



REVIEW ARTICLE

Global perspectives on youth participation in agriculture: A bibliometric analysis and literature review

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Abstract

Youth engagement in agriculture plays a vital role in strengthening food systems, promoting rural progress and enhancing economic resilience. Nevertheless, various socio-economic, institutional and environmental challenges often hinder their active participation. This study utilizes a bibliometric approach and comprehensive literature review to identify global patterns, core factors affecting youth involvement and regional disparities across developed, developing and underdeveloped nations. Key findings suggest that restricted access to land, financial hurdles, limited institutional backing and negative perceptions about agriculture collectively contribute to declining interest among young individuals. Despite these barriers, emerging developments in agricultural technology, supportive policies and evolving agribusiness models present new possibilities for youth involvement. Rather than offering a one-size-fits-all solution, the study underlines the importance of context-sensitive approaches, such as inclusive policy design, capacity-building initiatives and localized agricultural innovations, to make the sector more appealing and accessible to the next generation. These insights aim to guide policymakers and stakeholders toward creating an enabling environment for youth-led agricultural transformation that is both sustainable and inclusive.

Keywords: agricultural constraints; bibliometric analysis; rural development; youth participation in agriculture

Introduction

Youth represent a dynamic and diverse segment of the population, contributing significantly to a country's development across various contexts. They are often considered a vital resource due to their potential to bring innovation and energy into national growth efforts (1). Youth play a vital role in a country's development, particularly in the agriculture and rural sectors (2). According to the International Labour Organization (ILO), as of 2019, there were approximately 1.3 billion youth aged 15-24 globally, accounting for 17.6 % of the world's population (3). Since 1999, this population has grown significantly, increasing by about 300 million (4). In 2025, developed regions are expected to have a youth population of 207 million, while developing areas will have 1.63 billion. Africa's youth population is projected to reach 424 million, Asia's 1.06 billion and Europe's 111 million (5). These demographic variations influence socio-economic dynamics and global cultural fabric (6).

India holds the largest youth population worldwide. According to the World Population Prospects (2017), youth aged 15-24 comprised 247 million or 18 % of India's total population in 2019, with 130.2 million males and 116.8 million females. When considering the NYP-2014 age category (15-29

years), India's youth cohort increases to 363 million or 26.5 % of the population (7). Based on the 15-24 age group, this youth population exceeds the combined total of the same age group in Australia, Canada, Germany and the United Kingdom. However, this demographic advantage also leads to challenges such as rising unemployment. Youth unemployment rates are significantly higher than adult unemployment rates in developing countries. At the same time, young people represent a large share of the overall working-age population in these regions (6).

Youth are regarded as key agents of change for achieving overall growth across sectors, including agriculture. Their flexibility and dynamic nature equip them to address unemployment by actively participating in agricultural development programs (8). Agriculture holds immense potential to transform national economies and improve farmers' livelihoods, particularly the youth (9). As an essential part of economic prosperity and poverty reduction, agriculture can help meet the increasing food demands caused by global population growth. This requires innovative and modern solutions, an area where young people excel. Today, a growing number of young farmers are exploring opportunities in high-return agribusiness ventures such as precision farming, organic agriculture, floriculture, medicinal and aromatic plant

cultivation and protected agriculture although overall participation remains limited due to structural and economic challenges (10).

However, youth participation in agriculture remains limited due to various constraints. Economic challenges include restricted access to land, credit, profitable markets and adequate inputs. Social constraints involve low education levels, minimal contact with extension services, negative perceptions of agriculture as labor- and capital-intensive and discouragement from parents (7, 11). Environmental factors, including unfavorable weather conditions, pest attacks and crop diseases, further discourage youth participation in agriculture.

To effectively tackle these challenges, it is crucial to implement youth-friendly agricultural policies developed with active youth participation. These policies should acknowledge that youth form a diverse group influenced by cultural, social and economic factors. By catering to their specific needs-such as access to credit, land tenure systems, farm business opportunities and training-these policies can encourage youth engagement in agriculture and ensure long-term involvement (12). Modern agricultural practices require fresh ideologies and technologies to motivate youth participation (13). Social media platforms are emerging as effective tools for educating and encouraging youth to engage in agriculture (14). Despite their potential, youth unemployment rates remain high, with 43.2 % of individuals aged 15-34 unemployed and 33.4 % of those aged 15-24 experiencing multidimensional poverty (15). Factors such as agricultural knowledge, annual income, landholding size and exposure to mass media have been shown to positively influence youth participation in agriculture (16).

