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Article

Empowering Individual Farmers through Education: A Qualitative Document Analysis of Malaysia's Agriculture Census 2024 and the 13th Malaysia Plan (RMK13)

Chan Fatt Cheah

Ungku Aziz Centre for Development Studies, Universiti Malaya, Kuala Lumpur 50630, Malaysia;
cheahchanfatt@gmail.com

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Abstract: Education is a key driver of agricultural development, especially in developing countries where most producers are individual farmers. This study examines how education influences Malaysia's agricultural transformation under the 13th Malaysia Plan (RMK13) through qualitative document analysis (QDA). Sources include the Agriculture Census Report 2024, RMK13 policy documents, and scholarly literature on agricultural education, lifelong learning, Technical and Vocational Education and Training (TVET), and agricultural development. Thematic analysis identifies four main themes: the strategic role of individual farmers, demographic ageing and the need for lifelong learning, educational attainment as a human capital challenge, and education as a catalyst for transformation. Findings show that individual farmers manage most agricultural holdings, but the sector faces an ageing workforce and limited access to formal education and technical training. Applying Human Capital Theory and Lifelong Learning Theory, the analysis highlights formal education, TVET, extension services, farmer field schools, and digital learning as complementary ways to build farmers' skills. Case studies from the Netherlands, Japan, and South Korea illustrate the value of integrating education, research, extension, and innovation. The study concludes that education is essential for Malaysia's agricultural transformation, but its effectiveness depends on supportive institutions, technological progress, and policy implementation under RMK13.

Keywords: Agricultural Education; Farmer Empowerment; Human Capital Development; Lifelong Learning; Agricultural Transformation

1. Introduction

Agriculture continues to be a strategic sector in Malaysia, despite a declining contribution to the national Gross Domestic Product (GDP). In addition to its economic role, agriculture supports national food security, rural livelihoods, employment generation, and environmental sustainability. The sector is currently undergoing rapid transformation due to technological innovation, climate change, digitalisation, evolving market demands, and sustainability agendas [1, 2]. As a result, agricultural transformation now relies not only on investments in physical infrastructure and mechanisation but also on farmers' ability to acquire, interpret, and apply new knowledge within increasingly complex agricultural systems.

Recent agricultural development literature identifies education as a fundamental driver of agricultural transformation. Human Capital Theory posits that investments in education enhance individuals' knowledge, competencies, and decision-making abilities, which in turn increase productivity and innovation. Similarly, Rogers' Diffusion of Innovations Theory asserts that the adoption of agricultural technologies depends on farmers' access to knowl-

edge, communication networks, and learning opportunities. The Agricultural Innovation Systems (AIS) framework further highlights that agricultural transformation results from interactions among farmers, extension agencies, research institutions, universities, policymakers, and private-sector organisations, with education serving as a central mechanism for knowledge exchange rather than as an isolated intervention.

Agricultural education therefore encompasses more than formal schooling, including Technical and Vocational Education and Training (TVET), agricultural extension services, farmer field schools, lifelong learning programmes, digital advisory platforms, and informal knowledge-sharing mechanisms. These educational approaches enable farmers to develop technical competencies, adapt to climate change, engage in digital agriculture, and meet increasingly complex market requirements [3–5].

International experience indicates that countries achieving successful agricultural transformation have integrated education, research, innovation, and extension within coordinated policy frameworks. The Netherlands has advanced precision agriculture through collaboration among universities, research institutes, extension organisations, and farmers. Japan has addressed an ageing farming population through lifelong learning programmes and farmer field schools, while South Korea has made substantial investments in digital agricultural education and smart farming initiatives [6–8]. These examples are not intended as direct models for Malaysia but serve to illustrate how educational systems can facilitate agricultural modernisation in diverse institutional contexts.

Malaysia has also designated agricultural transformation as a national priority under the Thirteenth Malaysia Plan (RMK13), which emphasises food security, digitalisation, sustainability, agricultural modernisation, and inclusive rural development. Achieving these policy goals requires a farming population that can adopt innovation and respond to technological and environmental changes. However, recent data from the Agriculture Census Report 2024 highlight several demographic and educational challenges that may affect implementation. A key concern is the ageing profile of Malaysian farmers. As shown in **Table 1**, almost half (47.4%) of individual farmers are aged 60 years and above, while only 2.8% are between 15 and 30 years old. This demographic imbalance presents challenges for labour succession, knowledge renewal, technology adoption, and long-term sector sustainability. These patterns do not suggest that older farmers are less innovative, but rather underscore the need for educational strategies that address diverse learning needs and promote lifelong learning opportunities.

Table 1. Age Distribution of Individual Farmers in Malaysia, 2023.

Age Group	Number (n)	Percentage (%)
15–30 years	25,352	2.8
31–45 years	163,168	17.8
46–59 years	293,314	32.0
60 years and above	433,696	47.4
Total	915,530	100.0

Source: Agriculture Census Report 2024.

Beyond demographic challenges, Malaysian farmers generally have limited formal education. **Table 2** shows that over half lack formal qualifications (27.8%) or have not reached the Sijil Pelajaran Malaysia (SPM) level (26.6%). Participation in higher education and TVET is also low. While formal qualifications do not directly measure agricultural competence, these findings are important for understanding the role of education in Malaysia's agricultural transformation agenda.

