2023).

Based on these considerations, this study aims to conduct a systematic literature review on farmer regeneration in Indonesia, with a particular focus on the determinants of declining youth interest in the agricultural sector. This review is important for identifying patterns, key factors, and interrelationships among variables that influence young people's decisions to become farmers. The synthesis of the literature is expected to provide a conceptual contribution to understanding the farmer regeneration crisis and to serve as a basis for formulating more effective policies to promote sustainable farmer regeneration in Indonesia.

RESEARCH METHOD

Research Design and Approach

This study employed a Systematic Literature Review method guided by the PRISMA 2020 framework. PRISMA was used to ensure that the processes of identification, selection, eligibility assessment, and inclusion of articles in the synthesis were conducted transparently and systematically. The PRISMA flow diagram was used to illustrate the number of articles identified, screened, excluded, and included in the final review (Page et al., 2021).

This approach was selected because the study aims to examine, classify, and synthesize previous research findings related to farmer regeneration in Indonesia, particularly the determinants of declining youth interest in the agricultural sector.

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Data Sources and Search Databases

The articles were obtained through searches in several scientific databases, including Scopus, Google Scholar, ScienceDirect, SpringerLink, DOAJ, Garuda, SINTA, and national journal portals. These databases were selected to obtain both reputable international articles and national articles relevant to the Indonesian context.

The keywords used in the search process included:
"regenerasi petani", "petani muda", "minat generasi muda terhadap pertanian", "penuaan petani", "krisis petani muda", "aging farmers", "young farmers", "farmer regeneration", "farmer succession", "rural youth and agriculture", and "youth interest in agriculture".

The selected articles were those published between 2016 and 2026, written in either Indonesian or English, available in full text or with complete metadata, and relevant to the issues of farmer regeneration and the determinants of declining youth interest in the agricultural sector.

Inclusion and Exclusion Criteria

The articles identified through the search process were subsequently selected based on predefined inclusion and exclusion criteria. These criteria were applied to ensure that the articles analyzed were closely aligned with the focus of the review.

Table 1. Inclusion and Exclusion Criteria

Aspect	Inclusion Criteria	Exclusion Criteria
Document type	Scientific journal articles, scientific conference proceedings, and review articles	Undergraduate theses, master's theses, dissertations, popular opinions, news articles, blogs, and non-scientific documents
Publication year	Articles published between 2016 and 2026	Articles published before 2016, except for conceptually important articles
Language	Articles written in Indonesian or English	Articles written in other languages that could not be adequately analyzed

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Study focus	Articles discussing farmer regeneration, young farmers, youth interest, farmer aging, farmer succession, agricultural labor, or rural youth in agriculture	Agricultural articles that do not discuss human resources, youth, or farmer regeneration
Study location	Articles with an Indonesian context were prioritized; international articles were used as conceptual comparisons	International articles that were not relevant to farmer regeneration or young agricultural labor
Accessibility	Full-text articles or articles with at least complete abstracts and metadata	Articles without full-text access, incomplete metadata, or unverifiable information
Substantive relevance	Articles containing determinants, barriers, strategies, or policies related to farmer regeneration	Articles discussing only cultivation techniques without any connection to young farmers or farmer regeneration

Article Selection Procedure Based on PRISMA

The article selection process in this study was conducted through four stages: identification, screening, eligibility, and inclusion. The flow of article selection is presented in Figure 1. At the identification stage, the initial search yielded 210 articles from several databases. These consisted of 35 articles from Scopus, 85 articles from Google Scholar, 30 articles from ScienceDirect, SpringerLink, and DOAJ, and 60 articles from Garuda, SINTA, and national journal portals.

After duplicate checking, 42 duplicate articles were removed, leaving 168 articles for the screening stage. During the screening stage, the articles were assessed based on their titles and abstracts. From this process, 92 articles were excluded because they were not relevant to the focus of the review.

Subsequently, 76 articles proceeded to the eligibility stage for full-text assessment. At this stage, 46 articles were excluded for several reasons: 18 articles did not focus on

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farmer regeneration, 11 articles did not discuss youth or young farmers, 7 articles were not relevant to the socio-economic context of agriculture, and 10 articles had incomplete full texts or metadata.

Thus, the final number of articles included in the literature synthesis was 30 articles. These articles were then further analyzed using a thematic analysis approach.

