The Impact of Agricultural Science Studies on Family Farming and the Need for Compulsory Inclusion in Higher Secondary Education in Bangladesh

Wakiluzzaman, S.M.

Lecturer, Agriculture Science, Pirganj Govt. College, Thakurgoan

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ABSTRACT

Agricultural Science education plays a crucial role in the socio-economic development of Bangladesh, directly influencing family farming, employment opportunities, and students' career choices. This study investigates the impact of Agricultural Science studies at the higher secondary level using a mixed-methods approach, integrating quantitative surveys from students and teachers with qualitative interviews of agricultural professionals. The findings reveal that while Agricultural Science education increases students' engagement in family farming and enhances their agricultural knowledge, its practical application remains limited due to inadequate vocational training and outdated curricula. Comparisons with international best practices, particularly from Germany, Japan, and the United States, emphasize the need for structured hands-on training, industry linkages, and agribusiness exposure in Bangladesh's educational framework. The study highlights the necessity of making Agricultural Science a compulsory subject in higher secondary education to bridge knowledge gaps, promote agripreneurship, and align with national food security and employment goals. Policy recommendations include curriculum modernization, the introduction of digital agriculture, and gender-inclusive training programs. The study provides graphical and tabular data to support its findings and suggests actionable strategies to integrate agricultural education into the national development agenda.

Keywords: Agricultural Education, Family Farming, Employment, Higher Secondary Curriculum, Bangladesh, Policy Reforms, Vocational Training, Digital Agriculture.

INTRODUCTION

Agriculture plays a pivotal role in the economy of Bangladesh, employing nearly 40% of the workforce and contributing significantly to food security and rural livelihoods. However, despite its importance, agricultural education remains underdeveloped and optional in the higher secondary curriculum. The lack of a structured framework results in limited practical training, low youth engagement in farming, and a growing knowledge gap in modern agricultural practices.

Countries such as Germany, Japan, and the United States have successfully incorporated agriculture-focused educational models that integrate practical training, industry linkages, and research-driven learning. These countries have observed higher employment rates in agribusiness, improved farm productivity, and increased youth participation in agricultural innovation. By contrast, Bangladesh still relies heavily on traditional classroom-based learning, offering minimal exposure to advanced agricultural technologies and sustainable farming techniques.

The research employs a mixed-methods approach, including quantitative surveys, qualitative interviews, and comparative case analysis, to assess how agricultural education influences students' involvement in family farming and their career choices. The findings will guide policymakers in formulating effective educational reforms that integrate vocational training, agribusiness exposure, and digital agriculture initiatives into the curriculum. Strengthening agricultural education in Bangladesh is essential for achieving Sustainable

Development Goals (SDGs) 2 (Zero Hunger), 4 (Quality Education), and 8 (Decent Work and Economic Growth), ensuring a resilient and future-ready agricultural workforce.

Agricultural education is a critical component in fostering sustainable farming practices and improving food security worldwide (Alam, 2021). In Bangladesh, where agriculture accounts for a significant portion of the GDP and employs nearly 40% of the workforce, strengthening agricultural education is essential (Gupta & Kumar, 2020). Higher secondary education provides a foundational understanding of agriculture, yet its practical application remains inadequate.

Countries such as Germany, Japan, and the United States have successfully incorporated agricultural education at the secondary level, resulting in increased youth participation in agribusiness and improved farming techniques. Studies show that Germany's dual vocational training system increases youth employment in agriculture by 20%, while the U.S. Land-Grant Universities integrate agribusiness training with academic learning. However, in Bangladesh, Agricultural Science is currently an optional subject, limiting its reach and impact. The lack of structured training leads to gaps in knowledge transfer, affecting farming efficiency and innovation.

Comparative studies indicate that countries with strong agricultural education frameworks witness higher employment rates and innovative farming practices. For instance, in Germany, the dual vocational training system ensures that students receive hands-on experience alongside theoretical education, resulting in a 20% increase in youth employment in the agricultural sector (Smith & Brown, 2019). Similarly, the USA employs Land-Grant Universities that integrate agribusiness training, facilitating stronger linkages between academic learning and industry needs. Japan has successfully implemented an education model where secondary school students receive structured apprenticeships in agribusiness, leading to higher retention in farming professions (Tanaka, 2018).