Table 2. Educational Attainment of Individual Farmers in Malaysia, 2023.

Highest Certificate Attained	Number (n)	Percentage (%)
Doctor of Philosophy (PhD)	632	0.1
Degree/Advanced Diploma/Masters	21,949	2.5
Polytechnic/University Diploma	20,898	2.3
TVET Diploma/Advanced Diploma	8,247	0.9
Polytechnic/University Certificate	4,077	0.5
TVET Certificate	3,300	0.4
STPM or Equivalent	11,930	1.3
SPM or Equivalent	337,383	37.7
Below SPM Standard	237,865	26.6
No Certificate	248,807	27.8

Source: Agriculture Census Report 2024.

Previous Malaysian research has focused on agricultural productivity, technology adoption, extension services, and rural development. Education, however, is often viewed only as a supporting factor in agricultural performance, rather than as a central driver of transformation. Few studies have combined evidence from the Agriculture Census Report 2024, the RMK13, and international educational literature to assess how demographic characteristics, educational capacity, and policy priorities together influence Malaysia's agricultural transformation agenda. As a result, there is limited understanding of how education is positioned within national agricultural policy and how documentary evidence guides future educational strategies.

To address this gap, this study conducts a qualitative document analysis (QDA) using the Agriculture Census Report 2024, the RMK13, and selected scholarly literature on agricultural education, human capital development, lifelong learning, agricultural extension, and digital agriculture. Instead of evaluating the effectiveness of educational interventions or establishing causal links between education and agricultural performance, the analysis synthesises documentary evidence to identify recurring educational themes, interpreted through Human Capital Theory and Lifelong Learning Theory.

Figure 1 shows the analytical framework for this study. The framework is not a causal model but an interpretive guide for analysing documentary evidence. It positions education as one enabling component within a broader agricultural transformation system that includes institutional support, technological infrastructure, governance, market access, financial resources, and environmental conditions. Educational capacity is therefore examined in relation to these contextual factors, rather than as the sole driver of agricultural transformation.

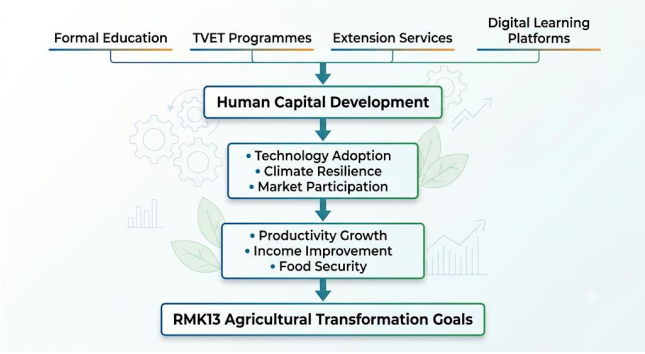

Figure 1. Conceptual Framework of Education-Led Agricultural Transformation under RMK13.

This analytical framework informs the following research questions:

1. What demographic and educational characteristics of Malaysian individual farmers are identified in the Agriculture Census Report 2024 and related policy documents?
2. How are these demographic and educational characteristics interpreted in relation to the agricultural transformation priorities outlined in RMK13?
3. How do national policy documents and international scholarly literature conceptualise the role of education within Malaysia's agricultural transformation agenda?

This study advances qualitative educational research by systematically analysing national statistical evidence, policy documents, and scholarly literature within a theoretically informed framework. Rather than establishing causal relationships, it offers an evidence-based interpretation of how education is positioned within Malaysia's agricultural transformation agenda, while recognising the influence of institutional, economic, technological, environmental, and governance factors on agricultural development.

2. Materials and Methods

2.1. Research Design

QDA was used to assess how education is positioned within Malaysia's agricultural transformation agenda under the RMK13. QDA facilitated the interpretation of policy, statistical, and scholarly documents, focusing on

representation rather than measuring causal relationships between education and agricultural performance. This method allowed for a systematic review of educational capacity, farmer characteristics, and agricultural transformation priorities in official reports, policy documents, and academic literature.

Consistent with qualitative policy research, the analysis identified patterns, assumptions, and recurring educational themes across various documentary sources. The aim was to provide an analytical interpretation of the evidence, not to assess the effectiveness of specific educational interventions or determine causal effects on productivity, technology adoption, or resilience.

2.2. Documentary Search Strategy and Data Sources

A purposive documentary sampling strategy was used to select sources directly related to agricultural education, human capital development, lifelong learning, extension services, digital agriculture, and agricultural transformation. The final corpus included 38 documents:

- 1 government statistical report (Agriculture Census Report 2024);
- 1 national policy document (RMK13);
- 36 scholarly and policy documents, including peer-reviewed journal articles, international policy reports, and academic publications on agricultural education, extension, TVET, lifelong learning, digital agriculture, and agricultural transformation.

