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Receptive agrarian tax policy as panacea for low agro-innovation uptake – a socio-agricultural concern in Sub-Saharan Africa

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ABSTRACT

Background: Although agriculture holds vast potentials for economic revolution internationally, Africa's agricultural sector and associated occupations continue to underperform. The sector is hindered by substantial challenges, including low productivity stemming from limited uptake of agricultural innovations which are now and again linked to existing unfavorable tax regimes and failed efforts to simplify tax policy in the agricultural milieu. **Methods:** This narative review uses comparative systematic lenses to blend existing literature while providing an objective consideration of multifaceted issues that have bearing to agricultural technology adoption and favourable tax policy. It utilizes secondary sources such as books, newspapers, archival materials, government and international organizations documents, electronic data bases, and a number of peer-reviewed journals across several disciplines to make available a well-balanced all-inclusive interdisciplinary review to highlight the importance of favourable tax policies in the quest for increase adoption of improved agricultural technologies and identifies key areas for improvement. **Findings:** While espousing the truism that favourable tax programs and subsidies incentivizes investment in agricultural innovations, it held that uncontrolled taxes stifle improved agricultural technology adoption. Tax incentives touted by this review to foster increase adoption include Tax Exemptions and Tax Holidays, Tax Rebates, Reduced VAT, Tax Exemption of loan Interest for banks, Concessional Import Duties, Lower Corporate Income Tax Rate, Investment Deductions, and Enhanced Capital Allowances. Beyond favourable tax policies, governments also provide subsidies that can be direct cash payments or circuitously support agricultural related operations through lessening prices of key inputs to make improved agricultural technologies more affordable. **Conclusion:** The paper concluded that stakeholders, especially in Africa, develop capacity to adopt and utilize innovations effectively while taking advantage of tax incentives in the agricultural milieu for improvement throughout the value chain to optimize gains from global agribusiness that could reach a trillion dollars by the end of the decade. **Novelty/Originality of this article:** This review is novel in its unambiguous positioning of supportive taxes and subsidies not simply as circumstantial policy instruments, but as key behavioural drivers of agricultural technology uptake. Diverging from most existing literature that treats fiscal policy incentives as auxiliary enablers or individual economic factors, this review conceptualizes taxation and subsidy regimes as direct triggers shaping innovation adoption intentions and behaviour.

KEYWORDS: behavioural drivers; fiscal policy; food security; institutional support; subsidy.

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1. Introduction

Agricultural holds enormous possibilities for economic revolution globally, considering that the food and agribusiness market could reach $1 trillion by the year 2030. (Africa Development Bank, 2018). The sector with attendant occupations is the single largest contributor to the wellbeing of the rural populations in Africa (Nash et al., 2013; Jack, 2013), and majority of continent's rural labor force are involved in the sector (Ijirshar, 2015). According to Ansu (2017) agriculture plays a crucial part in guaranteeing food security worldwide. Other than the fact that most African countries depend on local food production to feed their populations, the sector as well, is a major contributor to the GDP of these countries, with some regions like sub-Saharan Africa seeing it account for 30-40% of GDP (Banda, 2022).

Agricultural exports contribute significantly to foreign exchange earnings of African countries, and proceeds gotten thereof are used to finance imports and economic development in other sectors (Epaphra & Mwakalasya, 2017). For perspective, agriculture is responsible for about 25% of the Nigerian GDP (Oluwafemi et al., 2015), and 2% of the country's total exports (Gbaiye et al., 2013). Despite its potentials (vast natural resources and arable land) Africa's agricultural sector remains underdeveloped (Oyim et al., 2023). While agricultural development and the process of increasing the efficiency of agriculture depend majorly on the extent to which farmers utilize improved technologies in their operations, low uptake of improved technology is a bane and major constraint to agricultural development in Africa (Suleman, 2012, Adeyeye et al., 2013; Sibanda & Workneh, 2020).

Technological innovations have a key role in farming and agriculture practices. To illustrate, adoption of improved technologies like chemical fertilizers, high-yield seeds, and mechanization in the mid-20th century was a key technological advancement, allowing countries to radically raise agricultural output and attain food independence (Kumar, 2023). Green Revolution also known as Third Agricultural Revolution brought unprecedented agricultural growth to developing countries, especially for sub-Saharan countries of Africa, revolutionizing food production through utilization of improved technologies such as high-yielding crop varieties, chemical fertilizers, and pesticides (Dawson et al., 2016). Regardless of these feats and notable achievements, agricultural technology adoption in this continent is faced with daunting challenges, particularly, improved agricultural technology adoption has remained low (Zhan et al., 2025), especially among small scale farmers who dominate the segment, with rates being considerably lesser than in other developing regions like Asia and Latin America (Porteous, 2020).

Put in perspective, about 4 in every 5 small scale farmers in sub-Sahara Africa do not have access to improved agricultural technologies. For instance, in the ECOWAS sub-region, the use of appropriate fertilizers has been low with a typical yearly application rate of 12 kilograms per hectare (kg/ha). At this level, fertilizer use in the region remains well below the 50 kilograms per hectare standard recommended by African governments by 2015 (Falaju, 2016). In Ethiopia, also, only 30–40% of small-scale farmers utilize synthetic fertilizers, with an average application rate of 37–40 kg per hectare - considerably less than the recommended standard (Rashid et al., 2013). These significant challenges, resulting in substantial losses arising from low productivity, invasive species, pest and diseases, limited access to credit, high cost of inputs, and insecure land tenure. Also, climate change affect agricultural productivity, with extreme weather events like drought and floods destroying crops, livestock, and infrastructure (Moss, 2021).

In addition to these challenges, sub-Saharan African countries face substantial post-harvest losses (World Bank Group, 2025; Kaminski & Christiaensen, 2014). These losses that are connected to utilization of obsolete agricultural technologies are indicted for food insecurity and malnutrition, reduced income, economic hardship, and poverty for smallholder farmers (Mezgebe et al., 2016; Alliance for a Green Revolution in Africa, 2019). Put into context, post-harvest losses emanating from underutilization of improved postharvest technologies are becoming extremely important to actors in the agricultural

value chain and governments in sub-Saharan Africa, and are posing a threat to sustainable food security (Adegbola et al., 2018). For example, postharvest losses in sub-Saharan Africa alone surpass 30% of total crop production and represents more than $4 billion in value every year (FAO/World Bank, 2011). Despite the fact that increased utilization of improved technologies can significantly reduce these losses (Olayemi et al., 2010), contribute to economic growth and poverty alleviation amongst the poor (Jack, 2013), their adoption remain low, with many in the region continuing to use traditional methods (Bisheko & Rejikumar, 2023).

For perspective, modern technologies have improved agricultural production and standards of living through greater effectiveness, produce efficiency improvement, and proficient use of resources, leading to improved food security and prosperity (Kumar, 2023). Technologies such as GPS-guided planting, moisture, and temperature sensors allow farmers to accurately monitor and manage soil health, improving irrigation and crop nutrition, which ultimately improve crop productivity, and sensors for smart irrigation and fertilization systems (Baje, 2025). Drones and remote sensing for crop health monitoring using aerial imaging and sensors offer real-time data on plant health, allowing for well-timed strategies to manage pests' infestations and crop threats, culminating in improved crop quality and productivity (Adeyemo et al., 2024).

Furthermore, digital platforms for market access have reinforced farmers' capability and improve local economies (Gamage et al., 2024). Biotechnology have created insect-tolerant and improved crop varieties (contributing meaningfully to food self-reliance), and data driven decision that have been vital for aiding many developing countries attain self-reliance with respect to feeding their teeming population (Kumar, 2023). Similarly, automation and mechanization in farming reduces drudgery, boost operational effectiveness, and allows for unceasing, automated processes, leading to greater output and superior management of resources. Add to aforesaid, other modern technologies and machines helping to advance modern agricultural practices include the following amongst others: tractors (for soil preparation), combine harvesters, precision farming technologies like GPS-guided machineries (Baje, 2025).

Evidences from United Kingdom have shown that government tax relieve for agricultural technology R&D stimulated companies like KMS Projects and Vegetable Harvesting systems to develop innovative technologies (robots and scanners) that are affordable and largely adopted. Just like the United Kingdom, subsidies were found to have led to an increase in adoption of grain storage bags in Uganda (Omotilewa et al., 2019), and higher adoption rate for improved seed and fertilizer that have increased production in Mozambique, here, a one-time voucher for fertilizer and improved seeds led to significant, insistent increases in fertilizer use, overall production, market sales, and household assets (Carter et al., 2014). Furthermore, in Nepal subsidies for seeds, together with access to markets and training, have considerably increased the adoption of improved agricultural technologies and practices by farmers (Joshi et al., 2019).