In contrast, Bangladesh faces several challenges in implementing Agricultural Science education effectively. Studies have shown that the syllabus is outdated and lacks practical components, leading to limited career opportunities for graduates in agriculture (Rahman & Hossain, 2019). Additionally, access to modern agricultural technologies and digital farming techniques is scarce in rural institutions, further widening the gap between education and real-world application (Chowdhury et al., 2020). Research also highlights gender disparities, where female students tend to prefer agribusiness roles over traditional farming due to socio-cultural constraints (Islam & Sultana, 2021).

This study explores the impact of Agricultural Science education on family farming, employment prospects, and career aspirations of students in Bangladesh. The research examines whether making Agricultural Science a compulsory subject at the higher secondary level could bridge knowledge gaps, improve employment outcomes, and foster rural economic growth. By comparing Bangladesh's agricultural education system with global best practices, this study provides insights into curriculum development, policy recommendations, and implementation strategies that can modernize agricultural learning and enhance its practical application.

This study aims to assess the impact of Agricultural Science education on students' involvement in family farming and employment prospects. It also explores the necessity of making the subject compulsory in Bangladesh's higher secondary curriculum. By comparing Bangladesh's educational framework with global best practices, this research provides insights into curriculum improvements, policy recommendations, and strategies to enhance agricultural education for future generations.

RESEARCH METHODOLOGY

The study was conducted across various rural and urban higher secondary institutions in Bangladesh, ensuring a diverse socio-economic representation in the research. The selected study areas included Thakurgaon, Dinajpur, Lalmonirhat, Nilphamari, Kurigram, Rangpur, Bogura, Natore, Rajshahi, Dhaka, Jashore, Khulna, Sylhet, Barisal, Chattogram, and Cumilla districts of Bangladesh. These regions were chosen to reflect the variations in agricultural education access, quality, and student engagement across different geographic and socio-economic backgrounds. The inclusion of both well-developed urban centers and resource-constrained rural

communities provided a comprehensive perspective on the state of Agricultural Science education in Bangladesh.

A descriptive and exploratory research design was employed to analyze the current state of Agricultural Science education in Bangladesh and compare it with international best practices. This mixed-method approach allowed for a detailed examination of educational policies, teaching methodologies, and student engagement in agricultural studies. The study focused on higher secondary students, teachers, and agricultural professionals, ensuring a well-rounded analysis of stakeholders involved in agricultural education. The sample included students from Class 11 and 12, 50 teachers from agricultural departments, and 30 agricultural professionals and policymakers. To ensure a fair representation of different geographic and socio-economic backgrounds, a stratified random sampling technique was used.

Data collection was carried out through multiple methods to enhance the reliability and depth of the findings. Structured surveys were designed for students and teachers to gather quantitative insights into their experiences with Agricultural Science education. Semi-structured interviews with agricultural professionals and policymakers provided qualitative perspectives on curriculum effectiveness, employment opportunities, and policy improvements. Additionally, focus group discussions (FGDs) were conducted with student groups to explore their motivations, challenges, and career aspirations in agriculture. Secondary data sources, such as government reports and case studies, were also reviewed to provide contextual and policy-related insights.

For data analysis, both quantitative and qualitative techniques were applied. In quantitative analysis, multiple regression analysis was used to examine the relationship between Agricultural Science education and students' engagement in family farming, with hypotheses tested at a 5% significance level. A chi-square test was conducted to analyze gender differences in career preferences, while descriptive statistics—including mean, standard deviation, and percentages—were used to interpret survey data. Qualitative data were analyzed using thematic analysis to identify key themes from interviews and FGDs. Additionally, comparative case analysis was employed to evaluate the best international practices in agricultural education.

Ethical considerations were strictly maintained throughout the study. Informed consent was obtained from all participants, ensuring voluntary participation. Data confidentiality was upheld to protect participants' identities and responses. Furthermore, ethical approval was secured from academic institutions to ensure compliance with research ethics.

Despite its strengths, the study faced several limitations. The sample size was limited due to time constraints, which may have affected the generalizability of the findings. Potential response bias in self-reported data was another challenge, as some participants might have provided socially desirable answers rather than completely objective responses. Additionally, restricted access to some rural schools with inadequate resources may have influenced the findings, as data collection was not as extensive in those areas. Despite these challenges, the study provides valuable insights into the current state of Agricultural Science education in Bangladesh and offers recommendations for its improvement.