Academic documents were identified through searches in Scopus, Web of Science, ERIC, and Google Scholar between January and March 2026. The search combined terms such as "agricultural education", "human capital", "lifelong learning", "agricultural extension", "TVET", "digital agriculture", "agricultural transformation", and "Malaysia". The review focused on publications from 2010 to 2025 and included seminal theoretical works essential for conceptual grounding.

The documentary sources and their respective analytical roles are summarised in **Table 3**.

Table 3. Document Sources and Their Analytical Contributions.

Document Source	Type of Document	Analytical Contribution
Agriculture Census Report 2024	Government Statistical Report	Demographic and educational profile of individual farmers
RMK13	National Policy Document	Agricultural transformation priorities and educational policy directions
International agricultural education literature	Peer-reviewed Journal Articles	Comparative educational strategies and theoretical perspectives
Agricultural extension and TVET studies	Academic Literature	Capacity-building, skills development, and lifelong learning mechanisms
Human capital and innovation literature	Theoretical and empirical scholarship	Analytical interpretation of education within agricultural transformation

Rather than using methodological triangulation, this study corroborated documentary sources by systematically comparing census data, policy documents, and scholarly literature to improve interpretive consistency.

2.3. Document Selection Criteria

Documents were included if they satisfied four specific criteria:

- Addressed farmer education, agricultural learning, human capital development, or agricultural transformation;
- Had a clear connection to agricultural policy, extension systems, or development strategies;
- Were published by recognised government agencies, international organisations, or peer-reviewed academic journals;
- Contributed to understanding how educational capacity is addressed in agricultural development.

Documents were excluded if they focused only on technical crop production, engineering processes, or commodity markets without substantive discussion of education, training, extension, knowledge transfer, or human capital development. **Figure 2** summarises the document identification and screening process.

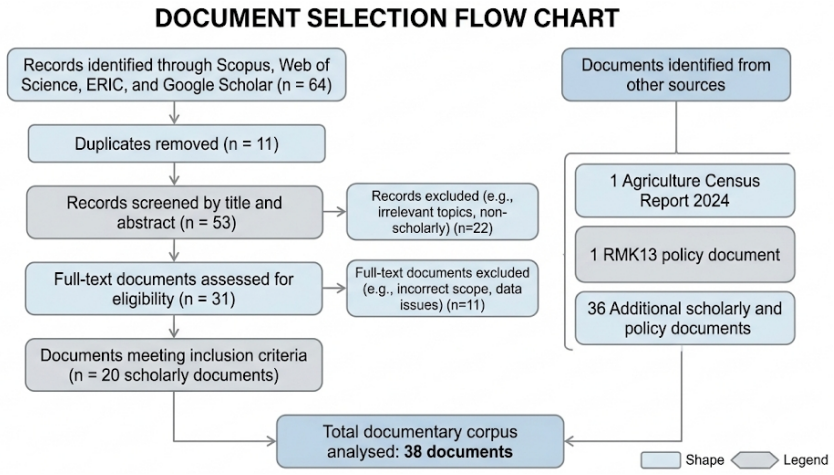

Figure 2. Documentary Search and Screening Process.

The Netherlands, Japan, and South Korea were chosen for comparison because they represent knowledge-intensive agricultural systems with strong integration of education, research, extension, and innovation. These examples are intended to highlight transferable educational principles, not to serve as direct models for Malaysia or to suggest institutional equivalence.

2.4. Data Analysis Procedure

A hybrid thematic analysis was conducted, combining deductive coding from theoretical frameworks with inductive coding to identify new themes in the documents. This approach aligned with the study's theoretical orientation while remaining open to unexpected patterns in the evidence.

The analysis adhered to the six-phase thematic approach:

- Familiarisation: All documents were read multiple times and annotated.
- Initial coding: Meaningful segments pertaining to education, ageing, skills development, extension, digitalisation, policy implementation, and agricultural transformation were systematically coded.
- Category development: Similar codes were consolidated into broader analytical categories.
- Theme generation: Analytical categories were reviewed across all documents to identify recurring patterns.
- Theme refinement: Identified themes were compared with the original documents and revised as necessary.
- Interpretation and reporting: Themes were interpreted through Human Capital Theory.

Table 4 provides an example of the coding process.

Table 4. Example of Coding and Theme Development.

Document Excerpt	Initial Code	Category	Theme
"Strengthen digital agriculture and farmer capability development" (RMK13)	Digital capability building	Skills development	Education for agricultural transformation
"47.4% of farmers are aged 60 years and above" (Agriculture Census Report 2024)	Ageing farmer population	Demographic challenge	Demographic challenges in Malaysian agriculture
"Farmer field schools support continuous learning among older farmers" (Japan literature)	Lifelong learning mechanism	Extension and adult learning	Education for agricultural transformation

This analysis identified four overarching themes (**Figure 3**):

- Demographic challenges in Malaysian agriculture;
- Educational attainment and human capital constraints;
- Education as an enabling mechanism for agricultural transformation;
- Policy opportunities for strengthening education under RMK13.