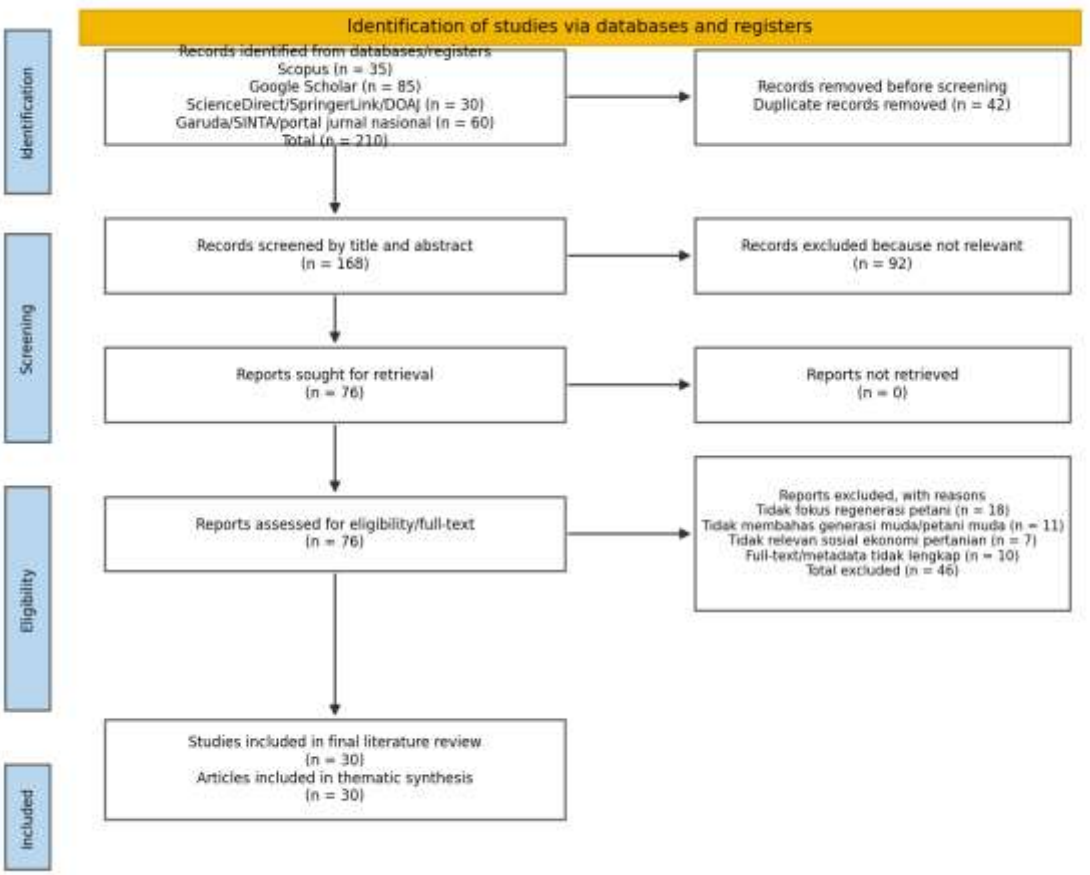


Figure 1. PRISMA diagram of the article selection process

Data Analysis Technique

The selected articles were analyzed using a thematic analysis approach. The analysis was conducted by reading each article in depth and then classifying the findings based on the main themes related to the determinants of declining youth interest in the agricultural sector.

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The themes used in the synthesis process included:

1. Economic factors, such as farm income, farming risks, price uncertainty, and access to financing.
2. Social factors and perceptions, such as the image of the farming profession, farmers' social status, youth perceptions of agriculture, and family influence.
3. Structural factors, such as access to land, land fragmentation, and the availability of non-agricultural employment.
4. Education and migration factors, such as education level, career aspirations, and rural youth mobility toward non-agricultural sectors.
5. Technology and modernization factors, such as agricultural digitalization, mechanization, smart farming, and access to information technology.
6. Institutional and policy factors, such as the role of agricultural extension workers, millennial farmer programs, incentives for young farmers, and farmer institutions.

The results of the thematic analysis were then used to develop a conceptual synthesis of the factors influencing the decline in youth interest in the agricultural sector in Indonesia.

RESULTS AND DISCUSSION

The Aging Trend of Farmers in Indonesia

Farmer aging is one of the fundamental issues in Indonesian agricultural development. This phenomenon is characterized by the increasing dominance of older farmers in the agricultural labor structure, while youth participation in agriculture continues to decline. Such a condition indicates that the agricultural sector faces a serious challenge in regenerating its workforce. Susilowati, (2016) emphasized that farmer aging and the declining number of young agricultural workers have significant implications for the sustainability of agricultural development, particularly because the sector requires a productive, adaptive workforce that is capable of adopting technological innovations.

Demographically, the structure of Indonesian farmers reveals an imbalance between older and younger farmers. Anwarudin et al., (2020) noted that, based on the 2013 Agricultural Census, farmers under the age of 35 accounted for only approximately 12.87%, while those aged 35–54 represented 54.37%, and those over 54 accounted for 32.76%. These data indicate that the agricultural sector is increasingly dominated by middle-aged and older farmers, while the entry of a new generation into agriculture has not yet progressed optimally.

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The tendency toward farmer aging is closely related to the low attractiveness of agriculture among young people. Many rural youth prefer non-agricultural employment because it is perceived as more economically promising, more stable, and associated with higher social status. Ngadi et al., (2023) found that younger age groups are more likely to migrate and choose employment in the manufacturing and service sectors rather than work in agriculture. This phenomenon is further reinforced by rising education levels, greater access to information, and changing career aspirations among young people, which make farming often perceived as less aligned with their expectations for social mobility (Arvianti et al., 2019).