Agriculture continues to be the largest source of employment in developing countries and a primary livelihood for a significant portion of the population. A significant share of the poor in many developing nations continues to depend on subsistence agriculture, although recent urbanization trends are gradually shifting this pattern in some regions (17). Therefore, developing agriculture and ensuring youth participation is vital for economic growth, food security and poverty alleviation (18). This review focuses on exploring key aspects related to youth participation in agriculture. It analyses global research trends and collaborations using bibliometric tools, identifies the constraints faced by youth in agriculture, examines the factors influencing their involvement and proposes strategic interventions to enhance their participation. These insights provide a comprehensive understanding of the opportunities and challenges in engaging youth as a dynamic force in the agricultural sector.

Methodology

This study employed bibliometric analysis and a structured literature review to examine scholarly work on youth participation in agriculture. To ensure data accuracy and quality, journal articles were primarily sourced from Scopus (a curated database of peer-reviewed literature) and Google Scholar, with careful manual filtering to include only peer-reviewed publications. The research aimed to understand the scope and dynamics of youth engagement in agriculture. A systematic search was conducted using a combination of

keywords such as “Youth,” “Participation,” “Agriculture,” along with Boolean operators (AND, OR) and related terms like “young farmers,” “engagement,” and “agribusiness.” The search focused on English-language articles published between 2000 and 2024. Titles and abstracts were screened for relevance and duplicate entries were removed. The final set of articles underwent bibliometric processing and an in-depth review to extract key insights. The data were analysed using RStudio and VOS viewer to map research trends, collaboration networks and thematic patterns in the field.

This study adopted the Preferred Reporting Items for Systematic Reviews (PRISMA) framework (Fig. 1) to ensure a structured and transparent research approach. The keywords used for literature searches are outlined in Table 1, while Table 2 details the inclusion and exclusion criteria applied during the initial screening of publications. Following this methodical process, a total of 221 articles were selected for bibliometric analysis. Care was taken to minimize regional publication bias by incorporating literature from both high-income and low- to middle-income countries. This systematic approach enabled a comprehensive synthesis of findings, offering valuable insights into youth participation in agriculture.

Fig. 1 indicates that 1422 articles were retrieved from the Scopus database and Google Scholar. During the initial screening phase, 111 records were excluded based on predefined criteria such as language (non-English), access limitations and publication year (outside 2000-2024). This left 1311 articles for manual title and abstract screening. As part of the quality review, 1,090 articles were excluded due to lack of relevance to core concepts - specifically, the absence of keywords such as Youth, Agriculture, Participation, or their close equivalents in the title or abstract. Ultimately, 221 studies were included in the final bibliometric and comprehensive review.

Result and Discussion

Most frequently used Words

A visual mapping of frequently occurring terms in the reviewed literature reveals a strong thematic emphasis on youth demographics, with the young population emerging as a central focus. Terms such as employment, *agribusiness*, *livelihood*, *perception* and sustainability reflect recurring research priorities related to rural employment, economic resilience and sustainable agricultural development. The presence of keywords like entrepreneur, *rural area*, *training* and *decision making* further highlights the significance of skill-building and policy support aimed at enhancing youth engagement in agriculture. This thematic synthesis offers insights into dominant discourse patterns and potential directions for future research (Fig. 2).

Country production over time

A noticeable increase in article production related to youth participation in agriculture has been observed in countries such as Indonesia, Kenya, Nigeria, South Africa and the USA (Fig. 3). South Africa and the USA, in particular, have made relatively higher contributions, reflecting strong institutional engagement and commitment to knowledge dissemination. Nigeria, Kenya and Indonesia have also shown consistent