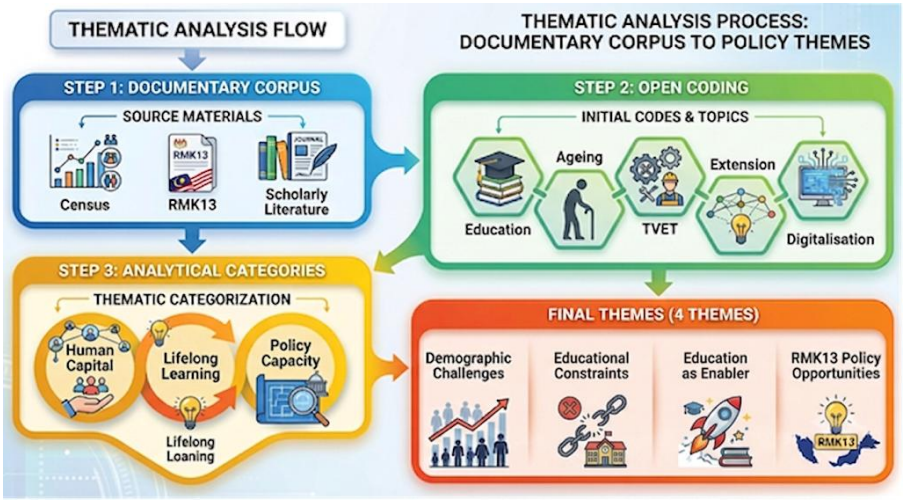

Figure 3. Analytical Pathway from Documents to Themes.

This theme illustrates the analytical pathway from documentary evidence to the final themes.

2.5. Trustworthiness and Rigour

We used several strategies to strengthen the study's trustworthiness.

2.5.1. Credibility

The analysis's credibility was strengthened by systematically comparing census statistics, RMK13 policy statements, and peer-reviewed scholarship. Interpretations were included only when supported by multiple documentary sources.

2.5.2. Dependability

Dependability was ensured through a documented audit trail outlining search decisions, inclusion and exclusion criteria, coding changes, category development, and theme refinement.

2.5.3. Confirmability

Confirmability was enhanced by maintaining a coding log and directly linking thematic interpretations to documentary excerpts rather than personal assumptions.

2.5.4. Transferability

This study examines the Malaysian context. Although some educational challenges identified may also occur in other agricultural systems, the findings are intended to provide analytical insights, not direct policy recommendations.

2.6. Ethical Considerations

This study used only publicly available documents and secondary data. Since no human participants or personal information were involved, formal ethical approval was not required. All sources were cited according to academic standards.

2.7. Theoretical and Analytical Framework

The analysis drew primarily on Human Capital Theory and Lifelong Learning Theory. Human Capital Theory was used deductively to interpret links among education, skills development, innovation adoption, and economic participation in policy documents and scholarly literature. Lifelong Learning Theory provided a complementary

lens to examine ongoing learning through extension services, vocational training, farmer field schools, digital platforms, and informal knowledge exchange, with a focus on the ageing farming population.

These theories did not predetermine the findings but served as analytical frameworks to guide interpretation of themes from the documentary evidence. This hybrid deductive and inductive approach kept the study theoretically grounded while allowing for unanticipated patterns.

Overall, the methodological framework conceptualised education as the methodological framework positioned education as one element within a broader agricultural transformation system that includes institutional support, technological infrastructure, governance, financial resources, market access, and environmental conditions. The analysis therefore focused on how educational capacity is represented in Malaysia's agricultural transformation agenda, without assuming that education alone determines agricultural outcomes.

3. Results

A qualitative analysis of 38 sources, including the Agriculture Census Report 2024, the RMK13, and key literature on agricultural education and related fields, identified four interrelated themes that clarify the role of education in Malaysia's agricultural transformation. These themes emerged through iterative coding and cross-document comparison, not from any single source. Initial codes such as farmer capability, ageing workforce, educational attainment, lifelong learning, digital skills, extension services, and knowledge transfer were refined into broader categories and synthesised into four main themes, following the thematic analysis procedures. **Figure 4** illustrates the analytical process from documentary evidence to the final themes.