In addition to career aspirations, farmer aging is also influenced by structural constraints, such as limited access to land, business capital, technology, and market networks. Saleh et al., (2021) showed that the difficulty of farmer regeneration in Indonesia is associated with limited land access, poverty among farming households, the education of farmers' children, and youth migration out of agriculture. If left unaddressed, farmer aging may weaken the agricultural sector's capacity to respond to technological, market, and climate changes. Therefore, farmer regeneration has become a strategic agenda for maintaining food production sustainability, strengthening national food security, and promoting a more modern and productive agricultural transformation (Anwarudin et al., 2018; Dayat et al., 2020; Susilowati, 2016b).

Economic Factors: Low Income, Farming Risks, and Access to Capital

Economic factors are among the main determinants of declining youth interest in the agricultural sector. Farming is still often perceived as an occupation characterized by low income, uncertainty, and limited future prospects compared with non-agricultural employment. This condition encourages young people, particularly those in rural areas, to choose jobs in industry, services, trade, or to migrate to urban areas, as these sectors are perceived to offer better income and social mobility. Ngadi et al., (2023) showed that young people are more likely to choose employment in the manufacturing and service sectors than in agriculture.

Relatively low farm income is a significant barrier to farmer regeneration. For young people, the decision to work in agriculture is not determined solely by land availability or family inheritance, but also by the economic prospects that farming can provide. If agriculture is unable to generate adequate income, farming will be viewed as an economically less rational career choice. Arvianti et al., (2019) explained that the low interest of young people in agriculture is associated with the perception that the sector is

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unable to provide sufficient economic security for the future. This is reinforced by Sitanggang et al., (2025), who found that income is one of the dominant factors influencing youth interest in the agricultural sector.

In addition to income, farming risks also weaken the attractiveness of agriculture for young people. Farming is highly vulnerable to weather uncertainty, climate change, pest and disease attacks, commodity price fluctuations, rising production costs, and the weak bargaining position of farmers within marketing chains. These risks make farmers' income unstable, while farm profits are often not proportional to production costs. In this context, non-agricultural employment is often perceived as safer because it offers more predictable income. Saleh et al., (2021) emphasized that farmer regeneration faces complex barriers, including poverty among farming households, limited resources, and economic uncertainty in agricultural activities. Rahman et al., (2025) also stated that the low economic prospects of agriculture are one of the barriers that discourage young people from working in the sector.

Access to capital is also a critical issue in farmer regeneration. Young people who wish to start farming often face limited capital to purchase production inputs, manage land, access technology, and develop agribusiness activities. Limited assets for collateral, lack of business experience, and weak connections with formal financial institutions restrict young farmers' opportunities to develop modern farming enterprises. Anwarudin et al., (2019) showed that the entrepreneurial capacity of young farmers is influenced by access to information technology, external support, motivation, and the role of agricultural extension workers. Meanwhile, Anwarudin et al., (2020a) emphasized that the sustainability of young farmers' agribusiness requires external support, access to information and communication technology, entrepreneurial capacity, and the role of extension workers. Therefore, farmer regeneration strategies should be directed toward improving the economic viability of farming, strengthening access to finance, developing technology-based agribusiness, and improving agricultural value chains so that agriculture can become a viable career choice for young people in Indonesia.

Structural Factors: Access to Land, Land Fragmentation, and Family Inheritance

Structural factors are among the important determinants of declining youth interest in the agricultural sector, particularly because farming is highly dependent on access to and control over land. In the context of Indonesian agriculture, land is not only the main factor of production but also the foundation for the sustainability of family farming. When young people do not have adequate access to land, their opportunities to enter, manage,

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and remain in the agricultural sector become limited. Many young people from farming families only serve as family laborers because land is still controlled by parents or older family members, leaving them without full authority in farm decision-making. This condition makes agriculture less attractive because it does not provide sufficient space for young people to apply innovation, technology, and business orientations that align with their aspirations (Anwarudin et al., 2019; Saleh et al., 2021). Evidence from Central Java also shows that parental landholding and parents' desire for their children to become farmers can positively influence rural youth interest in farming, suggesting that family resources and intergenerational support remain important factors in farmer regeneration (Saputra et al., 2021).

In addition to limited land access, land fragmentation is another structural barrier that weakens farmer regeneration. Land fragmentation occurs when family farmland is divided into increasingly smaller plots through intergenerational inheritance. The smaller the land area managed, the more limited the economies of scale that can be achieved, resulting in lower income and reduced competitiveness compared with non-agricultural employment. Small and scattered plots also make it difficult to implement mechanization, improve input-use efficiency, and develop modern agriculture. In fact, young people tend to be more interested in agricultural enterprises that are productive, efficient, modern, and have clear business prospects (Arvianti et al., 2019; Susilowati, 2016b).