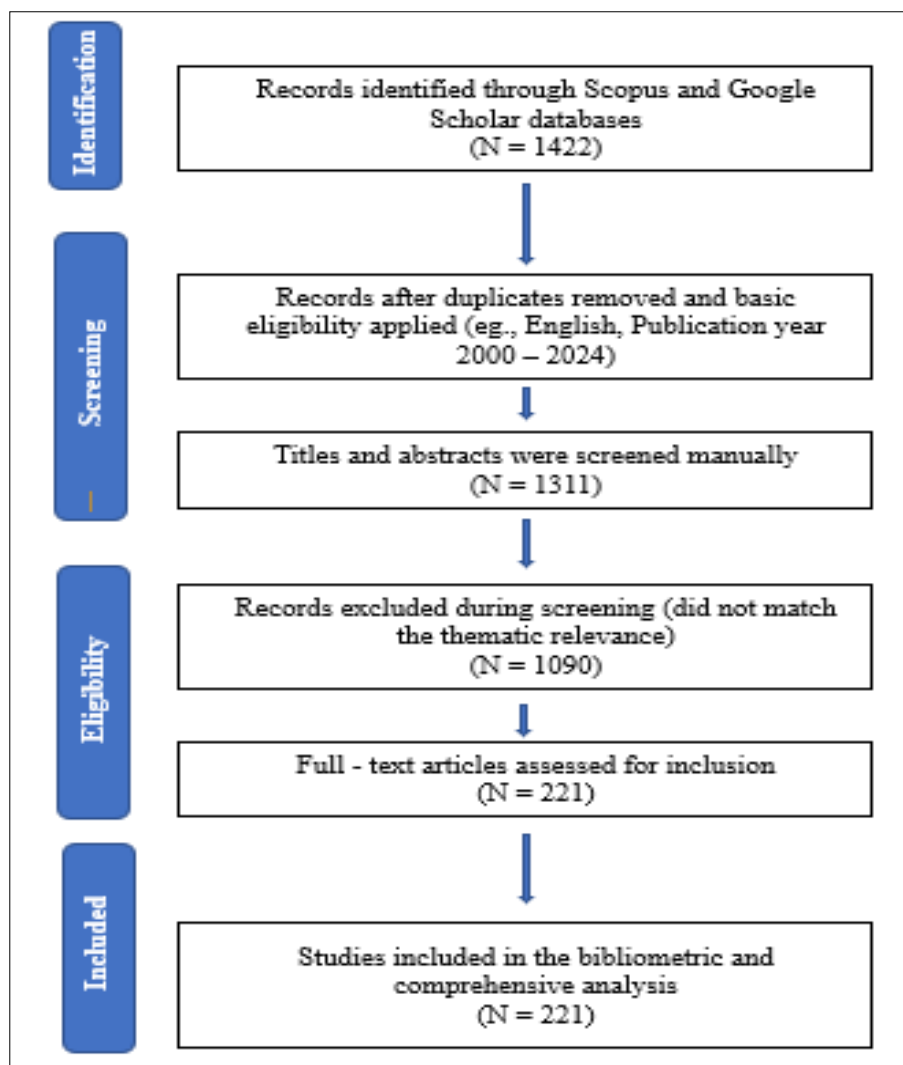


Fig. 1. PRISMA flowchart outlining the inclusion and exclusion process followed to identify relevant studies for bibliometric and comprehensive analysis.



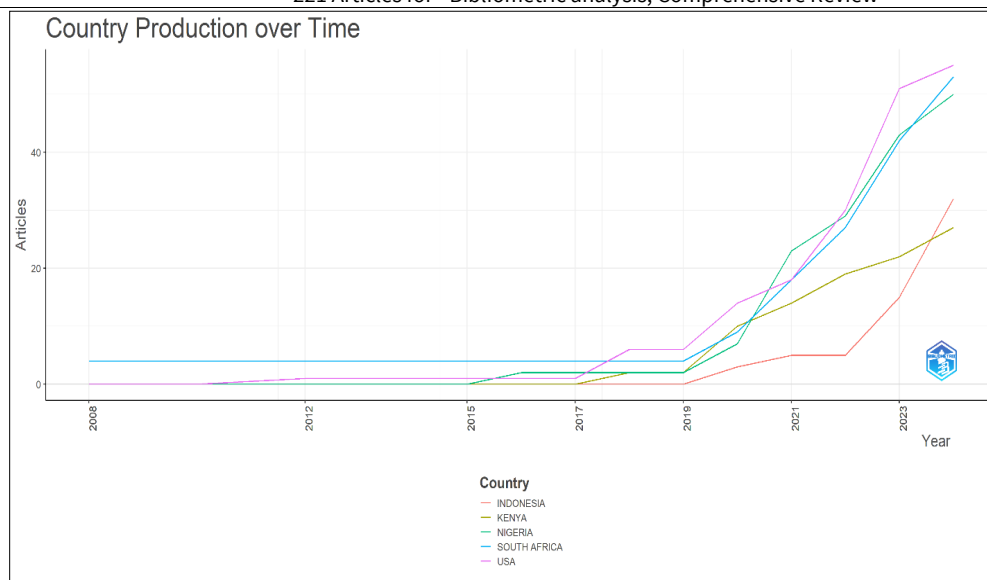
Fig. 2. Word cloud representing the most frequently occurring terms in the literature on youth participation in agriculture.

Table. 1. Combination of keywords used and the total number of publications from databases

Databases	Search terms	Number of articles
Scopes, Google Scholar	"Youth" OR "Young farmers" OR "Next-generation farmers" OR "Junior agriculturists" OR "Emerging farmers" OR "Newcomers to agriculture" OR "Young professionals" AND "agriculture" OR "Youth in farming" OR "Novice agriculturists" "agriculture" OR "farming" OR " agribusiness" OR "rural economy" AND" factors" OR "participation" OR "involvement" OR "engagement" OR "contribution" OR "elements" OR "components" OR "variables" OR "aspects" OR "intention" OR "Aspiration" OR "Goal"	1422