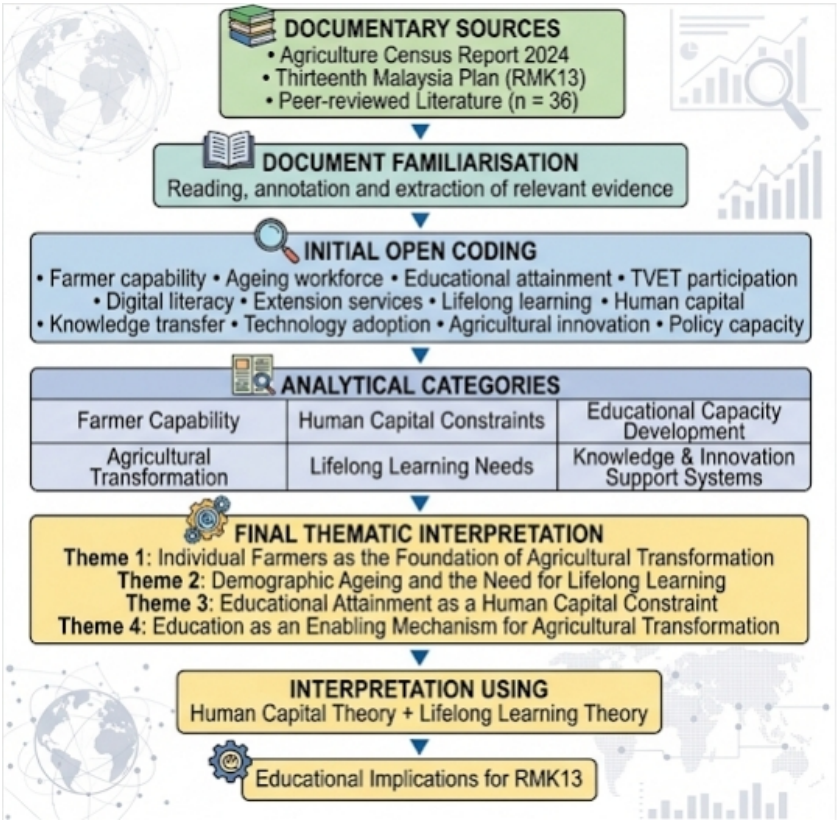

Figure 4. Analytical Pathway from Documents to Themes.

The four themes are: (1) individual farmers as the foundation of Malaysia's agricultural transformation; (2) demographic ageing and the need for lifelong learning; (3) limited educational attainment as a constraint on human capital; and (4) education as a driver of agricultural transformation under RMK13.

3.1. Theme 1: Individual Farmers as the Foundation of Malaysia's Agricultural Transformation

The first theme identified from documentary evidence is the dominant role of individual farmers in Malaysia's agricultural system. The coding process frequently referenced farmer capability, human capital development, capacity building, and inclusive agricultural development, which were grouped under farmer capability. The Agriculture Census Report 2024 shows that individual farmers manage 97.9% of agricultural holdings. This indicates that the success of agricultural transformation policies relies mainly on the knowledge, adaptability, and decision-making of individual producers rather than large commercial enterprises [3].

RMK13 further supports this finding by identifying human capital development, digital capability, and farmer empowerment as key policy priorities for agricultural modernisation [1]. The literature also highlights that agricultural transformation increasingly depends on farmers' ability to acquire, interpret, and apply new knowledge in response to changing technological, environmental, and market conditions [5,9].

The strategic importance of individual farmers is evident in their contributions across major agricultural subsectors. As shown in **Table 5**, individual holdings account for significant production of oil palm, paddy, rubber, fruits, and vegetables, highlighting their ongoing role in national food production and agricultural output [3].

Table 5. Land Use and Production Characteristics of Individual Agriculture Holdings by Crop Subsector, Malaysia, 2023.

Subsector	Planted Area (Ha)	Production Quantity (Metric Tonnes)	Sales Quantity (Metric Tonnes)
Oil Palm	907,511.4	13,378,023.6	13,378,023.6
Paddy	537,821.6	2,257,434.0	1,944,379.5
Rubber	604,013.7	344,661.5	344,661.5
Fruits	144,148.1	1,259,093.0	837,990.4
Vegetables	62,186.9	969,203.5	945,631.5

Source: Agriculture Census Report 2024.

These production statistics are not standalone findings; rather, they offer context for RMK13's strong focus on strengthening farmers' educational capacity. Documentary analysis consistently identifies education as essential for preparing farmers to adopt technological innovation and adapt to changing production systems. It also recognises that educational development works alongside institutional support, market access, financial resources, technological infrastructure, and governance arrangements [4,10].

3.2. Theme 2: Demographic Ageing and the Need for Lifelong Learning

The second theme examines the ageing demographic of Malaysia's farming population. Documentary analysis identified recurring codes, including ageing farmers, labour succession, lifelong learning, extension support, and adaptive learning. These were synthesised into the analytical category of educational adaptation to demographic change.

The Agriculture Census Report 2024 consistently identifies an ageing farming population across major crop subsectors. As shown in **Table 6**, farmers aged 60 years and above constitute the largest age group in oil palm, paddy, rubber, and fruit production, whereas younger farmers are comparatively underrepresented [3].

Table 6. Age Structure of Individual Farmers by Crop Subsector, Malaysia, 2023.

Subsector	15–30 Years	31–45 Years	46–59 Years	60 Years and above
Oil Palm	4,145	37,522	73,432	121,142
Paddy	3,084	20,526	41,988	64,796
Rubber	10,891	69,106	122,176	184,735
Fruits	3,039	17,886	29,287	37,517
Vegetables	2,672	11,522	15,305	14,762

Source: Agriculture Census Report 2024.

Figure 5 clearly shows the demographic pattern, emphasising the concentration of older farmers in different agricultural subsectors.