Family inheritance plays a dual role in farmer regeneration. On the one hand, farming families can serve as an entry point for young people to become familiar with agriculture from an early age through direct experience in farming activities. Such experience can shape practical skills and basic agricultural knowledge. On the other hand, family inheritance does not always encourage farmers' children to continue their parents' farming enterprises, especially when family farming is perceived as unable to provide adequate economic welfare. In many cases, farming parents instead encourage their children to work outside agriculture because farming is perceived as physically demanding, economically uncertain, and associated with low social status (Saleh et al., 2021; Susilowati, 2016b).

Thus, land access, land fragmentation, and family inheritance patterns are structural factors that strongly determine the success of farmer regeneration. Limited access to land makes it difficult for young people to establish independent farming enterprises, land fragmentation reduces the economic viability of farming, and unplanned inheritance patterns may weaken young people's sense of ownership over family farms. Therefore, farmer regeneration strategies need to address land consolidation, expanded access to

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productive land for young farmers, strengthened family farming institutions, and the development of modern farming models that provide viable economic opportunities for young people (Anwarudin et al., 2020b; Saleh et al., 2021).

Social Factors: Farmers' Social Status and Perceptions of Farming

Social factors are also important determinants of declining youth interest in the agricultural sector. Young people's decisions to become farmers are influenced not only by income or access to productive resources, but also by how the farming profession is perceived in society. In many rural contexts, farming is still often viewed as a traditional, physically demanding, low-income, and less prestigious occupation compared with jobs in the formal, industrial, trade, or service sectors. Such perceptions create a social image that farming is not an ideal career choice for young people with higher levels of education and greater aspirations for social mobility (Arvianti et al., 2019; Saleh et al., 2021).

The relatively low social status of farmers is a barrier to farmer regeneration. Young people consider not only economic returns but also the social recognition attached to their chosen occupation. When farming is perceived as lacking social prestige, young people tend to choose other occupations that are considered more modern, more respected, and more aligned with their social identity. This negative perception is also reinforced by the experiences of farmers' children, who often observe their parents working hard, facing production risks, and earning unstable incomes. As a result, farming is frequently interpreted as an occupation with limited prospects for the future (Makabori & Tapi, 2019).

Changes in young people's occupational orientation are also influenced by increasing access to education, information, and modernization narratives. Education is often viewed as a pathway out of agriculture and toward jobs perceived as better beyond the village. Urban employment, jobs in the service or industrial sectors, and technology-based occupations are considered more compatible with youth lifestyles than farming, which is still associated with manual labor and limited economic opportunities. Ngadi et al., (2023) showed that young people are more likely to migrate and choose employment in manufacturing and services than in agriculture. This indicates that social perceptions of agriculture contribute to the movement of young people out of the agricultural sector. In a village-level study in Sragen, Nugroho et al., (2024) found that youth perceptions of farming are related to formal education, personal experience, and access to information, indicating that social perceptions of agriculture are shaped not only by economic considerations but also by knowledge, exposure, and lived experience.

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However, perceptions of agriculture can change if the sector is developed as a modern, innovative, and entrepreneurial economic activity. Agricultural digitalization, mechanization, platform-based marketing, and agribusiness development can transform the image of agriculture from a traditional occupation into a more attractive business opportunity for young people. Toumbourou et al., (2025) showed that young people in agriculture are often represented in two ways: as a group reluctant to farm and, at the same time, as potential actors in modern and digital agriculture. Therefore, farmer regeneration strategies should not only improve income and access to capital but also build a new social image of agriculture as a modern, strategic economic sector that plays an important role in national food security (Anwarudin et al., 2018; Setiani et al., 2021).

Education and Career Aspirations

Education has an important influence on shaping young people's interest in and decisions about the agricultural sector. Increasing education levels in rural areas are a positive achievement in human resource development; however, they may also encourage a shift in occupational orientation from agriculture to non-agricultural sectors. Young people with higher levels of education generally have broader career aspirations and tend to seek occupations that are perceived to align with their skills, social status, and expectations for social mobility. In this context, farming is often no longer viewed as a primary career choice, but rather as an alternative when other employment opportunities are unavailable (Arvianti et al., 2019; Ngadi et al., 2023).

Education also influences how young people compare agricultural work with employment in the formal, industrial, service, or government sectors. Non-agricultural jobs are often perceived as more promising because they offer more stable income, more modern working environments, and higher social status. In addition, increasing access to information, technology, and social mobility encourages young people to consider lifestyle, prestige, work comfort, and opportunities for self-development when choosing a career. Thus, education and career aspirations contribute to the weakening attachment of young people to the agricultural sector (Arvianti et al., 2019; Ngadi et al., 2023).