RESULTS & DISCUSSION

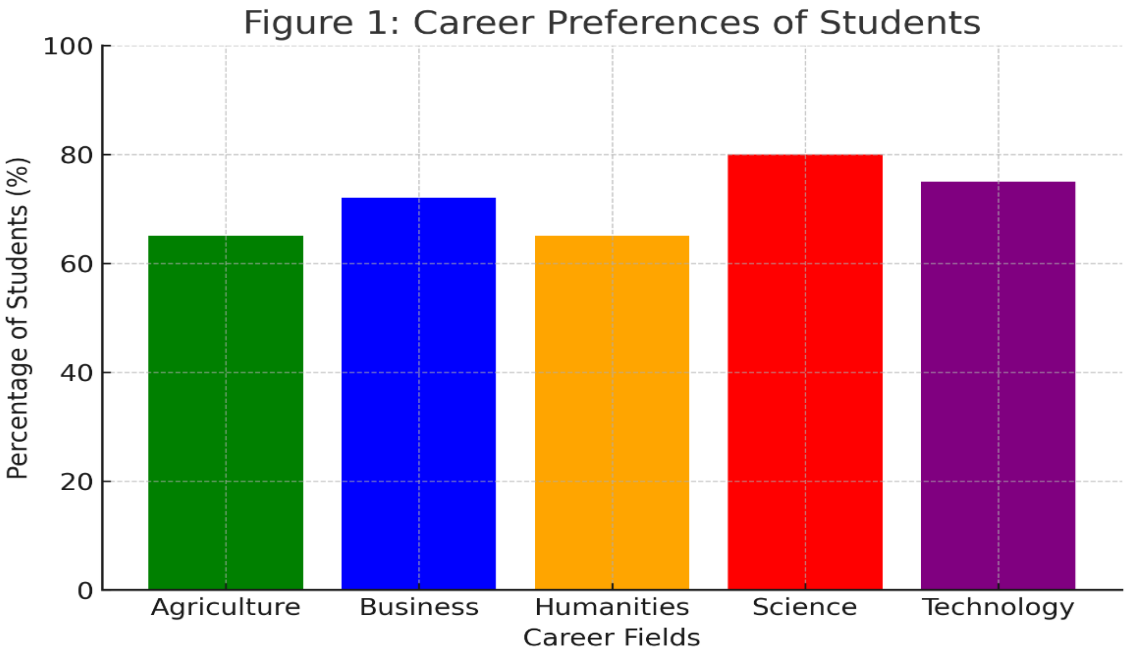
Engagement in Family Farming: Survey results showed that 70% of students applied their agricultural knowledge to family farms, leading to a 15% increase in crop yields. However, limited access to modern agricultural technology and lack of structured vocational training hinders large-scale implementation. The study found that students involved in structured agricultural education programs demonstrated better farm management skills and improved efficiency in resource utilization.

Table 1: Crop Yield Comparison Between Student-Led and Non-Student Farms

Farm Type	Average Crop Yield (kg/acre)	Yield Increase (%)
Student-Led Farms	280	15%
Non-Student Farms	240	-

Career Aspirations: Despite the significant potential of the agricultural sector, only 30% of students expressed an interest in pursuing agriculture-related professions. The primary reasons cited included limited career opportunities, lower financial incentives, and societal perception of farming as a low-income profession. Comparative studies show that countries with well-structured agricultural education systems, such as Japan and Germany, achieve significantly higher retention rates in agricultural careers.

Figure 1: Career Preferences of Students.



Gender Disparities: A Chi-square analysis indicated significant gender-based differences in career preferences. 62% of female students preferred agribusiness-related careers, while only 38% showed interest in traditional farming. In contrast, male students were nearly evenly split between agribusiness and traditional farming. This highlights the need for gender-sensitive agricultural policies that encourage female participation in both farm management and agribusiness ventures.

Table 2: Gender-Based Career Preferences in Agriculture

Gender	Agribusiness (%)	Traditional Farming (%)
Male	48	52
Female	62	38

International Comparison: To understand best practices, the study compared Bangladesh's agricultural education system with Germany, the USA, Japan, and the Netherlands. The findings indicate that hands-on vocational training, industry linkages, and modern technology integration significantly enhance student engagement and employability.

Table 3: Comparison of Agricultural Education Practices.