Table 2. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Period	2000-2024	< 2000
Subject area	Social science, Agricultural & biological science, Economics, Econometrics and Finance, Business, Management, Multidisciplinary	Earth and planetary science, Engineering, Biochemistry, Genetics and Molecular Biology, Environmental science, Energy, Medicine, Arts and Humanities, Computer Science, Decision Sciences, Immunology and Microbiology, Chemical Engineering, Veterinary, Mathematics, Chemistry, Psychology, Physics and Astronomy, Materials Science, Neuroscience, Pharmacology, Toxicology and Pharmaceuticals, Health Professions, Nursing
Document Type	Article	Conference papers, Book chapters, Thesis, Preprints, Reports
Languages	English	Non-English
Source type	Journal	Trade journal
Publication stage	Final	Press
Open access	Open access	Restricted access
Screening		
Title and Abstract	"Articles were collected from Scopus and Google Scholar by screening relevant keywords and reviewing the Title and Abstract of each article."	
Full text	221 Articles for - Bibliometric analysis, Comprehensive Review	

**Fig. 3.** Article production trends over time by country.

upward trends, especially from 2018 onwards, indicating a rise in regional interest and research activity. Although publication counts vary, these countries together account for a substantial portion of the global literature reviewed in this study. This overall trend points to increased investments in agricultural research, greater collaboration across institutions and growing responsiveness to global challenges such as the COVID-19 pandemic. Indonesia and the USA have emerged as key contributors in recent years, highlighting their influential role in advancing global research efforts and agricultural development discourse.

Thematic map

Fig. 4 is the thematic map generated using R Studio. A thematic map visually represents clusters of themes based on their relevance (centrality) and development degree (density). It divides themes into four quadrants: Motor Themes (high centrality and density), Basic Themes (high centrality, low density), Niche Themes (low centrality, high density) and Emerging or Declining Themes (low centrality and density).

Motor themes

Gender-specific youth focus: This theme highlights gender-specific aspects, focusing on females across various life stages. It includes discussions on adults, adolescents, young adults and students, emphasizing human-centered studies and gender roles

Basic themes

Young population, employment and agroindustry: This theme focuses on the significant role of youth in agriculture and employment. It covers key areas such as agroindustry, rural livelihoods, sustainability, entrepreneurship and the perceptions of young populations. Special attention is given to rural areas, with examples like Nigeria standing out.

Niche themes

Ghana, Tanzania and marketing: This theme explores marketing strategies and self-employment opportunities in African regions such as Ghana and Tanzania. It also references countries like Somalia, Uganda and Zimbabwe, reflecting regional economic and development dynamics.

Common Agricultural Policy (CAP) and Farmers' Attitude: This theme focuses on European agricultural policies, particularly the CAP. It also touches on farmers' knowledge, policymaking and regional influences, with special mention of Greece and its islands, such as Crete and the Aegean region.

Emerging or declining themes

Smallholder, rural migration and labour policy: This theme addresses smallholder farming systems and their challenges, such as labor migration and rural policies. It reflects discussions on rural livelihoods and emerging trends in migration.

Local participation and livestock farming: This theme

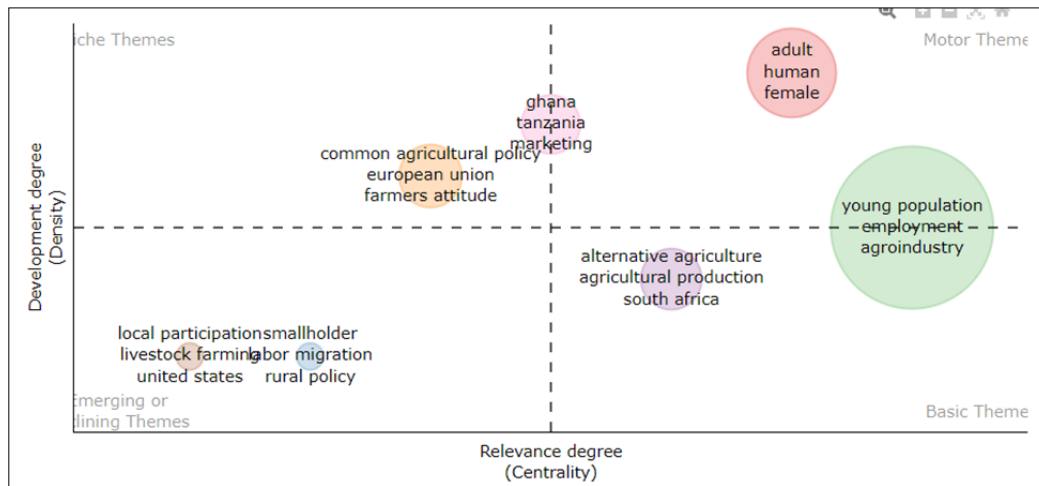


Fig. 4. Thematic map representing clusters of research themes based on their centrality and density.

emphasizes the significance of local community participation in livestock farming, with a notable focus on regions like the United States.