In many cases, formal education is viewed as a pathway out of agriculture. Farmers' children are often encouraged to pursue education in order to obtain jobs perceived as better than those of their parents. Saleh et al., (2021) showed that the education of farmers' children is one of the factors influencing the difficulty of farmer regeneration, because education is often associated with the expectation of obtaining non-agricultural employment rather than developing family farming enterprises. Nevertheless, education

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does not always distance young people from agriculture. If directed toward strengthening entrepreneurship, technological literacy, and agribusiness management skills, education can become an important asset for producing innovative, adaptive, and market-oriented young farmers (Anwarudin et al., 2019). Similarly, Zul et al., (2024) found that the motivation of young farmers in East Lombok is shaped by economic, social, environmental, and demographic factors, indicating that youth participation in agriculture depends not only on individual interest but also on the broader conditions that support farming as a viable livelihood.

Thus, education and career aspirations have a dual influence on farmer regeneration. On the one hand, education may encourage young people to leave agriculture because it opens access to non-agricultural jobs perceived as more attractive. On the other hand, education can become a strategic instrument to attract young people if agriculture is developed as a modern entrepreneurial space based on technology, digitalization, and innovation. Melani et al., (2025) showed that Generation Z's interest in agricultural careers is influenced by outcome expectations, career goals, and self-efficacy. Therefore, farmer regeneration strategies need to integrate agricultural education, agribusiness training, digitalization, and entrepreneurship development so that the agricultural sector aligns with the career aspirations of young people in Indonesia (Anwarudin et al., 2020b; Melani et al., 2025).

Technology and Digitalization

Technology and digitalization are important aspects of farmer regeneration because they can transform the image of agriculture from a traditional sector into a more modern, productive, and attractive economic sector for young people. The development of mechanization, access to digital information, online marketing, and agricultural information systems can expand youth participation in agribusiness. Young people, who are relatively more familiar with information technology, have opportunities to develop more innovative farming models, ranging from accessing technical cultivation information and market prices to product promotion, direct marketing to consumers, and farm financial recording (Anwarudin et al., 2018, 2019; Toumbourou et al., 2025).

However, the low adoption of technology in traditional farming practices remains one of the reasons why agriculture is less attractive to young people. Agriculture that is still associated with manual labor, simple tools, and conventional marketing is often perceived as physically demanding, inefficient, and less modern. This makes non-agricultural sectors appear more attractive because they are perceived as closer to

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technology, modern lifestyles, and opportunities for economic mobility. Ngadi et al., (2023) showed that young people tend to choose employment in manufacturing and services rather than agriculture, while (Toumbourou et al., 2025) emphasized that young people in agriculture are often represented as a group moving away from farming but also as potential actors in modern and digital agriculture.

Agricultural digitalization can also enhance the entrepreneurial capacity of young farmers. Access to information technology enables young farmers to acquire knowledge, build business networks, access markets, and develop agribusiness innovations. Digital agriculture also opens opportunities for young people to engage not only in production activities but also in downstream activities such as processing, packaging, branding, online marketing, and distribution. Anwarudin et al., (2019) found that the entrepreneurial capacity of young farmers is influenced by education, motivation, access to information and communication technology, external support, and the role of agricultural extension workers. This is consistent with Dayat et al., (2020), who showed that youth participation in agribusiness is influenced by interest, capacity, external support, and the business environment.

Nevertheless, agricultural digitalization still faces several constraints, including limited rural internet infrastructure, access to technological devices, digital literacy, capital, and mentoring. Therefore, digitalization cannot be effective without institutional support, financing, extension services, and policies that favor young farmers. Agricultural extension workers play an important role as facilitators who help young farmers understand technology, access government programs, and develop entrepreneurial capacity. In the context of young farmers' agribusiness sustainability, Anwarudin et al., (2020a) emphasized that access to information and communication technology, external support, the role of agricultural extension workers, and entrepreneurial capacity are key factors in strengthening the sustainability of young farmers' agribusiness. Thus, farmer regeneration strategies need to place technology and digitalization as part of agricultural transformation so that agriculture can become a more modern, productive, and aspirational career choice for young people in Indonesia (Anwarudin et al., 2020c; Bahagia et al., 2025; Hartini, 2021).

Farmer Regeneration Strategies

Farmer regeneration strategies need to be implemented comprehensively because declining youth interest in the agricultural sector is not caused by a single factor, but by a combination of economic, social, structural, educational, technological, and institutional

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factors. Therefore, efforts to attract young people into agriculture cannot rely merely on moral appeals for farmers' children to continue their parents' occupation. They must be accompanied by improvements in the farming system so that agriculture becomes economically viable, socially respected, and aligned with young people's aspirations (Anwarudin et al., 2018; Saleh et al., 2021). Understanding the profile and characteristics of young farmers is also important for designing appropriate regeneration strategies. Taopik et al., (2018), in their study of young farmers in Cianjur, West Java, highlighted that young farmers have specific characteristics that can serve as a basis for developing targeted farmer regeneration programs.