While in Ghana, farmers in the East region of the country have adopted digital agricultural technologies, including apps for market prices, weather information, and links to input dealers, with some of these solutions promoted and potentially influenced by government or private sector initiatives that can be seen as a form of subsidy or support (Miine et al., 2023). Subsidies also have led to increased agricultural technology adoption in Malawi and Zambia (Porteous, 2020). While sub-Saharan Africa agricultural sector is shaped by a blend of traditional practices and more recent efforts at modernization and reform, the evidences put forward show that the continent's agricultural sector holds tremendous possibilities for driving wide-ranging growth, food security, and sustainable growth if properly supported through investments, structural adjustments, and technological advancement.

Against the backdrop of the striking information on tax policy and agricultural technology adoption so far, this article becomes relevant as it examines the occurrence and impact of low agricultural technology adoption in Sub-Saharan African socio-agricultural system while giving insights into the phenomenon, a reoccurring course of concern in the

sub-region's agricultural milieu. This main question would be giving consideration and sort to be answered in the course of this review: How can receptive agrarian tax policies boost the adoption of agricultural innovations in Sub-Saharan Africa? However, these specific question would add more depth: How do tax incentives, exemptions, or subsidies sway eagerness and ability to adopt new agricultural technologies? To what degree do agrarian tax policies reduce the cost barriers associated with agricultural innovation adoption? How does receptive tax policy bear upon private sector investment in agricultural research, development, and innovation spread? Do institutional capacity and governance quality mediate the potency of agrarian tax incentives in promoting agricultural innovation? What admonition can Sub-saharan African countries draw from successful agrarian tax policy reforms within and outside the region? What tax policy are most practicable and suitable for accelerating sustainable agricultural innovation adoption in Sub-Saharan Africa? Furthermore, to avoid a weak evaluation of the phenomenon of adoption, the crux of this article, here are two key definitions that resonate across technology adoption literature: adoption refers to the stage in which a user selects, applies, and continues to use a new technology, often following exposure to information about it; adoption is the decision to make full use of an innovation as the best course of action available.

This review is grounded in the Theory of Planned Behavior (TPB), a psychological framework developed by Icek Ajzen that explains how attitudes, subjective norms, and perceived behavioral control shape individuals' decisions, including the adoption of technology. These psychological factors form the core of TPB and provide an effective lens for understanding why individuals or organizations choose to adopt innovations. Within this context, TPB offers a comprehensive structure for analyzing the relationship between tax policies and the adoption of agricultural technology. Policymakers can use tax instruments to encourage technological uptake, while farmers can make more informed adoption decisions by considering tax policies and institutional conditions. One key TPB assumption is that favorable tax policies reduce both purchase and maintenance costs, thereby increasing perceived economic benefits such as higher productivity and improved cost-effectiveness, which in turn foster more positive attitudes toward technology adoption. Another important aspect is that when technologies become more affordable, their use tends to spread more widely within agricultural communities. Peer adoption, extension and outreach programs, as well as clear policy signals from the government, help create shared expectations and social reinforcement, strengthening social approval and shaping positive subjective norms in support of adopting these technologies.

2. Methods

2.1 Study design and literature search strategy

This article is a narrative review that synthesizes existing literature to provide a nuanced and balanced consideration of diverse issue surrounding agricultural tax policies, subsidies, and utilization of improved agricultural technologies. The paper utilized electronic academic databases such as ResearchGate, JSTOR, Google Scholar, Scopus, DOAJ, Web of Science, and PubMed alongside others to search for applicable studies, research papers, and articles that have bearing on the theme being explored. Categorically, this piece utilizes secondary sources such as books, newspapers, archival materials, government and international organizations documents, electronic data bases, and a number of peer-reviewed journals across a number of disciplines until June 2025 to make available a well-adjusted interdisciplinary review. The search employed relevant keywords that include agricultural productivity, low taxes, agricultural technology adoption, tax policies, and agricultural modernization.

2.2 Literature search and selection criteria

Inclusion criteria comprise studies examining the relationship between tax policies and agricultural technology adoption, and studies conducted in various sub-Sahara African countries - out of 325 articles retrieved, 156 met the inclusion criteria. Exclusion criteria include studies unrelated to agricultural technology adoption or agricultural tax policies.

3. Results and Discussion

3.1 Agricultural tax policies and their implications for societal structure

Taxes are integral part of and influence the cultural, social, political, and economic environment, and they are altered with new demands and standards of the society and its economy (Khan, 2001). Agricultural tax policies can significantly transform the economic attitudes, cultural practices, and social structure of a society (Gadwin, 2022). They can strengthen or modify prevailing social hierarchies (Bahr, 2024), unsettle traditional agricultural practices if they alter the cost effectiveness of certain crops or farming methods (OECD, 2005), inform choices about family size (Gadwin, 2022), shape perception of work and leisure, possibly influencing work-life balance and lifestyle (Finger & Pedersen, 2025). Likewise, they can shape or have implications for community wealth distribution as income inequality can be mitigated by progressive taxes and worsened by regressive taxes (Komatsu et al., 2021).

Agricultural tax policies can create incentives or barriers for particular agricultural activities or farming approaches (OECD, 2005), play a role in rural urban migration patterns by determining whether individuals remain in rural areas or relocate to urban centers in search of jobs (Gadwin, 2022), or incentivize farmers to transition from subsistence to commercial farming, integrating more fully into market economy; they have significant implications for the larger economy (Bird, 1974). They also influence land use arrangements, sharing of resources, delivery of agricultural activities, investment choices, particularly capacity of farmers to spend on their farms, impact rural poverty, affect agricultural production, and the sectors involvement in microeconomic stability and growth (OECD, 2020). According to Khan (2001), agricultural tax policies also impact sustainable food systems (chiefly in developing countries where agriculture is an essential source of food supply and income for numerous families), distributive justice and inclusive development (mostly if these taxes excessively affect specific population, such as resource-poor farmers).

Historically, agricultural production was a key source of wealth in many societies, and taxes were most often than not imposed on them (Johnson & Koyama, 2014); agricultural taxation dates back centuries, progressing together with agriculture intrinsically (Bak & Szalkowska, 2020). Rulers in pre-modern societies collected a share of agricultural produce as taxes in kind; rulers collect a proportion of the yield, livestock, other agricultural products (OECD, 2005). Historical records indicate that ancient Egypt had a taxation system tied to agricultural output, where tax officials assess, determine, and collect agricultural taxes from farmers (Bristax, 2022; Peter, 1992). Also, agricultural taxes, typically collected in the form of goods (grain and other agricultural products), were the primary revenue source for medieval china (Zhang, 2023).

The Byzantine Empire had a system of agricultural taxation that evolved over time, including taxes on land and individual poll taxes (Simonovic, 2024). During the middle ages in India, kings use to receive as their due, about the fourth part of the gross produce of all privately held land (Golagani, 2024). In precolonial Nigeria, impressive tax system existed in Kanem Borno empire, including taxes on nomads (grazing fees) and land owners (in kind and cash), in the Hausa States, nomads pay Jingali (cattle tax), and In Yoruba states, land rent (Ishakole) was collected from farmers working on the lands of chiefs (Okaro, 2011). Historically, religious institutions have often been intertwined with agricultural taxation, with practices like tithes (a tenth of agricultural produce) and the collection of first fruits

being common across various faiths. These levies were used to support the clergy, religious institutions, and sometimes the poor (Chodorow, 2006)

While taxes provide crucial funding for public services and infrastructure, ineffective agricultural tax policies can undermine farmers' incentives, leading to lower productivity and slower growth (Ajiya et al., 2025; Akitoby et al., 2020). For example, tax policies for most developing countries are hampered by inefficiencies and overly complicated tax laws (Yeboah & Andrew, 2020). As well, the impact of tax policies on the food and agricultural sector can be far reaching, influencing innovation, productivity and sustainability. Specifically, tax policies have a ripple effect on investment decisions, impacting the adoption of innovation and economic growth. In particular, farms, suppliers, and food companies are influenced by tax policies, which shape their strategies, investments, and competitiveness. For example, depreciation provisions in tax laws can incentivize farm investments by reducing tax liabilities in some countries, while in other countries, the tax system supports farmers' financial stability through income averaging, reducing tax volatility. The tax system can foster innovation at multiple levels, from specific sectors to the entire economy, through strategic incentives– for example, tax incentives can be tailored to support private research and development efforts and startups with innovative potential (OECD, 2020).