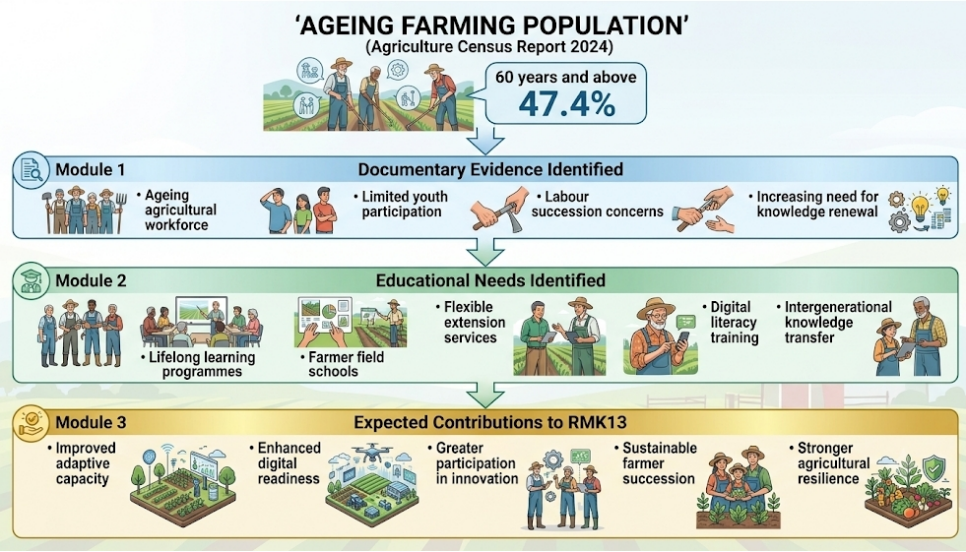

Figure 5. Age Profile of Malaysian Individual Farmers.

Documentary evidence shows that demographic ageing increases the importance of lifelong learning, extension services, farmer field schools, and flexible educational delivery [7,9]. It does not imply that older farmers are less innovative. The literature emphasises that ongoing learning is essential for knowledge renewal and adaptation in ageing agricultural communities [11,12]. Successful adaptation also depends on institutional support, financial incentives, digital infrastructure, and intergenerational knowledge transfer [13,14].

3.3. Theme 3: Educational Attainment as a Human Capital Constraint

The third theme, identified through documentary evidence, concerns educational qualifications, technical competencies, and workforce preparedness. Codes related to formal education, technical skills, digital literacy, TVET participation, and knowledge capability were grouped under human capital constraints.

As shown in **Table 7**, few farmers hold tertiary qualifications or have participated in technical and vocational education. Most have completed education at the SPM level or below [3].

Table 7. Educational Attainment of Individual Farmers by Crop Subsector, Malaysia, 2023 (Selected Categories).

Subsector	Degree/Masters	TVET Diploma	SPM or Equivalent	No Certificate
Oil Palm	11,220	5,007	75,337	66,157
Paddy	2,732	547	48,027	21,124
Rubber	3,072	803	144,548	128,312
Fruits	3,006	1,029	35,458	18,115
Vegetables	1,278	583	19,967	8,440

Source: Agriculture Census Report 2024.

Documentary sources view educational attainment as one component of broader human capital development, not a direct measure of farming competence. RMK13 and the literature emphasise that practical skills, extension program participation, experiential learning, and digital literacy are essential alongside formal qualifications [1,4,15]. The findings suggest that improving agricultural education requires diverse learning pathways that combine formal education with vocational training, lifelong learning, extension services, and digital knowledge-sharing platforms [5,15].

3.4. Theme 4: Education as an Enabling Mechanism for Agricultural Transformation

The final theme highlights education as a key driver of agricultural transformation, based on documentary evidence. During coding, recurring concepts such as capacity building, innovation adoption, knowledge transfer, digital capability, extension services, and lifelong learning were grouped under education for transformation.

Comparative evidence shows that successful agricultural systems consistently integrate educational institutions, research organisations, extension services, and farmers within coordinated knowledge systems [6–8]. As shown in **Table 8**, the Netherlands, Japan, and South Korea each use distinct approaches to strengthen agricultural capability through education.

Table 8. Educational Approaches Supporting Agricultural Transformation.

Country	Educational Mechanism	Key Outcome
Netherlands	University–Research–Extension integration	Knowledge-intensive and precision agriculture
Japan	Lifelong learning and farmer field schools	Continuous capability development for ageing farmers
South Korea	Smart farming education and digital learning	Technology adoption and digital transformation

Rather than recommending these countries as direct policy models for Malaysia, the documentary analysis highlights shared educational principles, including continuous learning, institutional collaboration, knowledge transfer, and farmer-centred extension. These principles can inform future educational strategies, while recognising differences in governance, agriculture, and economic contexts [6–8].

Figure 6 summarises the relationships identified across the documentary sources.

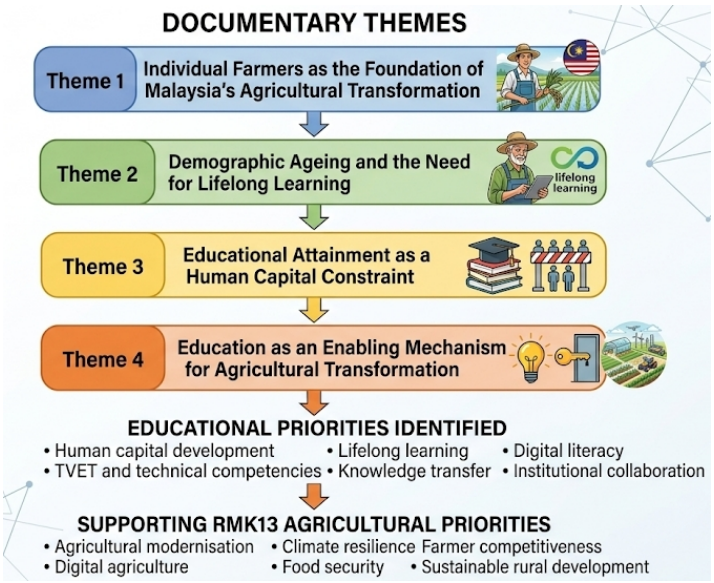

Figure 6. Thematic Relationships between Educational Capacity and Agricultural Transformation under RMK13.