Other Emerging Themes

Alternative agriculture, agricultural production and South Africa: This theme explores innovative agricultural practices, particularly in South Africa. It includes alternative agriculture, production systems, qualitative research, gender roles and stakeholder involvement.

Co-citation network

The co-citation network map highlights key subject patterns and intellectual linkages within the research domain. Each node in the map represents a scholarly source, with node size indicating the frequency of co-citation. The links between nodes illustrate co-citation relationships, showing the strength of association among sources (Fig. 5). Distinct color-coded clusters represent different thematic domains. The red cluster includes sources focused on agricultural techniques, land management and environmental sustainability. The green cluster, which includes publications such as World Development and Food Policy, relates to themes of policy-making, agricultural economics and global development. The blue cluster-led by journals such as Journal of Rural Studies and Rural Sociology-primarily reflects research in rural

economics and sociological studies. These clusters underscore the interdisciplinary nature of the field by connecting topics such as development policy, sustainability science and rural development. The network visualization provides an overview of the major sources and how they are intellectually linked within the research landscape.

Youth influencing factors and challenges in major developed countries

Various factors shape youth participation in agriculture across developed countries, yet numerous challenges hinder engagement. In the USA (19) technological competency, behavioral control, innovativeness and career planning motivate youth, while organizational support sustains interest. However, limited access to land and credit, negative perceptions and inadequate institutional support remain major barriers. Similarly, in Ireland (20) education, skill-building, career growth and strong community networks encourage youth involvement, entrepreneurship and broadband access. Despite these positive factors, unstable income, high land prices, weak policies and poor rural infrastructure discourage sustained participation. In Japan (21), while government initiatives aim to encourage youth engagement in farming, competing interests such as attractive careers in science and technology, along with an

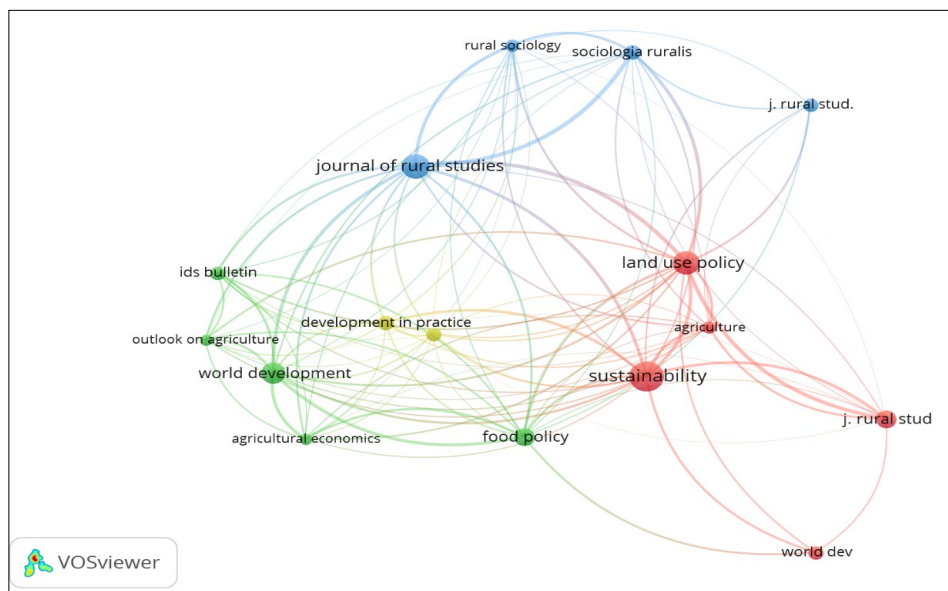


Fig. 5. Co-citation network illustrating relationships among frequently cited sources in the literature.

aging farming population and limited agricultural training, have reduced actual youth participation in the sector.

In Canada (22) a strong passion for farming, concerns about food security and sustainability drive youth interest, supported by government funding and entrepreneurial opportunities. However, high land prices, financial constraints, lack of mentorship, market restrictions and policy barriers pose significant obstacles. Across parts of Europe, including Sweden and Lithuania (23, 24) family influence, love for nature, farm succession, EU funding and modern technology attract youth to farming. Nevertheless, migration to cities, an aging population, small-scale farms with low profitability, land access issues and negative perceptions of agriculture deter participation. In France (25), advancements in mechanization, digital farming and sustainable practices have sparked youth interest. Vocational schools and agribusiness programs further equip young individuals with farming skills. However, difficulties in acquiring land, substantial financial investment requirements and gender-based challenges hinder entry into the sector.