Similar to the preceding paragraph, agricultural taxation has traditionally sought to extract a significant portion of resources from the sector to fund government activities and support broader economic objectives, especially, promoting sustainable industrial growth and reducing rural poverty through economic development, case for high level taxes on agriculture and by now the unpropitious fallouts are well documented (OECD, 2005; Stewart-Wilson & Waiswa, 2021; Gadwin, 2022; Okaro, 2011; Bak & Szalkowska, 2020). For example, Khan (2001) admitted that there is ample indication that taxes in most of its forms have diminished agricultural growth in developing countries, as significant portion of the tax liability on agricultural stakeholders has been due to taxes embedded in prices, including overestimated exchange rates, import tariffs, and procurement programs (monopoly marketing) impacting product prices.

3.2 Intemperate taxes asphyxiate adoption of improved agricultural technology

Taxes play a vital part in generating income for financing public services and infrastructure that can in due course profit the agricultural sector (Tom et al., 2024). Tariff is specifically a form of tax that control global trade and safeguard domestic industries while generating income for the government (Hahn, 2025). However, unbridled taxes is an key factor that can stand in the way of improved agricultural technology adoption (Awotide & Awoyemi, 2016); while utilization of these technologies can lead to surge in productivity and diminish costs, high taxes can counterpoise these benefits, demotivating farmers from adopting them (Habtewold & Heshmati, 2023). Conversely, a lighter tax regime can in due course lead to a greater adoption level for improved agricultural technologies culminating in and a flourishing, food-secure country (Alih, 2024).

The tax and tariff landscape affecting agricultural inputs internationally is multifarious (Van Tongeren et al., 2001); they diverge considerably by country, region, and product, with some nations offering incentives like tax credits, zero tax on agricultural loans and duty free imports for agricultural equipment (Josling, 1974; Kelly et al., 2003), and some inputs being exempted from tariffs completely (Koolwal et al., 2023). To illustrate, some EU countries permit farmers to take away cost incurred for investments in agricultural technologies from their taxable revenue (Gruziel & Raczkowska, 2018), also, energy used in agricultural machinery production is charged a bargain tax (OECD, 2020). In Canada for example, some agricultural machineries are zero-rated, connoting they are in theory taxable but at a rate of 0% (MacNevin, 1998). On the other hand, the US, have implemented tariffs on some categories of agricultural tools, even though others have lower or no tariffs (Morgan et al., 2022).

Equally, the government of Nigeria has put in place tax incentives and subventions for selected agricultural industries and associated businesses (Olokooba, 2019; Global Trade

Alert, 2021). For example, to promote adoption, modernization and technological advancement in agriculture the government provides a 10% tax credit on agricultural equipment (SDC, 2023). Unambiguously, exacting taxes regime affect embracing improved agricultural technologies in diverse deleterious ways. These include but are not limited to increased cost and reduced investment in agricultural innovations, discourages innovation and entrepreneurship in agro-technologies, reduces farmers' disposable income, impact adversely on profitability and reinvestment, and creates a drawback in the global market.

High tax burdens directly increase the cost of adopting improved technologies, thereby discouraging investment, particularly in the agricultural sector. Imported machinery, which is often essential for achieving substantial productivity gains, becomes significantly more expensive due to high import duties and tariffs (OECD, 2020). Similarly, domestically produced innovations are frequently affected by taxes imposed on imported raw materials and manufacturing inputs, which ultimately raise prices for end users (Abuselidze, 2012; Hufbauer et al., 2013; Kolapo et al., 2022). These inflated costs serve as a major disincentive, especially for small and medium-scale farmers who lack sufficient capital reserves to absorb such expenses. As a result, instead of investing in high-yielding and more efficient technologies, many farmers continue to rely on traditional methods that are often less effective, thereby perpetuating a cycle of low productivity and inefficiency (Evans, 1969).

High tax burdens can also discourage innovation and entrepreneurship within the agricultural technology ecosystem (Gentry & Hubbard, 2005; Lee, 2005). When firms involved in the production and dissemination of agricultural technologies are subjected to substantial tax obligations, their incentives to invest in research and development, expand operations, and reach underserved farming communities are significantly reduced. This, in turn, slows the pace of technological advancement and limits access to context-specific and effective solutions. Moreover, potential innovators who might otherwise be motivated to introduce new technologies into the agricultural sector may be deterred by heavy taxation, perceiving such ventures as marginal, risky, or uncertain (Elert et al., 2019). The resulting stagnation can ultimately hinder the broader progress, resilience, and revitalization of the agricultural system.

Table 1. Tax incentives and their likely effects on agro-innovation

Policy instrument	Description	Expected outcome
Tax Exemptions/Holidays	Provisional removal of taxes	Reduced cost of agro-technology adoption
Tax Rebates	Refunds on R&D and investments	Encourages Investment in agro-innovation
Reduced VAT	Lower tax on agricultural inputs	Makes agro-technologies more affordable
Import Duty Concessions	Lower tariffs on machinery	Improved access to improved agro-equipment
Interest Tax Exemptions	Tax-free loans for agriculture	Boosts access to finance
Investment Deductions	Deduct cost of equipment from income	promotes reinvestment in innovation
Lower Corporate Tax	Reduced tax for agri-businesses	Drives growth and expand research in ago-innovation
Enhanced Capital Allowance	Large tax relief on agricultural equipment purchase	Promotes mechanization and modernization

High tax burdens can significantly slow the adoption of agricultural technologies by reducing farmers' disposable income and limiting their capacity to invest, even when such technologies have the potential to enhance productivity and profitability (Feder et al., 1985; Kayizzi-Mugerwa, 1998). Steep taxation may also discourage farmers from expanding their operations, thereby constraining the uptake of technologies that require larger-scale implementation (Aboh, 2012; Adeyemo et al., 2024). Moreover, for farmers who have already adopted new technologies and achieved higher productivity, heavy taxes on agricultural revenues can substantially weaken their ability to reinvest in further

improvements or scale up production (Oluwole et al., 2020; Gadwin, 2022). When a significant share of earnings is absorbed by taxes, the financial incentive to innovate diminishes, leading to stagnation in technological adoption even among early adopters.

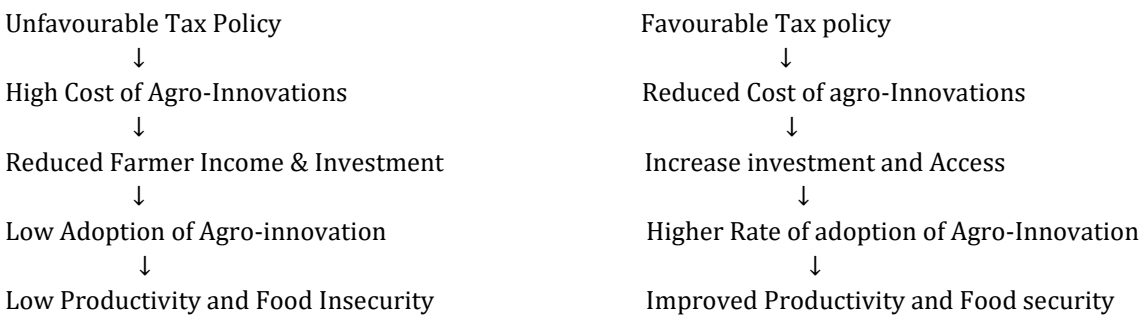

Fig. 1. Idea framework - How tax policy shapes agro-innovation uptake

High taxes on agricultural inputs can place local farmers at a significant disadvantage in the global market, particularly as economic interdependence continues to intensify (Essilfie, 2025; James, 2008). Elevated tax burdens increase production costs, rendering domestic agricultural products less competitive compared to those from countries that provide subsidies and tax incentives to their farming sectors. Limited access to affordable technologies—resulting from high import duties, taxes on logistics services, and export levies—further constrains farmers in resource-limited agrarian economies from adopting improved technologies and modern production methods. Consequently, these farmers struggle to achieve the levels of competitiveness, profitability, product quality, and compliance with international food safety standards required to compete effectively in global markets (Musungwini, 2023).