The first important strategy is to improve the economic viability of farming. Young people are more likely to be interested in agriculture if farming can provide adequate income, more manageable risks, and clear opportunities for business development. Low income and high uncertainty in farming have been major reasons why young people prefer non-agricultural employment. Therefore, farmer regeneration policies should focus on strengthening the value added of agricultural products, improving market access, stabilizing prices, and developing agribusiness based on priority commodities. Agriculture should be positioned not merely as a primary production activity, but as a business system from upstream to downstream that can generate profits for young farmers (Anwarudin et al., 2019; Ngadi et al., 2023; Sitanggang et al., 2025).

The second strategy is to expand young people's access to land and productive resources. One of the major barriers to farmer regeneration is limited land access for young people, particularly because land is still controlled by older generations, fragmented, or insufficient to achieve economies of scale. Without access to land, young people face difficulties in building independent and sustainable farming enterprises. Therefore, policies are needed to support land consolidation, farming partnerships, the use of idle land, and institutional models that enable young farmers to access productive land. Farmer regeneration should also pay attention to family farm succession so that the transfer of land, knowledge, and farming responsibilities can occur in a more planned manner (Anwarudin et al., 2020c; Saleh et al., 2021; Susilowati, 2016b).

The third strategy is to strengthen access to capital and financing for young farmers. Many young people are interested in developing agricultural enterprises but face constraints related to limited capital, collateral, business experience, and access to formal financial institutions. Therefore, agricultural financing programs should be designed to be more accessible to young farmers, for example through low-interest credit, group-based financing, agribusiness incubation, partnerships with cooperatives, and initial capital

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support for innovative farming enterprises. Access to capital should also be accompanied by business mentoring, financial literacy, and agribusiness management so that financing not only increases production but also strengthens the sustainability of young farmers' enterprises (Anwarudin et al., 2019, 2020b; Hartini, 2021).

The fourth strategy is to strengthen education, training, and entrepreneurial capacity among young farmers. Education should not become a factor that distances young people from agriculture; rather, it should be directed toward creating young farmers with managerial, innovative, and business-oriented capabilities. Training for young farmers should include technical cultivation, post-harvest processing, digital marketing, financial management, entrepreneurship, and technology utilization. Young people will be more interested in agriculture if the sector is understood as an entrepreneurial space that allows them to be creative, innovative, and economically independent. Therefore, strengthening entrepreneurial capacity is a key strategy in farmer regeneration (Anwarudin et al., 2019; Dayat et al., 2020; Melani et al., 2025).

The fifth strategy is to promote agricultural modernization and digitalization. Agriculture that is still perceived as traditional, manual, and physically demanding needs to be transformed into a more modern sector through mechanization, smart farming, information technology, digital marketing, and price information systems. Digitalization can bring agriculture closer to young people, who are familiar with technology. Moreover, digital technology can create new business opportunities not only in cultivation but also in processing, distribution, promotion, and marketing of agricultural products. Thus, agricultural digitalization can serve as an important instrument for transforming the image of agriculture into a more modern and attractive sector for young people (Anwarudin et al., 2020c; Bahagia et al., 2025; Toumbourou et al., 2025).

The sixth strategy is to strengthen the role of agricultural extension workers and young farmer institutions. Agricultural extension workers play an important role as facilitators, communicators, motivators, and mentors in the farmer regeneration process. Extension workers should not only provide technical information but also help young farmers access government programs, technology, markets, capital, and business networks. In addition, young farmer institutions such as young farmer groups, agripreneur communities, cooperatives, and farmer corporations need to be strengthened so that young people have spaces for learning, sharing experiences, and building business networks. Strong institutions can reduce individual risks in farming and improve the bargaining position of young farmers within agricultural value chains (Hartini, 2021; Mularahman et al., 2023).

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The seventh strategy is to build a new image of the farming profession. Farmer regeneration will not succeed if farming continues to be perceived as less prestigious, less modern, and economically unattractive. Therefore, a change in public narrative is needed to position farmers as strategic economic actors who play an important role in food security, rural development, and the national economy. Positive campaigns about young farmers, successful agripreneurs, digital agricultural innovation, and the contribution of agriculture to food security can help shape new perceptions among young people. Agriculture needs to be introduced as a profession with social, economic, and strategic value for the nation's future (Rahman et al., 2025; Setiani et al., 2021; Toumbourou et al., 2025).

The eighth strategy is to strengthen synergy among families, communities, government, educational institutions, and the private sector. Farmer regeneration cannot be the sole responsibility of farming families or the government. Families play a role in introducing agricultural values and skills from an early age, educational institutions contribute to building competencies and entrepreneurial interest in agriculture, the government provides regulations and incentives, while the private sector can create opportunities for partnerships, markets, and investment. Such multi-stakeholder synergy is important to ensure that young people not only enter agriculture but also remain and develop as key actors in modern agribusiness (Anwarudin et al., 2018; Haryanto et al., 2021; Sudrajat et al., 2025).