In Indonesia (26) psychological motivations, education and government-private agribusiness collaborations support youth engagement. The adoption of digital tools, smart farming and mechanization further enhances participation. However, land scarcity, financial constraints, poor working conditions and urban migration remain significant deterrents. Similarly, in Brazil (27) sustainable farming, agribusiness opportunities and farm succession encourage youth in agriculture. Despite this, urban migration, low farm profitability, unclear land tenure, policies favoring large agribusinesses and climate risks present long-term challenges. Overall, while various support systems, technological advancements and policy interventions foster youth participation in agriculture, persistent barriers such as financial constraints, land access issues, urban migration and negative perceptions continue to limit sustained engagement.

Youth influencing factors and challenges in major developing countries

In India (28-37) youth participation in agriculture is driven by mass media, extension services, education, vocational training and skill-building. Aspirations for agribusiness, particularly organic farming and value addition, are supported by government schemes like ARYA, youth-focused policies and ICT platforms. Family support, land ownership, societal norms, innovative technologies and diversification into horticulture and dairy farming further enhance engagement. Entrepreneurship opportunities and local food initiatives create employment avenues. However, challenges such as low profitability, unpredictable returns, high input costs, limited access to land, credit and financial resources restrict youth involvement. Urban migration and labor shortages affect rural productivity, while negative societal perceptions of farming as low-status work reduce interest. Climatic variability, agrarian distress and lack of mechanization add instability and gender discrimination limits women's participation. Additionally, poor processing, storage and marketing infrastructure hinder agricultural growth.

In South Africa and Sub-Saharan Africa (38-43) youth engagement in agriculture is driven by entrepreneurial spirit,

education and training. Family networks and kinship systems support land acquisition and capacity building, while diversified rural economies create farm and non-farm opportunities. Government programs enhance skills and social and economic structures promote asset accumulation and job creation. However, challenges include limited land access, credit, entrepreneurial training and negative perceptions of agriculture. Weather variability, market instability and high input costs disrupt farming, while migration depletes rural labor forces. Poor infrastructure and lack of exposure further hinder agricultural progress

In Turkey (44-46) financial incentives such as subsidies and grants encourage youth participation in farming. Agriculture's multifunctionality and entrepreneurial opportunities attract young individuals, while training and education support the adoption of new technologies. However, high production costs discourage engagement, especially for smart farming, while limited access to land and farming infrastructure further restricts opportunities. Urban migration exacerbates the decline in rural youth involvement.

In Nigeria (47 - 51) education, vocational training and ICT adoption enhance youth participation. Market access, income prospect and youth programs, including gender inclusion initiatives, serve as motivators. Credit availability and financial resources further encourage engagement, but challenges such as limited land access, financial constraints, high input costs and poor market infrastructure hinder agricultural development. A lack of modern skills, training opportunities, market volatility and restricted access to advanced technology further discourage youth from pursuing farming careers.

In Kenya (52-57) youth engagement in agriculture is supported by access to financial resources and government initiatives like Youth and Uwezo Funds. Digital tools, call centers and social media enhance market access, while education promotes modern farming technologies. Social media also spreads agricultural knowledge and inspires youth and efforts to promote agriculture as a profitable venture help tackle unemployment. However, challenges include lack of collateral for loans, high interest rates, unemployment and limited farming resources. Costly internet, limited smartphone access and digital unawareness hinder technology adoption. Gender roles restrict women's participation in labor-intensive farming and the low adoption of specialized agricultural apps due to insufficient content and support further limits youth involvement.

In Tanzania (58-60) youth participation is facilitated by financial aid through subsidies and loans, improved access to land, tools and essential resources and training programs that integrate traditional and modern agricultural practices for sustainability. However, limited access to modern infrastructure such as irrigation and storage constrains productivity. High production costs and pest management challenges add financial burdens, while unequal land access disproportionately affects women, limiting their engagement in agriculture.

In Vietnam (61, 62), youth participation in agriculture is influenced by improved access to land-use rights, agricultural tools, vocational programs and modern techniques that

support engagement. Connectivity to markets and value chains also enhances agribusiness prospects. However, limited access to affordable credit restricts youth from securing land ownership or investing in farm inputs. The high costs of seeds, fertilizers and equipment, along with reliance on traditional practices, further limit modernization. Additionally, unpredictable weather, inadequate storage, transportation and irrigation infrastructure reduce productivity and hinder agricultural operations.

In Sri Lanka (63), youth engagement in agriculture is influenced by personality traits such as risk-taking, innovation, persistence and enthusiasm, as identified through empirical analysis. Support from family, access to technology and promotional efforts further contribute to their interest. However, agriculture is often viewed as unprofitable and low status, while limited job opportunities, economic instability and weak infrastructure, subsidies and programs continue to discourage sustained youth involvement.