3.3 Tax incentives have potential for increased agricultural innovation adoption

To achieve food security, a critical part of the Sustainable Development Goals (SDGs), particularly SDG 2 - Zero Hunger - (Bjornlund et al., 2022; United Nations Statistics Division Development Data and Outreach Branch, 2016), attain a broad-based improvements in agricultural innovation adoption, and brood improved technology adoption in sub-Saharan Africa, a multidimensional receptive tax policy systems approach around agricultural innovations that focuses on creating an environment where peasant and small scale farmers and processors are motivated to adopt improved technologies, potentially through incentives as opposed to enforcing regulations are prioritized and pursued. What's more, the evolution of agricultural taxation has led to more sophisticated and complex systems beyond basic output levies reflecting changing economic philosophies and development stratagems, as such, governments today are navigating the dual goals of collecting agricultural tax revenue while promoting investment and growth in the sector (World Bank, 2012). Specifically, as economic understanding improved, the negative consequences of heavy agricultural taxation were recognized, prompting a policy shift towards tax reduction (Stewart-Wilson & Waiswa, 2021); policies were adjusted to alleviate the negative impacts of high agricultural taxes and optimize resource allocation (Khan, 2001). That said, there are plethora options for taxing agriculture that can strike a balance between incentivizing production and ensuring equity while generating substantial revenue (OECD, 2005).

Prohibitive costs of postharvest technologies can limit their uptake (Bisheko & Rejikumar, 2023; Kaur & Watson, 2024; Dimos et al., 2022), while tax incentives play a significant role in encouraging their adoption (Suwanda, 2023). Tax incentive is a tax benefit offered by government to stimulate particular actions or investments (Munongo et al., 2017). Governments around the world have offered a number of incentives to promote adoption of innovation (Organization for Economic Co-operation and Development, 2025), and this could takes the form of tax exemptions from payments, investment allowances, and import tariffs amongst others. For example, the government of Nigeria at a time introduced

tax incentives for agricultural businesses (Olokooba, 2019). While high taxes usually do not encourage technology adoption (tax incentives are the key fiscal motivators for agricultural technology adoption by dipping costs, increasing profitability, and boosting R&D investment), they could circuitously encourage adoption if they lead to greater operating costs for traditional methods, making improved technologies comparatively more appealing (Suwanda, 2023).

Several tax incentives can significantly enhance the adoption of agricultural innovations by lowering costs, stimulating investment, and improving access to technology. One widely used approach is tax exemptions and tax holidays, which temporarily reduce or eliminate tax obligations for businesses or consumers. These incentives have been applied in several African countries to make agricultural technologies, particularly postharvest solutions, more affordable. Examples include the zero-rating of value-added tax on hermetic storage technologies in Uganda, import duty exemptions on key agri-tech equipment in Tanzania, and tax holidays for small-scale agro-input producers in Nigeria, all of which aim to reduce financial barriers and encourage wider technology uptake (Klemm, 2010; Marangu, 2024a, 2024b; Food Business Africa, 2024; Jannamike, 2022).

Tax rebates also serve as an important incentive by reducing the overall tax burden associated with research and development activities. By easing the financial pressure on firms, rebates can encourage greater investment in innovation, improve production efficiency, and support sustainable development. Empirical evidence suggests that well-designed rebate schemes can substantially increase technology adoption rates, although their effectiveness depends on factors such as policy design, target beneficiaries, and local context (Shapiro & Slemrod, 2009; Batchelder et al., 2006; Zhang & Song, 2022).

Another effective measure is the reduction or exemption of value-added tax on agricultural technologies, components, and inputs. Because VAT is levied on the final price of goods and services, lowering or abolishing it can directly reduce costs for farmers while simultaneously encouraging local production and assembly of agri-tech equipment, particularly in emerging industries. Such policies can also free up resources for producers to reinvest in research and development, thereby accelerating innovation and adoption across the agricultural value chain (Crawford et al., 2010; World Bank Group, 2019).

Tax exemptions on interest earned from loans to agri-businesses further promote technology adoption by improving access to agricultural finance. When banks are allowed to earn tax-free interest on loans directed toward agricultural development and technology adoption, they are more likely to extend credit to farmers and agri-tech firms. This approach, as seen in Nigeria, helps lower financing constraints and supports investment in improved agricultural technologies, particularly where loan conditions such as moratorium periods and interest rate caps are met (Ernst & Young, 2021; Federal Inland Revenue Service, 2019). Concessional or reduced import duties on agricultural machinery and technologies represent another critical policy instrument. Although import duties are traditionally used to protect local industries, lowering these duties on essential agri-tech equipment can make technologies more affordable and widely available, especially in countries that depend on imports for mechanization. Evidence from several African countries shows that zero-duty or concessional import regimes can significantly increase adoption rates among smallholder farmers by reducing prohibitive upfront costs (FAO, 2022; Van Loon et al., 2020).

Finally, broader fiscal measures such as lower corporate income tax rates and investment deductions can indirectly but powerfully influence agricultural technology adoption. Reduced corporate income tax enhances cash flow for agri-tech firms, enabling greater investment in research, development, and market expansion, which ultimately improves the availability and attractiveness of technologies to farmers. Investment deductions, on the other hand, allow farmers to deduct the cost of technology investments from taxable income, reducing tax liabilities and increasing cash flow. These measures, implemented in parts of Europe and Ukraine, encourage reinvestment in modern agricultural machinery and innovations, contributing to more widespread and sustained

adoption of improved agricultural technologies (Goolsbee, 2004; Ahlvik & Harding, 2025; Chen et al., 2023).

Enhanced Capital Allowances (ECA)/First-year Allowances: Enhanced capital allowance is a tax break that incentivizes businesses to invest in innovative technologies (LexisNexis, 2025). While it is not exactly designed for agricultural technology adoption, this scheme can help farmers and agricultural businesses that seek to invest in improved technologies as initial and annual allowances on plant and machinery used in agricultural production can reduce taxable profits. In Nigeria for example, this incentive lets businesses who want to invest in improved agro technologies get as much as 95% first-year tax relief (PwC, 2025). That is, businesses can get back as much as 95% of the cost of certain types of agricultural equipment in the year that they buy them. To take advantage of the ECA however, stakeholders would first make certain they fulfil the conditions for the scheme and invest in qualifying technologies (Central Bank of Nigeria, 2013).

For tax-based policies to lead to increase in technology adoption, however, they must be part of a wider strategy including market incentives (better market demand for products manufactured with newer technologies can offer economic spur for adoption), extension services and training (providing farmers with information, training, and support to know and use improved technologies is critical to rising above hurdles and promoting adoption), and improved profitability (eventually, farmers will adopt technologies if they see them as offering a comparative advantage and helping with improved cost-effectiveness) (Liu & Liu, 2024). According to Sterling & Maddison (2024), these wider strategies vital for widespread technology utilization also include aligning tech with strategic policies and promoting collaboration between the public and private sectors.

Although it is an axiom that low taxes can potentially boost agricultural technology adoption by reducing financial burden on farmers, however, there are some weaknesses to consider. Even with low taxes high upfront cost for initial investment necessary for agricultural technologies can be excessively costly for many farmers, particularly for smallholder farmers and other small scale stakeholders (FAO, 2023). Again, farmers may strive to access credit or financing options to spend on improved agricultural technologies, also, improved agricultural technologies may be complicated and require expert know-how which may demotivate farmers from adopting them (Mori, 2018). Furthermore, imprecise or sometimes inconsistent government policies and guidelines can lead to ambiguity and hinder the adoption of improved agricultural technologies even when there are favourable tax policies (United States Government Accountability Office, 2024).

Outside favourable tax regimes, governments sometimes reduce the cost of agricultural inputs through subsidies rather than taxes. Agricultural subsidies are government-backed financial aid programs designed to support farmers stabilize food prices, and guarantee food security. These subsidies play acritical role in sustaining farming enterprises especially in developing countries where rising input cost and related factors threaten their livelihoods. There are three common types of agricultural subsidy; input subsidies, price support, and income schemes (Yusuf, 2021). Input subsidies, the most common agricultural subsidies, are a type of government-backed financial support that reduces the cost burden of agricultural inputs and technologies for farmers. For all its worth, subsidies can be in form of direct cash payments to farmers to support their operations or circuitously through lessening prices of key inputs (Fan et al., 2008), and by solicitously effecting subsidies, countries can promote the uptake of innovations (Feder & Umali, 1993; Jack, 2013).