Documentary evidence consistently identifies education as a key factor in Malaysia's agricultural transformation. However, the analysis indicates that education alone is insufficient without parallel investments in institutional support, technological infrastructure, financial resources, governance, market access, and AIS [4, 12, 16]. These findings guide the following discussion, which critically examines these themes in relation to existing theory and international scholarship.

4. Discussion

This study examines the role of education in Malaysia's agricultural transformation agenda through qualitative analysis of the Agriculture Census Report 2024, RMK13 policy documents, and relevant literature. Rather than establishing causality between education and agricultural performance, the analysis explores how these sources collectively present education as an enabling factor. Thematic analysis identified four key themes: education strengthens farmer capability, addresses demographic challenges, supports knowledge development, and facilitates policy implementation. However, the evidence shows that education operates alongside other critical factors, including institutional support, financial resources, technological infrastructure, market access, governance, and AIS [1,3,4].

These findings suggest that education contributes to agricultural transformation within a broader socio-economic and policy context, rather than serving as the sole determinant of agricultural outcomes.

4.1. Education, Human Capital Development and Agricultural Transformation

The first theme highlights the strategic role of individual farmers in Malaysia's agricultural system. **Table 5** shows that individual farmers significantly contribute to national production in the oil palm, paddy, rubber, fruit, and vegetable subsectors [3]. These statistics demonstrate that RMK13's success relies mainly on strengthening individual farmers' capabilities, rather than focusing only on large commercial enterprises.

Documentary analysis shows that educational development is consistently identified as a key mechanism for strengthening these capabilities. RMK13 prioritises human capital development, digital readiness, and knowledge acquisition to advance agricultural modernisation [1]. The documents link educational opportunities to farmer preparedness for technological change, sustainable practices, and knowledge-intensive systems. However, they do not suggest that education alone is sufficient to improve agricultural performance. Instead, educational development is presented alongside institutional support, agricultural extension, research collaboration, infrastructure, and financial investment.

These findings align with Human Capital Theory, which states that investments in education and training enhance productivity by improving knowledge, skills, and decision-making. However, this analysis shows that human capital includes more than formal education. Practical experience, extension program participation, vocational training, lifelong learning, and experiential knowledge all contribute to farmers' capabilities [4, 17]. Thus, educational attainment alone should not be seen as a direct measure of agricultural competence. This interpretation is further supported by the AIS perspective, which holds that agricultural transformation results from collaboration among farmers, universities, extension agencies, research organisations, government institutions, and private-sector actors, rather than from individual educational attainment alone. While **Figure 6** identifies education as an enabling mechanism for agricultural transformation, the evidence also shows that educational initiatives need complementary institutional and economic support to contribute to RMK13 implementation effectively.

4.2. Lifelong Learning for an Ageing Agricultural Workforce

The second and third themes highlight demographic ageing and educational preparedness as interconnected challenges for Malaysia's agricultural transformation. **Table 6** shows that farmers aged 60 and above make up the largest proportion in nearly all major agricultural subsectors [18]. **Figure 6** further illustrates how demographic ageing increases the need for lifelong learning, extension support, digital literacy, and intergenerational knowledge transfer.

The documentary sources do not suggest that older farmers are inherently resistant to innovation. Instead, they show that demographic ageing changes the educational needs within the agricultural sector. This view aligns with Lifelong Learning Theory, which sees learning as a continuous process that includes workplace learning, vocational training, agricultural extension, community participation, and informal knowledge exchange [19]. Educational programmes for ageing farmers should therefore prioritise flexible, practice-oriented approaches such as demonstration farms, farmer field schools, extension advisory services, peer-learning networks, and digital learning platforms. Documentary evidence shows that relatively few Malaysian farmers possess tertiary qualifications or TVET credentials. At the same time, a substantial proportion have educational attainment at the SPM level or below [20]. However, these findings do not imply that lower educational attainment directly limits technology adoption or productivity. Instead, the documents indicate that formal education is only one aspect of broader human capital development, which also encompasses practical skills, experiential knowledge, extension participation, and continuous learning opportunities.

International evidence provides additional context for these findings. As shown in **Table 8**, the Netherlands, Japan, and South Korea have each adopted distinct educational approaches to support agricultural modernisation [21–24]. These countries were chosen for their coordinated systems linking education, research, extension services, and agricultural innovation. However, the analysis recognises significant contextual differences between these countries and Malaysia, including economic development, institutional capacity, agricultural structure, and public investment. The study does not recommend direct policy transfer. Instead, it identifies broader educational principles, such as continuous learning, institutional collaboration, knowledge exchange, and farmer-centred ex-

tension, which may inform future educational strategies in Malaysia.