Youth influencing factors and challenges in major underdeveloped countries

In Ethiopia (64, 65), youth engagement in agriculture is shaped by complex factors. While family expectations and income potential may encourage participation, widespread land scarcity, limited credit access and weak market systems pose significant barriers. High population pressure, poor soil quality and climate shocks further affect productivity. In Zambia (66), agriculture remains a key income source, with youth contributing actively to farming. However, restricted loans, poor roads, high input costs and variable climate conditions limit progress, particularly among less-educated and resource-constrained groups. In Rwanda (67), cooperative farming, land rehabilitation and supportive policies promote youth participation. Still, challenges such as high population density, unequal land distribution, poor soil quality and limited financial access continue to hinder agricultural productivity, especially for women.

In Uganda (68-70) self-help groups, value chains and community initiatives mobilize youth, while tailored financial systems and market opportunities support engagement. Technical assistance and advisory services further aid participation. However, lack of start-up capital, financial dependence, weak governance, poor leadership and resource mismanagement pose challenges. Negative perceptions of agriculture as labor-intensive and unprofitable, along with unequal land access and cultural norms limiting women's participation in commercial farming, further hinder involvement. In Benin (71, 72), technical skills, hands-on training, motivation and creativity are essential for youth engagement. Membership in agricultural organizations and mentorship foster growth. However, lack of credit, land and resources restricts opportunities, while poor extension services and limited incubation facilities further limit success. Agriculture's association with poverty and low status discourages youth participation.

In Nepal, although some migrant returnees invest in agriculture, youth generally view farming as low-income and unstable, often preferring urban employment or overseas jobs due to better wages (73). Landless and marginalized youth face challenges in accessing land, finance and equal

opportunities. Perceptions of farming as labor-intensive and vulnerable to climate change, high input costs and low social status further discourage participation. In Bangladesh (74), government and NGO support, digital platforms and financial assistance aim to promote youth engagement in agriculture. However, digital adoption remains limited in rural areas and farming's low returns, land access issues and credit constraints continue to hinder youth involvement. Additionally, formal education and parental expectations often guide youth toward non-agricultural careers, especially in urban centers. In Malawi (75), contract farming and agribusiness initiatives supported by government and NGOs have seen limited youth inclusion. While inheritance, food security concerns and family traditions can influence interest, large-scale programs like the Farm Input Subsidy Programme (FISP) and Green Belt Initiative (GBI) are often designed around the needs of established or older farmers, unintentionally excluding youth. Land inequality, limited extension services and market inaccessibility further restrict youth entry into the sector (Table 3).

Discussion

Youth engagement in agriculture is crucial for sustainability and innovation. Strategies focus on skill development, entrepreneurship and inclusivity to make agriculture a viable and attractive career for the younger generation. In India, retaining youth in agriculture requires multifaceted approaches such as the Rural Agricultural Work Experience (RAWE) program, Agri-Clinics and Agri-Business Centers (AC&ABC) and training programs under the Agriculture Skill Council of India (ASCI). Entrepreneurship is fostered through initiatives like Biotech Parks, e-NAM for enhanced market access and agri-business platforms. Youth empowerment is further strengthened through clubs, self-help groups (SHGs) and ICT integration, promoting inclusivity and equity (76). Infrastructure improvements, access to land, timely rural credit, machinery hubs and irrigation enhancements also play pivotal roles. Programs like Start-up India inspire innovation, while rural women's participation supports sustainable practices and food security (77). Skill-oriented initiatives like Pradhan Mantri Kaushal Vikas Yojana (PMKVY), ASCI and Krishi Vigyan Kendras (KVKs) provide advanced training in farming techniques and entrepreneurship, equipping youth to modernize agriculture and reduce rural to urban migration (78). Allied enterprises such as dairy, poultry and food processing offer supplementary income, while barriers like limited land access, inadequate subsidies and lack of internet connectivity are addressed through targeted interventions (79).

In Africa, diverse strategies cater to unique regional challenges. In Malawi, capacity-building programs enhance youth understanding of agricultural policies and advocacy skills, utilizing District Youth Offices as agricultural youth units. Unified advocacy platforms promote collaborative lobbying to influence policies effectively. Partnerships between government and private sectors empower youth across rural and urban areas, ensuring diverse representation and participation (80). In Ethiopia, education often deters youth from agriculture, seen as labor-intensive and low-reward, especially by the educated (81). Limited land access

Table 3. Youth aspiration and challenges in Agriculture: common and distinct factors