Subsidies, direct or indirect, can make agricultural technologies more affordable especially for small scale stakeholders (Yusuf, 2021). For example, the Growth Enhancement Support Scheme (GESS), a Nigerian government initiative has been providing subsidized inputs and support to small scale farmers, subsequently influencing improved agricultural technology adoption in Nigeria (Tiri et al., 2014). Also, in Tanzania, through government subsidies, agribusinesses were able to invest in and adopt improved postharvest handling and storage technologies for high quality sunflower seeds (Karata, 2024). Be that as it may, factors that could negatively impact smooth delivery of agricultural subsidies in Sub-Saharan Africa countries, include but are not limited to poor database,

want of coordination, corruption, ineffectual targeting, high administrative cost, and poor distribution system (Uche et al., 2024). Another significant drawback of agricultural subsidies is that they can create dependence among farmers, decreasing their motivation to adopt more effectual and viable practices (Yusuf, 2021).

Ultimately, to remain effective, agricultural subsidies, just like tax concessions, need to be well-designed, efficiently implemented, and aligned with broader economic stability goals to achieve lasting effectiveness. Furthermore, their designs and execution call for cautious consideration to lessen financial obligations, and mismanagement of resources. What's more, with the growing challenges in global agriculture, innovative subsidy strategies might ultimately be key to securing the future of food production and availability in developing economies, especially countries of sub-Sahara Africa.

4. Conclusions

In conclusion, the evidence and arguments presented in this article demonstrated that favourable tax policies (which include but are not limited to tax exemption and tax holidays for producers of agro-technologies and other industry actors, tax rebates, reduced value added tax, and concessional import duties, and subsidies for industries and actors in the sector) and well-designed subsidies are not just fiscal instruments but plan of action development tools capable of defining investment behaviour, stirring innovation, and accelerating the adoption of productive technologies in the agricultural space. By decreasing the cost of investment and reducing precariousness, supportive fiscal measures create a helping ecosystem in which private and public actors are inclined to commit resources to innovation-driven activities. Across theoretical, empirical, and contextual discussions, the central argument advanced is that when governments deliberately reorient tax incentives and subsidies with development objectives, they can unlock routes to long-term progress and inclusive technological transformation. Importantly, this article has shown that the combined effect of favourable tax policies and subsidies is greater than the sum of their individual impacts.

Tax incentives chiefly influence investments supply by inspiring innovators to create and commercialize new technologies, while subsidies frequently boost demand by making these technologies low-priced and available to end-users. This dual-side intervention assist the whole innovation-adoption chain, from idealization and new product creation to market diffusion and post-adoption use. From this perspective, fiscal policy becomes an interface between innovation systems and real-world adoption results. This article demonstrates that favourable fiscal policies can reshape behavioural responses in ways that extend beyond immediate financial gains. Stable and predictable tax and subsidy frameworks strengthen investor confidence while signaling sustained government commitment to innovation and learning. In the long run, these signals shape norms, expectations, focus within tech-innovation companies and among adopters, reinforcing innovation-friendly behaviour particularly when there is incredulity towards new technologies.

However, this article alluded that favourable tax policies and subsidies are not by themselves effectual as their outcome count critically on regulatory design and institutional competence; poorly targeted subsidies, convoluted tax procedures, and policy incompatibility can distort incentives and public trust. Therefore, fiscal incentives must be embedded within coherent policy frameworks that stress clearness, transparency and responsibility, and coherence with overarching development priorities. This article also positions favaourable tax policy and subsidies within the more general sustainability conversation as innovation adoption impelled by supportive fiscal measures can impart productivity growth and environmental sustainability, especially when incentives are aligned with socially desirable outcomes. With this understanding, it is recommended that policymakers must move beyond impromptu incentives toward integrated, predictable, and inclusive frameworks that support innovation ecosystems over time. Also, governments make concerted efforts at making stakeholders become better aware of provision of agricultural tax incentives, and make more efficient tax procedures to reduce compliance

cost and administrative burdens. In addition, the government should recognize best practices in agricultural technology adoption (especially postharvest technology adoption) and tax policy design. Stakeholders must take advantage of tax incentives, build capacity, invest in and utilize improved technologies effectively in order to reduce losses in agricultural sector and improve food security. If these suggestions are followed through by policy and stakeholders, utilization of agricultural innovations would be well entrenched in these agrarian countries where utilization of traditional agricultural technology is rife. Finally, future inquiry could look at causal effects of tax policy instruments mentioned in this review on adoption across diverse technologies and actors along the agricultural value chain in sub-Saharan Africa, especially Nigeria.

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Author Contribution
A.J.A., A.S.J., and S.L.O. contributed to the conceptualization and framework of the review. A.J.A., O.M.E., and A.R.Q. performed the literature search and data curation. A.J.A., A.S., and A.R.Q. was responsible for the writing of the original draft. S.L.O. provided critical review and significantly edited the manuscript. A.J.A served as the corresponding author and managed the project administration.

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References

Aboh, C. L. (2012). Causes and implications of the slow pace of technology transfer and adoption in rural agriculture. *Journal of Agriculture and Social Research*, *12*(2), 163–170. https://www.ajol.info/index.php/jasr

Abuselidze, G. (2012). The influence of optimal tax burden on economic activity and production capacity. *Intelektinė ekonomika, 6*(4), 493–503. https://www.ceeol.com/

Adegbola, J. A., Wegh, F. S., Ikwuba, A. A., & Nwafor, S. C. (2018). Socio-economic factors influencing utilization of manual screw press for gari production in Kwara State, Nigeria. *Journal of Agricultural Extension Management, 19*(2), 17–27. https://www.jaem.org.ng/

Adeyemo, J. T., Ahmed, A., Abaver, D. T., Riyadh, H. A., Tabash, M. I., & Lawal, A. I. (2024). Technological innovation and agricultural productivity in Nigeria amidst oil transition: ARDL analysis. *Economies*, *12*(9), 253. https://doi.org/10.3390/economies12090253

Adeyeye, O., Oladipo, O. G., & Adeyeye, A. D. (2013). What drives technology utilization, learning and transfer in agriculture: Lessons from Nigerian women farmers. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, *13*(2). https://managementjournal.usamv.ro

African Development Bank. (2018). *Unlocking Africa's agricultural potential to create wealth*. https://www.afdb.org/en

Ahlvik, L., & Harding, T. (2025). Resource investments and the timing of tax deductions. *Journal of the Association of Environmental and Resource Economists*, *12*(1), 1–32. https://doi.org/10.1086/730391

Ajiya, S.T., Baban'numma, M.B., & Pious, A. G. (2025). Challenges Militating against International Fund for Agricultural Development (Ifad) in Implementing Rural Agricultural Development Projects in Nigeria. *Wukari International Studies Journal*, 9(1), 63-78. https://wissjournals.com.ng/index.php/wiss/article/view/582

Akitoby, B., Baum, A., Hackney, C., Harrison, O., Primus, K., & Salins, V. (2020). Tax revenue mobilization episodes in developing countries. *Policy Design and Practice*, *3*(1), 1–29. https://doi.org/10.1080/25741292.2019.1685729

Alih, L. (2024). Enhancing agricultural productivity in Nigeria through technological innovations. *International Journal of Research and Innovation in Social Science*, *8*(12), 1716–1733. https://rsisinternational.org

Alliance for a Green Revolution in Africa. (2019). *Africa agriculture status report 2019: The hidden middle*. https://agra.org

Ansu, Y. (2017). *Transforming agriculture to power Africa's economic transformation*. United Nations Sustainable Development. https://sustainabledevelopment.un.org/

Awotide, B. A., & Awoyemi, T. T. (2016). *Impact of improved agricultural technology adoption on sustainable rice productivity and rural farmers' welfare in Nigeria* (pp. 232–253). https://www.taylorfrancis.com/chapters/edit/10.4324/9781315562179-21/impact-improved-agricultural-technology-adoption-sustainable-rice-productivity-rural-farmers-welfare-nigeria-bola-amoke-awotide-taiwo-timothy-awoyemi

Bahr, B. (2024). *Progressive and regressive taxation – Social stratification*. https://library.fiveable.me/social-stratification/unit-5/progressive-regressive-taxation/study-guide/M7TgkyVNVQNphNxG

Baje, A. O. (2025). *Role of technology in transforming agriculture in Nigeria*. https://businessday.ng/life/article/role-of-technology-in-transforming-agriculture-in-nigeria/

Bak, J., & Szałkowska, M. (2020). The social security of farmers in Poland and in selected EU member states. *Olsztyn Economic Journal, 15*(3), 239–249. https://www.ceeol.com/search/article-detail?id=992755