Thus, farmer regeneration strategies should be directed toward the comprehensive transformation of the agricultural sector. Regeneration efforts should not only aim to increase the number of young farmers but also to create an agricultural ecosystem that is viable, modern, inclusive, and sustainable. Increasing income, improving access to land and financing, strengthening education, technology, extension services, institutions, and transforming the social image of farming are essential components that must be implemented in an integrated manner. If these strategies are carried out consistently, agriculture has the potential to become an attractive career choice for young people in Indonesia while also strengthening the sustainability of national food security (Ngadi et al., 2023; Nurarifin & Kurniawan, 2025; Susilowati, 2016b, 2016a).

CONCEPTUAL SYNTHESIS

Based on the literature synthesis, farmer regeneration in Indonesia is influenced by various interrelated factors. The conceptual model presented in Figure 2 shows that youth interest in becoming farmers is not formed by a single factor, but rather by a combination

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of economic factors, structural factors, social factors, education and career aspirations, technology and digitalization, and institutional support. These six groups of factors shape young people's perceptions, motivations, and decisions in determining whether agriculture is viewed as a viable, attractive, and long-term career option.

Economic factors play an important role because young people tend to consider income, business risks, market certainty, and access to capital before deciding to enter the agricultural sector. Agriculture that is still perceived as low-income, high-risk, and unable to provide economic certainty tends to weaken young people's interest in becoming farmers (Arvianti et al., 2019; Ngadi et al., 2023; Sitanggang et al., 2025). Therefore, improving the economic viability of farming is an essential prerequisite for strengthening farmer regeneration.

Structural factors are also key determinants because access to land, land fragmentation, and family farm inheritance patterns influence young people's opportunities to start and manage farming enterprises independently. Limited access to land can make it difficult for young people to establish economically viable farming operations, while land fragmentation can reduce the efficiency and economic attractiveness of agriculture. In this context, farmer regeneration requires not only individual interest but also a resource ownership structure that supports youth participation in farming (Saleh et al., 2021; Susilowati, 2016b).

Social factors shape young people's decisions through farmers' social status and perceptions of agricultural work. If farming continues to be viewed as a less prestigious, physically demanding, traditional, and economically unattractive occupation, young people are more likely to choose employment outside agriculture. Conversely, if the farming profession is constructed as strategic, modern, and essential to food security, young people's perceptions of agriculture may become more positive (Makabori & Tapi, 2019; Toumbourou et al., 2025).

Education and career aspirations are also important components of the conceptual model. Higher levels of education may open employment opportunities outside agriculture, causing farming to be positioned as a last-resort occupation. However, education can also become an important asset if it is directed toward strengthening entrepreneurial capacity, technological literacy, and agribusiness management. Thus, education has a dual effect: it may distance young people from agriculture when farming is perceived as inconsistent with their career aspirations, but it may also attract them if agriculture is developed as a modern entrepreneurial space (Anwarudin et al., 2019; Arvianti et al., 2019; Melani et al., 2025).

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Technology and digitalization serve as factors that can transform both the image and practice of agriculture. Young people are generally more familiar with information technology, making agricultural digitalization a potential bridge for increasing their interest in the sector. Through mechanization, smart farming, digital marketing, and agricultural information systems, agriculture can be perceived not merely as traditional physical work in the field but as a modern and innovative economic activity. Therefore, technology and digitalization function as transformation instruments that can strengthen the attractiveness of agriculture for young people (Anwarudin et al., 2020c; Bahagia et al., 2025; Toumbourou et al., 2025).

Institutional support acts as an enabling factor that connects these determinants. The roles of agricultural extension workers, government programs, young farmer communities, cooperatives, farmer corporations, educational institutions, and the private sector are needed to create a sustainable farmer regeneration ecosystem. Institutional support can help young people access capital, technology, training, market information, business networks, and agribusiness mentoring. Without strong institutional support, youth interest in agriculture may not develop into real and sustainable participation (Hartini, 2021; Haryanto et al., 2021; Mularahman et al., 2023).

Thus, this conceptual model emphasizes that youth interest in becoming farmers is a key variable that links various determinants to the ultimate goal of sustainable farmer regeneration. In other words, economic, structural, social, educational, technological, and institutional factors do not automatically produce farmer regeneration; rather, these factors first shape young people's interest, perceptions, motivations, and decisions. If these six factors are strengthened in an integrated manner, youth interest in agriculture may increase and ultimately promote sustainable farmer regeneration in Indonesia.