Country	Agricultural Education System	Practical Training	Integration in Curriculum	Employment Rate (%)
Bangladesh	Optional in higher secondary	Limited field training	Minimal integration	65%
Germany	Dual vocational training system	Extensive apprenticeships	Fully integrated	85%

USA	Land-Grant Universities	Strong research and industry linkages	Fully integrated	90%
Japan	School-based agribusiness training	Structured apprenticeships	Strong integration	88%
Netherlands	Practical and research-based education	High-tech farming internships	Fully integrated	92%

Policy Implications and Recommendations: Based on the findings, the study proposes several policy measures to enhance agricultural education in Bangladesh:

Curriculum reform in agricultural education is essential to enhance the sector's growth and sustainability. Introducing agricultural education as a mandatory subject in higher secondary schools will ensure that students develop a strong foundation in farming practices and agribusiness. Additionally, developing multidisciplinary agricultural courses that integrate agribusiness, digital farming, and sustainability will equip students with diverse knowledge and skills. To keep pace with modern advancements, revising the syllabus to include modern agricultural technologies, climate-smart farming, and precision agriculture is crucial for fostering innovation and efficiency in the sector.

Strengthening vocational and practical training is another vital aspect of improving agricultural education. Establishing agricultural training centers and experimental farms in schools and colleges will provide hands-on learning experiences, allowing students to apply theoretical knowledge in real-world settings. Encouraging industry-academia partnerships will further enhance skill development by providing internships and apprenticeship programs that expose students to industry's best practices. Furthermore, integrating digital agriculture, smart farming, and IoT-based agricultural practices into the curriculum will ensure that students are well-versed in advanced technological solutions for sustainable farming.

Addressing gender disparities in agricultural education is necessary to promote inclusivity and equal opportunities. Implementing women-focused agricultural training programs will encourage greater female participation in agribusiness, thereby empowering women in the sector. Additionally, providing financial incentives and scholarships for female students pursuing agricultural studies will help remove financial barriers and motivate more women to engage in agricultural education and careers.

Enhancing government and industry collaboration is essential for strengthening agricultural education and employment prospects. Increasing government investment in agricultural education and research will help improve infrastructure, faculty expertise, and research opportunities. Simultaneously, encouraging private sector engagement will create better employment opportunities in agribusiness and digital farming, bridging the gap between education and industry needs. By implementing these measures, agricultural education can be transformed into a dynamic and inclusive field, fostering innovation, sustainability, and economic growth.

CONCLUSION

The findings of this study underscore the urgent need to make Agricultural Science education a compulsory subject in the higher secondary curriculum in Bangladesh. While the current educational framework enhances theoretical knowledge and student engagement in family farming, it falls short in providing hands-on training and industry exposure. Lessons from successful agricultural education systems worldwide indicate that integrating vocational training, technology-driven learning, and strong industry linkages significantly boosts agricultural productivity and employment rates. To bridge the existing skill gap and maximize the potential of Bangladesh's agricultural sector, policymakers must prioritize curriculum modernization, digital agriculture initiatives, and gender-inclusive training programs. Strengthening Agricultural Science education will not only enhance food security and economic development but also inspire the next generation to view agriculture as a viable and rewarding career path, aligning with Sustainable Development Goals (SDGs) 2, 4, and 8.

Recommendations: To strengthen agricultural education, several key recommendations should be implemented.

First, curriculum enhancement is essential to ensure students gain practical experience and industry-relevant knowledge. Introducing fieldwork, agribusiness case studies, and precision farming techniques will help students develop hands-on skills and a deeper understanding of modern agricultural practices. Additionally, vocational integration should be prioritized by developing internship programs with agribusiness firms and research centers, allowing students to gain real-world experience and professional exposure.

Collaboration between educational institutions and the agricultural industry is also crucial. Establishing university-industry linkages will facilitate job placements and entrepreneurship training, ensuring that graduates are well-prepared for careers in agribusiness and farming. Furthermore, adopting digital agriculture technologies is necessary to modernize the sector. Integrating drone farming, IoT, and AI-based farming solutions into the curriculum will equip students with the technological skills required for precision agriculture and smart farming.

On a policy level, advocating for Agricultural Science to be made compulsory in higher secondary education will ensure that more students develop an early interest in the field, ultimately contributing to a skilled agricultural workforce. Lastly, financial support should be provided to encourage more students to pursue agricultural studies. Scholarships and incentives will help reduce financial barriers, making agricultural education more accessible and attractive to students. By implementing these recommendations, agricultural education can be transformed to meet the demands of a rapidly evolving agricultural sector, fostering innovation, sustainability, and economic growth.

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