Banda, P. C. (2022). Agriculture: The backbone of the African economy. *International Journal of Advanced Research in Social Sciences, Environmental Studies & Technology, 7*(1), 58–61. https://internationalpolicybrief.org/

Batchelder, L. L., Goldberg Jr, F. T., & Orzag, P. R. (2006). Efficiency and tax incentives: The case for refundable tax credits. *Stanford Law Review, 59*, 23. https://heinonline.org/HOL/LandingPage?handle=hein.journals/stflr59&div=10&id=&page=

Bird, R. M. (1974). Agricultural taxation in developing countries: A discussion of the policy issues in designing an effective system of agricultural taxation. *International Monetary Fund, 1*(3), 34. https://doi.org/10.5089/9781616353186.022

Bisheko, M. J., & Rejikumar, G. (2023). Major barriers to adoption of improved postharvest technologies among smallholder farmers in sub-Saharan Africa and South Asia: A systematic literature review. *World Development Sustainability, 2*, 100070. https://doi.org/10.1016/j.wds.2023.100070

Bjornlund, V., Bjornlund, H., & van Rooyen, A. (2022). Why food insecurity persists in sub-Saharan Africa: A review of existing evidence. *Food Security, 14*, 845–864. https://doi.org/10.1007/s12571-022-01256-1

Bristax. (2022). *Interesting tax facts*. https://bristax.com.au/tax-articles/interesting-tax-facts/

Carter, M. R., Laajaj, R., & Yang, D. (2014). *Subsidies and the persistence of technology adoption: Field experimental evidence from Mozambique*. World Bank. https://www.worldbank.org/

Central Bank of Nigeria. (2013). *Fiscal incentives in Nigeria: Lessons of experience* (Occasional Paper No. 47). https://www.cbn.gov.ng/

Chen, Z. R., Guo, J. Y., & Nie, P. Y. (2023). Tax scheme for agricultural technology innovation incentive. *Paddy and Water Environment, 21*(3), 343–352. https://link.springer.com/article/10.1007/s10333-023-00932-y

Chodorow, A. S. (2006). Agricultural tithing and (flat) tax complexity. *University of Pittsburgh Law Review, 68*, 267. https://heinonline.org/HOL/LandingPage?handle=hein.journals/upitt68&div=14&id=&page=

Crawford, I., Keen, M. J., & Smith, S. (2010). "VAT and excises," in J. Mirrlees et al. (Eds.), *Dimensions of tax design: The Mirrlees Review* (pp. 275–362). Oxford University Press. https://cir.nii.ac.jp/crid/1970304959818824457

Dawson, N., Martin, A., & Sikor, T. (2016). Green revolution in sub-Saharan Africa: Implications of imposed innovation for the wellbeing of rural smallholders. *World Development, 78*, 204–218. https://doi.org/10.1016/j.worlddev.2015.10.008

Dimos, C., Pugh, G., Hisarciklilar, M., Talam, E., & Jackson, I. (2022). The relative effectiveness of R&D tax credits and R&D subsidies: A comparative meta-regression analysis. *Technovation, 115*, 102450. https://pureportal.coventry.ac.uk/en/publications/the-relative-effectiveness-of-rampd-tax-credits-and-rampd-subsidi

Elert, N., Henrekson, M., & Sanders, M. (2019). *The entrepreneurial society: A reform strategy for the European Union*. Springer Nature. https://library.oapen.org/handle/20.500.12657/23115

Epaphra, M., & Mwakalasya, A. H. (2017). Analysis of foreign direct investment, agricultural sector and economic growth in Tanzania. *Modern Economy, 8*(1), 111–140. https://doi.org/10.4236/me.2017.81008

Ernst & Young. (2021). *Nigeria: Highlights of Finance Act 2020*. https://globaltaxnews.ey.com/news/2021-5139-nigeria-highlights-of-finance-act-2020

Evans, A. F. (1969). The impact of taxation on agriculture. *Journal of Agricultural Economics, 20*(2), 217–228. https://doi.org/10.1111/j.1477-9552.1969.tb01353.x

Falaju, J. (2016). USAID, ECOWAS canvass use of fertilizer to boost food production. *The Guardian*. https://guardian.ng/news/usaid-ecowas-canvass-use-of-fertilizer-to-boostfood-production/

Fan, S., Johnson, M., Saurkar, A., & Makombe, T. (2008). *Investing in African agriculture to halve poverty by 2015* (IFPRI Discussion Paper No. 00751). IFPRI. https://doi.org/10.22004/ag.econ.42807

Feder, G., & Umali, D. L. (1993). The adoption of agricultural innovations: A review. *Technological Forecasting and Social Change, 43*(3–4), 215–239. https://doi.org/10.1016/0040-1625(93)90053-A

Feder, G., Just, R. E., & Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: A survey. *Economic Development and Cultural Change, 33*(2), 255–298. https://www.journals.uchicago.edu/doi/abs/10.1086/451461

Federal Inland Revenue Service. (2019). *Companies income tax act*. https://www.firs.gov.ng/

Finger, R., & Pedersen, A. B. (2025). Input taxes in agriculture: Experiences and perspectives for European agriculture. *Ecological Economics, 233*, 108575. https://doi.org/10.1016/j.ecolecon.2025.10857

Food and Agriculture Organization (FAO). (2022). *The state of food and agriculture 2022*. https://openknowledge.fao.org/server/api/core/bitstreams/1c329966-521a-4277-83d7-07283273b64b/content/sofa-2022/policies-legislation-investments-agriculture.html

Food and Agriculture Organization (FAO). (2023). *What factors shape small-scale farmers' and firms' adoption of new technologies?* https://www.fao.org/support-to-investment/news/detail/en/c/1652579/

Food and Agriculture Organization (FAO) & World Bank. (2011). *Missing food: The case of postharvest grain losses in sub-Saharan Africa* (Report No. 60371-AFR). https://gala.gre.ac.uk/id/eprint/10385/

Food Business Africa. (2024). *Tanzania implements tax exemption strategy to minimize post-harvest losses.* https://www.foodbusinessafrica.com/tanzania-implements-tax-exemption-strategy-to-minimize-post-harvest-losses/

Gadwin, P. (2022). Impacts of taxation on agriculture. *Global Journal of Agricultural Economics, Extension and Rural Development, 10*(2), 1–?. https://www.globalscienceresearchjournals.org/

Gamage, A., Gangahagedara, R., Subasinghe, S., Gamage, J., Guruge, C., Senaratne, S., & Merah, O. (2024). Advancing sustainability: The impact of emerging technologies in agriculture. *Current Plant Biology*, 40, 100420. https://doi.org/10.1016/j.cpb.2024.100420

Gbaiye, O. G., Ogundipe, A., Osabuohien, E., Olugbire, O., Adeniran, O. A., Bolaji-Olatunji, K. O., Awodele, O. D., & Aduradola, O. (2013). Agricultural exports and economic growth in Nigeria (1980-2010). *Journal of Economics and Sustainable Development, 4*(16), 1–4. https://www.iiste.org/Journals/index.php/JEDS/article/view/8457/8387

Gentry, W. M., & Hubbard, R. G. (2005). Success taxes, entrepreneurial entry, and innovation. *Innovation Policy and the Economy, 5*, 87–108. https://www.journals.uchicago.edu/doi/10.1086/ipe.5.25056172

Global Trade Alert. (2021). *Nigeria: Government to provide around NGN 12.3 billion in agricultural subsidies*. https://www.globaltradealert.org/state-act/66785

Golagani, K. V. S. (2024). The taxation of agricultural income in India. *International Journal for Multidisciplinary Research, 6*(2), 1–9. https://www.ijfmr.com/

Goolsbee, A. (2004). The impact of the corporate income tax: Evidence from state organizational form data. *Journal of Public Economics, 88*(11), 2283–2299. https://doi.org/10.1016/j.jpubeco.2003.05.002

Gruziel, K., & Raczkowska, M. (2018). The taxation of agriculture in the European Union countries. *Scientific Journal Warsaw University of Life Sciences, 18*(4), 162–174. https://doi.org/10.22630/PRS.2018.18.4.107

Habtewold, T. M., & Heshmati, A. (2023). Impacts of improved agricultural technology adoption on welfare in Africa: A meta-analysis. *Heliyon, 9*(1), e17463. https://doi.org/10.1016/j.heliyon.2023.e17463

Hahn, C. (2025). Tariffs 101: What are they and how do they work? https://www.oxfordeconomics.com/resource/tariffs-101-what-are-they-and-how-do-they-work/

Hufbauer, G. C., Schott, J. J., & Cimino-Isaacs, C. (2013). *Local content requirements: A global problem* (Vol. 102). Columbia University Press.