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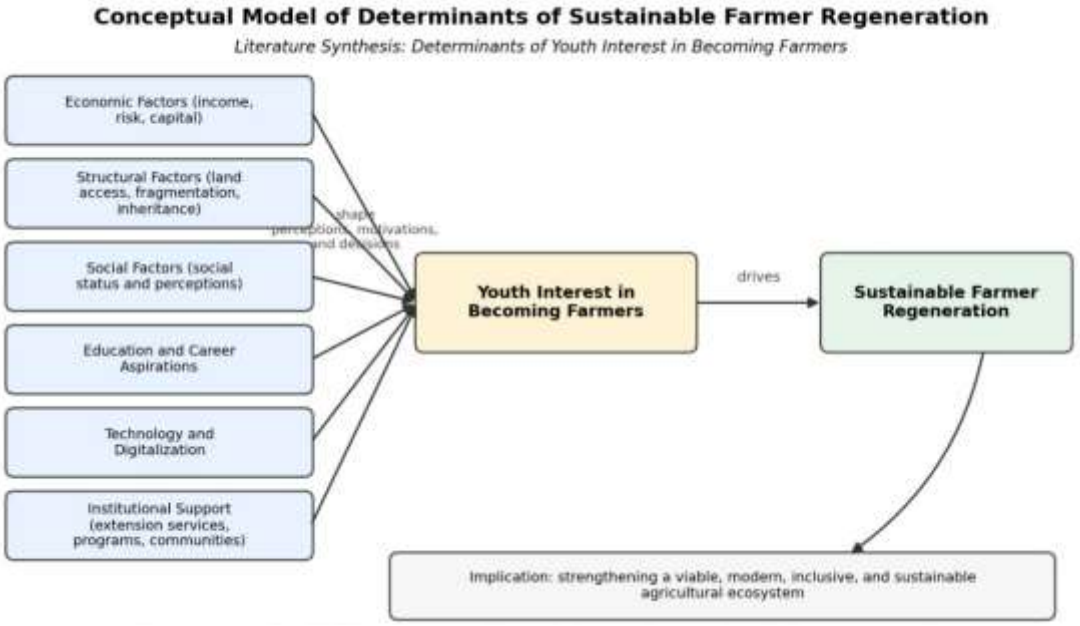


Figure 2 Conceptual model of determinants of sustainable smallholder regeneration

CONCLUSION

Based on the literature review, farmer regeneration in Indonesia is a multidimensional issue related to changes in the social, economic, educational, technological, and institutional structures of the agricultural sector. The aging trend among farmers indicates that agriculture faces serious challenges in attracting and retaining young people as key actors in farming activities. If this issue remains unaddressed, it may threaten the sustainability of agricultural production, food security, and future agricultural transformation.

The declining interest of young people in the agricultural sector is influenced by several main factors, including economic, structural, social, educational, technological, and institutional factors. Economic factors include low income, high farming risks, price uncertainty, and limited access to capital. Structural factors include limited access to land, land fragmentation, and inheritance patterns that do not yet support young people's independence in farming. Meanwhile, social factors, education, and career aspirations shape the perception that agriculture is less prestigious, physically demanding, and less aligned with young people's expectations for social mobility.

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The conceptual synthesis in this article shows that youth interest in becoming farmers is a key variable in the farmer regeneration process. Economic, structural, social, educational, technological, and institutional factors do not directly generate regeneration; rather, they first shape young people's perceptions, motivations, and decisions regarding the agricultural sector. If these factors are strengthened in an integrated manner, youth interest in agriculture may increase and support sustainable farmer regeneration. Therefore, farmer regeneration should not be understood merely as a process of replacing older farmers with younger ones, but as a transformation of the agricultural ecosystem. The agricultural sector needs to become more economically viable, technologically modern, institutionally stronger, and socially attractive. The success of farmer regeneration depends on the ability of various stakeholders to create a productive, innovative, inclusive, and sustainable agricultural sector.

POLICY IMPLICATIONS

Based on the literature synthesis, farmer regeneration policies should be directed toward creating an agricultural ecosystem that is more attractive, viable, and sustainable for young people. First, the government needs to strengthen economic incentives for young farmers through price support, targeted input subsidies, production facility assistance, farming risk protection, and market development that can increase young farmers' income.

Second, farmer regeneration policies should ensure access to land and financing. Young farmers need access to productive land, land rental schemes, the utilization of idle land, land consolidation, and financing that is accessible, low-interest, and not overly dependent on conventional collateral requirements.

Third, agricultural digitalization should be expanded through the provision of rural internet infrastructure, training in the use of digital technologies, the development of online marketing, price information systems, and smart farming applications appropriate to the scale of young farmers' enterprises. Digitalization is essential for transforming the image of agriculture into a modern and innovative sector.

Fourth, the government and educational institutions need to strengthen vocational agricultural education based on practical skills, entrepreneurship, technology, and market needs. Agricultural education should be directed toward producing young farmers who are not only capable of production but also able to manage agribusinesses, identify market opportunities, and create added value.

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Fifth, young farmer institutions should be strengthened through the establishment of young farmer groups, cooperatives, agripreneur communities, agricultural business incubators, and partnerships with the private sector. Strong institutions can help young farmers access capital, technology, markets, information, and business mentoring in a more sustainable manner.

Thus, farmer regeneration policies should be implemented in an integrated way, not merely by increasing the number of young farmers, but also by ensuring that agriculture becomes a rational, modern, and promising career choice for young people in Indonesia.

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