Overall, the documentary findings suggest that education should be seen as one enabling factor within Malaysia's broader agricultural transformation agenda, rather than the primary determinant of agricultural performance. As shown in **Figure 6**, educational development enhances farmer capability, but its impact relies on complementary investments in governance, innovation systems, financial resources, technological infrastructure, market access, and institutional support. This balanced view recognises the complexity of agricultural transformation and avoids overly deterministic conclusions about the role of education.

5. Conclusions

This research investigates the representation of education within Malaysia's agricultural transformation agenda through QDA of the Agriculture Census Report 2024, the RMK13, and relevant scholarly literature. Instead of assessing the effectiveness of specific educational interventions, the analysis synthesises documentary evidence to clarify how educational development is positioned within national agricultural policy and international discourse on agricultural transformation. Four interrelated themes are identified: the strategic role of individual farmers in Malaysia's agricultural system, challenges related to an ageing farming population, educational attainment as a human capital constraint, and education as an enabling mechanism for agricultural transformation.

The findings demonstrate that Malaysian policy documents consistently position education as a key factor in strengthening farmers' capabilities to address technological change, climate challenges, and evolving agricultural systems [1,3]. Nevertheless, the documentary evidence indicates that education should not be considered in isolation. Agricultural transformation is shaped by multiple interacting factors, such as institutional support, agricultural extension, financial resources, technological infrastructure, governance, market access, and innovation systems [4]. Therefore, the analysis concludes that educational attainment alone does not lead to improved agricultural performance; rather, educational development constitutes one component within a broader agricultural transformation framework.

The analysis underscores the importance of adopting multiple educational pathways to support Malaysia's diverse farming community. Formal education, TVET, lifelong learning, agricultural extension services, farmer field schools, and digital learning platforms each contribute distinct forms of knowledge and capability development [15,25]. The documentary evidence indicates that these approaches are particularly relevant for addressing demographic ageing, enhancing digital readiness, and supporting ongoing knowledge development among farmers. However, the effectiveness of these educational approaches relies on complementary investments in institutional capacity and supportive agricultural policies.

The comparative review of the Netherlands, Japan, and South Korea offers further insights into how coordinated education, research, extension, and innovation systems contribute to agricultural development [6–8]. Instead of recommending these models as direct policy templates, the analysis identifies broader principles such as institutional collaboration, continuous learning, and integrated knowledge exchange. These principles may inform future educational strategies in Malaysia, while acknowledging differences in governance, agricultural structure, and socio-economic conditions.

This research contributes to the literature by offering a systematic qualitative synthesis of documentary evidence linking educational development with Malaysia's agricultural transformation agenda under RMK13. In contrast to previous studies that primarily examined agricultural productivity or technology adoption, this analysis focuses on how education is conceptualised within national policy and scholarly discourse as part of broader human capital development. The findings inform educational policy discussions by emphasising the need to integrate formal education, vocational training, lifelong learning, and extension services within agricultural development strategies.

Several limitations are acknowledged. This analysis relied exclusively on documentary sources and did not include empirical data from farmers, extension officers, policymakers, or other agricultural stakeholders. Therefore, the findings should be viewed as interpretations of documentary evidence rather than as proof of causal relationships or evaluations of educational programme effectiveness. Additionally, the educational attainment data in the Agriculture Census Report 2024 reflect only formal qualifications and do not capture farmers' practical knowledge, experiential learning, or agricultural competence. Future research should incorporate primary qualitative and quantitative data from farmers, extension personnel, educators, and policymakers to examine how different edu-

cational approaches influence agricultural decision-making, technology adoption, and lifelong learning in diverse farming contexts. Comparative studies across Southeast Asia may also provide deeper insights into how educational systems interact with institutional and socio-economic factors to support agricultural transformation.

In summary, the analysis indicates that education is a critical enabling component within Malaysia's agricultural transformation agenda under RMK13. When combined with effective extension systems, supportive institutions, innovation networks, financial resources, and appropriate policy implementation, educational development can strengthen farmers' adaptive capacity and contribute to more resilient, knowledge-intensive, and sustainable agricultural systems [1,4].

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Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

The study did not generate any new datasets. All data analysed during this research were obtained from publicly available secondary sources, including the Agriculture Census Report 2024 published by the Department of Statistics Malaysia (DOSM), the RMK13 published by the Economic Planning Unit, Prime Minister's Department of Malaysia, and peer-reviewed academic literature available through scholarly databases. These documents are publicly accessible through their respective official websites and academic repositories. As the study relied exclusively on publicly available documentary sources, no additional datasets were created or deposited in a data repository. Further information regarding the sources used in this study can be obtained from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest.

AI Use Statement

During the preparation of this manuscript, the author used Grammarly solely for language refinement. No AI tools were used for data analysis, interpretation, or generation of scientific content. All outputs were critically reviewed and edited by the author. The author takes full responsibility for the integrity and accuracy of the work.

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