S. No	Category	Common Across All Countries	Developed Countries (Unique)	Developing Countries (Unique)	Underdeveloped Countries (Unique)
1.	Common Factors Influencing Youth Participation	1. Education & Skill Development (Vocational training, modern agricultural knowledge) Technology & ICT Adoption (Digital platforms, smart farming tools, mechanization) 2. Government Support & Policies (Subsidies, financial aid, training programs) Entrepreneurship & Agribusiness (Value addition, commercial farming, youth-led start-ups) 3. Market Access (Access to buyers, market linkages and price incentives)	1. Advanced Mechanization (AI, robotics, precision farming) 2. Corporate Agribusiness (Large-scale, export-driven farming)	1. Mid-scale Commercial Farming (Small & medium enterprises, cooperative models) 2. Digital Advisory Services (Mobile apps for extension support) 3. Moderate Government Support (Youth-targeted employment policies) 3. Sustainability Focus (Climate-smart farming, environmental regulations)	1. Subsistence & Smallholder Farming (Farming as survival, limited profit motives) 2. Traditional Land Systems (Communal ownership, reliance on inheritance) 3. NGO & Informal Sector Support (Microfinance, non-government interventions)
2.	Common Challenges Faced	1. Financial Constraints (Limited access to credit, high costs of inputs) 2. Land Access Issues (Difficulty in acquiring land, expensive land prices) 3. Urban Migration (Youth leaving agriculture for better-paying jobs in cities) 4. Negative Perceptions of Farming (Viewed as labour-intensive and less prestigious than other careers)	1. Labour Shortages (Youth prefer high-tech, service sector jobs) 2. High Cost of Entry (Expensive investment in technology and infrastructure)	1. Gender Discrimination (Women face difficulty in land ownership and financial access) 2. Market Instability (Price fluctuations, unreliable demand) 3. Climate Impact (Changing weather patterns affecting production)	1. Extreme Financial Constraints (Severe lack of capital, poor investment potential) 2. Weak Governance & Policy Implementation (Limited enforcement of agricultural reforms) 3. Infrastructure Deficiency (Lack of roads, irrigation and storage facilities) 4. Food Insecurity (Dependence on agriculture for survival, not business growth)

and gender inequality further hinder participation (82). The Agricultural Development Led Industrialization (ADLI) policy engages educated youth through Technical and Vocational Education and Training (TVET), extension services and financial support. However, challenges like insufficient land redistribution persist, underscoring the need for innovative approaches to make agriculture attractive (83).

The Fadama Graduate Unemployed Youths and Women Support (FGUYS) program addresses barriers through agribusiness training, improved credit access and enhanced farming appeal in Nigeria. Active youth involvement in policymaking and program assessments ensures long-term impact (84). Financial inclusion initiatives, such as supply chain financing in Rwanda and Mozambique, support youth ventures (85). Kenya leverages ICT solutions to enhance market access and business networks for youth (86). At the same time, Zambian rural youth contribute significantly to agriculture by creating jobs and earning revenue. Improved road networks, better storage facilities, farm insurance and government loans particularly from the Citizens Economic and Empowerment Commission. Youth involvement and agricultural production will be further increased by fortifying market infrastructure and financial access (87).

In Asia, several underdeveloped countries have developed region-specific strategies. In Bangladesh and Kenya, where agriculture plays a crucial role in livelihoods, investments in modern farming technologies, skill development, land access, affordable credit and agro-industry-focused education are prioritized (88). Uganda's Young Farmers Clubs (YFCs) promote hands-on training, life skills and career exploration, aligning with youth aspirations. Nationwide expansion, better infrastructure and integration with co-curricular activities are recommended to maximize their impact (89).

In developed countries like Japan, programs that promote early entry into agriculture and foster social capital through trust-based networks reduce risks and encourage youth involvement. Taiwan's experiential learning, such as organic farming camps, emphasizes environmental sustainability, while the Philippines integrates sustainable agriculture into education and government support programs to attract youth (45). Global efforts to retain youth in agriculture focus on overcoming barriers like limited land access, credit challenges and negative perceptions. Promoting entrepreneurship, skill training, inclusivity and modern technologies can make agriculture a sustainable and rewarding career, ensuring food security and economic growth.

Conclusion

In conclusion, youth participation in agriculture represents a vital component of broader strategies aimed at enhancing rural development and food security. Addressing challenges faced by young farmers-such as limited access to land, education, credit and markets-requires integrated approaches that combine youth-specific support with structural reforms benefiting all stakeholders. Stakeholders can strengthen outcomes by promoting inclusive policies, improving infrastructure and fostering innovation ecosystems that support both young and existing farmers. As the agricultural sector navigates global challenges such as climate change and population growth, leveraging youth potential-alongside systemic improvements-will be essential for building resilient and productive food systems. Future research should focus on actionable strategies that embed youth within inclusive agricultural frameworks to ensure meaningful and sustainable contributions.

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Authors' contributions

PPKS led the survey work, carried out data analysis and was primarily responsible for drafting the manuscript. RM contributed by assisting with data collection and supporting the analytical aspects of the study. KR played a vital role in shaping the research framework, reviewing the manuscript and facilitating access to research funding. SM assisted in organizing the content and refining the manuscript, while SV supported the summarization of findings and offered additional contributions throughout the research process.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None

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