Ijirshar, V. U. (2015). Empirical analysis of agricultural exports and economic growth in Nigeria. *Journal of Development and Agricultural Economics, 7*(3), 113–122. https://doi.org/10.5897/JDAE2014.0615

Jack, B. K. (2013). Market inefficiencies and the adoption of agricultural technologies in developing countries. *Agricultural Technology Adoption Initiative, J-PAL (MIT) & CEGA (UC Berkeley)*. https://escholarship.org/uc/item/6m25r19c

James, S. (2008). The use and misuse of trade negotiation simulations. *Journal of World Trade, 42*(1), 87–103. https://doi.org/10.54648/trad2008003

Jannamike, L. (2022, October 28). Why we approved 5-year tax break, other incentives for investors in agric sector. *The Vanguard*. https://www.vanguardngr.com/2022/10/why-we-approved-5-year-tax-break-other-incentives-for-investors-in-agric-sector-fg/

Johnson, N. D., & Koyama, M. (2014). Tax farming and the origins of state capacity in England and France. *Explorations in Economic History, 51*, 1–20. https://doi.org/10.1016/j.eeh.2013.07.005

Joshi, K. D., Conroy, C., & Witcombe, J. R. (2019). Agriculture, seed, and innovation in Nepal: Industry and policy issues for the future. *Gates Open Research, 3*, 232. https://doi.org/10.21955/gatesopenres.1115308.1

Josling, T. E. (1974). Agricultural policies in developed countries: A review. *Journal of Agricultural Economics, 25*(3), 229–264. https://doi.org/10.1111/j.1477-9552.1974.tb00547.x

Kaminski, J., & Christiaensen, L. (2014). Post-harvest loss in sub-Saharan Africa—what do farmers say? *Global Food Security, 3*(3–4), 149–158. https://doi.org/10.1016/j.gfs.2014.10.002

Karata, R. (2024). The impact of smart input subsidy program on farm productivity: Evidence from Tanzania. *Scientific African, 24*, e02181. https://doi.org/10.1016/j.sciaf.2024.e02181

Kaur, R., & Watson, J. A. (2024). A scoping review of postharvest losses, supply chain management, and technology: Implications for produce quality in developing countries. *Journal of the ASABE, 67*(5), 1103–1131. https://doi.org/10.13031/ja.15660

Kayizzi-Mugerwa, S. (1998). A review of macroeconomic impediments to technology adoption in African agriculture. *African Development Review, 10*(1), 211–225. https://doi.org/10.1111/j.1467-8268.1998.tb00105.x

Kelly, V., Adesina, A. A., & Gordon, A. (2003). Expanding access to agricultural inputs in Africa: A review of recent market development experience. *Food Policy, 28*(4), 379–404. https://doi.org/10.1016/j.foodpol.2003.08.006

Khan, M. H. (2001). Agricultural taxation in developing countries: A survey of issues and policy. *Agricultural Economics, 24*(3), 315–328. https://doi.org/10.1111/j.1574-0862.2001.tb00033.x

Klemm, A. (2010). Causes, benefits, and risks of business tax incentives. *International Tax and Public Finance, 17*, 315–336. https://doi.org/10.1007/s10797-010-9135-y

Kolapo, A., Adekunle, J. D., Oluwatoba, J. A., & Obembe, O. E. (2022). Adoption of multiple sustainable land management practices and its effects on productivity of smallholder maize farmers in Nigeria. *Resources, Environment and Sustainability, 10*, 100084. https://doi.org/10.1016/j.resenv.2022.100084

Komatsu, H., Ambel, A. A., Koolwal, G., & Yonis, M. B. (2021). *Gender implications of rural land use fee and agricultural income tax in Ethiopia* (Policy Brief No. 36029). The World Bank Group. https://www.worldbank.org/

Koolwal, G. B., Grown, C., & Ahmed, N. (2023). *How do agricultural import tariffs affect men and women smallholders? Evidence from Bangladesh* (Policy Research Working Paper No. 10488). The World Bank. https://www.worldbank.org/

Kumar, P. (2023). *Importance of modern technology in agriculture in India*. SMS Foundation. https://www.smsfoundation.org/role-of-modern-technology-in-agriculture/

Lee, D. R. (2005). Agricultural sustainability and technology adoption: Issues and policies for developing countries. *American Journal of Agricultural Economics, 87*(5), 1325–1334. http://www.jstor.org/stable/3697714

LexisNexis. (2025). *A–Z of capital allowances*. https://www.lexisnexis.co.uk/tolley/tax/guidance/a-z-of-capital-allowances

Liu, M., & Liu, H. (2024). Farmers' adoption of agriculture green production technologies: Perceived value or policy-driven? *Heliyon, 10*(1), e23925. https://doi.org/10.1016/j.heliyon.2023.e23925

MacNevin, A. S. (1998). Agricultural taxation in Canada: An overview and assessment. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie, 46*(2), 93–116. https://doi.org/10.1111/j.1744-7976.1998.tb00357.x

Marangu, N., Mhando, K., & Mwau, J. (2024a, February 5). *Making post-harvest technologies affordable and accessible for farmers in Uganda*. Eastern Africa Grain Council (EAGC).https://eagc.org/2024/02/05/making-post-harvest-technologies-affordable-and-accessible-for-farmers-in-uganda/

Marangu, N., Mhando, K., & Mwau, J. (2024b, February 5). *The EAC should re-look at the tax regime on post-harvest technologies*. Eastern Africa Grain Council (EAGC). https://eagc.org/2024/02/05/the-eac-should-re-look-at-the-tax-regime-on-post-harvest-technologies/

Mezgebe, A. G., Terefe, Z. K., Bosha, T., Muchie, T. D., & Teklegiorgis, Y. (2016). Post-harvest losses and handling practices of durable and perishable crops produced in relation with food security of households in Ethiopia: Secondary data analysis. *Journal of Stored Products and Postharvest Research, 7*(5), 45–52. https://doi.org/10.5897/JSPPR2016.0205

Miine, L. K., Akorsu, A. D., Boampong, O., & Bukari, S. (2023). Drivers and intensity of adoption of digital agricultural services by smallholder farmers in Ghana. *Heliyon, 9*(12), e23023. https://doi.org/10.1016/j.heliyon.2023.e23023

Morgan, S., Arita, S., Beckman, J., Ahsan, S., Russell, D., Jarrell, P., & Kenner, B. (2022). The economic impacts of retaliatory tariffs on US agriculture. *ERR-304, U.S. Department of Agriculture, Economic Research Service*. https://ers.usda.gov/sites/default/files/_laserfiche/publications/102980/ERR-304.pdf?v=13480

Mori, M. (2018). Modern finance: A catalyst for truly modern agriculture. *Review on Agriculture and Rural Development, 7*(1–2), 5–10. https://www.americanaejournal.hu/index.php/rard/article/view/33090

Munongo, S., Akanbi, O. A., & Robinson, Z. (2017). Do tax incentives matter for investment? A literature review. *Business and Economic Horizons, 13*(2), 152–168. http://dx.doi.org/10.15208/beh.2017.12

Moss, B. (2021). Tracing the history of farming across Africa gives clues to low production outputs. *Agrifocus African Markets*. https://agrifocusafrica.com/2021/07/07/tracing-the-history-of-farming-across-africa-gives-clues-to-low-production-outputs/

Musungwini, S. (2023). *Examining the non-adoption of mobile phone technologies for agricultural activities by smallholder farmers in Zimbabwe* (Doctoral dissertation, University of South Africa, South Africa). https://www.proquest.com/openview/0249622892961f09e001ff8c70411133/1?pq-origsite=gscholar&cbl=2026366&diss=y

Nash, J., Halewood, N., & Melhem, S. (2013). *Unlocking Africa's agricultural potential: An action agenda for transformation* (World Bank Policy Research Working Paper No. 76990, pp. 1–70). The World Bank. https://www.worldbank.org/

OECD. (2005). *Taxation and social security in agriculture*. Organisation for Economic Co-operation and Development. https://www.oecd.org/

OECD. (2020). *Taxation in agriculture*. OECD Publishing. https://doi.org/10.1787/073bdf99-en

Okaro, I. O. (2011). *History of African tax compliance – Nigeria as a case study*. National Generic Repository, Nigeria. https://ngfrepository.org.ng/

Olayemi, F. F., Adegbola, J. A., Bamishaiye, E. I., & Daura, A. M. (2010). Assessment of post-harvest challenges of small scale farm holders of tomatoes, bell and hot pepper in some local government areas of Kano State, Nigeria. *Bayero Journal of Pure and Applied Sciences, 3*(2), 39–42. https://doi.org/10.4314/bajopas.v3i2.63217

Olokooba, S. M., & Olokooba, S. M. (2019). The Nigerian tax incentives and relief policy. In *Nigerian Taxation: Law, Practice and Procedures Simplified* (pp. 161–178). https://doi.org/10.1007/978-981-13-2607-3_14

Oluwafemi, Z. O., Adedokun, M. A., Ogundele, A. A., & Oladokun, Y. O. M. (2015). An empirical analysis of the contribution of agricultural sector to Nigerian gross domestic product: Implications for economic development. *Developing Country Studies, 5*(21), 36–42. https://www.iiste.org/Journals/index.php/DCS/article/view/27459

Oluwole, O. S., Adekunle, A. H. R., & Olusola, A. A. (2020). Effect of tax incentives on the growth and development of manufacturing firms in Nigeria. *African Journal of Accounting and Financial Research, 3*(1), 77–84. https://abjournals.org/ajafr/

Omotilewa, O. J., Ricker-Gilbert, J., & Ainembabazi, J. H. (2019). Subsidies for agricultural technology adoption: Evidence from a randomized experiment with improved grain storage bags in Uganda. *American Journal of Agricultural Economics, 101*(3), 753–772. https://doi.org/10.1093/ajae/aay108

Organization for Economic Co-operation and Development. (2025). *R&D tax incentives*. OECD. https://www.oecd.org/en/topics/r&d-taxincentives.html

Oyim, A., Osayi, K. K., Okaforocha, C. M., & Nwokoye, E. S. (2023). Constraints to agricultural productivity in South East Nigeria: Evidence from small-scale farmers in Abakaliki metropolis. *International Journal of Research and Innovation in Social Science, 7*(10), 1586–1600. https://dx.doi.org/10.47772/IJRISS.2023.701122

Peter, S. (1992). Tax farming: A radical solution for developing country tax problem. *International Monetary Fund*. https://doi.org/10.5089/9781451960327.001

Porteous, O. (2020). Trade and agricultural technology adoption: Evidence from Africa. *Journal of Development Economics, 144*, 102440. https://doi.org/10.1016/j.jdeveco.2020.102440

PwC. (2025). *Nigeria corporate – Deductions*. https://taxsummaries.pwc.com/nigeria/corporate/deductions

Rashid, S., Tefera, N., Minot, N., & Ayele, G. (2013). Can modern input use be promoted without subsidies? An analysis of fertilizer in Ethiopia. *Agricultural Economics, 44*, 595–611. https://doi.org/10.1111/agec.12076

SDC. (2023). CIT and agribusiness: Tax incentives for agricultural development and food security in Nigeria. https://sunmoladavid.com/cit-and-agribusiness-tax-incentives-for-agricultural-development-and-food-security-in-nigeria/

Shapiro, M. D., & Slemrod, J. (2009). Did the 2008 tax rebates stimulate spending? *American Economic Review, 99*(2), 374–379. https://doi.org/10.1257/aer.99.2.374

Sibanda, S., & Workneh, T. S. (2020). Potential causes of postharvest losses, low-cost cooling technology for fresh produce farmers in Sub-Sahara Africa. *African Journal of Agricultural Research, 16*(5), 553–566. https://doi.org/10.5897/AJAR2020.14714

Sterling, E., & Maddison, H. (2024). *Digital technology adoption in SMEs: AI-driven strategies for improving competitiveness*. https://doi.org/10.13140/RG.2.2.28087.33447

Stewart-Wilson, G., & Waiswa, R. (2021). *Taxing agricultural income in the global south: Revisiting Uganda's national debate*. Institute of Development Studies. https://opendocs.ids.ac.uk/

Suleman, A. (2012). *Factors influencing adoption of improved cassava processing technologies by women processors in Akoko-Edo Local Government Area, Edo State, Nigeria* (MSc thesis, Ahmadu Bello University, Zaria). https://kubanni-backend.abu.edu.ng/server/api/core/bitstreams/84a55e97-5b4d-4d9d-837c-ce10ef8ad82a/content

Suwanda, S. (2023). The role of tax incentives in encouraging innovation and technology adoption in industrial management. *Atestasi: Jurnal Ilmiah Akuntansi, 6*(2), 718–729. https://doi.org/10.57178/atestasi.v6i2.737

Tiri, G. D., Ojoko, E. A., & Aruwayo, A. (2014). Growth enhancement support scheme (GESS) and the challenges of food security in Nigeria: A review. *ARPN Journal of Agricultural and Biological Science, 9*(7), 226–232. https://www.arpnjournals.org/

Tom, T., Nirmala, M. M., Kumar, N. S., & Reshmi, U. P. (2024). Unveiling the agricultural growth catalyst: A review on the importance of public expenditure in the agriculture sector. In *Anticipating Future Business Trends: Navigating Artificial Intelligence Innovations, 2*, 243–256. https://doi.org/10.1007/978-3-031-63402-4_19

Uche, I. V., Ekene, O. G., & Miebi, G. T. (2024). Prospects and challenges of agricultural financing in Nigeria: A review. *GSC Advanced Research and Reviews, 18*(3), 388–399. https://doi.org/10.30574/gscarr.2024.18.3.0116

United Nations Statistics Division Development Data and Outreach Branch. (2016). *Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture*. https://unstats.un.org/sdgs/report/2016/goal-02/

United States Government Accountability Office. (2024). *Precision agriculture: Benefits and challenges for technology adoption and use* (GAO-24-105962). https://www.gao.gov/products/gao-24-105962

Van Loon, J., Woltering, L., Krupnik, T. J., Baudron, F., Boa, M., & Govaerts, B. (2020). Scaling agricultural mechanization services in smallholder farming systems: Case studies from sub-Saharan Africa, South Asia, and Latin America. *Agricultural Systems, 180*, 102792. https://doi.org/10.1016/j.agsy.2020.102792

Van Tongeren, F., Van Meijl, H., & Surry, Y. (2001). Global models applied to agricultural and trade policies: A review and assessment. *Agricultural Economics, 26*(2), 149–172. https://doi.org/10.1111/j.1574-0862.2001.tb00060.x

World Bank. (2012). Agricultural taxation (English). *Tajikistan agriculture sector; policy note no. 5*. http://documents.worldbank.org/curated/en/188221468176058813

World Bank Group. (2019). *Agricultural innovation & technology hold key to poverty reduction in developing countries, says World Bank report*. PRESS RELEASE NO: 2020/033/EFI-AG. https://sdg.iisd.org/news/world-bank-report-ties-agriculture-technology-adoption-to-increased-productivity-and-income/

World Bank Group. (2025). *Is post-harvest loss significant in Sub-Saharan Africa?* https://www.worldbank.org/en/programs/africa-myths-and-facts/publication/is-post-harvest-loss-significant-in-sub-saharan-africa

Yeboah, E. N., & Andrew, M. (2020). Challenges faced by Metropolitan, Municipal, and District Assemblies (MMDAs) in internal revenue mobilization in Ghana. *International Journal of Asian Social Science, 10*(1), 68–80. https://doi.org/10.18488/journal.1.2020.101.68.80

Yusuf, S. A. (2021). Refocusing agricultural subsidy for food security in Nigeria. *Central Bank of Nigeria Economic and Financial Review, 59*(4), 159–196. https://dc.cbn.gov.ng/efr/vol59/iss4/12/

Zhan, Y., Zhan, X., & Wu, M. (2025). Institutional change and agricultural modernization: The impact of land certification on agricultural technology adoption. *Land, 14*(7), 1420. https://www.mdpi.com/2073-445X/14/7/1420

Zhang, T. (2023). *The ideological foundations of Qing taxation belief systems, politics, and institutions*. Cambridge University Press. https://doi.org/10.1017/9781108995955.003

Zhang, Y., & Song, Y. (2022). Tax rebates, technological innovation and sustainable development: Evidence from Chinese micro-level data. *Technological Forecasting and Social Change, 176*, 121481. https://doi.org/10.1016/j.techfore.2022.121481

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